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“

My name is Dheeraj Kumar, and I secured Rank 202 in the 70th BPSC Combined Competitive Examination, and got selected as SDM.

I used PRAM IAS notes for prelims PYQs and history notes for Mains preparation. However, Pram IAS played the most important role in my interview preparation.

A senior who had himself benefited from the rigor of the Pram IAS interview program recommended it to me. I am grateful to the Pram IAS board for conducting two mock interviews and providing detailed feedback on my performance.

I am especially thankful to Intab Sir for his deep insights into my personality and for suggesting areas where I could improve my overall performance. Guidance of Sir, gave me greater clarity and confidence. And, I want to confess that I benefited immensely from insights on GS-II.

I am happy to share that, I successfully cleared the BPSC Examination and Pram played a big role in it.

I sincerely thank the entire Pram IAS team for their guidance, mentorship, and support throughout this journey.

DHEERAJ KUMAR
(Dheeraj Kumar)
SDM - Rank 202 (BPSC 70th)

”



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71ST BPSC PYQ

Q1. The potential energy of a freely falling body continuously decreasing (71th BPSC 2025)

- A. The Principle of conservation of energy is violated
- B. The Principle of conservation of energy is not violated.
- C. Gravitational force is violated.
- D. Gravitational force is not violated.

Ans. B. The Principle of conservation of energy is not violated.

- ♦ The potential energy of a freely falling body decreases as it is converted into kinetic energy due to gravity.
- ♦ This process does not violate the principle of conservation of energy, as the total mechanical energy (potential + kinetic) remains constant, assuming no air resistance or other external forces.

Q2. A pair of Oxen exerts a force of 140 newton while ploughing the field. The field ploughed is 15 meter long. The work done in ploughing the length of the field is : (71th BPSC 2025)

- A. 2000 Joule
- B. 1900 Joule
- C. 2100 Joule
- D. 2200 Joule

Ans. C. 2100 Joule

As we know that

$$\text{Work done (W)} = F \times d$$

f= force, d = displacement

$$W = 140 \times 15 \text{ W} = 2100 \text{ Joule}$$

Q3. A truck starts from rest down a hill with a constant acceleration. It achieves 400 meters in 20 seconds. If the weight of the truck is 7 tons, then what will be the force acting on it? (71th BPSC 2025)

- A. 12000 Newtons
- B. 11000 Newtons
- C. 13000 Newtons
- D. 14000 Newtons

Ans. D. 14000 Newtons

For motion with uniform acceleration, the equation is:

$$s = ut + \frac{1}{2}at^2$$

Here, since $u = 0$:

$$s = \frac{1}{2}at^2$$

So,

$$400 = \frac{1}{2} \times a \times (20)^2$$

$$400 = \frac{1}{2} \times a \times 400$$

$$400 = 200a$$

$$a = 400/200 = 2 \text{ m/s}^2$$

Therefore, the acceleration of the truck is: $a = 2 \text{ m/s}^2$

Now, according to Newton's second law of motion:

$$F = ma$$

$$\text{Mass} = 7 \text{ tonnes} = 7000 \text{ kg}$$

$$\text{So, } F = ma = 7000 \times 2 = 14000 \text{ N}$$

Thus, the force acting on the truck will be 14000 N.

Q4. We apply a force of 200 Newtons on a wooden box and push it on the floor at constant velocity. The marginal friction force will be (71th BPSC 2025)

- A. 200 N
- B. 100 N
- C. 300 N
- D. 400 N

Ans. A. 200 N

When an object moves at constant velocity, the net force acting on it is zero. This means the frictional force is equal in magnitude and opposite in direction to the applied force.

Since a force of 200 Newtons is applied and the box moves at constant velocity, the frictional force must also be 200 Newtons.

Q5. What is the device to protect equipment from the electric shock? (71th BPSC 2025)

- A. Generator
- B. Fuse
- C. Motor
- D. Current controller

Ans. B. Fuse

A **fuse** is a protective device used in electrical and electronic circuits to prevent damage caused by excessive current. It contains a **metal wire or strip** that melts when the current exceeds a predetermined limit, thereby breaking the circuit and stopping the flow of electricity

Q6. The focal distance of a plane mirror is: (71th BPSC 2025)

- A. -1cm
- B. +1 cm
- C. 2 cm
- D. Infinity

Ans. D. Infinity

A plane mirror is a flat reflecting surface. Thus, in the case of a plane mirror, when the parallel rays of light strike the mirror, they get reflected back parallel to each other. So, they never meet or we can say they meet at infinity. So, the focal length of the plane mirror is Infinity

Q7. In which medium, the speed of sound is maximum? (71th BPSC 2025)

- A. Water
- B. Steel
- C. Air
- D. Hydrogen

Ans. B. Steel

Speed of sound is maximum in steel.

The speed of sound depends on the nature of the medium. The speed of sound also depends on atmospheric conditions such as temperature, humidity, etc. The speed of sound in different medium is as follows

Dry Air	(at 0°C)	332 m/s
Dry Air	(at 20°C)	344 m/s
Hydrogen	(at 0°C)	1284 m/s
Water (Distilled)	(at 20°C)	1498 m/s
Sea-Water	(at 0°C)	1531 m/s
Blood	(at 37°C)	1570 m/s
Copper	(at 20°C)	3750 m/s
Aluminium	(at 20°C)	5100 m/s
Iron (or Steel)	(at 20°C)	5130 m/s
Glass	(at 20°C)	5170 m/s

Q8. Which term in the following does NOT denote the electric power in electric circuit? (71th BPSC 2025)

- A. IR^2
- B. I^2R
- C. VI
- D. V^2/R

Ans. A. IR^2

Electric power is the **rate at which electrical energy is transferred or converted** in a circuit. Its SI unit is the **watt (W)**, equivalent to one joule per second. Power can be positive (consumed by a device) or negative (produced by a source like a battery or generator) depending on the direction of current flow and energy conversion

ELECTRIC POWER

$$P = VI$$

$$P = \frac{V^2}{R} \quad P = I^2R$$

P is power in watts, V is voltage in volts, and I is current in amperes

Q9. In short circuit, the value of electric current in a time circuit: (71th BPSC 2025)

- A. Do not change
- B. Very low
- C. Increases very high
- D. Continuously changing

Ans. C. Increases very high

- ♦ In a short circuit, the resistance in the circuit is very low, causing the electric current to increase significantly.
- ♦ This sudden surge in current can be extremely high, often leading to damage to the circuit or components if not protected by a fuse or circuit breaker.

Q10. Full form of PHBV biodegradable polymer: (71th BPSC 2025)

- A. Poly hydroxy butyl vanillin
- B. Poly hydroxy butane veratric acid
- C. Poly (3 - Hydroxy butyrate-co-3-hydroxy valerate)
- D. Poly hydroxy butyric acid veratric acid

Ans. C. Poly (3 - Hydroxy butyrate-co-3-hydroxy valerate)

PHBV (Poly (3-hydroxybutyrate-co-3-hydroxyvalerate)) is indeed a **biodegradable polymer**. It is produced naturally by bacteria and is considered a good alternative to many non-biodegradable synthetic polymers. PHBV is classified as a biodegradable aliphatic polyester, which can be decomposed by bacteria

Q11. Which metal compound is used for the treatment of carcinoma? (71th BPSC 2025)

- A. Platinum
- B. Chromium
- C. Iron
- D. Chlorine

Ans. A. Platinum

Certain platinum-based compounds, especially cisplatin, are widely used in chemotherapy for the treatment of carcinomas (cancers of epithelial tissues like lungs, bladder, ovaries, and testes)

Uses of Chlorine (Cl)

- ◆ It is used to get rid of the smell of putrefaction
- ◆ It is used as a disinfectant
- ◆ Chlorine is used in the treatment of drinking water to kill bacteria
- ◆ It is used to clean swimming pools
- ◆ It is used in the production of paper and paper products
- ◆ It is used as an antiseptic
- ◆ It is used to produce drugs
- ◆ It is used in the manufacture of dyes and plastics

Q12. Why oil is not stored in galvanized iron pot? (71th BPSC 2025)

- A. It Produces toxic compound
- B. It reduces quality of oil
- C. Corrosion observed
- D. All of above

Ans. D. All of above

Oil is not stored in a galvanized iron pot because it produces toxic compounds oil reacts with zinc, forming harmful substances. It also leads to oil quality reduction and corrosion.

Q13. Which compound is used in contraceptive pills? (71th BPSC 2025)

- A. Cholecalciferol
- B. Levonorgestrel
- C. Venlafaxine
- D. Cetirizine

Ans. B. Levonorgestrel

- ◆ Levonorgestrel is a synthetic progesterone hormone used in contraceptive pills (both daily oral contraceptives and emergency "morning-after" pills). It prevents pregnancy mainly by inhibiting ovulation, thickening cervical mucus (blocking sperm movement), and altering the uterine lining.
- ◆ Contraceptive pills include combined estrogen-progestin pills and progestin-only pills, with popular brands like Microval, Hy-an, Yasmin, and Diane-35.

Q14. pH value of 0.1 N HCl solution is approximately: (71th BPSC 2025)

- A. 11.0
- B. 1.0
- C. 10
- D. 2.0

Ans. B. 1.0

HCl is a strong acid that dissociates completely in water, the hydrogen ion concentration $[H^+]$ is 0.1M. Hence, $pH = -\log [H^+] = -\log [0.1] = 1$

Which compound is used for increase of octane rating? (71th BPSC 2025)

- A. Tetramethyl oxide
- B. Trimethyl hexane
- C. Tetraethyl lead
- D. Triethyl toluene

Ans. C. Tetraethyl lead

Tetraethyllead (TEL) has historically been used as an anti-knocking agent in petrol. It increases the octane rating, leading to smoother engine performance and higher stability.

Q15. Which compound is known as a night-glowing pigment from below? (71th BPSC 2025)

- A. Copper sulphide-doped zinc oxide
- B. Europium-doped strontium aluminate
- C. Barium sulphate-doped copper carbonate
- D. Boron oxide-doped copper sulphate

Ans. B. Europium-doped strontium aluminate

Europium-doped strontium aluminate is a phosphorescent compound that absorbs light during the day and glows in the dark at night, making it widely used as a night-glowing pigment in paints, watches, and safety signs.

Q16. Which material is used for smart film? (71th BPSC 2025)

- A. Indium tin oxide
- B. Calcium carbonate
- C. Zinc chloride
- D. Silica

Ans. A. Indium tin oxide

Smart film is primarily composed of **Indium tin oxide (ITO)**, which serves as a transparent conductive material. It typically consists of a **PDLC (polymer-dispersed liquid crystal)** layer sandwiched between two layers of PET (polyethylene terephthalate) that are coated with ITO. This combination allows the film to

switch between transparent and opaque states, providing privacy and light control.

Q17. Who was first to use the characteristics of vascular tissues in the classification of plants? (71th BPSC 2025)

- A. Engler and Prantl
- B. Bentham and Hooker
- C. A.P. de Candolle
- D. More than one of the above

Ans. C. A.P. de Candolle

The first to use the characteristics of vascular tissues in the classification of plants was **A.P. de Candolle**. He recognized the importance of vascular tissue (xylem and phloem) in plant classification, which was a significant advancement in botanical taxonomy.

Q18. In mycorrhizal association, the advantage of plant is : (71th BPSC 2025)

- A. Protection
- B. Food
- C. A and B
- D. Increased mineral absorption and disease protection

Ans. D. Increased mineral absorption and disease protection

In a mycorrhizal association, the plant gains increased mineral absorption and protection from diseases, making this a vital mutualistic relationship in plant ecology.

Q19. Which of the following is a non-sense codon? (71th BPSC 2025)

- A. AUG
- B. UAA
- C. UUU
- D. UGC

Ans. A. AUG

In Genetics, a three-nucleotide sequence of mRNA is called a codon. Codons are of two types—

- ♦ **Sense codons:** These are codons for amino acids and are responsible for protein formation. Their total number is 61.
- ♦ **Nonsense (stop) codons:** These indicate the termination of protein synthesis. In the standard genetic code, three major stop (nonsense) codons are accepted. These give the termination signal for protein synthesis— UAA (ochre), UAG (amber), and UGA (opal)

AUG is a start codon, not a nonsense codon. It initiates translation and also codes for the amino acid Methionine.

Q20. The biological membranes are composed of: (71th BPSC 2025)

- A. Lipids and proteins in varying combinations which are specific to each species, cell type and organelle
- B. Lipids only
- C. Proteins only
- D. None of the above

Ans. A. Lipids and proteins in varying combinations which are specific to each species, cell type and organelle

Lipids and proteins in varying combinations which are specific to each species, cell type, and organelle. Biological membranes are composed of **lipids and proteins in varying combinations**, which are specific to each species, cell type, and organelle, following the fluid mosaic model.

Q21. Hormones are secreted by: (71th BPSC 2025)

- A. Reproductive glands
- B. Sebaceous glands
- C. Exocrine glands
- D. Endocrine glands

Ans. D. Endocrine glands

- ♦ Hormones are secreted by **endocrine glands**. These glands release hormones directly into the bloodstream, regulating various bodily functions such as metabolism, growth, and reproduction.
- ♦ **Reproductive glands**, or gonads, are specialized organs that produce gametes and hormones essential for human reproduction.
- ♦ **Sebaceous glands** are microscopic exocrine glands in the skin that secrete sebum, an oily substance that lubricates and protects the skin and hair.
- ♦ **Exocrine glands** are specialized glands that secrete substances through ducts onto body surfaces or into body cavities, performing localized functions essential for digestion, lubrication, thermoregulation, and protection.

Q22. Xylem in plants is responsible for following function: (71th BPSC 2025)

- A. Transport of food
- B. Transport of water and dissolved minerals
- C. Transport of oxygen and other gases
- D. Transport of essential amino acids

Ans. B. Transport of water and dissolved minerals

Xylem is a **permanent complex tissue** that conducts water and minerals from roots to other parts of the plant and provides mechanical support. It consists of:

- ♦ **Tracheid:** Elongated, thick-walled dead cells with tapering ends that help in water conduction.
- ♦ **Vessels:** Long, tubular structures formed from vessel members with lignified walls and large central cavities, also dead at maturity.
- ♦ **Xylem fibres:** Thick-walled cells providing mechanical strength.
- ♦ **Xylem parenchyma:** Living cells that store food and assist in radial water conduction

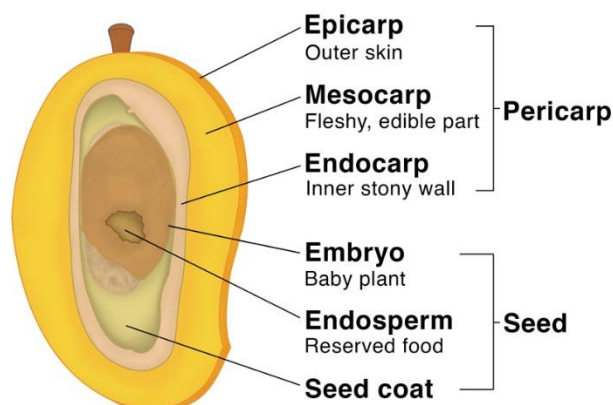
Q23. The part which we eat in Mango is : (71th BPSC 2025)

- A. Epicarp
- B. Mesocarp
- C. Endocarp
- D. None of the above

Ans. B. Mesocarp

The **edible part of the mango is the mesocarp**. This is the fleshy portion that is eaten, located between the skin (epicarp) and the seed (endocarp)

Parts of a Fruit



Q24. Which one of the following term characterizes the interaction between herpes simplex virus and a human? (71th BPSC 2025)

- A. Symbiosis
- B. Parasitism
- C. Endosymbiosis
- D. Endoparasitism

Ans. B. Parasitism

- ♦ Herpes simplex virus (HSV) benefits by using the human host's cells to replicate, while the host is harmed (e.g., lesions, disease). This one-

benefits/one-harmed relationship is called parasitism.

- ♦ Symbiosis (and endosymbiosis) usually implies a mutually beneficial or at least neutral long-term association, which is not the case here.
- ♦ Endoparasitism is a subtype of parasitism where the parasite lives inside the host. While HSV does live inside host cells (so it is an endoparasite), the standard term that characterizes the interaction itself is parasitism.

Q25. Which class of immunoglobulin is the first to be produced in response to an infection? (71th BPSC 2025)

- A. IgA
- B. IgG
- C. IgM
- D. IgE

Ans. C. IgM

- ♦ **IgM** is the first class of immunoglobulin produced during the initial immune response to an infection. It is typically found in the bloodstream and acts as a first line of defense against pathogens. It can neutralize pathogens by binding to them and preventing them from infecting cells.
- ♦ Immunoglobulin A (**IgA**) is a type of antibody found in your mucous membranes and body fluids. It's mostly found in your digestive and respiratory tracts. It protects you from germs and toxins by preventing them from entering your cells, trapping them in mucus and moving them out of your body.
- ♦ **IgG** antibodies (immunoglobulin G) are proteins that your immune system makes to fight off infections. They're especially important as part of your secondary immune response, which fights off pathogens — like bacteria and viruses — that you've been infected with before. IgG is the most abundant antibody in your blood.
- ♦ **IgE**, or Immunoglobulin E, is a type of antibody that plays a key role in allergic reactions and defense against parasitic infections.

Q26. Ozone day is celebrated on: (71th BPSC 2025)

- A. 5th June
- B. 16th September
- C. 21st April
- D. 5th December

Ans. B. 16th September

- World Ozone Day is celebrated annually on **September 16** to commemorate the signing of the **Montreal Protocol on Substances that Deplete**

the **Ozone Layer** in 1987, a landmark international treaty aimed at phasing out ozone-depleting substances and protecting the ozone layer. The 2026 theme emphasizes the dual benefits of the Montreal Protocol: **restoring the ozone layer** and **mitigating climate change** by reducing the production and use of hydrofluorocarbons (HFCs) under the Kigali Amendment

Q27. Steam methane reforming technique is used to obtain

- A. Brown Hydrogen
- B. Grey Hydrogen
- C. Green Hydrogen
- D. None of the above

ANS:- (b); Grey Hydrogen

Explanation (in English):

Steam Methane Reforming (SMR) is the most common method used to produce Grey Hydrogen.

- In this process, **methane (CH₄)** from **natural gas** reacts with **steam (H₂O)** at high temperatures (700–1000°C) in the presence of a **nickel-based catalyst**. This reaction produces **hydrogen gas (H₂)** along with **carbon monoxide (CO)** and **carbon dioxide (CO₂)**.

The reaction is as follows:

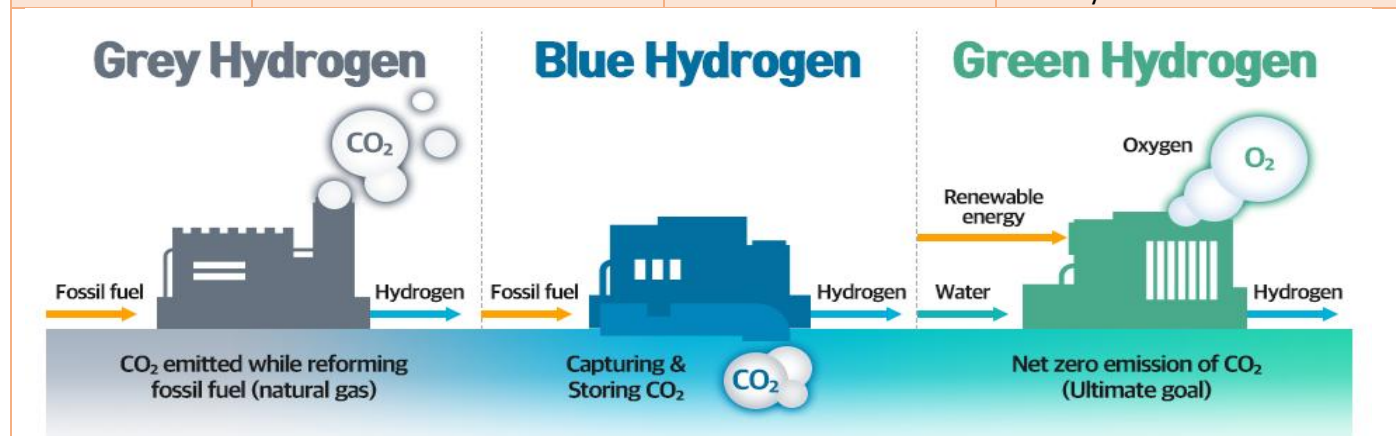
- $\text{CH}_4 + \text{H}_2\text{O} \rightarrow \text{CO} + 3\text{H}_2$
- $\text{CO} + \text{H}_2\text{O} \rightarrow \text{CO}_2 + \text{H}_2$

However, this process emits a large amount of **carbon dioxide (CO₂)**, a greenhouse gas, into the atmosphere. Since no carbon capture is involved, the hydrogen produced is called **Grey Hydrogen**.

Color classification of hydrogen:

Types of Hydrogen Based on Production Method

Type of Hydrogen	Production Method	Energy Source	Environmental Impact
Grey Hydrogen	Steam Methane Reforming (SMR)	Fossil Fuels (mainly natural gas)	✗ High CO ₂ emissions; not sustainable
Blue Hydrogen	Steam Methane Reforming (SMR) + Carbon Capture	Fossil Fuels	⚠ CO ₂ captured and stored; less polluting but still uses fossil fuels
Green Hydrogen	Electrolysis of Water	Renewable Energy (solar, wind, etc.)	✓ Zero greenhouse gas emissions; sustainable and eco-friendly



Explanation of Each Type

Grey Hydrogen

- Produced using **natural gas** through **steam methane reforming (SMR)**.
- It is **cheap and efficient**, but releases **carbon dioxide (CO₂)** into the atmosphere.
- Contributes to **global warming** and is **not environmentally friendly**.

Blue Hydrogen

- Also produced via **SMR**, but includes **Carbon Capture and Storage (CCS)**.

- CO₂ is **captured and not released** into the atmosphere.
- **Cleaner** than grey hydrogen, but still relies on **non-renewable fossil fuels**.

Green Hydrogen

- Produced via **electrolysis of water** using electricity from **renewable sources**.
- No CO₂ emissions; water is split into **hydrogen and oxygen**.
- Considered the **cleanest and most sustainable** form of hydrogen.

Q28. Sour taste of vinegar is due to

- A. Tartaric acid
- B. Lactic acid
- C. Citric acid
- D. None of these

ANS: - (d); None of these

The **sour taste of vinegar** is mainly due to **acetic acid (CH₃COOH)**, not tartaric, lactic, or citric acid.

- **Acetic acid** is the main component (about 4–8%) in vinegar and is responsible for its sharp sourness.
- Hence, since acetic acid is **not listed** in the options, the correct choice is **(d) None of these**.

Q29. Standard electrode potential of three metals A, B, and C are respectively 0.5 V, -3 V, and -1.2 V. Reducing power of these metals would be:

- A. A > C > B
- B. B > C > A
- C. C > B > A
- D. None of the above

Correct Answer: (b) B > C > A

Step-by-step Conceptual Solution:

Step 1: Understand what standard electrode potential (E°) means

- The **standard electrode potential (E°)** of an element refers to the tendency of the element to **gain electrons** (i.e. **get reduced**) under standard conditions.
- It is measured in volts (V) relative to the **Standard Hydrogen Electrode (SHE)**, which is assigned a potential of **0 V**.

Step 2: Relation between E° and reducing power

- **Reducing Power** = Tendency to **lose electrons** (i.e. to **get oxidized**).
- Metals with **more negative E° values** have a **greater tendency to lose electrons**.
- Hence, the **more negative the electrode potential, the stronger the reducing agent**.

Concept	Higher E°	Lower E° (more negative)
Nature	More easily reduced	More easily oxidized
Role	Good oxidizing agent	Good reducing agent
Electron Tendency	Gains electrons	Loses electrons

Step 3: Arrange the given metals in increasing E° value

Metal	E° (in Volts)	Reducing Power
A	+0.5 V	Least (poor reducing agent)
B	-3.0 V	Highest (strongest reducing agent)
C	-1.2 V	Medium

Based on E° values:

- **B has the most negative E° → Best reducing agent**
- **C is next**
- **A has positive E° → Poor reducing agent**

Final Order of Reducing Power: B > C > A

Thus, correct answer is:

👉 **(b) B > C > A**

💡 Quick Tip for Exams:

"More negative E° → higher reducing power"
"More positive E° → higher oxidizing power"

Q30. Buds are typically found –

- A. Both at the base of leaves and tip of branches
- B. At the tip of branches
- C. At the base of leaves
- D. None of the above

Ans: (a) Both at the base of leaves and tip of branches

What is a Bud?

A **bud** is an undeveloped or embryonic shoot which **may develop into a flower, leaf, or branch**. It consists of a **short stem with immature leaves or flowers** tightly packed together and protected by **bud scales**.

🌱 Classification of Buds Based on Position:

Let's explore **where** buds are typically found on a plant:

1. **Terminal Bud (Apical Bud)**

- **Location:** Found at the **tip of the stem or branch**.
- **Function:** Causes **primary growth** (increased length of the plant).
- **Key Feature:** Contains actively dividing cells (apical meristem).
- **Example:** The growing tip of a rose or mango shoot.

2. **Axillary Bud (Lateral Bud)**

- **Location:** Found in the **axil**, which is the angle between a **leaf and the stem** (i.e. **at the base of leaves**).
- **Function:** Can grow into **lateral branches or flowers**.
- **Key Feature:** Remains dormant often, but may develop if the apical bud is removed.
- **Example:** Buds at the base of hibiscus or cotton leaves.

3. **Adventitious Bud (Irregular Location – sometimes extra)**

- **Location:** Found **elsewhere**, like on the **roots, internodes, or margins of leaves**.

- **Function:** Helps in **vegetative reproduction or regeneration**.
- **Example:** In Bryophyllum, buds arise on leaf margins.

Q31. The Ishihara test is related with –

- A. Bone density
- B. IQ
- C. Colour blindness
- D. Haemoglobin level

Answer: (c) Colour blindness

Detailed Explanation:

What is the Ishihara Test?

- The **Ishihara Test** is a **vision test** designed to **detect color blindness**, especially **red-green color deficiencies**.
- It was developed by **Dr. Shinobu Ishihara**, a Japanese ophthalmologist, in **1917**.

How does the test work?

- The test consists of a **series of plates** known as **Ishihara plates**.
- Each plate contains a **circle (plate) filled with colored dots** of various sizes and colors.
- Within the dots, a **number or pattern is embedded** in a slightly different color.
 - **People with normal vision** can read the number/pattern easily.
 - **People with color blindness** may not be able to see the number or may see a different one.

Types of Color Blindness Detected:

Type of Deficiency	Detected by Ishihara Test?
Protanopia (red deficiency)	Yes
 Deuteranopia (green deficiency)	Yes
Tritanopia (blue deficiency)	No (not effectively)

Why Other Options Are Incorrect:

- **Bone density** – Measured by **DEXA scan**, not Ishihara.
- **IQ (Intelligence Quotient)** – Tested by **psychological assessments**, not vision tests.
- **Haemoglobin level** – Measured via **blood tests**, not color plates.

Q32. Reactance of a capacitor is –

- A. Directly proportional to frequency
- B. Inversely proportional to square root of frequency
- C. Inversely proportional to frequency

D. None of the above

Correct Answer: (c)

Detailed Explanation (Without Symbols):

What is Capacitive Reactance?

- Capacitive reactance is the **opposition offered by a capacitor** to the flow of alternating current (AC).
- It is **measured in ohms** and depends on two factors:
 - The **capacitance** of the capacitor.
 - The **frequency** of the alternating current.

Relationship Between Reactance and Frequency:

- The **higher the frequency**, the **lower the reactance**.
- The **lower the frequency**, the **higher the reactance**.
- This means there is an **inverse relationship** between the two.

In simple terms:

Capacitive reactance decreases as frequency increases.
That is why it is said to be **inversely proportional to frequency**.

Q33. A nail is nailed into the trunk of a tree at a point 1 metre from the soil level. After 2 years, the nail will –

- A. Remain at same position
- B. Move sideways
- C. Move up
- D. None of the above

Correct Answer: (a) Remain at same position

Detailed Explanation:

 *How Do Trees Grow?*

Trees grow through two main processes:

1. **Apical Growth (Primary Growth):**
 - Takes place at the **tips of shoots and roots**.
 - Causes the tree to grow **taller and deeper**.
2. **Lateral Growth (Secondary Growth):**
 - Occurs in the **girth (width)** of the tree trunk.
 - Caused by the **cambium layer**, which adds layers to the trunk.

What happens to the nail?

- The **nail is fixed in the trunk at a certain height**.
- The trunk **does not grow vertically from the middle or lower parts**; it **only grows from the tips**.
- Therefore, even after many years, the **nail stays at the same height** (1 metre above the ground).

Why Other Options Are Incorrect:

Option	What It Says	Why It's Incorrect
(b) Move sideways	Nail shifts horizontally	Trunk doesn't grow sideways like that
(c) Move up	Nail rises with growth	Only tips grow upward, not the trunk itself
(d) None of the above	Implies no correct option	But (a) is correct

Q34. Actual site of dark reaction in photosynthesis inside chloroplast is –

- A. Granum
- B. Grana lamella
- C. Stroma
- D. None of the above

Correct Answer: (c) Stroma

Detailed Explanation:

 *Photosynthesis Overview:*

Photosynthesis occurs in **two stages** within the **chloroplast**:

1. **Light Reaction** (also called **Photochemical Phase**):
 - Takes place in the **grana (granum)** — the stack of thylakoid membranes.
 - Requires **light** to occur.
 - Produces **ATP** and **NADPH**.
2. **Dark Reaction** (also called **Calvin Cycle** or **Biosynthetic Phase**):
 - Takes place in the **stroma** — the fluid-filled region surrounding the grana.
 - Does **not require light directly** (but depends on products of light reaction).
 - Utilizes **ATP and NADPH** to convert **carbon dioxide into glucose**.

What is the Stroma?

- The **stroma** is the **matrix of the chloroplast**, filled with enzymes needed for the Calvin cycle.
- It contains **RuBisCO**, the key enzyme for carbon fixation.

Why Other Options Are Incorrect:

Option	Description	Why It's Incorrect
(a) Granum	Stack of thylakoids, site of light reaction	Not involved in dark reaction
(b) Grana lamella	Connects grana, helps in light reaction	Also not part of dark reaction

(d) None of the above	Implies no correct choice	But (c) is correct
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Q35. Catalyst used in hydrogenation of vegetable oil into vanaspati ghee is –

- A. Pd
- B. Fe
- C. Ni
- D. None of the above

Correct Answer: (c) Ni

Detailed Explanation:

What is Hydrogenation?

- **Hydrogenation** is the **chemical process of adding hydrogen** to unsaturated compounds.
- In the case of vegetable oils, it involves **adding hydrogen to unsaturated fatty acids** (which contain double bonds) to **convert them into saturated fatty acids** (which have single bonds).

Why is Hydrogenation Done in Oils?

- Vegetable oils are generally **liquid at room temperature**.
- After hydrogenation, they become **semi-solid or solid**, turning into **vanaspati ghee**.
- This increases **shelf life** and changes texture for culinary use.

Catalyst Used:

- The catalyst used in this process is **Nickel (Ni)**.
- **Nickel is a solid catalyst** that helps in **breaking the hydrogen molecules** and adding them across the double bonds in the oil.
- The reaction is carried out at **high temperature and pressure** in the presence of **finely divided nickel**.

Why Other Options Are Incorrect:

Option	Element	Role
(a) Pd (Palladium)	Used in other types of hydrogenation reactions but too expensive for industrial-scale hydrogenation of oils.	
(b) Fe (Iron)	Not effective as a catalyst for this process.	
(d) None of the above	Incorrect because Ni is the correct answer.	

Q36. Which of the following is not an electrophile?

- A. Na⁺
- B. BF₃
- C. H⁺
- D. All of the above

Correct Answer: (a) Na^+

Detailed Explanation:

What is an Electrophile?

- An **electrophile** is a species that is **electron-deficient** and seeks to **gain electrons**.
- It is usually **positively charged or neutral** with an **electron-deficient center**.
- Electrophiles are attracted to **electron-rich regions**, like **double bonds or lone pairs**.

Analyzing the Options:

(a) Na^+ (Sodium ion):

- Na^+ is a **cation**, but it has a **completely filled outer shell** (noble gas configuration).
- It is **not electron-deficient in terms of forming covalent bonds**.
- It **does not accept electrons to form new covalent bonds**, so it is **not an electrophile**.

(b) BF_3 (Boron trifluoride):

- Boron has **only 6 electrons** in its outer shell in BF_3 .
 - So, it is **electron-deficient** and can **accept a pair of electrons**.
- Electrophile**

(c) H^+ (Proton):

- A **proton** has **no electrons at all**, so it's **highly electron-deficient**.
 - It **readily accepts electrons**, making it a **strong electrophile**.
- Electrophile**

(d) All of the above:

- Incorrect, because (a) is **not an electrophile**, while (b) and (c) are.

Q37. The conductivity of a strong electrolyte –

- A. Decreases on dilution
- B. Does not change with dilution
- C. Increases slightly on dilution
- D. None of the above

Correct Answer: (c) Increases slightly on dilution

Detailed Explanation:

What is Conductivity?

- **Conductivity** is the ability of a solution to **conduct electric current**.
- It depends on:
 - **Number of ions present**
 - **Mobility of ions**

Strong Electrolytes:

A **strong electrolyte** (like HCl , NaCl , KOH) **completely dissociates** into ions in water.

On **dilution**:

- The number of **ions remains the same**, but they **move more freely** due to **reduced inter-ionic attraction**.
- This **increases the mobility** of ions.

Key Concept:

- **Molar conductivity** (conductivity per mole of electrolyte) **increases significantly** on dilution.
- **Specific conductivity** (total conductivity of solution) may **slightly increase or decrease**, but for **strong electrolytes**, it **usually increases slightly at first** due to increased ion mobility.

Therefore, the correct answer is:

(c) **Increases slightly on dilution**

Why Other Options Are Incorrect:

Option	Why It's Incorrect
(a) Decreases on dilution	True for specific conductivity , but the question refers generally to conductivity of strong electrolytes
(b) Does not change	Wrong — there is change due to ion mobility
(d) None of the above	Incorrect — (c) is correct

Q38. For two liquids A and B to form an ideal solution –

- A. Entropy of mixing must be zero
- B. Free energy of mixing should be zero
- C. Enthalpy of mixing should be zero
- D. None of the above

Correct Answer: (c) Enthalpy of mixing should be zero

Detailed Explanation:

What is an Ideal Solution?

An **ideal solution** is a solution in which:

- The **intermolecular interactions** between A–A, B–B, and A–B are **equal**.
- The solution **obeys Raoult's law** at all compositions and temperatures.

Characteristics of an Ideal Solution:

1. **Enthalpy of mixing (ΔH_{mix}) = 0**
 - Because no extra energy is absorbed or released when A and B mix.
 - This means **no heat is evolved or absorbed**.
2. **Volume of mixing (ΔV_{mix}) = 0**
 - Total volume = sum of volumes of components.
3. **Entropy of mixing (ΔS_{mix}) is positive**
 - Because mixing increases randomness.

4. **Free energy of mixing (ΔG_{mix}) is negative**

- A spontaneous process (all real and ideal mixing processes reduce free energy).

Why Other Options Are Incorrect:

Option	Statement	Why It's Incorrect
(a) Entropy of mixing must be zero	False – entropy increases when two liquids mix	
(b) Free energy of mixing should be zero	False – free energy decreases (becomes negative)	
(d) None of the above	Incorrect – (c) is correct	

Q39. Liver stores:

- A. A, B, C and D vitamins
- B. Only A and B vitamins
- C. A, B and C vitamins
- D. None of these

Correct Answer: (d) None of these

Detailed Solution:

The liver plays a significant role in **vitamin storage**, but it does **not store all types of vitamins** listed in the options. Let's examine each vitamin:

◇ Vitamin A (Retinol)

- **Stored in Liver:** Yes.
- The liver is the **primary storage site** for vitamin A. It stores it in **stellate cells** (also called Ito cells).
- Helps in **vision, immune function, and reproduction**.

Vitamin B Complex

This includes a group of 8 vitamins:

- **B1 (Thiamine), B2 (Riboflavin), B3 (Niacin), B5 (Pantothenic acid), B6 (Pyridoxine), B7 (Biotin), B9 (Folate), B12 (Cobalamin)**
- **Some B vitamins (like B12) are stored in the liver**, especially **Vitamin B12**, which the liver can store for **years**.
- So, some B vitamins are stored, but **not all B vitamins are stored significantly**.

◇ Vitamin C (Ascorbic acid)

- **Not stored in the liver.**
- It is a **water-soluble vitamin**, and excess is **excreted via urine**.

- The body needs a **continuous dietary intake** of Vitamin C.

◇ Vitamin D

- **Stored, but mostly in fat tissue and skin, not mainly in the liver.**
- While the liver plays a role in the **conversion** of vitamin D to its active form (25-hydroxyvitamin D), it **does not act as the primary storage site**.

Key Concept:

- The **liver stores only specific fat-soluble vitamins** (like **A**, and to some extent **D** and **B12**), but **not all** of them.
- It does **not store** water-soluble vitamins like **Vitamin C** and most of the **B-complex group** (except **B12**).

Why the given options are incorrect:

- **A, B, C and D** → Vitamin C is not stored.
- **Only A and B** → B-complex includes many types, not all stored.
- **A, B and C** → Vitamin C is not stored.
- **Hence, (d) None of these** is the most appropriate choice.

Q40. There is no atmosphere on the surface of the Moon because

- A. It is closer to Earth
- B. Escape velocity of gas molecules is less than rms velocity
- C. It revolves around Earth
- D. It gets light from Sun

Correct Answer: (b) Escape velocity of gas molecules is less than rms velocity

Detailed Explanation:

Why doesn't the Moon have an atmosphere?

To retain an atmosphere, a celestial body must have **sufficient gravitational pull** so that the **gas molecules don't escape into space**. This is governed by the comparison between:

- **Escape velocity:** The **minimum speed** needed for a molecule to escape the gravitational field of a planet/moon.
- **Root Mean Square (rms) velocity:** The **average speed** of gas molecules due to thermal motion at a given temperature.

Key Concept:

If: **rms velocity of gas molecules $\geq$ escape velocity**
→ The molecules will escape into space over time
→ **No sustained atmosphere**

If: **Escape velocity > rms velocity of gas molecules**
→ The planet can **hold onto** its atmospheric gases

On the Moon:

- The **escape velocity** on the Moon ≈ 2.38 km/s (Much lower than Earth's escape velocity ≈ 11.2 km/s)
- The **rms velocity** of lighter gases (like hydrogen, helium, etc.) is **greater than 2.38 km/s**, especially at higher temperatures.
- Hence, these molecules easily **escape the Moon's gravity**.

Over billions of years, this causes the Moon to **lose any atmosphere it may have had**.

Why other options are incorrect:

- **It is closer to Earth**
→ Irrelevant to atmosphere retention; distance from Earth has no role here.
- **It revolves around Earth**
→ Orbital motion doesn't influence atmospheric retention directly.
- **It gets light from the Sun**
→ Every planet and moon in the solar system gets sunlight, but that alone doesn't determine presence of atmosphere.

Q41. Quinine is a common drug for malaria that is obtained from a plant. Which part of the plant yields this drug?

- A. Leaves
 - B. Root
 - C. Stem bark
 - D. None of the above
- Correct Answer: (c) Stem bark

Detailed Solution:

1. Introduction to Quinine:

Quinine is a **natural alkaloid** that has been used for centuries as an **antimalarial drug**. It is especially effective against *Plasmodium falciparum*, the parasite responsible for the most severe form of malaria.

2. Plant Source of Quinine:

- Quinine is extracted from the **Cinchona plant**, which is native to the **Andean regions of South America**, especially Peru, Ecuador, and Bolivia.
- The **botanical name** of the commonly used species is **Cinchona officinalis**, though other species like *Cinchona ledgeriana* and *Cinchona calisaya* are also sources.

3. Part of the Plant Used:

- The **stem bark** of the Cinchona tree is the specific part used to extract quinine.
- The bark contains **quinoline alkaloids**, such as:
 - **Quinine** – antimalarial
 - **Quinidine** – antiarrhythmic
 - **Cinchonine** and **Cinchonidine**

Hence, the correct answer is **(c) Stem bark**.

Q42. Turmeric powder is obtained from which part of the turmeric plant?

- A. Dried foot
- B. Dried root
- C. Seed
- D. None of the above

Correct Answer: (d) None of the above

 Detailed Solution:

◇ **1. What is Turmeric?**

- **Turmeric** is a **spice** derived from the plant **Curcuma longa**, which belongs to the **ginger family (Zingiberaceae)**.
- It is widely used in **Indian cuisine**, **traditional medicine (Ayurveda/Unani)**, and **dyeing**.

◇ **2. Actual Source of Turmeric Powder:**

- Turmeric powder is obtained from the **rhizome** of the plant — **a modified underground stem, not a root**.
- This rhizome is:
 - **Boiled**, then
 - **Dried**, and finally
 - **Ground into powder**

So, even though it looks like a root, botanically it is **not a root**.

◇ **3. Why Not Option (b) "Dried Root"?**

- While often mistaken for a root due to its underground nature, the turmeric part we use is technically a **rhizome**, which:
 - Has **nodes, internodes, buds**, and can give rise to new shoots.
 - Unlike roots, **rhizomes store food and help in vegetative reproduction**.

👉 Therefore, calling it a "root" is **botanically incorrect**.

◇ 4. What is a Rhizome?

- A **rhizome** is an **underground stem** that grows horizontally and gives rise to roots and shoots.
- Examples of plants with rhizomes:
 - **Turmeric,**
 - **Ginger,**
 - **Banana,**
 - **Canna**

Conclusion:

Turmeric powder is obtained from the **rhizome** (underground stem) of the turmeric plant. Since none of the options mention "**rhizome**", the correct answer is:

Q43. How is Hydrogen stored physically?

- A. In form of hydrides
- B. In form of water
- C. By compressing hydrogen gas
- D. None of the above

Correct Answer: (c) By compressing hydrogen gas

Detailed Solution:

1. What is Physical Storage of Hydrogen?

- **Physical storage** refers to storing hydrogen **without altering its chemical structure**, i.e., as **molecular hydrogen (H₂)** in gaseous or liquid form.

◇ 2. Methods of Physical Storage:

(c) By Compressing Hydrogen Gas – Correct

- Hydrogen gas (H₂) is stored in high-pressure **gas cylinders**.
- Typically stored at **pressures of 350–700 bar (5000–10,000 psi)**.
- This is the **most common physical storage** method.
- Used in fuel cells, hydrogen-powered vehicles, and labs.

(a) In form of hydrides – Incorrect

Metal hydrides (like sodium borohydride, magnesium hydride) store hydrogen **chemically**, not physically.

(b) In form of water – Incorrect

Water (H₂O) contains hydrogen atoms, but **hydrogen is chemically bonded**, not stored in free form.

(d) None of the above – Incorrect

Option (c) is correct, so this can't be the answer.

3. Other Physical Storage Options (for context):

- **Liquid hydrogen:** Stored at **-253°C** (cryogenic storage).

- **Adsorption:** In **porous materials** (like activated carbon), still under research.

Q44. As the diameter of the objective lens of a telescope increases, the resolution of the telescope:

- A. Remains same
- B. Depends on focal length of lens
- C. Increases
- D. Decreases

Correct Answer: (c) Increases

Detailed Explanation:

1. What is Resolution in a Telescope?

Resolution refers to the telescope's ability to **distinguish between two closely spaced objects**. A higher resolution means the telescope can see finer details and separate stars or planets that are close together.

◇ 2. Role of Diameter of Objective Lens:

- The **objective lens** or mirror is the part of the telescope that gathers light.
- A **larger diameter** allows the telescope to **collect more light** and also to **resolve smaller details**.
- As the diameter increases, the telescope can distinguish between objects that are closer together in the sky.
- So, the **resolution improves** with increasing diameter.

Why Other Options Are Incorrect?

- **(a) Remains same** – Incorrect because resolution **does change** with diameter.
- **(b) Depends on focal length** – Focal length affects **magnification**, not directly the resolution.
- **(d) Decreases** – Incorrect because increasing diameter **improves** resolution, not worsens it.

Q45. Compared to a burn due to air at 100°C, the burn due to steam at 100°C is:

- A. Less dangerous due to high latent heat of evaporation
- B. More dangerous due to high latent heat of evaporation
- C. Less dangerous due to low latent heat of evaporation
- D. More dangerous due to low latent heat of evaporation

Correct Answer: (b) More dangerous due to high latent heat of evaporation

 Easy Explanation:

Both **hot air** and **steam** at **100°C** are hot, but **steam causes a worse burn**.

◇ *Why is steam more dangerous?*

- When **steam touches your skin**, it **turns into water** (condenses).
- While doing this, it gives off **extra heat energy** — this is called **latent heat**.
- This **extra heat** goes into your skin and causes **more damage** than just hot air.

◇ *Hot air just feels hot.*

But it **doesn't release extra heat** like steam does.

So, it's **less harmful** compared to steam at the same temperature.

Conclusion (in short):

- **Steam at 100°C gives more severe burns than air at 100°C** because it releases **extra hidden heat** when it turns into water. So the correct answer is:
(b) More dangerous due to high latent heat of evaporation

Q46. Light weight bullet-proof helmets and jackets use which of the following fibres for their production?

- A. Terylene
- B. Nylon
- C. Kevlar
- D. None of the above

Correct Answer: (c) Kevlar

Easy Explanation:

What is Kevlar?

- **Kevlar** is a **strong synthetic fibre** made from a type of plastic (called aramid).
- It is **5 times stronger than steel** (by weight).
- Kevlar is **lightweight but extremely strong**, making it perfect for making **bullet-proof jackets and helmets**.

◇ *Why not other options?*

- **Terylene** — Used in making clothes and plastics, **not strong enough** for bullet-proof materials.
- **Nylon** — Strong and elastic, but **not as tough** as Kevlar.
- **Kevlar** — Specifically designed for **high-strength protective gear**.

Conclusion:

Kevlar is the fibre used to make **lightweight, bullet-proof helmets and jackets** due to its **extreme strength and durability**.

 Correct answer: (c) Kevlar

Q47. What is the unit of measure of magnetic field?

- A. Cobalt
- B. Ampere
- C. Ohm
- D. Tesla

Correct Answer: (d) Tesla

Easy Explanation:

What is a magnetic field?

- A **magnetic field** is the area around a magnet or current-carrying wire where magnetic force can be felt.
- It is measured to know **how strong** the magnetic effect is.

◇ *What is Tesla?*

- **Tesla (T)** is the **SI unit** of magnetic field strength (also called magnetic flux density).
- It tells us **how strong the magnetic field is** in a given area.
- Named after the famous scientist **Nikola Tesla**.

Why other options are wrong:

- **(a) Cobalt** — It is a magnetic metal, **not a unit**.
- **(b) Ampere** — It is the unit of **electric current**, not magnetic field.
- **(c) Ohm** — It is the unit of **electrical resistance**.

Conclusion:

The **magnetic field** is measured in **Tesla**, which is the **standard unit** in physics.

 Correct Answer: (d) Tesla

Q48. Besides spreading Malaria, Anopheles mosquitoes are also vectors of

- A. Dengue and Filariasis
- B. Dengue and Encephalitis
- C. Encephalitis and Filariasis
- D. None of the above

Correct Answer: c) Encephalitis and Filariasis

What is a vector?

A vector is a living organism (like a mosquito) that carries and spreads disease-causing germs from one person or animal to another.

About Anopheles mosquitoes:

- They are mainly known for spreading **malaria**, which is caused by a parasite.
- But they can **also spread** two other diseases:
 - **Filariasis** — a disease caused by tiny worms that affect the lymphatic system

- **Encephalitis** – a condition where the brain gets inflamed, usually due to a virus

Why other options are wrong:

- Option a: Dengue is spread by **Aedes mosquitoes**, not Anopheles
- Option b: Again, dengue is not spread by Anopheles
- Option d: Incorrect, because Anopheles **does** spread filariasis and encephalitis

Q49. Blood group of an individual is determined by

- A. Presence of Haemoglobin
- B. Combination of WBC and RBC
- C. Shape of RBC
- D. None of the above

Correct Answer: d) None of the above

Easy Explanation:

What actually determines blood group?

- A person's **blood group** (like A, B, AB, or O) is determined by the **type of antigens** present on the surface of **Red Blood Cells (RBCs)**.
- These antigens are **special proteins or sugars** known as **A and B antigens**.
- Another important factor is the **Rh factor** (positive or negative), which is **another antigen**.

Why are the options incorrect?

- **Presence of Haemoglobin** – Haemoglobin is a protein in RBCs that **carries oxygen**, but it does **not determine** blood group.
- **Combination of WBC and RBC** – Blood group depends **only on antigens on RBCs, not on WBCs** (white blood cells).
- **Shape of RBC** – Shape does not affect blood group. All normal RBCs are disc-shaped, regardless of group.

Conclusion:

- Blood group is determined by **specific antigens on the surface of RBCs**, not by haemoglobin, WBCs, or shape of cells. Since none of the options mention **antigens**, the correct answer is:
- **d) None of the above**

Q50. One of the properties associated with X-rays is that they can be deflected by:

- A. Both electric and magnetic fields together
- B. Electric fields only
- C. Magnetic fields only
- D. None of the above

Correct Answer: d) None of the above

Easy Explanation:

What are X-rays?

- X-rays are a type of **electromagnetic wave**, just like visible light, radio waves, or gamma rays.
- They have **no charge** and **no mass**.
- Because of this, they behave like **neutral waves**.

Can X-rays be deflected by electric or magnetic fields?

- No, X-rays **cannot be deflected** by either electric or magnetic fields.
- Only **charged particles** (like electrons or protons) can be deflected by these fields.
- Since **X-rays have no charge**, they **pass straight through** such fields unaffected.

Why other options are incorrect:

- **Option a (both fields):** Only applies to charged particles. Not valid for X-rays.
- **Option b (electric only):** X-rays are unaffected by electric fields.
- **Option c (magnetic only):** Again, only charged particles are affected by magnetic fields.

Q51. The number of scientific payloads on the Aditya-L1 mission for the systematic study of the Sun is:

- A. 9
- B. 6
- C. 7
- D. 5

Correct Answer: c) 7

Easy Explanation:

◇ *What is Aditya-L1?*

- **Aditya-L1** is India's **first space-based mission to study the Sun**.
- Launched by **ISRO** (Indian Space Research Organisation).
- It is positioned at the **Lagrange Point 1 (L1)**, about 1.5 million kilometers from Earth, where it can continuously observe the Sun without any eclipses.

◇ *Scientific Payloads on Aditya-L1:*

The mission carries **7 scientific instruments (payloads)** to study different layers and aspects of the Sun, such as:

- **Visible Emission Line Coronagraph (VELC)** – studies solar corona
- **Solar Ultraviolet Imaging Telescope (SUIT)** – studies Sun's photosphere and chromosphere
- **Aditya Solar wind Particle Experiment (ASPEX)** – analyzes solar wind particles

- **Plasma Analyser Package for Aditya (PAPA)** – studies solar wind composition
- **Solar Low Energy X-ray Spectrometer (SoLEXS)** – monitors soft X-rays
- **High Energy L1 Orbiting X-ray Spectrometer (HEL1OS)** – studies hard X-rays
- **Magnetometer** – measures magnetic fields at L1 point

Q52. Which of the following is responsible for production of shadow?

- A. Polarisation
- B. Rectilinear propagation of light
- C. Diffraction
- D. Interference

Correct Answer: b) Rectilinear propagation of light

Easy Explanation:

- ♦ What is a shadow?

A **shadow** is formed when an object **blocks light** and prevents it from reaching a surface behind it. This creates a **dark region** (shadow) on that surface.

Why does shadow form?

- Light travels in a **straight line** — this is known as **rectilinear propagation of light**.
- Because of this straight-line motion, when something blocks the light, the area behind the object doesn't get light, forming a shadow.

Why other options are incorrect?

- **Polarisation** – It's related to the orientation of light waves, not shadow formation.
- **Diffraction** – It causes light to bend around small edges, but does **not cause shadow** directly.
- **Interference** – It's the mixing of light waves to create bright or dark patterns, not shadows.

Q53. An electron of mass M kg and charge e coulomb travels from rest through a potential difference of V volts. The final energy in joules would be:

- A. eV
- B. M
- C. E/V
- D. MeV

Correct Answer: (a) eV

Easy Explanation:

When a **charged particle** (like an electron) is accelerated through a **potential difference (V)**, it gains **kinetic energy**. This energy is given by the formula:

$$\text{Energy} = \text{Charge} \times \text{Potential difference}$$

$$E = e \times V$$

Where:

- e = charge of the electron (in coulombs)
- V = potential difference (in volts)
- So, the energy is eV (in joules)

Why are the other options wrong?

- **(b) M** – Mass (M) is not energy.
- **(c) E/V** – That would give charge (e), not energy.
- **(d) MeV** – " MeV " is a unit of energy (Mega electron Volt), not the actual value in joules unless specified. The correct value in joules is $e \times V$.

Q54. When antigens are introduced into the body through vaccination, antibodies are produced to fight off infection. These antibodies are produced:

- A. By both B and T cells
 - B. By only B cells
 - C. By only T cells
 - D. None of the above
- Correct Answer: (b) By only B cells

When we are given a **vaccine**, it contains **antigens** (weakened or inactive forms of germs). These **antigens** don't cause disease but **stimulate our immune system**.

Our immune system has special types of **white blood cells**:

 **B cells (B lymphocytes):**

- Their **main job** is to make **antibodies**.
- Antibodies are proteins that **attach to antigens** and help destroy them.
- **So, only B cells produce antibodies.**

 **T cells (T lymphocytes):**

- They help by **killing infected cells** and **activating B cells**.
- But they **do not produce antibodies** themselves.

Why are other options incorrect?

- **(a) Both B and T cells** → T cells don't make antibodies.
- **(c) Only T cells** → T cells help in defense, but **don't produce antibodies**.
- **(d) None of the above** → Antibodies are produced, by **B cells**.

Q55. Name of the first 3D printed humanoid robot in India is:

- A. Indro
- B. Robcop
- C. Mitra
- D. Manav

Correct Answer: (d) Manav

Easy Explanation:

- **Manav** is widely recognized as **India's first 3D-printed humanoid robot**, developed by **Diwakar Vaish** at **A-SET Training & Research Institutes**. It debuted at the **IIT Bombay TechFest 2014-15**
- The robot resembles a person and stands about **2 feet tall**, weighing just **2 kg**, and its **outer body is entirely made from 3D-printed plastic**.
- Manav is equipped with cameras, microphones, and 21 servos, enabling it to **walk, dance, play football, and follow voice commands** — neatly combining robotics and 3D-printing innovation

Summary:

- Manav: India's pioneering 3D-printed humanoid robot
- Inventor: Diwakar Vaish
- Year: Late 2014, showcased during IIT Bombay's TechFest 2014-15
- Features: Lightweight, voice- and vision-enabled, entirely 3D-printed

Q56. Which of the following vitamins are water soluble?

- (a) Vitamin A
- (b) Vitamin D
- (c) Vitamin K
- (d) None of these

ANS:- (d); None of these

Summary Table:

Vitamin	Solubility	Function
Vitamin A	Fat-soluble	Vision, skin, immune function
Vitamin D	Fat-soluble	Calcium absorption, bone health
Vitamin K	Fat-soluble	Blood clotting
B & C	Water-soluble	Energy metabolism (B), immunity (C)

Q57. Which of the following is the first artificially prepared element?

- A. Th
- B. Ti
- C. Te
- D. Tc

Correct Answer: Technetium (Tc)

Background:

Technetium (symbol: **Tc**, atomic number: **43**) is **the first element to be artificially synthesized**. It does not

naturally occur in significant quantities on Earth because **it is radioactive** and all its isotopes have relatively short half-lives compared to the age of the Earth.

How was it discovered?

- **Discovered in 1937** by **Carlo Perrier** and **Emilio Segrè**, Technetium was the **first element to be created artificially**.
- They isolated it from **molybdenum (Mo)** that had been **bombarded with deuterons** (hydrogen nuclei with one neutron).
- The isotope **Technetium-99m** is now widely used in **medical imaging**.

 Why is it artificial?

Technetium is **not found in nature in stable form**.

It was **created in a laboratory before it was found in nature**, making it the **first man-made element**.

Even though **trace amounts** of Technetium have been found in nature later (e.g., in uranium ores), its initial production was purely artificial.

Why not the others?

Element	Symbol	Naturally Occurring ?	Artificial ?	Notes
Thorium	Th	Yes	No	Naturally occurring radioactive metal
Titanium	Ti	Yes	No	Found in minerals like rutile and ilmenite
Tellurium	Te	Yes	No	Rare, but naturally occurring

 Summary:

- **Technetium (Tc)** is the **first element that was artificially prepared** in a laboratory (1937).
- It was **not discovered in nature** before that.
- It marks the beginning of **man-made elements** in the periodic table.

Q58. Which part of the alimentary canal receives bile from the liver?

- A. Small intestine
- B. Large intestine
- C. Stomach
- D. Oesophagus

Answer: (a) Small intestine

Detailed Explanation:

Bile is a **greenish-yellow fluid** produced by the **liver** and stored in the **gallbladder**. It plays a crucial role in the **digestion and absorption of fats**.

Key Functions and Pathway of Bile:

1. **Production:**
 - **Liver** continuously produces bile.
2. **Storage:**
 - Bile is stored and concentrated in the **gallbladder**.
3. **Release:**
 - When **fatty food** enters the **duodenum** (first part of the **small intestine**), the gallbladder contracts and releases bile.
 - This release is triggered by a hormone called **cholecystikinin (CCK)**.
4. **Pathway:**
 - Bile flows from the **gallbladder** through the **bile duct** into the **duodenum**.
5. **Function in Small Intestine:**
 - Bile **emulsifies fats** (breaks them into small droplets), increasing the surface area for enzymes like **lipase** to act efficiently.

Why not the other options?

Option	Organ	Reason it's incorrect
(b) Large intestine	Absorbs water & minerals	Does not receive bile
(c) Stomach	Digests proteins via acid and pepsin	No bile enters here
(d) Oesophagus	Carries food to stomach	No role in digestion or bile

 **Conclusion:**

- The **small intestine**, specifically the **duodenum**, is the **correct site** where bile is delivered for digestion.
- It plays a vital role in **fat digestion and absorption**.

Q1. Which of the following corundum and cryolite are important ores of?

- A. Tin
- B. Iron
- C. Aluminium
- D. Silver

Answer: (c) Aluminium

Detailed Explanation:

Corundum and **cryolite** are **important minerals associated with aluminium**, although they differ in how aluminium is extracted from them.

◇ 1. Corundum (Al_2O_3):

- It is a **naturally occurring mineral form of aluminium oxide**.
- Corundum is **not typically used as a primary ore for aluminium extraction**, but it's an **important aluminium-containing mineral**.
- **Hardness:** 9 on the Mohs scale (second hardest after diamond).
- **Uses:**
 - Abrasives (e.g., sandpapers)
 - Gemstones (ruby and sapphire are varieties of corundum)

◇ 2. Cryolite (Na_3AlF_6):

- A **rare mineral** used in the **extraction of aluminium**.
- It is **not an ore** in the sense of providing aluminium directly, but it plays a **critical role in the electrolytic extraction process**.
- **Function:**
 - Acts as a **flux** in the **Hall-Héroult process**.
 - **Lowers the melting point** of alumina (Al_2O_3), making the electrolysis of aluminium economically feasible.

Main Ore of Aluminium:

- **Bauxite** ($\text{Al}_2\text{O}_3 \cdot x\text{H}_2\text{O}$) is the **chief ore** of aluminium, from which aluminium is actually extracted.
- However, **corundum** (Al_2O_3) and **cryolite** (Na_3AlF_6) are **important related minerals** in the production and processing of aluminium.

Q59. Which of the following the chlorophyll in photosynthesis is used for?

- A. (a) No function
- B. (b) Absorbing light
- C. (c) Reduction of CO_2
- D. (d) Breaking down water molecules

Answer: (b) Absorbing light

 **Detailed Explanation:**

Chlorophyll is the **green pigment** found in the **chloroplasts** of plant cells. It plays a **crucial role in photosynthesis**, which is the process by which plants convert **light energy into chemical energy**.

 **Function of Chlorophyll in Photosynthesis:**

- **Chlorophyll absorbs light energy**, primarily from the **blue and red** wavelengths of the sunlight.
- This **absorbed energy** is then used to **drive the light-dependent reactions** of photosynthesis.

- Specifically, it **excites electrons**, initiating the **electron transport chain** in the thylakoid membranes.

 Why not the other options?

Option	Explanation
(a) No function	Incorrect – Chlorophyll is essential for light absorption.
(c) Reduction of CO₂	This occurs in the Calvin cycle (light-independent reactions) and does not directly involve chlorophyll.
(d) Breaking down water molecules	Water is split during the light reaction , but by the oxygen-evolving complex (not chlorophyll itself). Chlorophyll's role is to capture light , not to split water directly.

Summary:

- Chlorophyll = Light absorber**
- It is **not directly involved in CO₂ fixation or water splitting**.
- It initiates photosynthesis by **absorbing light** and passing energized electrons into the **photosystems**.

Q60. Which of the following are exothermic processes?

- Evaporation of water
- Dilution of an acid (H₂SO₄)
- Reaction of water with quick lime
- Sublimation of camphor (crystals)

- i and iv
- i and ii
- iii and iv
- ii and iii

Answer: (d) ii and iii

Detailed Explanation:

Exothermic processes are those that **release heat** into the surroundings.

Let's examine each process:

ii. Dilution of Sulfuric Acid (H₂SO₄):

- Highly exothermic process.**
- When **concentrated sulfuric acid is diluted with water**, a **large amount of heat is released**.
- That's why **acid should always be added to water slowly**, never the other way around — to avoid splashing due to sudden boiling.

iii. Reaction of Water with Quick Lime (CaO):

- CaO + H₂O → Ca(OH)₂ + heat**
- This is a **vigorous exothermic reaction**.
- It releases **a lot of heat**, sometimes enough to **boil water** or cause burns.
- Quick lime is used in **whitewashing**, where this heat helps in setting.

i. Evaporation of Water:

- Endothermic process.**
- Water molecules **absorb heat** from surroundings to escape as vapor.
- It causes **cooling** — that's why sweating cools your body.

iv. Sublimation of Camphor:

- Also an **endothermic process**.
- Camphor absorbs **heat** to change directly from solid to vapor.
 - Like evaporation, **energy is taken in**.

Summary Table:

Process	Exothermic / Endothermic	Explanation
i. Evaporation of water	Endothermic	Absorbs heat to convert liquid to vapor
ii. Dilution of acid (H₂SO₄)	Exothermic	Releases large amount of heat
iii. Water + Quick lime (CaO)	Exothermic	Releases heat during reaction
iv. Sublimation of camphor	Endothermic	Absorbs heat to convert solid to vapor

Q61. The process of breaking down organic matter by microorganisms is called

- Decomposition
- Fermentation
- Respiration
- Photosynthesis

Answer: (a) Decomposition

Detailed Explanation:

Decomposition is the **biological process** by which **microorganisms like bacteria and fungi** break down **complex organic matter** (such as dead plants, animals, and waste) into **simpler substances**.

 How It Works:

- Microorganisms **feed on dead and decaying material**.

- They **break down complex organic compounds** (proteins, carbohydrates, fats) into **simpler molecules** like **carbon dioxide (CO₂)**, **water (H₂O)**, **ammonia (NH₃)**, and **minerals**.
- This process **releases nutrients** back into the soil and environment, helping in **nutrient cycling**.

Importance of Decomposition:

- Essential part of the **ecosystem** and **carbon cycle**.
- Maintains **soil fertility**.
- Prevents accumulation of **dead organic material**.

Why Not the Others?

Option	Process	Why It's Incorrect
(b) Fermentation	Anaerobic breakdown of sugar by microbes (e.g., in making alcohol or curd)	Not general breakdown of all organic matter
(c) Respiration	Process by which organisms convert glucose to energy	Involves glucose, not overall decomposition
(d) Photosynthesis	Plants convert CO ₂ + H ₂ O into glucose using sunlight	It's a constructive (not breakdown) process

Conclusion:

- **Decomposition** is the **correct term** for the microbial breakdown of organic matter.
- It plays a **vital ecological role**.

Q62. What is the structural and functional unit of life?

- A. Tissue
 - B. Organism
 - C. Cell
 - D. Organ
- Answer: (c) Cell

Detailed Explanation:

The **cell** is known as the **structural and functional unit of life** because:

◇ 1. Structural Unit:

- All **living organisms** are made up of **cells**.
- In **unicellular organisms** (like Amoeba, Paramecium), a single cell performs all life functions.
- In **multicellular organisms**, cells form **tissues**, tissues form **organs**, and organs form **organ systems**.

2. Functional Unit:

- All basic life processes—like **nutrition, respiration, excretion, reproduction, and response to stimuli**—occur within the **cell**.
- Even in multicellular organisms, it is the **cells** that perform specific functions (e.g., muscle cells for movement, nerve cells for conduction).

Discovery of Cell:

- Discovered by **Robert Hooke** in **1665** while observing cork under a microscope.
- The word "cell" comes from the Latin *cellula*, meaning **small room**.

Why Not the Other Options?

Option	Explanation
(a) Tissue	Group of similar cells performing a function, but not the basic unit of life
(b) Organism	Entire living being, made up of many cells, not the basic unit
(d) Organ	Made up of tissues; higher level of organization than cells

Q63. Which of the following is the fluid part of the blood?

- A. Blood platelets
- B. RBC
- C. WBC
- D. Plasma

Answer: (d) Plasma

💧 Detailed Explanation:

Plasma is the **fluid, straw-colored part of the blood** that makes up about **55%** of total blood volume. It acts as the **transport medium** for various substances in the body.

◇ Composition of Plasma:

- **90–92% Water**
- **Proteins:** Albumin, globulin, fibrinogen
- **Nutrients:** Glucose, amino acids, fatty acids
- **Waste products:** Urea, uric acid
- **Gases:** Oxygen, carbon dioxide
- **Hormones, enzymes, antibodies, electrolytes**

◇ Functions of Plasma:

- **Transports** nutrients, hormones, and waste materials.
- **Maintains blood pressure** and volume.
- Helps in **thermoregulation**.
- Contains **clotting factors** for wound healing.

Why Not the Other Options?

Component	Full Form	Function	Why Incorrect?
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(a) Blood platelets	Also called thrombocytes	Help in blood clotting	Solid component
(b) RBC	Red Blood Cells	Transport oxygen via hemoglobin	Solid/cellular part
(c) WBC	White Blood Cells	Defend body against infections	Solid/cellular part

Conclusion:

Among the options, **only plasma is the fluid** component of blood that suspends the other cells and carries nutrients and waste.

Q64. Which of the following is equivalent to tesla?

- A. Newton per ampere-second
- B. Newton per ampere meter
- C. Ampere per Newton
- D. Newton per Coulomb

Answer: (b) Newton per ampere meter

Detailed Explanation (Without Symbols or Formulas):

- **Tesla** is the SI unit used to measure the **strength of a magnetic field**. It describes how strong the magnetic force is in a given area when current flows through a conductor.
- A **magnetic field of one tesla** is defined as the force of one newton acting on a one-meter length of wire carrying one ampere of current at right angles to the magnetic field.

Why not the other options?

Option	Meaning	Why Incorrect
(a) Newton per ampere-second	Incorrect combination of units, not related to magnetic field	
(c) Ampere per Newton	Inverted and incorrect unit	
(d) Newton per Coulomb	This is the unit of electric field, not magnetic field	

Q65. Which one of the following is an example of melamine used for making floor tiles?

- A. PVC
- B. Thermo setting plastic
- C. Polyethene
- D. Thermoplastic

Answer: (b) Thermo setting plastic

Detailed Explanation:

Melamine is a **thermosetting plastic**, which means:

- Once it is molded and set by heat, it **cannot be softened or reshaped** by heating again.
- It becomes **hard, rigid, and heat-resistant**.

Uses of Melamine:

- **Floor tiles**
- **Kitchenware** (like plates and bowls)
- **Fire-resistant fabrics**
- **Furniture laminates**

It is **durable, scratch-resistant, and does not melt**, making it ideal for **floor tiles** and other long-lasting surfaces.

Why Not the Other Options?

Option	Type	Why Incorrect
(a) PVC	Thermoplastic	Used in pipes, wires — can be softened on heating
(c) Polyethene	Thermoplastic	Used in bags and bottles — softens on heating
(d) Thermoplastics	General term for plastics that melt on heating	Melamine is not thermoplastic

Q66. Which of the following is the value of the solar constant?

- A. 1.2 kW/m²
- B. 1.8 kW/m²
- C. 1.6 kW/m²
- D. 1.4 kW/m²

Answer: (d) 1.4 kW/m²

Detailed Explanation:

The **solar constant** is defined as:

The amount of **solar energy received per unit area per second** on a surface **perpendicular to the Sun's rays**, in **space**, at the average distance of the Earth from the Sun.

Numerical Value:

- The **standard accepted value** of the solar constant is approximately **1.366 kilowatts per square meter (kW/m²)**, often rounded off to **1.4 kW/m²**.

Key Points:

- This value is **measured outside Earth's atmosphere**, before any atmospheric absorption or scattering.
- On Earth's surface, the value is **lower** due to **cloud cover, atmospheric gases, and angle of incidence**.
- It represents the **maximum possible solar power** per unit area in space.

Q67. Which of the following are the constituents of a soda acid fire extinguisher?

- A. Dilute sulphuric acid and sodium bicarbonate solution
- B. Concentrated sulphuric acid and sodium carbonate solution
- C. Concentrated sulphuric acid and aluminium sulphate
- D. Dilute sulphuric acid and sodium

Answer: (a) Dilute sulphuric acid and sodium bicarbonate solution

 Detailed Explanation:

A **soda acid fire extinguisher** is a **traditional type of fire extinguisher** used mainly for **Class A fires** (caused by combustible materials like wood, paper, cloth).

 Constituents:

- **Dilute sulphuric acid** (kept in a sealed container or vial inside the extinguisher)
- **Sodium bicarbonate solution (NaHCO₃)** — fills the main body of the extinguisher

 How it works:

1. When the extinguisher is activated (by striking or inverting it), the **acid mixes with the sodium bicarbonate solution**.
2. This causes a **chemical reaction**, releasing **carbon dioxide gas (CO₂)**:
 - CO₂ forms **foam or bubbles** and is released under pressure.
3. The **CO₂ displaces oxygen** near the fire, **suffocating the flames** and extinguishing the fire.

Why not the other options?

Option	Why Incorrect
(b) Concentrated sulphuric acid is dangerous and not used; sodium carbonate is less effective	
(c) Aluminium sulphate is not part of soda acid extinguishers	
(d) Reaction of sulphuric acid with sodium metal is highly explosive and unsafe	

Q68. Which of the following bacterial diseases is called as splenic fever?

- A. Cholera
- B. Typhoid
- C. Anthrax

D. None of the above

Correct Answer: (c) Anthrax

Detailed Explanation:

Anthrax is a **bacterial disease** caused by the bacterium *Bacillus anthracis*.

It is commonly referred to as "**splenic fever**", especially in animals, because:

- It often causes **swelling and hemorrhaging of the spleen**.
- In animals, the spleen becomes **enlarged and darkened**, hence the name.

 Key Points about Anthrax:

- **Causative agent:** *Bacillus anthracis* (a gram-positive, spore-forming bacterium)
- **Transmission:** Contact with infected animals, animal products, or spores
- **Types in humans:**
 - **Cutaneous Anthrax** (most common)
 - **Inhalation Anthrax** (most severe)
 - **Gastrointestinal Anthrax**
- **Symptoms:** Skin ulcers, fever, difficulty breathing (depending on the type)

Q69. Which of the following bacterial diseases is called as splenic fever?

- A. Cholera
- B. Typhoid
- C. Anthrax
- D. None of the above

Correct Answer: (c) Anthrax

Explanation:

- **Anthrax** is also known as "**splenic fever**" because it often causes **enlargement and hemorrhage of the spleen** in infected animals and humans.
- It is caused by the **bacterium *Bacillus anthracis***, which forms hardy spores that can survive in soil for decades.
- It primarily affects herbivorous animals, but can be transmitted to humans via:
 - Contact with infected animals or animal products (cutaneous anthrax)
 - Inhalation of spores (inhalational anthrax)
 - Ingestion (gastrointestinal anthrax)

Other options:

- (a) **Cholera** – caused by *Vibrio cholerae*, affects the intestines.

- (b) **Typhoid** – caused by *Salmonella typhi*, affects the intestinal tract and bloodstream.
- (d) None of the above – incorrect, as (c) is correct.

Q70. Which component of fertilizer is used for stimulating early growth purpose?

- A. Oxygen
- B. Phosphorus
- C. Potassium
- D. Nitrogen

Correct Answer: (b) Phosphorus

Explanation:

- **Phosphorus (P)** plays a **key role in root development, energy transfer (ATP), and early plant growth.**
- It helps plants establish a strong root system in the early stages, which is essential for:
 - Seedling vigor
 - Early shoot and leaf development
 - Flower and fruit formation later in the plant's lifecycle

Other Options:

- **Oxygen** – Not a fertilizer component; plants get it from air and water.
- **Potassium (K)** – Helps in **flowering, fruiting, and disease resistance**, not early growth.
- **Nitrogen (N)** – Promotes **leafy growth** and is essential later for vegetative development, but **not specifically for early root development.**

Remember:

NPK fertilizers = **Nitrogen (N), Phosphorus (P), Potassium (K)**

- **P** = Early growth and roots
- **N** = Leaf and shoot development
- **K** = Overall strength and disease resistance

Q71. Which of the following is the resistance of the wire ?

- A. $R = IV$
- B. $R = I/2V$
- C. $R = V/I$
- D. $R = I/V$

Correct Answer: c) $R = V/I$

- **Correct Answer: c) $R = V/I$**

• **Explanation:**

- The resistance of a wire is determined using Ohm's Law, which states:
- $V = IR$
- Where:
 - V is the voltage across the wire (in volts),
 - I is the current flowing through the wire (in amperes),

– R is the resistance of the wire (in ohms).

- Rearranging the formula to solve for resistance (R):
- $R = V/I$
- Thus, the correct formula for resistance is $R = V/I$, which corresponds to option c.

Q72. Which of the following pairs will give displacement reactions?

- A. FeSO_4 solution and silver metal
- B. MgCl_2 solution and aluminium metal
- C. AgNO_3 solution and copper metal
- D. NaCl solution and copper metal

Answer: (c) AgNO_3 solution and copper metal

Explanation:

A displacement reaction occurs when a more reactive metal displaces a less reactive metal from its salt solution.

- Reactivity order of metals:
 $K > Na > Ca > Mg > Al > Zn > Fe > Pb > (H) > Cu > Hg > Ag > Au$
- In option (c), copper (Cu) is more reactive than silver (Ag). So, copper can displace silver from silver nitrate (AgNO_3) solution:

Q73. Which of the following acid is secreted in the stomach?

- A. Phosphoric acid
- B. Hydrochloric acid
- C. Sulphuric acid
- D. Nitric acid

Answer: (b) Hydrochloric acid

Explanation:

The human **stomach secretes hydrochloric acid (HCl)** as a part of the digestive process. It is produced by the **parietal cells** (also called oxyntic cells) of the stomach lining. Hydrochloric acid serves several vital functions:

- It **creates an acidic environment** (pH 1.5 to 3.5) that helps in the **digestion of food**, especially proteins.
- It **activates pepsinogen into pepsin**, an enzyme that digests proteins.
- It **kills harmful bacteria and pathogens** that enter with food.
- It helps in the **absorption of certain nutrients** like iron and calcium.

Other acids like phosphoric, sulphuric, or nitric acid are not found in the human body and are not secreted in the stomach.

Therefore, the correct answer is (b) Hydrochloric acid.

Q74. Which of the following is a non-contact force?

- A. Impact force
- B. Magnetic force
- C. Frictional force
- D. None of these

Correct Answer: (b) Magnetic force

 **Explanation:**

Non-contact forces are those that act **without physical contact** between two objects.

 **(b) Magnetic Force – Correct**

- Acts at a distance.
- A magnet can attract or repel another object **without touching it**.

Other Options:

- **Impact Force** – Occurs due to **physical collision** → **contact force**
- **Frictional Force** – Requires **contact between surfaces** → **contact force**
- **None of these** – Incorrect because (b) is correct

Q75. Heat transfer that does not require a medium is called

- A. Conduction
- B. Convection
- C. Radiation
- D. Reflection

Answer: (c) Radiation

Explanation:

Radiation is the mode of **heat transfer** that does **not require any medium**—it can occur even in **vacuum**. In this process, heat is transferred through **electromagnetic waves**, mainly **infrared radiation**.

Example:

- The **Sun's heat reaches Earth** through **radiation**, as there is no medium (like air) in space.

Other options:

- **Conduction** requires a **solid medium**, where heat transfers from particle to particle.
- **Convection** occurs in **liquids and gases**, where particles themselves move to transfer heat.
- **Reflection** is **not a heat transfer** process; it is the bouncing back of light or heat.

Hence, the correct answer is **(c) Radiation**.

Q76. Who was the first one to propose a model for the structure of an atom?

- A. Neils Bohr
- B. J.J. Thomson

C. E. Goldstein

D. Rutherford

Answer: (b) J.J. Thomson

Explanation:

J.J. Thomson was the first scientist to propose a **model of the atom** in **1898** after discovering the **electron**. His model is known as the **"Plum Pudding Model"** (or raisin pudding model).

According to his model:

- The atom is a positively charged sphere with negatively charged electrons embedded in it like raisins in a pudding.
- The atom as a whole is electrically neutral.

Though this model was later replaced by more accurate models (like Rutherford's and Bohr's), it was the **first scientific attempt** to describe the **internal structure of the atom**.

Therefore, the correct answer is **(b) J.J. Thomson**.

Q77. According to the Reserve Bank of India, what is one of the eligibility criteria for a Small Finance Bank (SFB) to transition to a Universal Bank?

- A. Minimum net worth of ₹500 crore
- B. Minimum net worth of ₹1,000 crore
- C. Minimum net worth of ₹1,500 crore
- D. Minimum net worth of ₹2,000 crore

Answer: (b) Minimum net worth of ₹1,000 crore

Explanation:

As per the **Reserve Bank of India (RBI)** guidelines, a **Small Finance Bank (SFB)** can apply to become a **Universal Bank** only after meeting certain eligibility conditions. One of the key criteria is that the SFB must have a **minimum net worth of ₹1,000 crore**.

Other important conditions include:

- The SFB must have completed at least **5 years of operations**.
- It should have a **track record of sound financial performance and good governance**.
- RBI assesses parameters like **capital adequacy, asset quality, and compliance record** before granting approval.

This transition allows the SFB to offer a **wider range of banking services**, including larger corporate loans and international banking.

Hence, the correct answer is **(b) Minimum net worth of ₹1,000 crore**.

Q78. The meter that is used to measure the distance moved by the vehicle is known as

- A. Chronometer

- B. Odometer
C. Ammeter
D. Speedometer
Answer: (b) Odometer

Explanation:

An **odometer** is an instrument installed in vehicles that **measures the total distance** traveled by the vehicle. It is usually located on the **dashboard** near the speedometer and displays the distance in **kilometers or miles**.

- It helps vehicle owners track total mileage, which is important for maintenance, servicing, fuel efficiency calculations, and resale value.

Other options:

- Chronometer** is a precise time-keeping instrument used in navigation.
- Ammeter** measures **electric current** in a circuit.
- Speedometer** measures the **current speed** of the vehicle, not the total distance.

Therefore, the correct answer is **(b) Odometer**.

Q79. Q.40. Dalton's atomic theory successfully explained:

- Law of conservation of mass.
 - Law of constant composition.
 - Law of radioactivity.
 - Law of multiple proportion.
- A. i, ii and iv
B. i, iii and iv
C. ii, iii and iv
D. i, ii and iii

Answer: (a) i, ii and iv

Explanation

Dalton's atomic theory provided a strong foundation for understanding basic chemical laws. It stated that atoms are indivisible particles that cannot be created or destroyed in a chemical reaction, which clearly supports the **Law of Conservation of Mass**. It also proposed that atoms of different elements combine in fixed whole-number ratios to form compounds, supporting the **Law of Constant Composition** and the **Law of Multiple Proportion**. However, **Law of Radioactivity** was not known at Dalton's time and couldn't be explained by his theory. Therefore, the correct answer is **(a) i, ii and iv**.

Q80. Which of the following represent the suitable condition for the liquefaction of gases?

- A. High temperature, high pressure
B. High temperature, low pressure
C. Low temperature, high pressure
D. Low temperature, low pressure

Answer: (c) Low temperature, high pressure

Explanation

Liquefaction of gases means converting a gas into liquid. For this to happen, the gas particles must come close together, which is possible when the **temperature is low** (so particles move slowly) and **pressure is high** (so particles are forced closer). High temperature keeps particles too energetic to come together, and low pressure gives them too much space. Therefore, the most suitable condition for gas liquefaction is **low temperature and high pressure**, making option **(c)** the correct answer.

Q81. Which of the following radiation is used to get relief from body aches?

- A. Visible radiation
B. Infra-red radiation
C. UV radiation
D. None of these

Answer: (b) Infra-red radiation

Explanation (in English):

- Infra-red radiation is a type of electromagnetic wave that carries **heat energy**. It is **not visible to the human eye**, but it can penetrate the skin and **generate warmth** in tissues and muscles. That's why **infra-red lamps** are often used in physiotherapy and pain relief treatments. They **increase blood circulation**, relax muscles, and help **relieve body aches** like back pain, joint pain, or muscle soreness.
- Hence, the correct answer is:
- (b) Infra-red radiation.**

Q82. Which of the following are not the tastes of the tongue? (69th BPSC)

- Sweet
- Bitter
- Salty
- Spicy
- Umami
- Sour
- Pungent

Select the correct answer using the codes given below.

- A. 2, 5 and 7
B. 1, 3 and 4
C. 4 and 7
D. 3 and 6

Ans. C. 4 and 7

The traditional five basic tastes, such as sweet, sour, salty, bitter, and umami, have been part of our understanding of taste for years. However, recent scientific research has unveiled evidence of a sixth basic taste sensation.

Q83. Which of the following pairs are correctly matched? (69th BPSC)

1. Anorexia : Sleep disorder
2. Insomnia : Eating disorder
3. Dyspnoea : Shortness of breath
4. Anosmia : Partial or full loss of smell

Select the correct answer using the codes given below.

- A. Only 1 and 2
- B. Only 2 and 3
- C. Only 3 and 4
- D. All of the above

Ans. C. Only 3 and 4

- ❖ Anorexia is associated with 'Eating disorder'
- ❖ Insomnia – Sleep disorder
- ❖ Dyspnoea - Shortness of breath
- ❖ Anosmia is associated with 'Partial or full loss of smell'.

Q84. In the universe, what are pulsars? (69th BPSC)

- A. A group of stars
- B. Rotating neutron stars
- C. Explosion of a star
- D. Radio waves emitted by a star

Ans. B. Rotating neutron stars

Pulsars are neutron stars which rotate on their axis. The rotation creates the pulses. They may or may not be created by the supernovas.

Q85. In the context of lab-grown diamonds (LGDs), what is used as a diamond seed? (69th BPSC)

- A. White sapphire
- B. Moissanite
- C. Graphite
- D. Cubic zirconia (CZ)

Ans. C. Graphite

Diamond structure can be produced by graphite only by applying temperature of 3000k and pressure of 125000 atmosphere. Catalysts such as chromium, Iron or platinum may be use.

White Sapphire is Aluminium Oxide. It cannot form diamond which is pure carbon

Q86. What is the 'fibre' used to make bulletproof jackets? (69th BPSC)

- A. Nylon
- B. Terylene
- C. Tweed
- D. Kevlar

Ans. D. Kevlar

Kevlar is a polymer of p-phenylenediamine and Terephthalic acid. The fibre produced has ten times greater tensile strength than steel.

Uses of Nylon

- ❖ Clothing – Shirts, Foundation garments, lingerie, raincoats, underwear, swimwear and cycle wear.
- ❖ Industrial uses – Conveyer and seat belts, parachutes, airbags, nets and ropes, tarpaulins, thread, and tents.
- ❖ It is used to make a fishnet.
- ❖ It is used as plastic in manufacturing machine parts

Tweed

Tweed is a rough, woollen fabric, of a soft, open, flexible texture, resembling cheviot or homespun, but more closely woven. It is usually woven with a plain weave, twill or herringbone structure. Colour effects in the yarn may be obtained by mixing dyed wool before it is spun.

Terylene

Polyester (commonly referred to as Terylene) is resistant to stretching, shrinking, wrinkling and abrasion. This makes it popular for use in the manufacture of sleeves and connectors in product transfer applications.

Q87. What is/are the full form(s) of HMX? (69th BPSC)

1. High Melting Explosive
2. High-Density Monoatomic Xenon
3. Hedge Monetizing Xenocurrency
4. Her Majesty's Explosive

Select the correct answer using the codes given below.

- A. 1 and 2
- B. 2 and 3
- C. Only 1
- D. 1 and 4

Ans. C. Only 1

HMX (Octogen) is an acronym for High Melting eXplosive. It is also known as octogen and cyclotetramethylene-tetranitramine, as well as by other names. It is a colorless solid that dissolves slightly in water.

Q88. What is the name of Tesla's humanoid robot launched in October 2022? (69th BPSC)

- A. Sophia
- B. Atlas
- C. Pepper
- D. Optimus

Ans. D. Optimus

Tesla CEO Elon Musk released AI-powered humanoid robot, 'Optimus', engaging in various activities in October 2022

Q89. What is the 'Manhattan Project'? (69th BPSC)

- A. A research and development undertaking that produced the first nuclear weapons
- B. One of the largest art auctions of the world
- C. A real estate project in New York City
- D. A famous theme park

Ans. A. A research and development undertaking that produced the first nuclear weapons

The Manhattan Project has a top secret research and development undertaking, by USA, to make atomic bomb during World War II.

Q90. The image formed by concave mirror is real, inverted and of the same size as that of the object. The position of the object should be (69th BPSC)

- A. at the focus
- B. at the centre of curvature
- C. between the focus and centre of curvature
- D. beyond the centre of curvature

Ans. B. at the centre of curvature

When the object is at the centre of curvature (C) of the concave mirror then the image formed is real, inverted and of the same size as that of the object and the image forms at the centre of curvature itself.

Position of the object	Position of the image	Nature and size of the image	Use
At infinity	At the focus	Real, inverted and diminished	As collector of radiation in solar heating devices
Beyond the centre of curvature	Between the focus and the centre of curvature	Real, inverted and diminished	
At the centre of curvature	At centre of curvature	Real, inverted and same size as object	As a reflecting mirror behind a projector lamp
Between the focus and centre of curvature	Beyond the centre of curvature	Real, inverted and magnified	In flood lights
At focus	At infinity	Real, inverted and magnified	As a reflecting mirror in car, head lights, search lights etc.
Between the pole of the mirror and the focus	Appears behind the mirror	Virtual, erect and magnified	As a shaving mirror or makeup mirror and dentist's mirror

Q91. A photoelectric cell is a device which (69th BPSC)

- A. converts light energy into electric energy
- B. converts electric energy into light energy
- C. stores light energy
- D. None of the above

Ans. A. converts light energy into electric energy

A photo electric cell such as solar cell or photo transistor converts light energy into electric energy.

Name of apparatus	Transformation of energy
Dynamo	Conversion of mechanical energy into electric energy

Electric motor	Conversion of electrical energy into mechanical energy
Microphone	Conversion of sound energy into electrical energy
Loudspeaker	Conversion of electric energy into sound energy
Solar cell	Conversion of solar energy into electrical energy
Tubelight	Conversion of electric energy into light energy
Electric bulb	Conversion of electric energy into heat and light energy
Electric cell	Conversion of chemical into electric energy
Candle	Conversion of chemical energy into heat and light energy
Sitar	Conversion of mechanical energy into sound energy

Q92. The amount of solute present per unit volume or per unit mass of the solution/solvent is known as _____ in Chemistry. (69th BPSC)

- A. composition of solute
- B. concentration of solvent
- C. concentration of solute
- D. concentration of solution

Ans. D. concentration of solution

The amount of solute present per unit volume or unit mass of the solution/solvent is known as the Concentration of a solution. SI unit is moles per cubic meter. The number of moles of solute = mass of solute (in gm) / molar mass of solute.

Q93. How do COVID vaccines stimulate an immune response?(69th BPSC)

- A. By introducing live attenuated SARS-CoV-2 virus
- B. By introducing a real SARS-CoV-2 virus
- C. By introducing a harmless piece of SARS-CoV-2 virus
- D. By introducing antibodies against SARS-CoV-2 virus

Ans. A. By introducing live attenuated SARS-CoV-2 virus

Immune responses can be stimulated in host by introducing live, attenuated pathogen i.e SARS CoV2 virus. Option 'B' and option 'D' are not associated with the mechanism of stimulating immune response by covid vaccines.

The statement made in option 'C' is unscientific. WHO recommended two main types of SARS CoV2 vaccines- 1. mRNA vaccines 2. Vector vaccines.

Recently, Novavax Inc. Maryland, USA has made covid vaccine using spike protein of omicron variant XBVB.1.5 and FDA has granted its emergency use authorization to

the people of age of 12 and above, who has not received their updated mRNA vaccines on 3rd Oct 2023. Nevertheless, the introduction of adjuvanted spike protein can't be considered as harmless piece, since it is the main component of the virus through which it enters the host and spread the infection.

Q94. Which of the following liquids is a bad conductor of electricity? (69th BPSC)

- A. Salted water
- B. Orange juice
- C. Lemon juice
- D. None of the above

Ans. D. None of the above

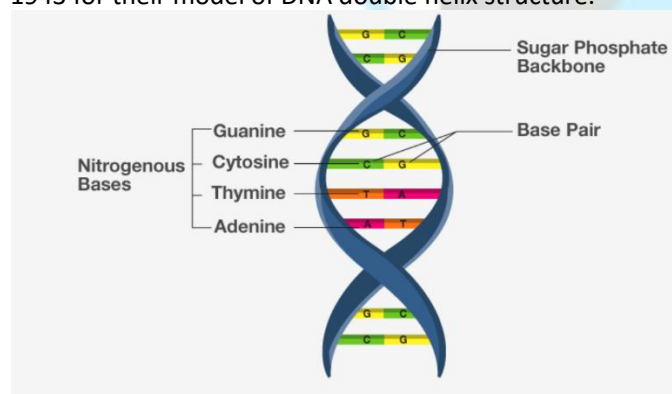
A salt water is completely ionized in water. Hence it is a good conductor of electricity. Orange and Lemon juice contain various salts and acids and are therefore good conductors of electricity. 'D' is the only option for a bad conductor.

Q95. The DNA double helix structure was discovered by (69th BPSC)

- A. James Watson and Francis Crick
- B. Rosalind Franklin and Maurice Wilkins
- C. Linus Pauling
- D. Gregor Mendel

Ans. A. James Watson and Francis Crick

James Watson and Francis Crick received Nobel Prize, 1943 for their model of DNA double helix structure.



Q96. Two objects of different masses falling freely near the surface of the Moon would (69th BPSC)

- A. have different accelerations
- B. undergo a change in their inertia
- C. have same velocity at any instant
- D. experience forces of same magnitude

Ans. C. have same velocity at any instant

The Question does not give the parameters for height and time. Assuming that both objects are dropped at the same

time from the same reasonable height, they will have "The same velocity at any instant" as they fall freely near the surface of the moon

Q97. How do vector vaccines work to provide immunity? (69th BPSC)

- A. By introducing a weakened or inactivated virus into the body
- B. By directly attacking and destroying pathogens in the body
- C. By placing the virus in a modified version of a different virus
- D. By entering directly into the cells and enabling them to create spike proteins

Ans. C. By placing the virus in a modified version of a different virus

Vector vaccine refers to the introduction of viral gene into a harmless virus (adeo virus) i.e. Modified version of another virus, which is then introduced in the host body to stimulate immune response. Hence option 'C' is correct. Option 'A' and 'B' are not related to vector vaccines. Option 'D' is one of the principles of vaccines against SARS - COV-2 but no vector was used in this technology.

Q98. What is the expanded form of the term 'mRNA' that has been widely discussed since the beginning of the pandemic? (69th BPSC)

- A. Messenger Ribonucleic Acid
- B. Mutant Ribonucleic Acid
- C. Modified Ribonucleic Acid
- D. Mnemonic Ribonucleic Acid

Ans. A. Messenger Ribonucleic Acid

mRNA stands for messenger RiboNucleic Acid and is the single stranded molecule that carries the instructions to make proteins. During pandemic mRNA is detected by RT-PCR for diagnosis of disease

Q99. An AC current can be produced by (69th BPSC)

- A. choke coil
- B. dynamo
- C. transformer
- D. None of the above

Ans. B. Dynamo

An AC current is produced by a Dynamo which is called AC Dynamo or Alternator. This is done by rotating a coil or Armature within the magnetic field created by field coils. If a DC current is required it can be supplied by a commutator in a DC Dynamo.

AC Generator	DC Generator
AC generator is a mechanical device which converts mechanical energy into AC electrical power.	DC generator is a mechanical device which converts mechanical energy into DC electrical power.
In an AC generator, the electrical current reverses direction periodically.	In a DC generator, the electrical current flows only in one direction.
In an AC generator, the coil through which the current flows is fixed while the magnet moves. The construction is simple and costs are less.	In a DC generator, the coil through which the current flows rotates in a fixed field. The overall design is very simple but construction is complex due to commutators and slip rings.
AC generator does not have commutators.	DC generators have commutators to make the current flow in one direction only.
AC generators have slip-rings.	DC generators have split-ring commutators.

Q100. Current density is (69th BPSC)

- A. a scalar quantity
- B. a vector quantity
- C. dimensionless
- D. None of the above

Ans. B. a vector quantity

Before thinking about the question, we will understand the concepts of vector and scalar quantity. A quantity that has magnitude, as well as direction is known as vector quantity but it doesn't have a position, it is represented by an arrow. Some examples of vector quantity are velocity and force and the other side a quantity that has only magnitude, no direction is known as a scalar quantity. Some examples of scalar quantity are mass and speed. Now, we will understand the current and current density. Current is produced when electric charge flows in a direction. Its unit is Ampere. The current is a scalar quantity. Now, we will be able to understand the concept of current density - The amount of current flowing in per unit area is known as the current density. It is the ratio of the amount of current flowing and the area of current flowing, the current density is represented as J and its unit is Ampere/m^2 . Current density is a vector quantity because it's a product of charge density and velocity, here charge density is a scalar quantity and velocity is a vector quantity, which makes current density also a vector quantity.

Q101. What is the basis of most useful classification of medications in medical chemistry? (69th BPSC)

- A. Pharmacological
- B. Molecular targets
- C. Chemical structure
- D. None of the above

Ans. B. Molecular targets

- ❖ We have to know that during the design of drugs which have various classification in medical chemistry. There are,
 - Based on the chemical structure of the drug
 - Based on the drug action in our body
 - Based on the solubility of the drug
 - Based on the molecular target
 - Based on the pharmaceutical effect of the drug.
- ❖ We must remember that the one drug designed for the guest and host method is the correct way. In this way design of drug like lock and key method. Drug to attack over target like a key to affect the target. This classification of designing only able to give best result. One drug to attack the target and destroy them. This is ultimate aim for drug designing in medical chemistry. Therefore, the most useful classification of drugs for medical chemists is on the basis of molecular targets.
- ❖ We have to know the chemical structure of the drug, various drugs able to design and prepare in drug. The some functional groups and substitution groups in the structure. This sometimes affects the reactivity of the drug in another environment. So, the drug design based on the structure is sometimes not applicable. Therefore, option C is not the correct answer.
- ❖ We need to know that the pharmaceutical effect of the drug is various from one person to another person. The amount of drugs is mainly in medicinal chemistry. Over intake of drugs leads to some problems or death also. So, the pharmaceutical effect of the drug is a suitable way for design of drugs. Therefore, option A is not the correct answer.

Q102. Which of the following slows down the reaction rate? (69th BPSC)

- A. Catalytic promoter
- B. Homogeneous catalyst
- C. Heterogeneous catalyst
- D. None of the above

Ans. D. None of the above

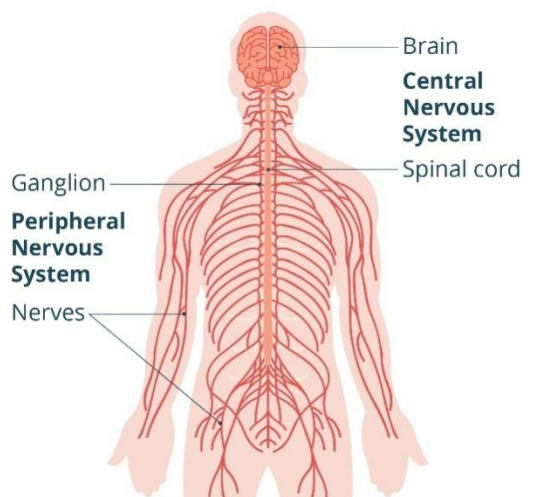
Homogeneous catalysis because a catalyst is a substance that boosts the rate of a reaction but does not change chemically during the process. The reactants and catalyst are in the same phase in homogeneous catalysis (i.e., liquid or gas). The activity of the catalyst is reduced by the promoter. The correct answer should be B but BPSC considered D as the correct option.

Q103. Input and output nerves meet at (69th BPSC)

- A. liver
- B. central nervous system
- C. heart
- D. None of the above

Ans. B. central nervous system

The central nervous system has four parts, namely, Brain, Spinal cord, Nerve and Neurons. The Input and output nerves meet at several places, particularly in the spinal cord. They do not meet in the liver or the heart as they do not form part of nervous system



Q104. Large number of thin strips of black paint are made on the surface of a convex lens of focal length 20 cm to catch the image of a white horse. The image will be (68th BPSC)

- A. A zebra of black stripes
- B. A horse of black stripes
- C. A horse of less brightness
- D. More than one of the above

Answer: C. A horse of less brightness

An image of a white horse is captured by the convex lens. Since the light falling on the curved portion won't react at the picture point, the white horse's entire image is produced, but its intensity is reduced. **A horse of less brightness is produced by the lens.**

Convex Lens

- ✚ The convex lens is relatively thick in the center and thin at the lower and higher borders.
- ✚ It converges light rays that travel parallel to its principal axis.
- ✚ Instead of curving inside, the edges are curled outward.

Concave Lens

- ✚ A concave lens has thicker edges and a thinner center.

- ✚ It is one that bends a straight light beam away from the source and focuses it into a distorted, upright virtual image.

Q105. Shrillness of sound is determined by (68th BPSC)

- A. Amplitude of Sound
- B. Wavelength of Sound
- C. Velocity of Sound
- D. More than one of the above

Answer: B. Wavelength of Sound

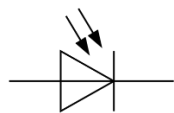
- ❖ It is true that shrillness of sound is determined by its frequency but frequency and wavelength are inversely proportionate. So, it is also true to say that shrillness of sound depends on its wavelength. Since, frequency and wavelength are inseparably interlinked ($\text{velocity} = \text{wavelength} \times \text{frequency}$ and velocity is constant in a medium), the correct answer is 'b'.
- ❖ The amplitude of sound determines the loudness of a sound. The larger the amplitude, the louder the sound.
- ❖ The velocity of sound refers to the speed at which sound waves propagate through a particular medium, such as air, water, or solids. The velocity of sound can vary depending on the properties of the medium, such as its density, temperature, and elasticity.

Q106. Which of the following photoelectric devices is most suitable for digital applications? (68th BPSC)

- A. Photovoltaic cell
- B. Photoemitter
- C. Photodiode
- D. More than one of the above

Answer: A. Photovoltaic cell

- ❖ Photovoltaic cells or commonly known as solar cells have vast use in digital technology. For example, entire satellite communication depends on it since this is the main source of power for it.
- ❖ A photodiode is a PN-junction diode that consumes light energy to produce an electric current. They are also called a photo-detector, a light detector, and a photo-sensor. Photodiodes are designed to work in reverse bias condition.
- ❖ **Typical photodiode materials are Silicon, Germanium and Indium gallium arsenide.**



The symbol of the photodiode is similar to that of an LED, but here the arrow points inwards.

Q107. Ball Bearings are used to convert static friction into (68th BPSC)

- A. Drag
- B. Sliding
- C. Rolling
- D. More than one of the above

Answer: C. Rolling

- ❖ Ball bearings are used to convert static friction into rolling friction.
- ❖ Ball bearings convert static friction into rolling friction.
- ❖ They consist of small metal balls housed within a ring or raceway.
- ❖ The rolling motion of the metal balls reduces resistance and minimizes friction.
- ❖ This allows for smoother movement, reduced wear and tear, and improved efficiency in mechanical systems.

Rolling Friction Examples

Rolling friction is one of the types of kinetic or dynamic friction, which comes into force when one body rolls over the other. For example, when a circular disc, a wheel, a ring, or a sphere rolls over the surface, a force that opposes its motion is the rolling friction.

Other examples are:

- ❖ A basketball rolling on the court comes to rest after some time.
- ❖ A tire rolling on the road or skateboard wheels rolling on the road are all examples of rolling friction.
- ❖ The shape, size, and weight are the factors that affect the motion of vehicles; for example, a twenty-wheeler heavy loaded truck will have higher rolling friction than that of a TATA Nano Car.
- ❖ Painting the walls using paint rollers.

Static Friction Examples

Static friction acts on two bodies in contact, i.e., one body over the other. Let us consider a few real-life examples:

- ❖ While walking, our feet's backward motion exerts pressure on the road as the other foot goes forward.
- ❖ Static friction generates when two fabrics slide over each other.

Sliding Friction Examples

When an object slides over the other, an opposing force that comes into play is the sliding friction. Illustrative sliding friction examples are as follows:

- ❖ Pushing a lawn roller on the grass.
- ❖ Rubbing one's hands together causes heat because of the sliding friction.
- ❖ Opening a sliding door/window.
- ❖ Dragging mouse on the surface.
- ❖ Sliding chalk to make art on the floor.
- ❖ Speed car racing.

Fluid Friction Examples

- ❖ While swimming, a swimmer experiences an opposing force; this force is the fluid friction force.
- ❖ While sucking a drink through a straw, you experience some friction; that friction is fluid friction.
- ❖ During skydiving, the parachute slows down because of the air resistance.
- ❖ Flying a paper made an aeroplane.

Q108. A goalkeeper in a game of football pulls his hands backward after holding the ball shot at the goal. This enables the goalkeeper to (68th BPSC)

- A. Exert large force on the ball
- B. Increase the force exerted by the ball on hands
- C. Decrease the rate of change of momentum
- D. More than one of the above

Answer: C. Decrease the rate of change of momentum

- ❖ After holding the ball, the goalkeeper pulls his hands backward to slow down the rate of change of momentum while increasing the time.
- ❖ The force is directly related to the rate of change of momentum, this allows less force to be exerted on his hands if he moves his hands backward.
- ❖ According to Newton's second law, the rate of change of momentum of a body is equal to the force applied to the body.

We know that force is equal to the rate of change of momentum. When a moving ball is caught by the goalkeeper, ultimately it stops. It means the change in momentum of the ball will be same whether he catches the ball directly or by moving his hands backwards. By moving his hand backwards during the catch, he gives more time to change the momentum of the ball. This process ensures minimum acceleration, hence the force will be minimum by the goalkeeper on the ball. The law of action-reaction says that the force on the goalkeeper by the ball will also be minimum.

Q109. Which among the following is a positively charged particle emitted by a radioactive element? (68th BPSC)

- A. Beta ray
- B. Alpha ray
- C. Cathode ray
- D. More than one of the above

Answer: B. Alpha ray

Alpha rays are the positively charged particles. Alpha-particle is highly active and energetic helium atom that contains two neutrons and protons. These particles have the minimum penetration power and highest ionization power. They can cause serious damage if get into the body due to their high ionization power. They are capable of ionizing numerous atoms by a short distance. It is due to the fact that the radioactive substances that release alpha particles are required to be handled after wearing rubber gloves.

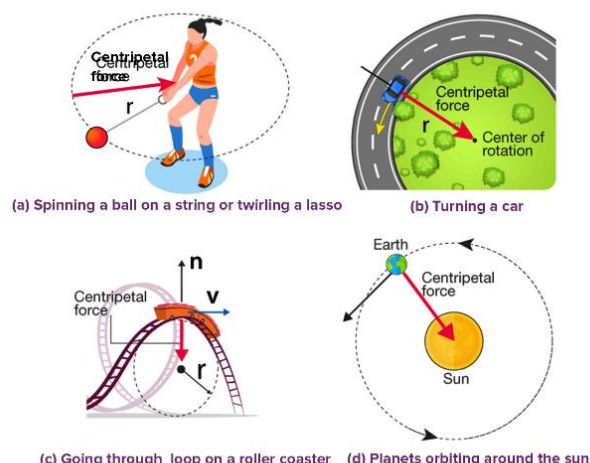
Properties	α -Rays	
Penetrating power.	Low penetrating power (even stopped by a thick paper)	Penetrating that of α -Ray penetrate the foil.
Effect of an electric and magnetic field.	Deflected by both the fields (in accordance with Fleming's left hand rule.)	Deflected by the direction opposite to the left hand rule.)
Speed	Their speed ranges from $1/10$ to $1/20$ times the speed of light.	Their speed times the speed of light.

Q110. Centripetal force is responsible to (68th BPSC)

- A. Keep the body moving along the circular path
- B. Fly the object along a straight line
- C. Independent motion of the object in space
- D. More than one of the above

Answer: A. Keep the body moving along the circular path

- ❖ Centripetal force is the force acting on an object in curvilinear motion directed towards the axis of rotation or center of curvature.
- ❖ When an object which moves in a circular path experiences a force acting radially inwards called centripetal force.
- ❖ The force is directed inward toward the rotational axis.



Q111. Which of the following energy changes involves frictional force? (68th BPSC)

- A. Potential Energy to Sound Energy
- B. Chemical energy to heat energy
- C. Kinetic energy to heat energy
- D. More than one of the above

Answer: C. Kinetic energy to heat energy

Kinetic energy to heat energy:

- ❖ The conversion of kinetic energy to heat energy often involves frictional forces.
- ❖ When objects rub or slide against each other, the friction between their surfaces converts some of the kinetic energy into heat energy.
- ❖ This energy transformation occurs in various situations, such as rubbing your hands together, where the kinetic energy of your hands is converted into heat energy due to friction.
- ❖ Similarly, when a vehicle moves on the road, the friction between the tires and the road surface causes some of the kinetic energy of the vehicle to be converted into heat energy.

Dynamo	Conversion of mechanical energy into electrical energy
Electric motor	Conversion of electrical energy into mechanical energy
Microphone	Conversion of sound energy into electrical energy.
Loudspeaker	Conversion of electric energy into sound energy
Solar cell	Conversion of solar energy into electrical energy
Tubelight	Conversion of electric energy into light energy.

Electric bulb	Conversion of electric energy into heat energy and light energy
Electric cell	Conversion of chemical energy into electric energy.
Candle	Conversion of chemical energy into light & heat energy.
Sitar	Conversion of mechanical energy into sound energy.

Q112. A bus is moving along a straight path and takes a sharp turn to the right side suddenly. The passengers sitting in the bus will (68th BPSC)

- A. Fall in the forward direction
- B. Bent towards the left side
- C. Bent towards the right side
- D. More than one of the above

Answer: B. Bent towards the left side

A bus is moving along a straight path and takes a sharp turn to the right side suddenly. The passengers sitting on the bus will bend towards the left side. The lower portion of passengers closest to the bus tends to go in the direction of the sharp turn because of centripetal force, but the upper portion of passengers throws an outside centrifugal force. This is happening due to two forces that are acting at that time centripetal and centrifugal forces.

Q113. Before playing the orchestra in a musical concert, a sitarist tries to adjust the tension and pluck the string suitably. By doing so, he/she is adjusting (68th BPSC)

- A. Amplitude of sound
- B. Intensity of sound
- C. Frequency of the sitar string with the frequency of other musical instruments
- D. More than one of the above

Answer: C. Frequency of the sitar string with the frequency of other musical instruments

- ❖ When a string is plucked, it vibrates, producing sound waves. The pitch or frequency of the sound produced is directly related to the frequency of vibration of the string
- ❖ Higher tension in the string results in a higher frequency of vibration and a higher pitch, while lower tension produces a lower frequency and a lower pitch.
- ❖ In an orchestra, different musical instruments play different pitches. To achieve harmony and coordination among the instruments, their frequencies need to be matched.

- ❖ The sitarist adjusts the tension of the sitar string to align its frequency with the frequencies of the other instruments being played.
- ❖ This adjustment ensures that the sitar's sound blends well with the overall sound produced by the orchestra, resulting in a harmonious and coordinated musical performance.

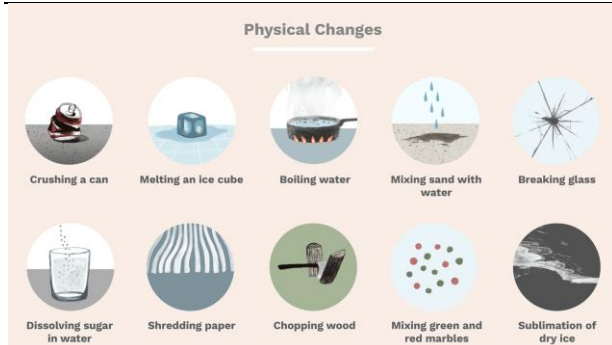
Q114. Detect the odd one(68th BPSC)

- A. Setting of cement
- B. Burning of coal
- C. Ripening of fruit
- D. None of the above

Answer: D. None of the above

- ❖ Water and cement initially form a cement paste that begins to react and harden (set). This paste binds the aggregate particles through the chemical process of hydration. In the hydration of cement, chemical changes occur slowly, eventually creating new crystalline products, heat evolution, and other measurable signs. Setting of cement is an example of permanent change which is irreversible, hence is not a physical change.
- ❖ Ripening of fruit is a chemical change. When the fruit gets ripped, the pigments present in the fruit skin get changed and this process cannot get reversed.
- ❖ The burning of coal is a chemical change. When the coal gets burnt, the carbon present in the coal gets converted into a carbon dioxide gas. The burning of coal is an irreversible process.





Q115. A form of matter has no fixed shape but it has a fixed volume. An example of this form of matter is (68th BPSC)

- A. Krypton
- B. Kerosene
- C. Carbon Steel
- D. More than one of the above

Answer: B. Kerosene

Krypton is a gas and kerosene is liquid. While both don't have fixed form, it is kerosene whose volume cannot be changed significantly with pressure/temperature whereas krypton being a gas, its volume can be changed drastically with change of pressure/temperature. So, it is kerosene alone which has no fixed form but fixed volume. So, the correct answer is (b).

Q116. Which gas contributes to global warming through its greenhouse effect? (68th BPSC)

- A. Nitrous Oxide
- B. Methane
- C. Carbon dioxide
- D. More than one of the above

Answer: D. More than one of the above

The greenhouse effect is a phenomenon where certain gases in the Earth's atmosphere trap heat from the sun and warm the planet.

These gases are known as greenhouse gases and include

- ❖ carbon dioxide
- ❖ methane
- ❖ nitrous oxide
- ❖ fluorinated gases
- ❖ water vapour

Q117. Some metal oxides react with acid as well as base to produce salt and water. They are known as amphoteric oxides. The examples amphoteric oxides are (68th BPSC)

- A. Al_2O_3 and ZnO
- B. Al_2O_3 and CuO

- C. CuO and ZnO
- D. More than one of the above

Answer: A. Al_2O_3 and ZnO

Both Al_2O_3 (aluminium oxide) and ZnO (zinc oxide) are examples of amphoteric oxides.

- ❖ They can react with both acids and bases to form salts and water, exhibiting their amphoteric nature.
- ❖ When these oxides react with acids, such as hydrochloric acid, they form salts (e.g., aluminium chloride, zinc chloride) and water. Similarly, when reacted with bases like sodium hydroxide, they yield salts (e.g., sodium aluminate, sodium zincate) and water.

Q118. Acids react with metal carbonates to liberate _____ gas. (68th BPSC)

- A. CO_2
- B. CO
- C. H_2
- D. More than one of the above

Answer: A. CO_2

Acid reaction with metal carbonates

Acids react with metal carbonates to liberate carbon dioxide gas.

The reaction occurs because

- ✚ the hydrogen ions from the acid react with the metal ions in the carbonate to form water
- ✚ the carbonate ion reacts with the hydrogen ion to form carbon dioxide.

The balanced chemical equation for this reaction can be written as:

Metal Carbonate + Acid $\rightarrow$ Salt + Carbon Dioxide + Water

- ❖ The carbonate ion reacts with the hydrogen ion to produce carbon dioxide gas and water.
- ❖ This reaction is exothermic, it releases heat energy and is a classic example of an acid-base reaction.
- ❖ The amount of carbon dioxide produced is proportional to the amount of acid used in the reaction.
- ❖ It can be measured by collecting the gas produced and weighing it.

CO (carbon monoxide) gas: This option is incorrect.

Carbon monoxide is typically produced from the incomplete combustion of carbon-containing materials.

H_2 (hydrogen) gas: This option is incorrect

Q119. Which acid is described as HOOC-COOH ? (68th BPSC)

- A. Oxalic Acid
- B. Acetic Acid
- C. Carbonic acid

D. More than one of the above

Answer: A. Oxalic Acid

- ❖ Oxalic acid is a dicarboxylic acid with a chemical formula $C_2H_2O_4$. It is also known as Ethanedioic acid or Oxiric acid. This organic compound is found in many vegetables and plants. It is the simplest dicarboxylic acid with condensed formula $HOOC-COOH$ and has an acidic strength greater than acetic acid.
- ❖ Acetic acid, systematically named ethanoic acid, is an acidic, colourless liquid and organic compound with the chemical formula CH_3COOH . Vinegar is at least 4% acetic acid by volume, making acetic acid the main component of vinegar apart from water.
- ❖ Carbonic acid is a chemical compound with the chemical formula H_2CO_3 . The molecule rapidly converts to water and carbon dioxide in the presence of water. However, in the absence of water, it is quite stable at room temperature.

Q120. The odour of acetic acid resembles that of (68th BPSC)

- A. Tomato
- B. Kerosene
- C. Vinegar
- D. More than one of the above

Answer: C. Vinegar

The odor of acetic acid closely resembles that of vinegar. This is because acetic acid is the main component of vinegar, and its characteristic smell is what gives vinegar its distinct aroma.

The sour, pungent, and slightly sweet scent of vinegar is primarily due to the presence of acetic acid.

Uses of Acetic Acid

- ❖ Ethanoic acid is used in the manufacturing of various dyes, plastics, rayons, silk, and perfumes.
- ❖ It is most simply used as table vinegar.
- ❖ In medicines, it is used as a local irritant.
- ❖ In the rubber industry, it is also used as a coagulating agent.
- ❖ It is useful in the manufacturing of acetate, acetone, and esters used in various industries.
- ❖ It is widely used in the production of VAM (vinyl acetate monomer).
- ❖ In the treatment of cancer, it is directly injected into the tumour.
- ❖ Acetic acid has desirable solvent properties, along with the ability to form miscible mixtures with both polar and nonpolar compounds. Hence, it is a very important industrial solvent. It is widely used in the industrial preparation of dimethyl terephthalate (DMT).

- ❖ It is an active micro bactericidal disinfectant that is also effective against most other bacteria.

Q121. You have been provided with three test tubes. One of them contains distilled water and the other two contain an acidic solution and a basic solution respectively. Which of them will turn red litmus to blue? (68th BPSC)

- A. Acid
- B. Base
- C. Distilled Water
- D. More than one of the above

Answer: B. Base

Acid:

- ❖ Acids can be defined in many ways but generally their aqueous solutions have the following properties.
- ❖ They are sour in taste.
- ❖ They turn blue litmus red.
- ❖ They react with certain metals and liberate hydrogen gas.
- ❖ They react with oxides and hydroxides of metals forming salt and water.
- ❖ Their aqueous solutions conduct electricity

Base:

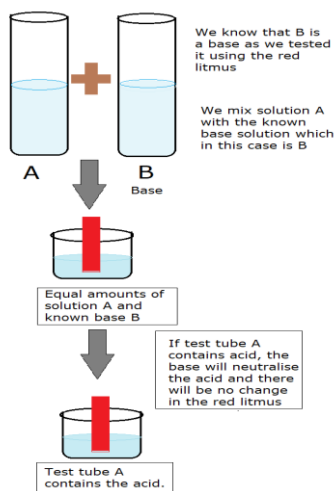
- ❖ Bases are defined in various ways but generally substances having the following characteristics are called bases.
- ❖ They have a bitter taste.
- ❖ Their aqueous solutions have a soapy touch.
- ❖ They turn red litmus blue.
- ❖ They react with acids to form salt and water.
- ❖ Their aqueous solutions conduct electricity.

Characteristic	Acids	Bases
Definition	Donate protons (H^+ ions)	Accept protons (H^+ ions) or donate pairs of electrons
pH on the Scale	Less than 7 (lower pH indicates stronger acid)	Greater than 7 (higher pH indicates stronger base)
Ion Formation	Produce hydrogen ions (H^+) when dissolved in water	Produce hydroxide ions (OH^-) when dissolved in water
Taste	Sour	Bitter
Feel (on Skin)	Can be corrosive and may cause a burning sensation	Slippery and soapy feeling
Examples	Hydrochloric acid (HCl), sulfuric acid (H_2SO_4)	Sodium hydroxide (NaOH),

potassium
hydroxide (KOH)

Distilled Water:

- ❖ Distilled water is neutral and has a pH value of 7. It does not significantly affect the color of litmus paper.



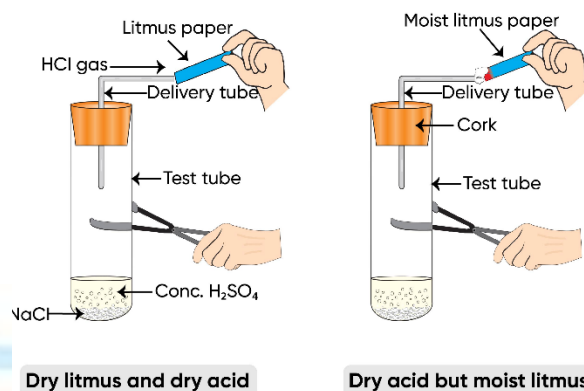
Q122. Why does dry HCl gas not change the color of dry litmus paper? (68th BPSC)

- Blue litmus becomes dry in the presence of dry HCl gas.
- No H_3O^+ ions are present. Litmus changes color only in the presence of H_3O^+ ions.
- HCl gas acts as a dehydrating agent.
- More than one of the above

Answer: B. No H_3O^+ ions are present. Litmus changes color only in the presence of H_3O^+ ions.

Dry HCl gas does not change the colour of dry litmus paper because no H_3O^+ ions are present. Litmus changes colour only in the presence of H_3O^+ ions. Dry HCl is not able to dissociate to give Hydrogen ions. Acids like HCl is only able to dissociate only in an aqueous medium. HCl is not aqueous and not the litmus paper is wet. Thus, there is no colour change in litmus paper.

WHY DOES DRY HCL GAS NOT CHANGE THE COLOUR OF THE DRY LITMUS PAPER



Q123. Which of the following statements about diamond and graphite is true? (68th BPSC)

- They have same crystal structure
- They have the same degree of hardness
- They have the same electrical conductivity
- None of the above

Answer: D. None of the above

Diamond and Graphite, both are known as the allotrope of Carbon, but neither their crystalline structure nor their hardness are same carbon other in diamond form 3-dimensional tetrahedron rings in a plane, diamond is one of the hardest material while graphite is very soft. Similarly, diamond is poor conductor of electricity whereas graphites are used in the manufacture of electrodes of carbon employed in the electrolytic cells as it is an excellent conductor of electricity- Hence none of the answer is correct.

Q124. The stomata open or close due to change in the – (68th BPSC)

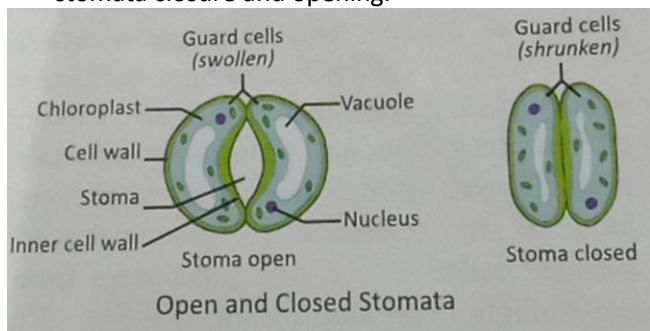
- Protein composition of cells.
- Amount of water in cells.
- Position of nucleus in cells.
- More than one of the above

Answer: B. Amount of water in cells

- ❖ Stomata opening and closure is a process that regulates gas exchange and water balance in plants.
- ❖ The process is controlled by two main cells called the guard cells. Guard cells are located around the stomatal pore and are responsible for opening and closing the pore.
- ❖ The water uptake controls the opening of the stomata by the guard cells It leads to turgor pressure and an

increase in the size of the guard cells. This causes the stomata to open and allow the exchange of gases. Gases such as carbon dioxide and oxygen are exchanged between the plant and the atmosphere.

- ❖ The stomata's closure results from water loss from the guard cells and a decrease in turgor pressure.
- ❖ This causes the guard cells to shrink, resulting in the stomata closing. Nucleus position and protein composition do not have any major effect on the stomata closure and opening.



Q125. Chlorophyll absorbs _____ wavelengths of the sunlight. (68th BPSC)

- A. Green and blue
- B. Green and red
- C. Red and Blue
- D. More than one of the above

Answer: C. Red and Blue

Chlorophyll is a chemical photoreceptor that traps light for photosynthesis in plants. It absorbs light in the red (long wavelength) and the blue (short wavelength) regions of the visible light spectrum. Green light is not absorbed but reflected, making the plant appear green.

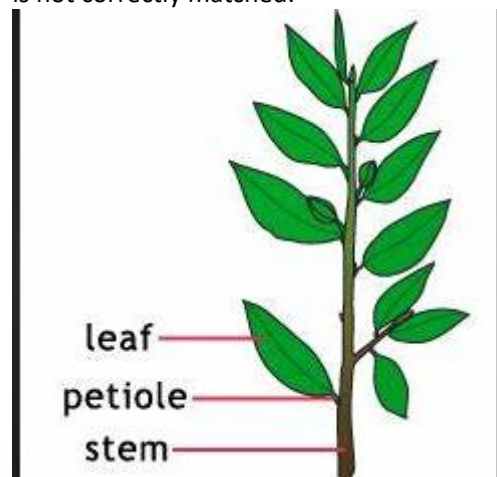
Q126. Which of the following is not a correct match? (68th BPSC)

- A. Thick, hard with branching near base: Tree
- B. Weak stem which cannot stand upright: Creeper
- C. Petiole: Attaches leaf to stem
- D. More than one of the above

Answer: A. Thick, hard with branching near base: Tree

Petiole, a part of leaf, attaches leaf to stem by leaf base. It also helps leaf blade to light & allow them to flutter in wind. Creepers are plants with weak soft stem that grow horizontally along with the soil since they cannot stand upright. Trees are tall and big plants having one hard woody stem, the trunk bearing wood branches, leaves and twigs always at some distance from ground, not near the base shrubs, on the other hand are plants with woody stem (thick, hard) with branches of almost equal size arising from the stem always above the soil near the base. Option (b) and (c) are correctly matched while option (a)

is not correctly matched.



Q127. Water reaches great heights in trees because of suction pull caused by (68th BPSC)

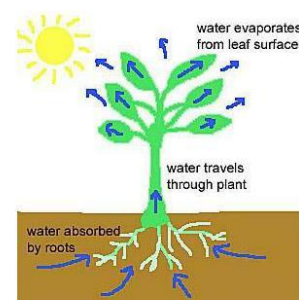
- A. Absorption
- B. Transpiration
- C. Evaporation
- D. More than one of the above

Answer: B. Transpiration

Transpiration is a process that involves loss of water vapour through the stomata of plant. The loss of water vapour from the plant cools the plant down when the weather is very hot, and water from the stem and roots moves upwards or is pulled into the leaves. On the other hand, plants absorb water and minerals from the soil via their roots but water does not move upward due to absorption. Similarly water escapes the tree through evaporation.

Transpiration

- The process by which plants roots lose water from leaves and stems through evaporation.



<http://www.youtube.com/watch?v=mc9gUm1mMzc>

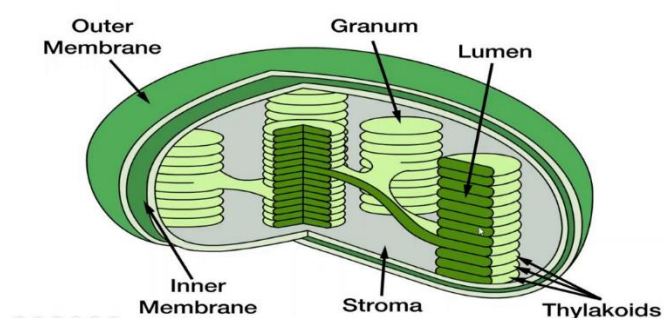
Q128. Which among the following is a character of chloroplast which makes them qualified for self-replication? (68th BPSC)

- A. Presence of DNA only
- B. Absence of RNA
- C. Presence of both DNA and RNA
- D. More than one of the above

Answer: C. Presence of both DNA and RNA

Presence of Both DNA & RNA in Chloroplast makes them qualified to self-replication. Chloroplasts, like mitochondria, contain their own DNA. This DNA is inherited from their ancestor—a photosynthetic cyanobacterium that was engulfed by an early eukaryotic cell.

Chloroplast



- ❖ Chloroplasts are found in all green plants and algae. They are the food producers of plants. These are found in mesophyll cells located in the leaves of the plants. They contain a high concentration of chlorophyll that traps sunlight. This cell organelle is not present in animal cells.
- ❖ Chloroplast has its own extra-nuclear DNA and therefore are semiautonomous, like mitochondria. They also produce proteins and lipids required for the production of chloroplast membrane.

Q129. The parts of the skeleton that are not as hard as bones and which can be bent are called as (68th BPSC)

- A. Carpals
- B. Cartilage
- C. Vertebrae
- D. More than one of the above

Answer: B. Cartilage

Cartilage

- ❖ It is a strong, flexible connective tissue that protects your joints and bones.
- ❖ It acts as a shock absorber throughout your body.
- ❖ Cartilage at the end of your bones reduces friction and prevents them from rubbing together when you use your joints.

- ❖ It's also the main tissue in some parts of your body and gives them their structure and shape.

Carpals

- ❖ The carpal bones are a group of eight small bones that make up the wrist in higher vertebrates. It helps in connecting the hand to the forearm. The bones facilitate easy movement and flexibility in the arm.
- ❖ The eight bones are scaphoid, trapezium, trapezoid, lunate, capitate, pisiform, triquetrum and hamate. These eight bones are arranged in three columns.

Vertebrae

- ❖ Vertebrae are the individual bones that make up the spinal column or backbone.
- ❖ While vertebrae are relatively rigid, they are not as flexible as cartilage.

Q130. In lichen, a chlorophyll containing partner _____ lives together. (68th BPSC)

- A. Fungus and a bacterium
- B. Algae and a virus
- C. Algae and a fungus
- D. More than one of the above

Answer: C. Algae and a fungus

A chlorophyll containing partner, which is an algae and fungus living together. The fungus provide shelter, water and minerals to algae. In return, the algae provides food which is prepared by it through photosynthesis.

Q131. Female Anopheles can be distinguished from female Culex because it sits (68th BPSC)

- A. At an angle with substratum
- B. Parallel to the surface of the substratum
- C. At right angle to the surface of the substratum
- D. More than one of the above

Answer: A. at an angle with substratum

- ❖ Mosquito is a vector and transmits the disease.
- ❖ Insects, when fed on human blood transmit the pathogen.
- ❖ Anopheles transmits malaria parasites.
- ❖ Culex transmits the west Nile virus and filarial nematodes.
- ❖ There are differences between female culex and female anopheles in their feeding pattern, size, eggs, and habitat.
- ❖ Female Anopheles body rests at an angle to the substratum
- ❖ Culex body rests parallel to the substratum.
- ❖ Anopheles mosquito makes angles its body at 45 degrees from the surface

Q132. The most important cell type associated with the immunity of the body is (68th BPSC)

- A. Platelets
- B. Lymphocytes
- C. RBCs
- D. More than one of the above

Answer: B. Lymphocytes

Lymphocytes, a white blood cell found in the blood and lymphatic system, play a crucial role in adaptive or acquired immunity. They are classified as agranulocytes, with B and T lymphocytes comprising approximately 20-25% of total white blood cells. Lymphocytes make up about 99% of the cells in the lymph.

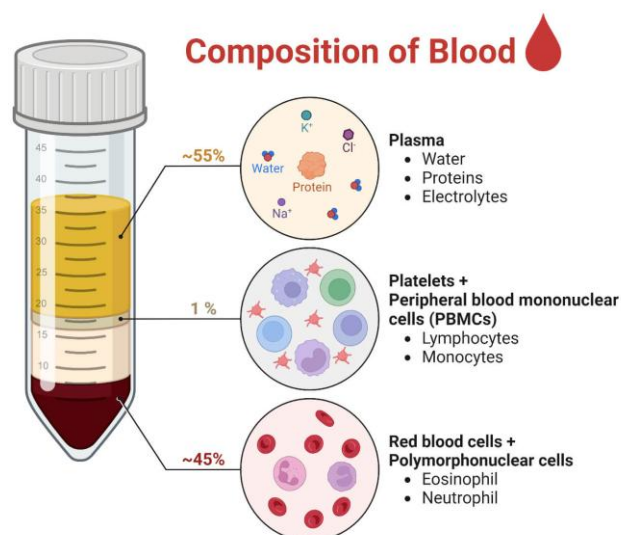
Lymphocytes are primarily found in lymphoid organs such as the spleen, lymph nodes, and tonsils. They play a key role in initiating immune responses against foreign pathogens. All lymphocytes originate from stem cells in the bone marrow. B-lymphocytes mature in the bone marrow, while T-lymphocytes mature in the thymus. Upon exposure to antigens, B and T lymphocytes differentiate into effector and memory cells. Lymphocytes are responsible for both humoral (antibody-mediated) and cell-mediated immune responses.

Red Blood Cell

- ❖ The Red Blood Cells (RBCs) are also known as Erythrocytes.
- ❖ RBCs contain the iron-rich protein called haemoglobin that gives blood its red colour.
- ❖ RBCs are the most copious blood cell produced in bone marrows. Their main function is to transport oxygen from and to various tissues and organs.

Blood platelets

Blood platelets are tiny blood cells that form clots over the injury and stop the bleeding. These blood cells are produced in the bone marrow and appear as a small, disc-shaped, colourless fragment without a nucleus. The total number of platelets present in the blood usually varies between 1,50,000 and 4,50,000 per cubic millimetre in a healthy individual.



Q133. Which one of the following statements is incorrect about muscles in the human body? (68th BPSC)

- A. Muscle work in pairs
- B. Muscles become shorter, stiffer and thicker when contracted
- C. Muscles can only push the bone
- D. More than one of the above

Answer: C. Muscles can only push the bone

- ❖ Muscles are part of the human skeletal system.
- ❖ Myofibers form muscles and parallel bundles of myofibrils form these muscles. **Muscles consist of various proteins such as actin, myosin, troponin, and tropomyosin.**
- ❖ It helps in locomotion.
- ❖ Muscles can pull not push.
- ❖ It is because muscles contract with the help of proteins actin and myosin. Muscles work in pairs.
- ❖ One muscle contracts and the other relaxes, thus working in pairs.
- ❖ Muscles get shorter, stiffer, and thicker when contracted.
- ❖ The length of sarcomere shortens while contracting. Muscles become longer and thinner while relaxing.

Q134. Which type of lens is used in magnifying glass? (67th BPSC Re-exam)

- A. Plano-Concave lens
- B. Convex lens
- C. Convex Mirror
- D. Concave lens

Answer: B. Convex lens

Uses of Convex Lenses

- ❖ Magnifying Glass

- When the rays enter the convex lens of the magnifying glass, these rays focus on a specific focal point at the center of it.

❖ **In Cameras**

- Most of the cameras that we use have convex lenses, while a few have concave lenses.
- Convex lenses help focus on the image well and magnify these at the same time.

❖ **Microscope Lenses**

- Convex lenses are also called microscopic lenses.
- A simple microscope usually has three lenses, out of which, one (convex lens) produces an inverted and magnified image of microorganisms like bacteria, amoeba, etc.

❖ **Multi-Junction Solar Cells**

- Convex lenses are widely used for multi-junction electric cell. The lens is added above the Fresnel lens to increase the output power of the setup and retrieve the requirement for the employment of solar trackers.

Concave lens	Convex lens
(i) It is called diverging lens.	(i) It is called converging lens.
(ii) This lens is thinner in the centre than at its edges.	(ii) This lens is thicker at the centre than at its edges.
(iii) The principal focus is virtual.	(iii) The principal focus is real.
(iv) The focal length is negative.	(iv) The focal length is positive.
(v) This lens is used to correct myopia.	(v) This lens can be used to correct hypermetropia.

Q135. The paramagnetic theory of magnetism applies to (67th BPSC Re-exam)

- A. Mercury
- B. Iron
- C. Platinum
- D. Nickel

Answer: C. Platinum

The paramagnetic theory of magnetism applies to platinum. Paramagnetic materials are those materials that are weakly attracted to magnet. Hence out of given options platinum is the correct answer to the question.

Q136. The nucleus of an atom consists of (67th BPSC Re-exam)

- A. Electrons and Protons
- B. Protons and Neutrons
- C. Electrons only
- D. Electrons and Neutrons

Answer: B. Protons and Neutrons

The nucleus of the atom, also called the atomic nucleus, is the small, dense, spherical center of an atom. The nucleus contains two subatomic particles: the protons

and the neutrons

Fundamental Particles of Atom :

❖ **Electron**

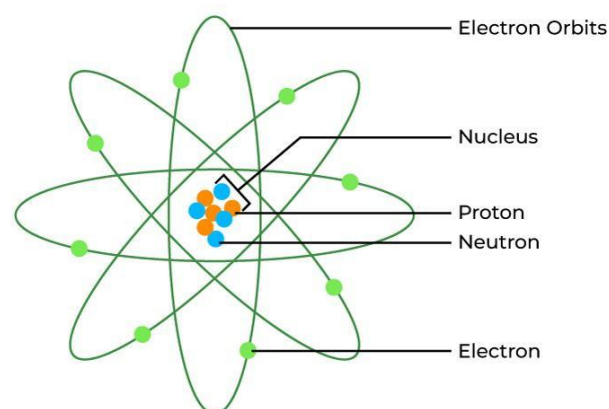
- An electron is negatively charged sub-atomic particle.
- It can be either free (not attached to any atom) or bound to the nucleus of an atom.
- Electrons in atoms exist in spherical shells of various radii, representing energy levels.
- The charge on an electron is (-) 1.6022×10^{-19} coulomb.
- The electron has a mass that is approximately $1/1837$ that of the proton or 9.109×10^{-31} kg.
- It was discovered by J.J. Thomson (1897).
- Atomic mass unit of the electron is 0.0005486.

❖ **Proton**

- A proton is a positively charged sub-atomic particle.
- The charge on a proton is (+) 1.6022×10^{-19} coulomb.
- Its weight is 1.6726×10^{-27} kg.
- Its atomic mass unit is 1.00727.
- It was first discovered by Goldstein as anode rays (1886) and finally identified and named by Rutherford (1919).
- Note : The number of electrons is equal to the number of protons in an atom with an equal charge of opposite nature. Hence the atom is neutral.

❖ **Neutron**

- It is a neutral sub-atomic particle so its name is neutron.
- Its mass is slightly larger than that of proton i.e 1.0087 amu.
- It was discovered by James Chadwick (1932).
- Note : Atomic mass unit (amu) is defined as precisely $1/12$ of the mass of an atom of Carbon-12.



Q137. The metallurgical process in which a metal is obtained in a fused state is called (67th BPSC Re-exam)

- A. Roasting
- B. Calcination
- C. Froth Floatation
- D. Smelting

Answer: D. Smelting

- ❖ The process of extraction of metal in its molten state by any reducing agent in the presence of flux is called smelting. For example oxides of less electropositive metals like Pb, Zn, Fe, Cu are reduced by any other reducing agent.
- ❖ Roasting is a process of metallurgy where ore is converted into its oxide by heating it below its melting point in the presence of excess air. While calcination is mostly used in the oxidation of carbonates, roasting is a method that is used for converting sulphide ores.
- ❖ Froth floatation is a process that selectively separates materials based upon whether they are water repelling (hydrophobic) or have an affinity for water (hydrophilic).

Q138. Important Differences Between Calcination and Roasting

Here are some of the major differences between calcination and roasting.

Calcination	Roasting
Calcination is a process in which ore is heated in the absence of air or air might be supplied in a limited quantity	Roasting involves the heating of ore lower than its melting point in the presence of air or oxygen.
Calcination involves the thermal decomposition of carbonate ores.	Roasting is carried out mostly for sulfide minerals.
During calcination, moisture is driven out from an ore.	Roasting does not involve dehydrating an ore.

Carbon dioxide is given out during calcination

During roasting, large amounts of toxic, metallic and acidic compounds are released.

Q139. Consider the following statements

1. Addition of salt to pure water increases the boiling point of water and decreases the freezing point of water.
2. When methyl alcohol is added to water, the boiling point of water decreases.

Which of the above statements is/are correct? (67th BPSC Re-exam)

- A. Only 1
- B. Only 2
- C. Both 1 and 2
- D. Salt and methyl alcohol are the same in behaviour.

Answer: C. Both 1 and 2

Addition of salt to pure water increases the boiling point of water and decreases the freezing point of water. Statement (1) is correct.

When methyl alcohol is added to water, boiling points of water decreases. Statement (2) is correct.

Uses of Methyl Alcohol :

- ❖ It is used as a solvent for paint, celluloid, shellac, etc.
- ❖ The mixture of petrol and methyl alcohol is used as fuel in automobiles.
- ❖ It is used in the preparation of dyes, perfumes, medicines etc.
- ❖ It is used in the preparation of formaldehyde, formic acid, acetic acid, methyl chloride, methyl salicylate, etc.
- ❖ It is used in the preparation of the methylated spirit. A mixture of methyl alcohol and ethyl alcohol is known as methylated spirit or denaturated spirit, which is not suitable for drinking.
- ❖ The mixture of methyl alcohol (40%) and water (60%) is used in radiators of automobiles as antifreeze.

Q140. Which among the following are constituents of Brass? (67th BPSC Re-exam)

- A. Iron and Zinc
- B. Copper and Nickel
- C. Iron and Copper
- D. Zinc and Copper

Answer: D. Zinc and Copper

- ❖ Brass is an alloy composed primarily of Copper (Cu) and Zinc (Zn).
- ❖ Copper(60%) is the main component of brass, usually accounting for a higher percentage of the alloy.
- ❖ Zinc(40%) is added to copper to form brass, typically in varying proportions depending on the desired properties.

List of some alloys, their components and uses

Alloys, Their Composition & Uses

Name of Alloy	Composition	Uses in Daily Life
Brass	34% Zinc + 66% Copper	Doorknobs, utensils, plumbing, musical instruments, zippers, electronics, boats, etc.
Bronze	83% Copper + 12% Tin + 5% Misc. Metals (Mn, Al, etc.)	Marine fittings, electrical connectors, medals, bells, etc.
Sterling Silver	92.5% Silver + 7.5% Copper	Jewellery, coins, medical instruments, utensils, photography, etc.
Bell Metal	77% Copper + 23% Tin	Bell casting, statue construction
Stainless Steel	82% Iron + 18% Chromium and Nickel	Utensils, surgical instruments, watches, construction, etc.
Coin Metal	75% Copper + 25% Nickel	Making of coins
Duralumin	95% Aluminium + 4% Copper + 0.5% Manganese	Construction of aeroplanes and ships
Solder Metal	50% Tin + 50% Lead	Electrical wires, etc.

Q141. Which among the following is the main constituent of biogas? (67th BPSC Re-exam)

- A. Propane
- B. Butane
- C. Ethane
- D. Methane

Answer: D. Methane

Biogas is produced under anaerobic conditions, the process is denominated as anaerobic digestion. The major

constituent of biogas is methane (55-70%), CO₂ (30-45%) and some traces of gases such as H₂S and ammonia. Biogas is considered a renewable source of energy. It is also referred to as "Gobar gas" because the starting material is bovine dung, or "gobar" in Hindi.

Q142. Which among the following would cause the bright red colour due to bursting of crackers? (67th BPSC Re-exam)

- A. Sodium
- B. Sulphur
- C. Magnesium
- D. Strontium

Answer: D. Strontium

The colors in fireworks are created by the use of metal salts. Metal salts commonly used in firework displays include: strontium carbonate (red fireworks), calcium chloride (orange fireworks), sodium nitrate (yellow fireworks), barium chloride (green fireworks) and copper chloride (blue fireworks).

Q143. What are salt loving plants called? (67th BPSC Re-exam)

- A. Mesophytes
- B. Glycophytes
- C. Halophytes
- D. Xerophytes

Answer: C. Halophytes

Halophytes : A halophyte is a plant that can survive in and near salty environments like Mangroves. These plants may spend their entire lives in extremely salty conditions. Halophytes are most usually found growing near coastal shorelines, although they can also grow in swamps, marshlands, and desert environments.

Mesophytes: A majority of plants living on this planet are mesophytes. These are the plants that can survive in moderate environments that are neither particularly dry nor particularly wet. They thrive in soil that is not swamped in water and has moderate salt content and humidity. They have well differentiated roots and shoots with a fully developed vascular system. They do not need any adaptations to survive. They have an exposed stomata on leaves that are flat, broad and green. They require moderate to less amounts of water. They grow fast and usually large. Their leaves have a cuticle with thin epidermis. Example: corn, rose, clover, squash, etc.

Xerophytes: Plants that are adapted to survive in physiologically dry conditions are called xerophytes. They have special adaptations to prevent loss of water, and also store some water. Plants that store water are called

succulents, e.g, cacti, agave. They have thick and fleshy stems that are able to store water. This water can be used whenever required. Other adaptations in xerophytes include waxy coatings on leaves, dropping leaves during dry periods, folding or repositioning of leaves for sunlight absorption and hairy coverings on leaves. Other examples of xerophytes include pineapple, Acacia, prickly pear and alfalfa.

Glycophytes: The large majority of plant species are Glycophytes, which are not salt-tolerant and are damaged fairly easily by high salinity.

Q144. Which among the following is known as quicklime? (67th BPSC Re-exam)

- A. CaCO_3
- B. Ca(OH)_2
- C. CaCl_2
- D. CaO

Answer: D. CaO

Calcium oxide (CaO) is commonly known as quick lime.

Common Names of Chemical Compounds	Chemical Name of Compound	Common Chemical Compounds Formula	Uses of Compound
Aqua Fortis/ Spirit of Niter	Nitric Acid	HNO_3	Aqua fortis is used in the production of explosives and fertilizers.
Baking Soda	Sodium Bicarbonate or Sodium Hydrogen Carbonate	NaHCO_3	Baking soda is the main ingredient which is used in baking.
Blue Vitriol	Copper Sulphate	$\text{CuSO}_4 \cdot x\text{H}_2\text{O}$	Blue Vitriol is used in insecticides and germicides and also as electrolytes for batteries.
Bleaching Powder	Calcium Oxychloride	CaOCl_2	Bleaching powder is mainly used in the textile industry for bleaching cotton and linen.
Bleach/ Antiformin/ Chloride of Soda	Sodium Hypochlorite	NaOCl	Sodium Hypochlorite is used on a large scale for bleaching, surface purification, water disinfection and odour removal.
Borax	Sodium Tetraborate Decahydrate/ Sodium Borate	$\text{Na}_2[\text{B}_4\text{O}_5(\text{OH})_4] \cdot 8\text{H}_2\text{O}$	Borax is used as a cleaner, and it is also used as an ingredient in paint, herbicides, toothpaste, skin creams, moisturizers, etc.
Calomel	Mercurous Chloride	Hg_2Cl_2	Calomel has been used as a fungicide, it was previously used to treat malaria and yellow fever.
Carborundum	Silicon Carbide	SiC	Carborundum is mainly used as an abrasive for cutting, polishing, grinding, and as an antislip additive.
Carbolic Acid/ Phenol / Hydroxybenzene / Phenic Acid	Phenol	$\text{C}_6\text{H}_5\text{OH}$	Carbolic acid is one of the oldest antiseptic agents which is used as a disinfectant in household cleaners.
Caustic Potash	Potassium Hydroxide	KOH	Caustic potash is used in potassium soaps and detergents and in liquid fertilizers.
Chile Saltpetre	Sodium Nitrate	NaNO_3	Chile Saltpetre is an agricultural source of nitrogen is used for making fertilizers, high-strength glasses and explosives.
Caustic Soda	Sodium Hydroxide	NaOH	Caustic soda is used to manufacture paper and pulp, alumina, soap, detergents and petroleum products. It is also used for water treatment, metal processing, mining, etc.

Cream of Tartar	Potassium Tartrate/ Bitartrate	Hydrogen Potassium	$KC_4H_5O_6$	Cream of tartar is used in the bakery for stabilizing egg whites
Chloroform	Trichloromethane		$CHCl_3$	Chloroform is used a solvent for floor polishes and lacquer. It is also used in paper, board and pesticide industries.
CFC-12/ Freon-12	Dichlorodifluoromethane		CCl_2F_2	CFC-12 is used as a refrigerant in air conditioners and refrigerators.
Dolomite	Calcium Carbonate	Magnesium	$CaMg(CO_3)_2$	Dolomite is used as an element for the production of glass, ceramics and bricks.
Dry Ice	Solid Carbon Dioxide		CO_2	Dry Ice is actually a solid form of CO_2 . It is mainly used as a cooling agent and in theatres for dramatic effects.
Epsom Salt	Magnesium Heptahydrate	Sulphate	$MgSO_4 \cdot 7H_2O$	Epsom salt is used to treat body aches, pain and inflammation
Galena	Lead (II) Sulphide		PbS	Galena is mined for its silver content and it is a primary ore of lead.
Glauber's Salt	Sodium Decahydrate	Sulphate	$Na_2SO_4 \cdot 10H_2O$	It is used for medicinal purposes for the removal of certain drugs overdose such as paracetamol.
Glycerol	Propane-1,2,3-triol		$C_3H_8O_3$	Glycerol is used in food and beverages industry, it serves as a solvent, humectant and also helps in food preservation
Green Vitriol	Ferrous Heptahydrate	Sulphate	$FeSO_4 \cdot 7H_2O$	Green vitriol is used for treatment against moss on the lawn and to treat iron clorosis of vine, berries and fruit trees.
Gypsum	Calcium Dihydrate	Sulphate	$CaSO_4 \cdot 2H_2O$	Gypsum is used a retarder in Portland cement, and filler in paper and textiles.
Heavy Water	Deuterium Oxide		D_2O	D_2O is used as a neutron moderator in nuclear reactors
Hematite	Iron (III) Oxide/ Ferric Oxide		Fe_2O_3	Hematite is used to preparation of heavy metal separation, radiation shielding and to produce pigments.
Hypo Solution	Sodium Pentahydrate	Thiosulphate	$Na_2S_2O_3 \cdot 5H_2O$	Hypo solution is mainly used for photographic paper processing
Laughing Gas	Dinitrogen Nitrous Oxide	Monoxide/	N_2O	Nitrous Oxide is used by dentists to make the patients comfortable during certain procedures
Quick Lime/ Burnt Lime	Calcium Oxide		CaO	Quick Lime is mainly used in the production of steel, paper and pulp production, treatment of water.
Slaked Lime	Calcium Hydroxide		$Ca(OH)_2$	Slaked Lime is used in plasters, cements, and mortars
Limestone	Calcium Carbonate		$CaCO_3$	Limestone is used in building material, it is also one of the main ingredient in toothpaste.
Litharge (Red) and Massicot (Yellow)	Lead (II) Oxide/ Lead Monoxide		PbO	Massicot and Litharge are used in the production of lead stabilizers, lead glass, enamels, and pottery.
Methyl Ethyl Ketone/ Butanone	Butan-2-one		C_4H_8O	Butanone is the is main ingredient in paint formation

Marsh Gas	Methane	CH ₄	Methane at high temperatures reacts with steam to form Carbon Monoxide and Hydrogen. The product is used in the production of ammonia for fertilizers and explosives.
Milk of Magnesia	Magnesium Hydroxide	Mg(OH) ₂	Milk of Magnesia acts as an antacid which helps at the time of indigestion, heartburn and sour stomach.
Mohr's Salt	Ammonium Iron (II) Sulphate	(NH ₄) ₂ Fe(SO ₄) ₂ .6H ₂ O	Mohr's Salt is used to enhance iron's shelf life and lower oxidation levels.
Muriatic Acid	Hydrochloric Acid	HCl	Muriatic Acid is used in leather processing, food additive, and gelatin production.
Oil of Vitriol	Sulphuric Acid	H ₂ SO ₄	Sulphuric Acid is used for making fertilizer
Phosgene	Carbonyl Dichloride	COCl ₂	Phosgene is used for making pesticides and plastics
Plaster of Paris	Calcium Sulphate Hemihydrate	CaSO ₄ .1/2H ₂ O	Plaster of Paris is mainly used as a protective coating on ceilings and walls. It is also used for making sculptures.
Potash Alum/ Potassium Alum	Potassium Aluminum Sulphate Dodecahydrate	KAl(SO ₄) ₂ .12H ₂ O	Potash Alum is mainly used in the purification of water, dyeing, and leather tanning.
Propan-2-ol	Isopropyl Alcohol	(CH ₃) ₂ CHOH	Isopropyl Alcohol is mainly used to treat tremors, hypertension, chest pain, heart rhythm disorder and other circulatory conditions.
Quartz	Silicon Dioxide (Silica)	SiO ₂	Quartz is used in making of glass, hydraulic fracturing proppant, foundry sand, and gemstones.
Quicksilver	Mercury	Hg	Mercury is mainly used in barometers, thermostats, and thermometers
Rochelle Salt	Potassium Sodium Tartrate	KNaC ₄ H ₄ O ₆ .4H ₂ O	Rochelle salt is used in the production of gelatins and pectins
Sal Ammoniac	Ammonium Chloride	NH ₄ Cl	Ammonium Chloride is used in industries as a cleaning agent
Saltpetre	Potassium Nitrate	KNO ₃	Saltpetre is commonly used as a food preservative
Slaked Lime	Calcium Hydroxide	Ca(OH) ₂	Slaked Lime is used to form mortars, cement and plasters
Table Salt/ Common Salt	Sodium Chloride	NaCl	Common Salt enhances the flavour of food and also plays a key role in food preservation.
TNT	Trinitrotoluene	C ₆ H ₂ (NO ₂) ₃ CH ₃	TNT is used in bombs, military shells and grenades
Vermillion/ Cinnabar	Mercuric Sulphide	HgS	It is used in colour paints and also as one of the red coloring agents used in tattoo dyes.
Washing Soda	Sodium Carbonate Decahydrate	NaCO ₃ .10H ₂ O	Washing Soda is used to unclog drains and in commercial detergent, mixtures, to treat hard water.

Wintergreen Oil	Methyl Salicylate	$C_8H_8O_3$	Wintergreen oil is used in traditional medicine for bacterial infections.
White Vitriol	Zinc Sulphate	$ZnSO_4 \cdot 7H_2O$	White Vitriol is used in the manufacture of rayon fabric. It is used in eye drops and also for preserving skins and wood.

Q145. What happens to the weight of iron, when it rusts? (67th BPSC Re-exam)

- A. Decreases then increases.
- B. Increases then decreases
- C. Remains the same
- D. Increases for long time

Answer: B. Increases then decreases

When iron rusts, it undergoes a chemical reaction with oxygen and water to form iron oxide, commonly known as rust. The formation of rust involves the addition of oxygen atoms to the iron, which increases its overall weight. However, over time, the rust can flake off and corrode further, resulting in a decrease in the weight of the iron object. Therefore, initially, the weight of iron increases when it rusts, but over time, it may decrease as the rust continues to corrode.



Q146. Which among the following is also known as "White metal"? (67th BPSC Re-exam)

- A. Rhodium
- B. Platinum
- C. Palladium
- D. Nickel
- E. None of the above

Answer: E. None of the above

- ❖ Platinum is a naturally white metal. It does not need to be alloyed for colour. Due to its appearance as white, it is commonly known as white gold. However BPSC has considered option (e) correct answer in its final answer key.
- ❖ White metal refers to a group of alloys with a silvery white appearance, often composed of tin, antimony,

and other elements. It is commonly used for making objects such as jewellery, coins, and decorative items.

Q147. Consider the following statements with respect to noble metals

1. Noble metals are found in pure form in nature.
2. Uranium and lead are examples of noble metal.

Which of the above statements is/is/are correct? (67th BPSC Re-exam)

- A. Only 1
- B. Only 2
- C. Both 1 and 2
- D. Brass is also noble metal

Answer: A. Only 1

- ❖ Noble metals are found in pure form in nature because they are non-reactive and don't combine with other elements to form compounds. Hence, the statement (1) is correct.
- ❖ Uranium and lead are not examples of noble metals. Hence, the statement (2) is incorrect
- ❖ Noble metals are a specific group of elements that include gold (Au), silver (Ag), platinum (Pt), and palladium (Pd).
- ❖ Brass is not a noble metal. It is an alloy made by combining copper and zinc

Q148. Fungi are plants that lack (67th BPSC Re-exam)

- A. Carbon dioxide
- B. Chlorophyll
- C. Sunlight
- D. Oxygen

Answer: B. Chlorophyll

Fungi are plant like organisms that lack chlorophyll since they do not have chlorophyll, fungi must absorb food from dead organic matter.

Fungi

❖ **About:**

- Fungi or fungus are a diverse group of eukaryotic microorganisms or macroscopic organisms that belong to their own biological kingdom, distinct from plants, animals, and bacteria.

❖ **Characteristics:**

- Eukaryotic: Like plants, animals, and protists, fungi have complex, membrane-bound cell organelles and a true nucleus.

- Heterotrophic: Fungi are primarily decomposers or saprophytes, meaning they obtain nutrients by absorbing organic matter from their surroundings.
- Secrete Enzymes: Fungi secrete enzymes to break down complex organic compounds into simpler substances, which they can then absorb.

❖ **Harmful Effects of Fungi:**

Human and Animal Diseases:	Fungi can cause a variety of diseases in humans and animals. Examples include athlete's foot (caused by dermatophytes), ringworm, histoplasmosis, and aspergillosis. Some fungi produce toxic compounds known as mycotoxins, which can contaminate food and lead to health problems when consumed.
Crop and Plant Diseases:	Fungal pathogens can infect and damage crops and plants, leading to significant economic losses in agriculture. Examples include rusts, powdery mildews, and various types of fungal blights.
Allergic Reactions:	Exposure to fungal spores, especially in indoor environments with high humidity, can trigger allergies and respiratory problems in some individuals. Conditions like allergic rhinitis and allergic bronchopulmonary aspergillosis are associated with fungal allergens.
Biodegradation of Materials:	Fungi can break down materials such as textiles, leather, and paper, which can be detrimental if these materials are not properly preserved or stored.

Q149. Pollination is best defined as (67th BPSC Re-exam)

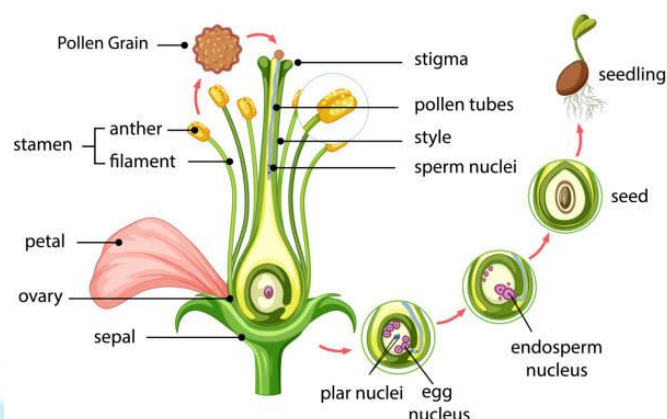
- Germination of pollen grains
- Growth of pollen tube in ovule
- Visiting flowers by insects
- Transfer of pollen grain from anther to stigma

Answer: D. Transfer of pollen grain from anther to stigma
Pollination

- ❖ When a pollen grain moves from the anther (male part) of a flower to the stigma (female part), pollination happens and it is the first step in a process that produces seeds, fruits, and the next generation of plants.

- ❖ This can happen through self-pollination, wind and water pollination or through pollinators.

Pollination of Flowering Plants



Parts of flowers :

Bisexual flowers typically contain male and female parts in it.

There are four main layers of the parts of the flower-

- ❖ **Calyx** : It is a collection of sepals forming the first circle of the flower. These are typically green coloured. In some cases, the sepals have a colour called petaloid. Their main function is to protect the flower while it is still in the bud stage.
- ❖ **Corolla** : This layer is the collection of petals. It is the second circle of the flower, superior to the calyx. The petals are the colourful part of a flower that helps to attract insects and birds to the flower to facilitate pollination.
- ❖ **Androecium** : It is the third layer of flower superior to the corolla. It is the male part of the sexual reproduction of a plant. The androecium is made up of a collection of stamens. Each stamen has the following parts-(i) **Anther** : It is present at the tip of the filament. It is internally lobed. Pollen grains are formed inside the anther. (ii) **Filament** : It is a thin stalk-like structure that holds the anther.
- ❖ **Gynoecium** : It is the fourth layer of flowers. It is a collection of carpels and considered the female reproductive part of the plant. It has three parts- (i) **Stigma** : It is a small and sticky landing structure. The pollen grains from the same or different flower stick to it. This structure acts as a landing for the insects or birds that act as a pollinating agent. (ii) **Style** : It is a thin stalk-like structure that holds the stigma. Two or more carpels may be fused together to varying degrees and the entire structure, including the fused styles and stigmas may be called a pistil. (iii) **Ovary** : It is a base of the style or the lower part of the pistil and contains the ovules, which contain the female gamete

Q150. Plants receive their nutrients mainly from (67th BPSC Re-exam)

- A. Atmosphere
- B. Light
- C. Soil
- D. Chlorophyll

Answer: C. Soil

Plants absorb essential nutrients, such as nitrogen, phosphorus, potassium, and micronutrients, from the soil through their root systems. The soil provides a rich source of minerals and organic matter that plants need for growth and development.

Q151. Pine, Fir, Spruce, Cedar, Larch and Cypress are the famous timber-yielding plants of which several also occur widely in the hilly regions of India. All these belong to (67th BPSC Re-exam)

- A. Gymnosperm
- B. Monocotyledons
- C. Dicotyledons
- D. Angiosperm

Answer: A. Gymnosperm

- ❖ The gymnosperms are a group of seed producing plants that includes cycads, ginkgo, geophytes and conifers. They are also known as Acrogymnospermae. Pine, Fir, Spruce, Larch and Cypress are the famous timber-yielding plants which belongs to gymnosperm.
- ❖ Angiosperms are vascular plants with stems, roots, and leaves. The seeds of the angiosperm are found in a flower. These make up the majority of all plants on earth. The seeds develop inside the plant organs and form fruit. Hence, they are also known as flowering plants. Angiosperms are the most advanced and beneficial group of plants. They can grow in various habitats as trees, herbs, shrubs, and bushes.

Monocotyledon	Dicotyledon
The monocotyledonous embryos have a single cotyledon	The dicotyledonous embryos have a pair of cotyledons
They have a fibrous root system	They have a tap root system
Leaves in monocots have parallel venation	Leaves in dicots have reticulate or net venation
In monocot flowers, the count of parts of the flower is a multiple of three or equal to three	The count of parts in a dicot flower is a multiple of four or five or equal to four or five
The roots and stems of monocotyledons do not possess a cambium and cannot increase in diameter	The roots and stems of dicotyledons possess a cambium and have the

	ability to increase in diameter
A few examples of monocotyledons are garlic, onions, wheat, corn and grass, etc.	A few examples of dicots are beans, cauliflower, apples and pear, etc.

Q152. From the following pairs, find the one which is correctly matched? (67th BPSC Re-exam)

- A. Tuberculosis - ATS
- B. Tetanus - BCG
- C. Malaria - Chloroquine
- D. Scurvy - Thiamine

Answer: C. Malaria – Chloroquine

- ❖ Tuberculosis— BCG
- ❖ Tetanus — DTaP and Tdap
- ❖ Malaria— Chloroquine
- ❖ Scurvy—Vitamin C (Ascorbic acid)

Q153. The animal without red blood cells is (67th BPSC Re-exam)

- A. Earthworm
- B. Snake
- C. Peacock
- D. Frog

Answer: A. Earthworm

- ❖ Earthworms belong to a group of animals called annelids, and they have a circulatory system that does not rely on red blood cells to transport oxygen.
- ❖ Instead, earthworms have a fluid-filled circulatory system called a coelomic fluid that aids in the exchange of gases and nutrients throughout their body
- ❖ Flatworms, nematodes, cnidarians do not have a circulatory system and that's why they do not have blood. They have no lining or fluid in their body cavity. Ants and other insects have a type of liquid inside their body that helps them to move the nutrients around.

Q154. The ultimate substance to which the carbohydrates are degraded is (67th BPSC Re-exam)

- A. Glycerol
- B. Glucose
- C. Maltose
- D. Amino Acid

Answer: B. Glucose

Carbohydrate digestion is converted into glucose (a monosaccharide), proteins are broken down into their

basic units such as amino acids. And the fats are converted to fatty acids and glycerol.

Q155. Most of the enzymes are (67th BPSC Re-exam)

- A. Lipids
- B. Acids
- C. Alkalis
- D. Proteins

Answer: D. Proteins

- ❖ Proteins are products of ribosomal translation and they are composed of sequences of amino acids which are also known as polypeptide chains. Protein composes the majority of organic molecules and is highly diverse. Enzymes, hormones, structural elements, etc. are examples of proteins. Therefore, this is the correct answer. Enzymes are globular proteins or folded proteins. In enzymes, protein is folded in such a way that it can bind with substrates specifically. The binding site for different enzymes differs according to the specific substrate with which it binds.
- ❖ Lipids are a class of biomolecules that are synthesized from fats. They are soluble in nonpolar solvents. Lipids are structural components of cell membranes and are responsible for the storage of energy also. Some hormones are also lipids. Example: phospholipid, sterols. Therefore, this is the incorrect option.

Q156. Who was the first scientist/doctor, who attempted vaccination? (67th BPSC Re-exam)

- A. Robert Koch
- B. Elie Metchnikoff
- C. Edward Jenner
- D. Joseph Lister

Answer: C. Edward Jenner

- ❖ The smallpox vaccine, introduced by Edward Jenner in 1776, was the first successful vaccine to be developed. He observed that milkmaids who previously had caught cowpox did not catch smallpox and showed that inoculated vaccine protected against inoculated variola virus.
- ❖ Heinrich Hermann Robert Koch was a German physician and microbiologist. As the discoverer of the specific causative agents of deadly infectious diseases including tuberculosis, cholera and anthrax, he is regarded as one of the main founders of modern bacteriology.
- ❖ Ilya Ilyich Mechnikov, also spelled Élie Metchnikoff, was a zoologist from the Russian Empire of Moldavian

noble ancestry best known for his pioneering research in immunology and thanatology.

- ❖ Joseph Lister was a British surgeon, medical scientist, experimental pathologist and a pioneer of antiseptic surgery and preventive healthcare.

Q157. The working principle of a washing machine is (67th BPSC Re-exam)

- A. Diffusion
- B. Centrifugation
- C. Dialysis
- D. Reverse Osmosis.

Answer: B. Centrifugation

- ❖ When we put cloth and soap in the washing machine to mix it together and then the machine rotates or spins at a very high speed which forces the dirt and soap in the clothes to leave the surface of the clothes. It will clean the surface of the cloth and then we can again spin the machine to partially dry the clothes in it. The process uses the centrifugal force to both clean and dry the clothes in the machine.
- ❖ Centrifugation is the process with which we can separate particles depending on their size, shape and density from a solution. In this process we put the solution where the particles are suspended, in a centrifuge tube. Then we spin the tube at a defined speed for a time interval. After that we will get the suspended particles at the bottom of the tube and then we can separate the liquid from the particles. It uses the centrifugal force to move the particles to the bottom of the tube.
- ❖ In the above processes, both processes use the centrifugal force and act in the same manner. So, we can say that the working principle of the washing machine is centrifugation.

Note: A body moving on a circular path has two forces acting on it. One is centripetal force and the other is centrifugal force. A body moving in a circular path will constantly change direction and hence will change velocity. It means that it has an acceleration. So, from Newton's 2nd law we can say that a force is acting constantly in the body towards the centre. It is called centripetal force. A body moving in a circular path will experience an outward force which depends on its mass, velocity and the radius of the circular path. It is called centrifugal force. The centrifugal force is a fictitious force. Both the centrifugal and centripetal forces are equal but opposite in direction.

- ❖ **Diffusion:** It is the process of particles moving from an area of high concentration to an area of low concentration, which is not directly involved in the working principle of a washing machine.

❖ **Dialysis:** It is a process used in medical settings to remove waste products and excess fluids from the blood when the kidneys are unable to perform their function adequately.

❖ **Reverse osmosis:** It is a process used to remove impurities and purify water by applying pressure to force water molecules through a semipermeable membrane while leaving behind larger molecules, ions, and other impurities. This process effectively filters out substances such as dissolved salts, bacteria, viruses, heavy metals, and other contaminants, resulting in purified water. It is not the working principle of a washing machine.

Q158. The speed of light will be minimum while passing through (67th BPSC Re-exam)

- A. Vacuum
- B. Air
- C. Glass
- D. Water

Answer: C. glass

In order to solve this question, we should know about rarer and denser mediums. Generally, a medium in which speed of light is maximum is known as optically rarer medium whereas the mediums in which speed of light is minimum those mediums are known as optically denser medium. Here, we will discuss each option one by one and later decide which medium light will pass with minimum speed.

- ❖ It's found that Glass is much denser medium as the refractive index of pure glass lies in between 1.60–1.62
- ❖ It's found that Air is optically a very rarer medium as the value of refractive index of air is generally found as 1.0003
- ❖ Water is optically denser medium as compared to that of air but rarer than glass as refractive index of water generally is 1.33
- ❖ Since, light travels fastest in vacuum so refractive index of vacuum is 1
- ❖ So, among the four options, the denser medium is glass having a refractive index of 1.60–1.62 so light will travel with minimum speed in glass.

Note: It should be remembered that, Refractive index of a medium is the ratio of speed of light in vacuum and to the speed of light in medium written as $\mu = \frac{c}{v}$ as the refractive index of a medium increases the value of speed of light decreases and the speed of light in vacuum is $3 \times 10^8 \text{ ms}^{-1}$ which is maximum and it's the universal speed limit.

Q159. Which of the following is not a vector quantity? (67th BPSC Re-exam)

- A. Velocity
- B. Torque
- C. Speed
- D. Displacement

Answer: C. Speed

Speed is not a vector quantity. Speed is a scalar quantity that describes how fast an object is moving without considering its direction.

On the other hand, velocity, torque, and displacement are all vector quantities as they involve both magnitude and direction.

Scalar vs Vector Comparison:

S.No.	Scalar	Vector
1.	A scalar is a quantity that has magnitude only , but no direction .	A vector is a quantity that has both direction and magnitude .
2.	For scalars, normal rules of algebra are applicable.	For vectors, only vector algebra is applicable.
3.	Scalar quantity can change in terms of its magnitude only .	Vector quantity can change in terms of magnitude or direction .
4.	The resultant of two scalars will always be a scalar quantity .	The resultant of two vectors can be either a scalar or a vector .
5.	Examples: mass, length, time , etc.	Examples: velocity, acceleration , etc.

Q160. If the spinning speed of the earth increases then the weight of the body at equator will (67th BPSC Re-exam)

- A. Decrease
- B. Remain same
- C. Be doubled
- D. Increase

Answer: A. Decrease

- ❖ The weight of an object is the force exerted on it due to gravity.
- ❖ The spinning motion of the Earth causes a centrifugal force at the equator, which is directed away from the Earth's center. This centrifugal force partially counteracts the force of gravity.
- ❖ If the spinning speed of the Earth increases, the centrifugal force at the equator also increases. As a result, the effective gravitational force on a body at

the equator decreases, leading to a decrease in weight.

Q161. Who is the first person to define speed? (67th BPSC Re-exam)

- A. Newton
- B. Kepler
- C. Ptolemy
- D. Galileo

Answer: D. Galileo

The Italian, physicist Galileo Galilei is credited with being the first to measure speed by considering the distance covered and the time taken. He defined speed as the distance covered per unit of time.

Newton:

- ❖ Isaac Newton's discoveries created a launchpad for future developments in science. His most noteworthy innovations were as follows:
- ❖ Newton's three laws of motion set the foundation for modern classical mechanics.
- ❖ The discovery of gravitational force gave us the ability to predict the movement of heavenly bodies.
- ❖ His discovery of calculus gave us a potent mathematical tool, aiding the precise analytical treatment of the physical world.

Kepler: Considered a pioneer in astronomy, Johannes Kepler is best known for his three laws of planetary motion. The first and most famous law states that planets orbit in ellipses, not in circles, as was the common belief at the time.

Ptolemy: Claudius Ptolemy was a 2nd century Greek mathematician, astronomer and geographer famous for his controversial geocentric theory of the universe, which would form the basis of our understanding of the motions of stars and planets for over than a thousand years.

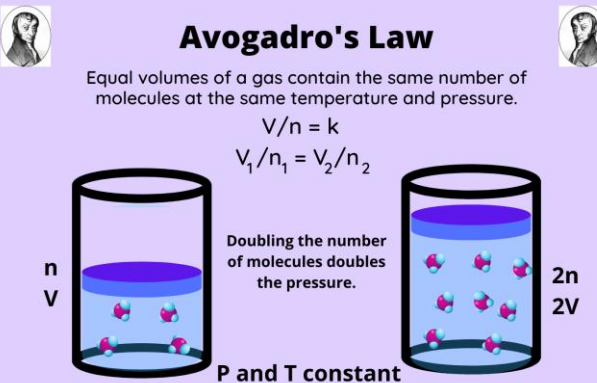
Q162. What is the law in which under the same conditions of temperature and pressure, equal volumes of all gases contain equal number of molecules? (67th BPSC Re-exam)

- A. Graham's law
- B. Pascal's Law
- C. Avogadro's Law
- D. Coriolis effect

Answer: C. Avogadro's Law

- ❖ **Avogadro's Law:** Avogadro's Law states that under the same conditions of temperature and pressure, equal volumes of all gases contain an equal number of molecules. Avogadro's Law provides a basis for understanding the relationship between the volume

and amount of gas and is a key concept in the study of ideal gases.



Avogadro's Law

Equal volumes of a gas contain the same number of molecules at the same temperature and pressure.

$$V/n = k$$

$$V_1/n_1 = V_2/n_2$$

Doubling the number of molecules doubles the pressure.

P and T constant

- ❖ **Graham's law:** Graham's law of effusion states that the rate of effusion or diffusion of a gas is inversely proportional to the square root of its molar mass. In simpler terms, lighter gases diffuse or effuse faster than heavier gases under the same conditions of temperature and pressure.
- ❖ **Pascal's law:** Pascal's law, also known as the principle of transmission of fluid-pressure, states that when there is an increase in pressure at any point in a confined fluid, there is an equal increase in pressure throughout the fluid. This principle is the foundation of hydraulic systems and explains how a small force can be multiplied to generate a larger force using a hydraulic fluid.
- ❖ **Coriolis effect:** The Coriolis effect is an apparent deflection of moving objects caused by the rotation of the Earth. It states that in a rotating reference frame, an object moving in a straight path will appear to be deflected to one side. In the Northern Hemisphere, moving objects tend to be deflected to the right, while in the Southern Hemisphere, they tend to be deflected to the left. The Coriolis effect influences various phenomena, such as the rotation of weather systems and the path of ocean currents.

Q163. The "theory of relativity" is presented by which scientist? (67th BPSC Re-exam)

- A. Issac Newton
- B. Stephen Hawking
- C. Marie Curie
- D. Albert Einstein

Answer: D. Albert Einstein

Year	Discoveries	Scientist Name
1905	Photon	Albert Einstein
1897	Electron	J.J. Thomson
1919	Proton	Ernest Rutherford
1808	Atom	John Dalton
1932	Neutron	James Chadwick
1687	Law of Motion	Isaac Newton

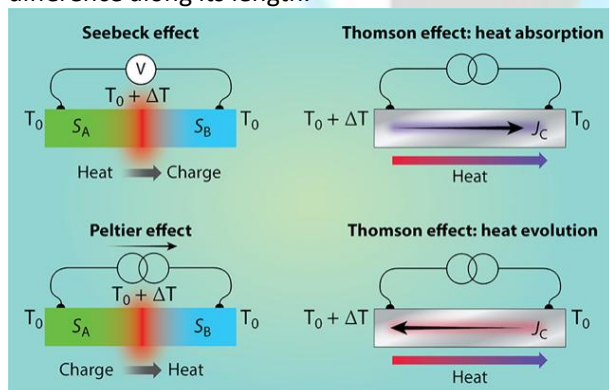
1779	Coulomb	Charles-Augustin de Coulomb
1827	Ohm's Law	Georg Simon Ohm
1831	Electromagnetic Induction	Michael Faraday
1880	Thermionic Emission	Thomas Edison
1896	Radioactivity	Henri Becquerel
1898	Radium	Marie Sklodowska-Curie
1900	Quantum theory	Max Planck
1905	Photoelectric Effect	Heinrich Rudolf Hertz
1895	X-Ray	Röntgen
1905	Relativity	Albert Einstein
1913	Atomic Structure	Neils Bohr & Rutherford
1942	Nuclear Reactor	Enrico Fermi

Q164. Due to temperature variation along a conductor, potential variation occurs along it. This phenomenon is known as (67th BPSC Re-exam)

- A. Joule effect
- B. Seebeck effect
- C. Peltier effect
- D. Thomson effect

Answer: D. Thomson effect

- ❖ Thomson effect is the evolution or absorption of heat when an electric current passes through a circuit composed of a single material that has a temperature difference along its length.



- ❖ The Joule effect, also known as Joule heating or resistive heating, refers to the phenomenon where heat is generated when electric current passes through a conductor with resistance. It is characterized by the conversion of electrical energy into heat.
- ❖ The Seebeck effect, also known as thermoelectric effect, occurs when a temperature difference is applied across a junction of two dissimilar materials, resulting in the generation of an electric potential difference or voltage.
- ❖ The Peltier effect is the reverse of the Seebeck effect. It

describes the phenomenon where an electric current passing through a junction of dissimilar materials causes a temperature difference to develop across the junction.

Q165. Which among the following is an incorrect option? (67th BPSC Cancelled exam)

- A. Atom is electrically neutral due to presence of protons and electrons inside the nucleus.
- B. Electrons are negatively charged and have negligible mass.
- C. Atomic number is the number of protons in an atom of an element.
- D. Isotopes are useful as nuclear fuel in medical field, in carbon dating etc.

Answer: A. Atom is electrically neutral due to presence of protons and electrons inside the nucleus.

Atom are electrically neutral because they have the same number of negatively charged electrons and Positively charged protons. Proton is present in nucleus but electron revolves in orbit around nucleus. A neutron is a neutral particle, carrying no charge which is present in the nucleus of the atom.

Q166. Select the incorrect statement out of the following: (67th BPSC Cancelled exam)

- A. Cotton is suitable for use as clothing in summer because it absorbs moisture.
- B. Polycarbonate is used for making CDs.
- C. Acrylic is also called artificial silk as it is prepared from cotton but has shine like silk.
- D. Teflon is used for coating non-stick kitchen wares

Answer: C. Acrylic is also called artificial silk as it is prepared from cotton but has shine like silk.

- ❖ Acrylic is also called artificial silk as it is prepared from cotton but has shine like silk. This statement is incorrect. Acrylic is a synthetic fiber and is not prepared from cotton. It is not referred to as artificial silk either.
- ❖ Acrylic is often referred to as "artificial wool" because it is commonly used as a synthetic substitute for wool in various applications such as knitwear, blankets, and upholstery.
- ❖ Acrylic fibers can mimic the softness and warmth of wool while providing additional benefits such as being lightweight, moisture-wicking, and resistant to shrinking or stretching.

Q167. Which of the following statements about graphite and diamond is true? (67th BPSC Cancelled exam)

- A. They have the same crystal structure.
- B. They have the same hardness.
- C. They have the same electrical conductivity.
- D. They can undergo the same chemical reaction

Answer: D. They can undergo the same chemical reaction.

- ❖ Diamond and graphite both are the allotrope of carbon.
- ❖ Diamond has a crystalline structure but Graphite has a layered structure.
- ❖ Diamond is an insulator of electricity and Graphite is a good conductor of electricity.
- ❖ Diamond is the hardest naturally occurring substance but graphite is soft and has a greasy touch.
- ❖ Diamond and graphite are both made up of carbon and have same chemical properties as that of carbon and they both undergo same type of chemical reactions.

The difference in the properties of diamond and graphite are:

DIAMOND	GRAPHITE
Diamonds have a strong three-dimensional network structure	Graphites have a two-dimensional sheet-like structure
The networks are formed because of the presence of covalent bonds.	They are formed due to weak Van der Waal's forces of attraction.
They are hard in nature.	They are soft in nature.
Molecules are closely packed, as a result, they have high density.	There is a large gap between molecules. Therefore, they have low density.
There is no presence of free carbon atoms in diamonds.	There is presence of free Carbon atoms in graphite.
Diamonds do not conduct electricity.	Graphite conducts electricity.

Q168. Which of the following is the major constituent of the liquified petroleum gas? (67th BPSC Cancelled exam)

- A. Methane
- B. Ethane
- C. Propane
- D. Butane

Answer: D. Butane

- ❖ We should know that LPG stands for Liquefied petroleum gas or liquid petroleum gas. We are already familiar with it because we use LPG for

cooking our food. The red cylinders that come to our home contain LPG. We should know that LPG is a flammable mixture of hydrocarbon gases.

- ❖ We should know that LPG is composed of liquid or gas (vapour), depending on pressure and LPG gas temperature. In our home, the domestic LPG composition and the commercial LPG composition are typically the same propane, butane or a mixture of the two gases. LPG – Liquefied Petroleum Gas – is produced during natural gas processing and petroleum refining.
- ❖ We should know that Liquefied Petroleum Gas – LPG – constituents are primarily propane, butane, butylene, propylene and mixtures of these gases. LPG gas constituents are produced from crude oil refining and natural gas processing. They are liquid under pressure and gas at room temperature and pressure.
- ❖ We should note that in India we use a mixture of butane and propane. In India, we use 60% butane and 40% propane. So, the mixture of LPG major constituents is butane. The correct answer is option D.

Note: In its natural state, LPG is an odourless gas. The distinctive smell in propane that people associate with LPG is actually added to it as a safety measure. Without the addition of a smell in propane, leaking gas could collect without detection. The smell that we notice when there is a leak is actually the stench of an entirely different agent, called Ethyl Mercaptan. This substance is added to the gas when it leaves the main storage terminals.

Q169. Water passed from the soil into the roots by a physical process called (67th BPSC Cancelled exam)

- A. Diffusion
- B. Transpiration
- C. Absorption
- D. Osmosis

Answer: D. Osmosis

- ❖ Osmosis is the physical process by which water passes from the soil into the roots of plants, driven by the osmotic gradient and the difference in solute concentration.
- ❖ Diffusion is the movement of particles from an area of higher concentration to an area of lower concentration.
- ❖ Transpiration is the process by which water is lost from the leaves of plants in the form of vapor. It occurs through tiny openings called stomata present on the leaf surface. Transpiration creates a "pull" or suction force that helps in the upward movement of water through the plant, but it does not directly involve the process of water absorption by roots.

- ❖ Absorption refers to the process by which roots take up water and nutrients from the soil. It involves multiple steps, including the physical process of water entering the roots through osmosis, as well as the active transport of mineral nutrients across the root cells.

Q170. Biodegradable wastes can usually be converted into useful substances with the help of (67th BPSC Cancelled exam)

- A. Bacteria
- B. Viruses
- C. Nuclear Proteins
- D. Radioactive substances

Answer: A. Bacteria

- ❖ Biodegradable wastes can usually be converted into useful substances with the help of Bacteria. Biodegradable waste includes any organic matter in which waste can be broken down into carbon dioxide, water, methane or simple organic molecules by micro-organisms such as bacteria. Biodegradable waste can be used for composting and are resource for heat, electricity and fuel by means of incineration or anaerobic digestion.
- ❖ **Viruses:** A virus is an infectious microbe consisting of a segment of nucleic acid (either DNA or RNA) surrounded by a protein coat. A virus cannot replicate alone; instead, it must infect cells and use components of the host cell to make copies of itself.
- ❖ **"Nuclear Proteins"** is a descriptor in the National Library of Medicine's controlled vocabulary thesaurus, MeSH (Medical Subject Headings). Descriptors are arranged in a hierarchical structure, which enables searching at various levels of specificity. Proteins found in the nucleus of a cell.

Q171. In the nighttime, it is not advised to sleep under trees because (67th BPSC Cancelled exam)

- A. They liberate less amount of oxygen.
- B. They liberate harmful gases at night.
- C. They liberate carbon dioxide.
- D. They liberate carbon monoxide.

Answer: C. They liberate carbon dioxide.

- ❖ Photosynthesis does not take place in plants during night time as the sunlight is absent and the accumulation of carbon dioxide is more. We feel suffocated if we sleep under trees during night times when more carbon dioxide is present around the trees.
- ❖ During photosynthesis in green plants, light energy is captured and used to convert water, carbon dioxide,

and minerals into oxygen and energy- rich organic compounds. In most cases, oxygen is also released as a waste product.

- ❖ Most plants, most algae, and cyanobacteria perform photosynthesis; such organisms are called photoautotrophs. Photosynthesis is largely responsible for producing and maintaining the oxygen content of the Earth's atmosphere and supplies most of the energy necessary for life on earth.
- ❖ The process of photosynthesis always begins when energy from light is absorbed by proteins called reaction centers that contain green- colored pigment chlorophyll.
- ❖ In plants, these proteins are present inside organelles called a chloroplast.
- ❖ In these light- dependent reactions, some energy is used to strip electrons from water, producing oxygen gas.
- ❖ **The three main stages of photosynthesis are:**
 - Harvesting Radiant Energy: the plant absorbs light with the help of chloroplast.
 - Converting Radiant Energy: the plant converts light energy into a usable form of chemical energy to fuel the plant's cells.
 - Storing Radiant Energy: plants use carbon dioxide and water from the soil to convert ATP and NADPH, resulting in the production of sugar, fatty acids, and glycerol.

Q172. Insectivorous plants grow in soil deficient in (67th BPSC Cancelled exam)

- A. Water
- B. Magnesium
- C. Nitrogen
- D. Calcium

Answer: C. Nitrogen

Insectivorous plants are also referred to as carnivorous plants that consume insects and animals for the nutrition requirement of their body. These plants have special ability to trap the insects and consume them. These plants grow in humid areas, where moisture and sunlight is present. They also grow optimally in the soil where there is deficiency of the nitrogen element. Due to deficiency of the nitrogen element which is essential for overall growth and development of the plants, insectivorous plants consume insects in order to absorb required nutrients. Some of the insectivorous plants are venus flytrap, cobra lily, and pitcher plant. The insectivorous plants use attractants in order to attract the insects towards them so that they can trap and consume them. They are colourful and shiny in appearance which helps them to attract the insects. They

also contain nectars and pleasing odour that attracts the insects towards them. These plants digest the entrapped insects in order to fulfill their nutrient requirement, especially nitrogen.

Q173. Stem of a plant helps in distributing food to all parts of the plant. It also helps in –(67th BPSC Cancelled exam)

- A. Storing the food
- B. Shaping the plant
- C. Respiration
- D. Photosynthesis
- E. More than one of the above

Answer: E. More than one of the above

Following are the functions of stem:

- ❖ Stem helps in transportation of absorbed water and nutrients through vascular tissues from roots to leaves.
- ❖ Stem also transports food from the leaves to different storage organs.
- ❖ Sometimes, stem can store food which is mostly underground.
- ❖ Stem can store water by becoming fleshy as in desert plants.
- ❖ Green stem can perform photosynthesis when leaves are reduced or absent as in desert plants.

Q174. In transfusion, blood must be compatible not only in blood type but also in (67th BPSC Cancelled exam)

- A. Rh factor
- B. The number of white cells
- C. The number of red cells
- D. Race of donor and recipient

Answer: A. Rh factor

In transfusion, blood must be compatible not only in blood type but also in the Rh factor.

- ❖ Before a blood transfusion, the blood is tested to determine its blood type (A, B, AB, or O) and the Rh factor (Rh positive or Rh negative).
- ❖ The Rh factor refers to the presence or absence of a specific antigen on the surface of red blood cells.
- ❖ If an individual has the specific antigen, they are considered Rh positive (Rh+), and if they lack the antigen, they are Rh negative (Rh-).
- ❖ It is essential to match the blood type and Rh factor of the donor with the recipient to ensure compatibility and prevent adverse reactions.

The number of white cells, the number of red cells, and the race of the donor and recipient are not typically factors that determine blood compatibility in

transfusions. However, other factors such as blood group compatibility, cross-matching, and screening for specific antibodies are important considerations to ensure a successful and safe blood transfusion.

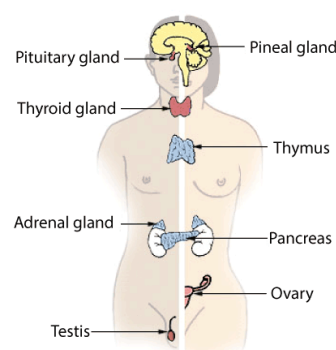
Q175. Pituitary gland is located in (67th BPSC Cancelled exam)

- A. Intestine
- B. Liver
- C. Kidney
- D. Brain

Answer: D. Brain

Major Endocrine Glands

ENDOCRINE GLANDS



Human Glands and Their Functions

Gland	Detailed Description
Pituitary Gland	- About the size of a pea - Sits at the base of the brain - Hangs by a stalk from the hypothalamus - Known as the master gland because it controls other endocrine glands - Produces prolactin (stimulates milk production) - Produces cortisol (affects metabolism & blood pressure)
Thyroid Gland	- Located at the front of the neck - Produces T3 (triiodothyronine) and T4 (thyroxine) hormones - Regulates metabolism - Has a very rich blood supply
Parathyroid Glands	- 4 tiny glands behind the thyroid - Produce Parathyroid Hormone (PTH) - Maintains calcium and phosphorus levels - Too much PTH → brittle bones and kidney stones
Adrenal Glands	- Located on top of each kidney - Size of a walnut - Secretes over 150 hormones including

	adrenaline (epinephrine) - Adrenaline helps the body respond to stress ("fight or flight" response): - Increases blood sugar - Increases blood flow to muscles - Dilates pupils - Increases heart rate - Tightens jaw muscles
Pancreas	- Located behind the stomach - Functions as both an endocrine and exocrine gland - Produces digestive enzymes - Endocrine cells in clusters called Islets of Langerhans : Alpha (α) cells secrete glucagon (raises blood sugar) Beta (β) cells secrete insulin (lowers blood sugar) - Dysfunction leads to diabetes (low insulin) or hypoglycemia (low blood sugar)
Gonads	- Also called sex glands - In females : Ovaries secrete estrogen (female traits, reproduction) - In males : Testes secrete testosterone (male traits, muscle mass, body hair)
Pineal Gland	- Located deep in the center of the brain between the two hemispheres - Sometimes called the " third eye " due to its location and light sensitivity - Secretes melatonin , which controls sleep/wake cycles (circadian rhythm) - Affected by jet lag, night shifts, and screen time

Q176. The universal acceptor blood group is(67th BPSC Cancelled exam)

- A. A
- B. B
- C. AB
- D. O

Answer: C. AB

Karl Landsteiner discovered the blood groups. There are 4 main blood groups (types of blood) – A, B, AB and O. Your blood group is determined by the genes you inherit from your parents. AB positive blood type is known as the "universal recipient" because AB positive patients can receive red blood cells from all blood types. People with type O- blood are called universal donors because their donated red blood cells have no A, B or Rh antigens and

can therefore be safely given to people of any blood group

Type	You can give blood to	You can receive blood from
A+	A+,AB+	A+,A-,O+,O-
O+	O+,A+,B+,AB+	O+,O-
B+	B+,AB+	B+,B-,O+,O-
AB+	AB+	Everyone
A-	A+,A-,AB+,AB-	A-,O-
O-	Everyone	O-
B-	B+,B-,AB+,AB-	B-,O-
AB-	AB+,AB-	AB-,A-,B-,O-

Q177. Which of the following rays/waves are used to know the growth of fetus in the womb?(67th BPSC Cancelled exam)

- A. X-Rays
- B. Microwaves
- C. Ultrasonic Waves
- D. Ultraviolet rays

Answer: C. Ultrasonic Waves

Applications of Different Types of Waves

Type of Wave	Description & Applications
Ultrasonic Waves	- Also called ultrasound , these are high-frequency sound waves beyond the range of human hearing. - Non-ionizing and safe , making them ideal for medical diagnostics . - Widely used in prenatal care to monitor fetal development — helps assess growth, position, organ formation, and detect abnormalities.
X-Rays	- Form of ionizing radiation used extensively in the medical field. - Essential for medical imaging to view bones, organs, and tissues. - Common in dentistry for examining teeth and jaw alignment. - Used in security systems (like airports) to scan baggage and personal items.

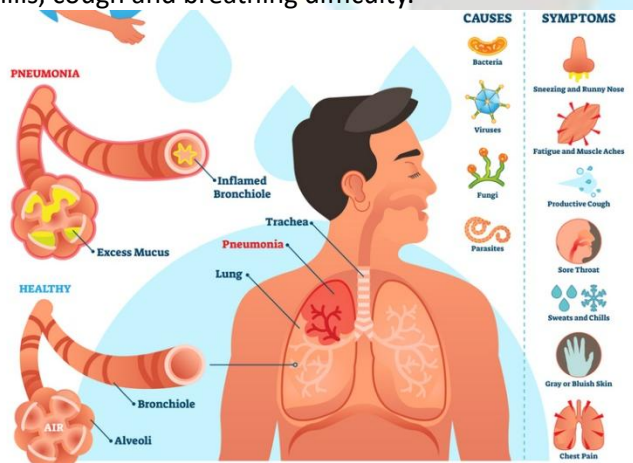
Microwaves	- These waves cause water molecules in food to vibrate, producing heat — used in microwave ovens. - Crucial in communication technology, including satellite communication, GPS, and radar systems.
Ultraviolet (UV) Rays	- Possess germicidal properties; used in sterilization and disinfection of water, air, and surfaces. - UV lamps are common in water purifiers to eliminate microorganisms.

Q178. Pneumonia is an infection of (67th BPSC Cancelled exam)

- A. Nerve
- B. Blood
- C. Skin
- D. Lungs

Answer: D. Lungs

Pneumonia is a common disease that can have more than 30 different causes and symptoms. It is a highly contagious lung infection characterised by inflammation of air sacs in one or both the lungs. The air sacs get filled with fluid or pus resulting in fever, chills, cough and breathing difficulty.



Diseases	Caused by
Tetanus	Clostridium tetani
Whooping cough	Bordetella pertussis
Gonorrhea	Neisseria gonorrhoeae
Leprosy	Mycobacterium leprae
Diphtheria	Corynebacterium diphtheria
Plague	Yersinia pestis
Typhoid	Salmonella Typhi
Tuberculosis	Mycobacterium tuberculosis
Cholera	Vibrio cholera
Syphilis	Treponema pallidum

Q179. A person standing in front of a mirror finds his image larger than himself. This implies that the mirror is (67th BPSC Cancelled exam)

- A. Concave
- B. Plane
- C. Convex
- D. Cylindrical with bulging side outwards

Answer: A. Concave

Types of Mirrors

Following are the types of mirrors that are most widely used:

Plane mirror:

The images formed from a plane mirror are the reflected images in their normal proportions but reversed from left to right. These are the most widely used mirrors.

Convex mirror:

These are the spherical mirrors that are curved outward and the image obtained is virtual, diminished and erect for a real object.

Concave Mirror Image Formation Summary

S. No	Position Of Object	Position of Image	Size of Image	Nature of Image
1	At Infinity	At the focus F, behind the mirror	Highly diminished	Virtual and Erect
2	Between Infinity and the Pole	Between P and F, behind the mirror	Diminished	Virtual and Erect

Concave mirrors:

These are the spherical mirrors that are curved inward and the image obtained from these mirrors depends on the placement of the object.

Concave Mirror Image Formation Summary

S. No	Position of Object	Position of Image	Size of Image	Nature of Image
1	Object at Infinity	At the Focus	Highly Diminished	Real and Inverted

2	Object Beyond the Centre of Curvature	Between the Centre of Curvature and Focus	Diminished	Real and Inverted
3	Object at the Centre of Curvature or Focus	At the Centre of Curvature	Same Size	Real and Inverted
4	Object Between the Centre of Curvature and Focus	Behind the Centre of Curvature	Enlarged	Real and Inverted
5	Object at the Focus	At Infinity	Highly Enlarged	Real and Inverted
6	Object Between the Focus and the Pole	Behind the Mirror	Enlarged	Virtual and Erect

Q180. A fan produces a feeling of comfort during the hot weather because (67th BPSC Cancelled exam)

- A. Fan supplies cool air
- B. Our body radiates more heat in the air
- C. Conductivity of air increases
- D. Our perspiration evaporates rapidly

Answer: D. Our perspiration evaporates rapidly.

The fast moving air increases the rate at which our bodies lose heat due to convection and evaporation. A fan produces a feeling of comfort because our perspiration or sweating evaporates rapidly

Q181. Twinkling of stars in clear sky during nighttime can be explained with (67th BPSC Cancelled exam)

- A. Refraction of light
- B. Reflection of light
- C. Polarization of light
- D. Interference of light

Answer: A. Refraction of light

The twinkling of light is just due to the refraction of light through different layers. They don't actually twinkle but just appear to be so, because of the different densities of the different layers of light. Due to different densities and different temperatures in different layers of our atmosphere, the light ray is refracted, or bent, many times which results in the twinkling of the light.

Why do Stars Twinkle and Planets do not?

- ❖ When the light from the stars enters the atmosphere, it collides with gas molecules and scatters (reflection and interference). Planets are a collection of a large number of point sources of light, whereas stars are considered to have a point source.
- ❖ We are able to see a tiny beam of light from it as the star is so far away from it. This light will get scattered from our eyes and then back into them, almost like it is blinking on and off. The process is so fast it appears like twinkling.

- ❖ As compared to stars, planets are closer to us and send more light; even if some light beams get scattered away, others get to us. So, planets do not usually twinkle.

What Is Reflection of Light?

- ❖ When a ray of light approaches a smooth polished surface and the light ray bounces back, it is called the reflection of light. The incident light ray that land on the surface is reflected off the surface. The ray that bounces back is called the reflected ray. If a perpendicular were drawn on a reflecting surface, it would be called normal.
- ❖ Here, the angle of incidence and angle of reflection are with respect to normal and the reflective surface.

What Is Polarization?

- ❖ Light is the interaction of electric and magnetic fields travelling through space. The electric and magnetic vibrations of a light wave occur perpendicularly to each other. The electric field moves in one direction and the magnetic field in another 'perpendicular to each other. So, we have one plane occupied by an electric field, another plane of the magnetic field perpendicular to it, and the direction of travel is perpendicular to both. These electric and magnetic vibrations can occur in numerous planes. A light wave that is vibrating in more than one plane is known as unpolarized light. The light emitted by the sun, by a lamp or a tube light are all unpolarised light sources.

What is Interference of Light?

- ❖ Interference is a natural phenomenon that happens at every place and at every moment. Yet we don't see interference patterns everywhere. Interference is the phenomenon in which two waves superpose to form the resultant wave of the lower, higher or same amplitude. The most commonly seen interference is the optical interference or light interference. This is because light waves are generated randomly by most of the sources. This means that light waves coming out of a source do not have a constant amplitude, frequency or phase.
- ❖ The most common example of interference of light is the soap bubble which reflects wide colours when illuminated by a light source.

- ❖ For example, incandescent bulbs generate a wide range of frequencies of light, including all colours of the rainbow. Moreover, the light coming out of the bulb is randomly generated every moment in all directions. This means that the starting point of the wave generated may be a maximum, a minimum or any point in between. There is no way of predicting in which phase the wave will start. Such a source is said to be incoherent.

Q182. Hydrogen bomb is based on the principle of (67th BPSC Cancelled exam)

- A. controlled fusion reaction
- B. uncontrolled fusion reaction
- C. controlled fission reaction
- D. uncontrolled fission reaction

Answer: B. uncontrolled fusion reaction

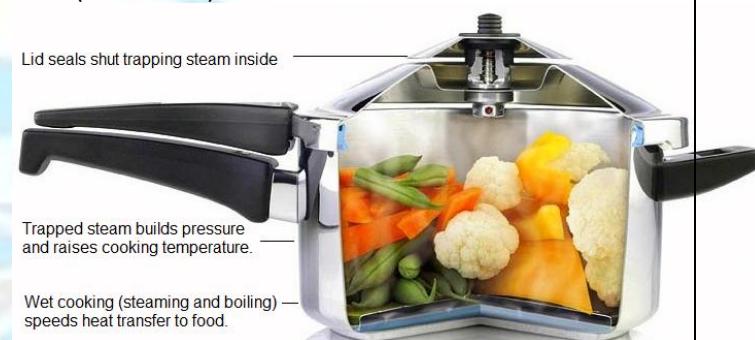
- ❖ Atomic bomb and hydrogen bomb are different types of nuclear bomb. Both are working with nuclear reactions. But the only difference is how the energy is created. In an atomic bomb, a fission reaction is taking place. That is, it will try to break the nucleus of an atom into smaller atoms. This result, the release of tremendous energy as well as several sub atomic particles like neutrons and finally that becomes an explosion.
- ❖ Hydrogen is based on the fusion reaction. That is fusing smaller atomic nuclei into a bigger one. In this reaction we need high energy for the initiation process. So, hydrogen bombs are started with a fission reaction. Then followed by the fusion reaction. The energy released by a fusion reaction is approximately four times greater than the energy released by a fission reaction.
- ❖ This name is given because, for the fusion reaction we are using tritium and deuterium. They are basically isotopes of hydrogen. The four hydrogen nuclei can form a helium nucleus after fusion reaction. It will create a mass defect. According to Einstein relation, mass is directly proportional to energy. At this time, they will release around 25 MeV of energy per fusion. It is assumed that if a million fusion reactions take place, the temperature can attain more than 10 million kelvins. In stars uncontrolled fusion reactions take place.
- ❖ Basically, the fusion reaction is uncontrollable. The controlled reactions are extensively dependent upon the amount of fuel. Mostly, controlled nuclear chain reactions are used for constructive purposes like energy harvesting. But the uncontrolled nuclear chain reactions have been used for destructive purposes like atom bombs. So, the hydrogen bomb works with the principle of uncontrolled fusion reaction.

Q183. Food gets cooked faster in a pressure cooker because (67th BPSC Cancelled exam)

- A. Water starts boiling at low temperatures due to high pressure.
- B. Water starts boiling at high temperatures due to high pressure.
- C. Water starts boiling at low temperatures due to low pressure.
- D. Water starts boiling at high temperatures due to low pressure

Answer: B. Water starts boiling at high temperatures due to high pressure.

Principle utilized in pressure cooker is that boiling point of water increases with increase in pressure. Because of increase in boiling point heat provided to cooker is utilised to increase its temperature rather than converting its state (latent heat) - water to steam



Q184. If the doors of a refrigerator are left open for a few houses then the room temperature will (67th BPSC Cancelled exam)

- A. decrease
- B. increase
- C. remain the same
- D. decrease only in the area in the vicinity of the refrigerator

Answer: B. increase

The room is going to get warmer. A refrigerator is a heat engine it extracts heat from low temperature reservoir and transfer it to high temperature. If a refrigerator's door is kept open, then room will become hot, because then refrigerator exhaust more heat into the room than earlier. In this way, temperature of the room increases and room becomes hot.

Q185. A piece of ice is floating in a beaker containing water up to its brim. When the whole of the ice melts (67th BPSC Cancelled exam)

- A. The water will spill on the floor.
- B. The level of water will come down in the beaker.

- C. The level of water will first fall and then it will go out of the beaker.
D. The water level will not change.

Answer: D. The water level will not change.

- ❖ Conservation of Mass: When the ice melts, it transitions from a solid state to a liquid state, but the total mass of the system remains the same. Therefore, the melted ice will occupy the same volume as the ice did before melting.
- ❖ Archimedes' Principle: The buoyant force acting on an object submerged in a fluid is equal to the weight of the fluid displaced by the object. In this case, the ice was already floating in the water, which means that it displaced an amount of water equal to its own weight.
- ❖ Melting of the Ice: When the ice melts, it transforms into water, but the water already occupies the same volume as the ice did. Therefore, there is no additional water added to or removed from the system.

Combining these points, we can conclude that the water level will not change in the beaker when the ice melts. The melted ice will simply mix with the existing water in the beaker, maintaining the same level as before.

Q186. Which of the following is not correctly matched? (67th BPSC Cancelled exam)

- A. Voltmeter: Potential difference
B. Ammeter: Electric Current
C. Potentiometer: Electromotive force
D. Galvanometer: Electrical resistance

Answer: D. Galvanometer: Electrical resistance

Galvanometer is an instrument used for measuring a small electrical current or a function of the current by deflection of a moving coil.

IMPORTANT MEASURING DEVICES	
Devices/Equipments	Uses
Accumulator	It serves as a kind of electrical energy storage.
Altimeter	It is used in aeroplanes to measure altitude.
Ammeter	Electric current strength is measured by this instrument (in amperes).
Anemometer	It calculates the wind's speed and force.
Audiometer	It gauges the intensity of sound.
Audiphones	It is used for improving the imperfect sense of hearing.
Barograph	It is utilised for continuous atmospheric pressure recording.

Barometer	It is used to measure atmospheric pressure. It is used in weather forecasting.
Binocular	It is utilised to see faraway objects.
Bolometer	It measures heat radiation
Calorimeter	It is used to gauge how much heat a material emits or absorbs. It is employed in thermodynamics and chemistry.
Carburettor	It is used in an internal combustion engine for charging the air with petrol vapour.
Cardiogram	It tracks the heart's motion as it is captured on a cardiograph.
Chronometer	It establishes a location's longitude on a ship.
Cinematography	It is a tool used in filmmaking to project an enlarged picture of the photograph on the screen.
Colorimeter	a device for contrasting hue intensity.
Commutator	An instrument to change or remove the direction of an electric current, in dynamo is used to convert alternating current into direct current.
Cresco graph	It measures the growth in plants.
Cyclotron	It is a charged particle accelerator that is capable of raising the energy of charged particles.
Dynamo	Mechanical energy is transformed into electrical energy by it.
Dynamometer	It computes power, torque, and force.
Electroscope	It detects the presence of an electric charge.
Endoscope	It looks at the body's interior organs.
Eudiometer	a glass tube used to measure volume changes in gas chemical processes.
Fathometer	It computes the ocean's depth.
Galvanometer	It measures small-amplitude electric currents.

Hydrometer	It computes the liquids' specific gravities.
Hydrophone	It gauges underwater sound.
Hygrometer	It gauges the air's humidity.
Kymograph	It graphically records physiological movements (Blood pressure and heartbeat).
Lactometer	It determines the purity of milk.
Manometer	Gas pressure is measured by it.
Mariner's compass	It is a tool that sailors use to identify the direction.
Microphone	It amplifies the sound and changes the sound waves into electrical vibrations
Microscope	It is used to view small objects or organisms that cannot be seen with the naked eye. It is used in biology, medicine, and research.
Odometer	An instrument by which the distance covered by wheeled vehicles is measured.
Periscope	It is used to view objects above sea level (used in submarines)
Photometer	The instrument compares the luminous intensity of the source of light
Potentiometer	It is used for comparing the electromotive force of cells.
Pyrometer	It measures very high temperatures.
Quartz Clock	A highly accurate clock used in astronomical observations and other precision work
Radar	Radio, angle, detection and range is used to detect the direction and range of an approaching aeroplane by means of radio microwaves
Radiometer	It measures the emission of radiant energy.
Rain Gauge	An apparatus for recording rainfall at a particular place.
Rectifier	An instrument used for the conversion of AC into DC.
Refractometer	It measures the refractive index.
Saccharimeter	It measures the amount of sugar in the solution.

Salinometer	It determines the salinity of the solution.
Seismograph	It measures the intensity of earthquake shocks.
Sextant	This is used by navigators to find the latitude of a place by measuring the elevation above the horizon of the sun or another star.
Spectrometer	It is used to measure the intensity of light absorbed by a substance. It is used in chemistry and biology.
Spectroscope	An instrument used for spectrum analysis
Speedometer	It is an instrument placed in a vehicle to record its speed.
Spherometer	It measures the curvatures of surfaces.
Sphygmomanometer	It measures blood pressure.
Stereoscope	It is used to view two-dimensional pictures.
Stroboscope	It is used to view rapidly moving objects.
Tachometer	An instrument used in measuring the speeds of aeroplanes and motor boats.
Teleprinter	This instrument receives and sends typed messages from one place to another.
Telescope	It is used to view distant objects in space. It is used in astronomy.
Theodolite	It measures horizontal and vertical angles.
Thermometer	It is used to measure temperature. It is used in medicine, meteorology, and other fields that require temperature measurement.
Thermostat	It regulates the temperature at a particular point.
Transistor	A small device which may be used to amplify currents and perform other functions usually performed by a thermionic valve
Udometer	It is used to measure the amount of liquid precipitation over a set period of time. It is also called Rain Gauge.

Vernier	An adjustable scale for measuring small subdivisions of scale
Viscometer	It measures the viscosity of liquids.
Voltmeter	It measures the electric potential difference between two points.

Q187. If a feather, a rubber ball and a wooden ball are falling freely simultaneously from the same height in a vacuum then (67th BPSC Cancelled exam)

- A. The feather will reach the ground first.
- B. The rubber ball will reach the ground first.
- C. The wooden ball will reach the ground first.
- D. All three will reach the ground together.

Answer: D. all the three will reach at the ground together

All of the objects will fall with the same speed, because there is no air resistance in the vacuum, and gravitational force acts same on all the objects. Hence in the vacuum, every object will reach at the ground together.

Q188. When a soap film on the water is seen in the daytime, it shows beautiful colors. This phenomenon is due to (67th BPSC Cancelled exam)

- A. Diffraction of light
- B. Refraction of light
- C. Polarization of light
- D. Interference of light

Answer: D. Interference of light

- ❖ We are asked to find which phenomenon is involved in formation of colour in soap bubble. First let us know how soap bubbles appear colored. When light enters a soap bubble some part of the light gets reflected from the outer surface and some part of the light gets refracted and enters inside and gets reflected from the other inner surface of the soap bubble.
- ❖ Therefore, there are two sets of light waves that travel back to our eyes. These two sets of waves combine together or we can say there is interference of waves. Waves travel in the form of wavefronts, therefore there is division of wavefronts when the light waves come out of the soap bubble which is why the soap bubble appears to be coloured. Therefore, soap bubble appears coloured due to the phenomenon of interference by division of wavefront.

Q189. The mass number of a nucleus is (67th BPSC Cancelled exam)

- A. The sum of the numbers of neutrons and protons.
- B. The total mass of neutrons and protons.
- C. Always more than the atomic weight.
- D. Always less than its atomic number.

Answer: A. The sum of the numbers of neutrons and protons.

The mass number of an atom is its total number of protons and neutrons. Atoms of different elements usually have different mass numbers, but they can be the same. For example, the mass number of argon atoms and calcium atoms can both be 40.

The other options are not correct:

- ❖ **The total mass of neutrons and protons:** The mass number represents the total number of nucleons, not the mass itself.
- ❖ **Always more than the atomic weight:** The atomic weight is the average mass of all the isotopes of an element, taking into account their relative abundances. The mass number of a specific nucleus may or may not be greater than the atomic weight, depending on the isotopic composition of the element.
- ❖ **Always less than its atomic number:** The atomic number represents the number of protons in the nucleus, which is not necessarily equal to the mass number. The mass number can be greater or equal to the atomic number, but not less.

Q190. Which of the following is the main ingredient of cement? (67th BPSC Cancelled exam)

- A. Limestone
- B. Silica Clay
- C. Gypsum
- D. Ash

Answer: A. Limestone

Limestone, due to its high calcium carbonate content, serves as the main ingredient in the production of cement. Cement is most important construction material. Its ingredients are as follows:

- ❖ Lime- 60.65%
- ❖ Magnesia 1–3%
- ❖ Alkaline 0–1%
- ❖ Silica 17–25%
- ❖ Alumina 3–8%
- ❖ Iron oxide 0.5–6%
- ❖ Calcium Sulfate 0.1–0.5%
- ❖ Sulfur Trioxide 0–1%

Q191. Isotopes of an element differ in (67th BPSC Cancelled exam)

- A. The number of protons.
- B. The mass number.
- C. The number of electrons.
- D. The atomic number.

Answer: B. The mass number.

The atoms of different isotopes are atoms of the same chemical element, they differ in the number of neutrons in the nucleus.

❖ **Isotopes:** Isotopes are different versions of an element, distinguished by the number of neutrons they contain. For instance, consider Uranium isotopes $^{235}_{92}\text{U}$ and $^{239}_{92}\text{U}$. While they have the same number of protons, their neutron counts differ, with 143 for the former and 147 for the latter. This additional neutron dramatically alters the properties of the atom. Isotopes can be classified as stable or radioactive. Stable isotopes remain intact without any spontaneous disintegration. At the same time, radioactive isotopes are too unstable to sustain themselves and eventually break down into lighter elements through the emission of particles like alpha, beta, and gamma rays.

❖ **Isobar:** A series of elements with 40 mass numbers serves as a good example of an isobar; $^{40}_{16}\text{S}$, $^{40}_{17}\text{Cl}$, $^{40}_{18}\text{Ar}$, $^{40}_{19}\text{K}$, and $^{40}_{20}\text{Ca}$. are all elements with the same number of nucleons (protons and neutrons). There are the same number of particles in the nucleus of all of the above-mentioned elements, but their protons and neutrons vary in number.

❖ **Isotones:** It is an atom containing the same neutron number but a different proton number that is called an isotone. For example, $^{36}_{16}\text{S}$, $^{37}_{17}\text{Cl}$, $^{38}_{18}\text{Ar}$, $^{39}_{19}\text{K}$, and $^{40}_{20}\text{Ca}$ contain all 20 neutrons and are all isotones of 20. In order to tap the explosive power of the nucleus, nuclear energy and radioactivity utilize unstable isotopes of heavy elements.

Examples of Isotopes, Isobars, and Isotones

- ❖ **Isotopes Example -:** Let's consider hydrogen. It has three isotopes: protium (^1H), deuterium (^2H), and tritium (^3H). All three have one proton, but they differ in the number of neutrons (0, 1, and 2, respectively).
- ❖ **Isobars Example -** Take calcium-40 and potassium-40. Calcium-40 has 20 protons and 20 neutrons, while potassium-40 has 19 protons and 21 neutrons. Despite different atomic numbers, they have the same mass number, 40.
- ❖ **Isotones Example -** Boron-10 and carbon-14 can serve as examples. Boron-10 has 5 protons and 5 neutrons, while carbon-14 has 6 protons and 8

neutrons. These isotones share the same number of neutrons, which is 5.

Q192. The temperature point at which solid, liquid and gaseous states may stay together is known as (67th BPSC Cancelled exam)

- A. Boiling point
- B. Melting point
- C. Freezing point
- D. Triple point

Ans: D. Triple point

- ❖ In thermodynamics, the triple point of a substance is the temperature and pressure at which the three phases of that substance coexist in thermodynamic equilibrium. It is that temperature and pressure at which the sublimation, fusion, and vaporisation curves meet.
- ❖ The boiling point of a substance is the temperature at which the vapor pressure of a liquid equals the pressure surrounding the liquid and the liquid changes into a vapor. The boiling point of a liquid varies depending upon the surrounding environmental pressure.
- ❖ The melting point of a substance is the temperature at which it changes state from solid to liquid. At the melting point the solid and liquid phase exist in equilibrium. The melting point of a substance depends on pressure and is usually specified at a standard pressure such as 1 atmosphere or 100 kPa.
- ❖ In science, the freezing point is the exact temperature at which a liquid becomes a solid. For water, the freezing point is 32 degrees Fahrenheit or 0 degrees Celsius. The term freezing point describes a moment of transition, much as the melting point captures the moment when ice turns from a solid to a liquid.

Q193. The most important ore of aluminium is (67th BPSC Cancelled exam)

- A. Bauxite
- B. Calamine
- C. Calcite
- D. Galena

Ans. A. Bauxite

Bauxite is the most common aluminum ore. Approximately 98% of primary aluminum production is based on bauxite.

IMPORTANT METALS AND THEIR ORES		
METAL	ORES	CHEMICAL FORMULA
Sodium(Na)	Chile	NaNO_3
	Saltpeter	$\text{Na}_2\text{CO}_3, \text{NaHCO}_3 \cdot 3\text{H}_2\text{O}$
	Trona	$\text{Na}_2\text{B}_4\text{O}_7 \cdot 10\text{H}_2\text{O}$

	Borax Common Salt	NaCl
Calcium(Ca)	Dolomite Calcite Gypsum Fluorspar Asbestos	$\text{CaCO}_3 \cdot \text{MgCO}_3$ CaCO_3 $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ CaF_2 $\text{CaSiO}_3 \cdot \text{MgSiO}_3$
Aluminium(Al)	Bauxite Corundum Feldspar Cryolite Alunite kaolin	$\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$ Al_2O_3 $\text{K Al Si}_3 \text{O}_8$ Na_3AlF_6 $\text{K}_2\text{SO}_4 \cdot \text{Al}_2(\text{SO}_4)_3 \cdot 4\text{Al}(\text{OH})_3$ $3\text{Al}_2\text{O}_3 \cdot 6\text{SiO}_2 \cdot 2\text{H}_2\text{O}$
Potassium(K)	Nitre(salt peter) Carnalite	KNO_3 $\text{KCl} \cdot \text{MgCl}_2 \cdot 6\text{H}_2\text{O}$
Magnesium(Mg)	Magnesite Dolomite Epsom salt Kieserite carnalite	MgCO_3 $\text{MgCO}_3 \cdot \text{CaCO}_3$ $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ $\text{MgSO}_4 \cdot \text{H}_2\text{O}$ $\text{KCl} \cdot \text{MgCl}_2 \cdot 6\text{H}_2\text{O}$
Strontium(Sr)	Strontianite Silestine	SrCO_3 SrSO_4
Copper(Cu)	Cuprite Copper glance Copper pyrites	Cu_2O Cu_2S CuFeS_2
Silver(Ag)	Ruby silver Horn silver	$3\text{Ag}_2\text{S} \cdot \text{Sb}_2\text{S}_3$ AgCl
Gold(Au)	Calaverite Silvenites	AuTe_2 $[(\text{Ag}, \text{Au})\text{Te}_2]$
Barium(Ba)	Barytes	BaSO_4
Zinc(Zn)	Zinc blende Zincite calamine	ZnS ZnO ZnCO_3
Mercury(Hg)	Cinnabar	HgS
Tin(Sn)	Cassiterite	SnO_2
Lead(Pb)	Galena	PbS
Antimony(Sb)	Stibnite	Sb_2S_3
Cadmium(Cd)	Greenocite	CdS
Bismuth(Bi)	Bismuthite	Bi_2S_3
Iron(Fe)	Haemetite Lemonite Magnetite Siderite Iron Pyrites	Fe_2O_3 $2\text{Fe}_2\text{O}_3 \cdot 3\text{H}_2\text{O}$ Fe_3O_4 FeCO_3 FeS_2 CuFeS_2

	Copper pyrites	
Cobalt(Co)	Smelite	CoAsS_2
Nickel(Ni)	Milarite	NiS
Manganese(Mn)	Pyrolusite Magnite	MnO_2 $\text{Mn}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$
Uranium(U)	Carnotite Pitch blende	$\text{K}(\text{UO})_2 \cdot \text{VO}_4 \cdot 3\text{H}_2\text{O}$ U_3O_8

Q194. Which among the following solutions has a pH value more than 7? (67th BPSC Cancelled exam)

- A. Buffer solution
- B. Basic Solution
- C. Acidic solution
- D. Neutral Solution

Ans: B. Basic Solution

- ❖ **pH of Neutral Solution (Pure Water):** pH of water is 7. Whenever the pH of a solution is 7, it will be a neutral solution. Such a solution will have no effect on any litmus solution or any other indicator.
- ❖ **pH of an Acidic Solution:** All the acidic solutions have a pH of less than 7. So, whenever a solution has a pH less than 7, it will be acidic in nature and it will turn blue litmus into the red as well as methyl orange pink and phenolphthalein colourless.
- ❖ **pH of a basic solution:** All the alkaline solution has a pH of more than 7. So, whenever a solution has more than 7 values then it will be basic in nature and it will turn red litmus to blue, methyl orange to yellow and phenolphthalein to pink.
- ❖ **Buffer Solution:** A Buffer Solution or a buffer is defined as a solution whose pH does not change when small amount of an acid or base is added in it. It is used as a means of keeping pH at a nearly constant value in a wide variety of chemical applications. Many life forms thrive only in a relatively small pH range so they utilize a buffer solution to maintain a constant pH. In nature, the bicarbonate buffering system is used to regulate the pH of blood. The solution of Sodium Acetate and Acetic acid is an example of an effective buffer solution. The solution in which buffer solution is accommodated that works like an extremely slow acid.

Q195. In the following, which is the fundamental physical quantity? (66th BPSC Re-exam)

- A. Force
- B. Velocity
- C. Electric Current
- D. Work

Ans: C. Electric current

Fundamental physical quantities are those that cannot be defined in terms of other physical quantities but serve as the base units of measurement in a system of units.

Fundamental Quantities, Units and Dimensions

Fundamental Quantity	SI Unit	Dimensions
Length	meter (m)	[L]
Mass	kilogram (kg)	[M]
Time	second (s)	[T]
Temperature	kelvin (K)	[K]
Luminosity	candela (cd)	[J]
Electric current	ampere (A)	[A]
Amount of substance	mole	[mole]

Q196. An example of longitudinal wave is (66th BPSC Re-exam)

- A. Radio Wave
- B. Sound Wave
- C. X-Ray
- D. Gamma Ray

Ans: B. Sound Wave

Longitudinal Waves :

- ❖ Longitudinal waves are waves in which the displacement of the medium is in the same direction as, or the opposite direction to, the direction of propagation of the wave.
- ❖ In longitudinal waves, the oscillations occur in the direction of the wave.

- ❖ After stretching if spring is left, longitudinal waves originate in it.
- ❖ The places where the circles of spring are very near called compression and the places where circles of spring are far away are called rarefaction.
- ❖ The distance between two consecutive compressions or rarefactions is called wavelength of longitudinal waves.
- ❖ Longitudinal waves are originated in all mediums i.e. solid, liquid & gas.
- ❖ A sound wave (in air and in any fluid medium) is the standard example of a longitudinal wave.
- ❖ Along with propagating transverse waves on the surface of the liquid, longitudinal waves can be propagated inside the liquid.
- ❖ Longitudinal waves are always mechanical waves.

Longitudinal Waves	Transverse Waves
The vibration of the particles of the medium are in the direction of the propagation of the wave	Here, the particles of the medium vibrate in a direction perpendicular to the direction of wave propagation
It proceeds in the form of rarefaction and compression which is the stretch and compression in the same direction as that of the movement of the waves	The wave travels using the crest and troughs which is the up and down motion of the particles that are perpendicular to the wave motion
Longitudinal waves can propagate through gasses	Transverse waves cannot propagate through gasses
Examples are sound waves, earthquake P waves, vibrations in gas, internal water waves, ultrasounds, etc	Examples of transverse waves are light waves, magnetic waves, surface waves, ultramagnetic waves, etc

Chart of Electromagnetic Waves

Sl. No.	Name of Wave	Discoverer	Wavelength range	Applications
1	Gamma Rays	Henry Becquerel Paul Villard	10^{-14} to 10^{-10} m	It has maximum penetrating power. Its application is in nuclear reaction and artificial radioactivity. Gamma rays can kill living cells, they are used to kill cancerous cells. This technique is called Radiotherapy
2	X-Rays	Wilhelm Rontgen	10^{-10} to 3×10^{-8} m	Its application is in the field of medical and in industries.
3	Ultraviolet Rays	Johann Ritter	10^{-8} to 4×10^{-7} m	Hospitals use UV lamps to sterilise surgical equipment and the air in operating theatres. Food & drug companies also use UV lamps to sterilize their products. Suitable doses of ultraviolet rays cause the body to produce Vitamin D.
4	Visible Radiation (light)	-	4×10^{-7} m to 7.8×10^{-7} m	It is the visible spectrum that is visible to the human eyes and is responsible for the sense of sight.
5	Infrared Rays	William Herschel	7.8×10^{-7} m to 10^{-3} m	These waves are responsible for heating of any object. These are used in night vision cameras and in TV remote control

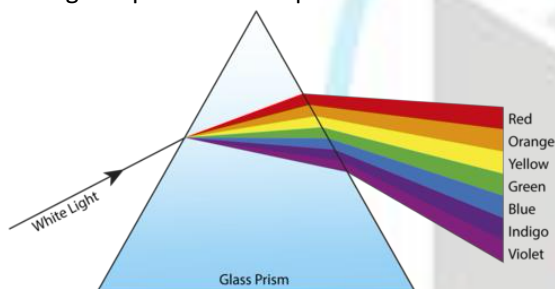
6	Shortwave Radio or Hertzian waves (Microwaves)	Heinrich Hertz	10^{-3} to 1 m	These are used for the transmission of radio & television signals. The microwaves used in RADAR and microwave oven also use Radio waves. Many celestial objects, such as pulsars emit radio waves.
7	Longwave Radio	Marconi	1 to 10^4 m	Applied in the transmission of radio & televisions Programmes.

Q197. Dispersion of light is possible by (66th BPSC Re-exam)

- A. Prism
- B. Convex lens
- C. Concave lens
- D. Simple mirror

Ans: A. Prism

When white light is passed through a glass prism it splits into its spectrum of colours (in order violet, indigo, blue, green, yellow, orange and red) and this process of white light splitting into its constituent colours is termed as dispersion. The simplest way to explain dispersion is through dispersion in the prism.



Convex Lens

- ❖ Convex lens is thick in center but thin at corner.
- ❖ Convex lens is also known as a converging lens because it converges the parallel light rays at one point. Its focal length is positive. Objects appear closer and larger and their images are real and inverted through a convex lens.
- ❖ Convex lens is used to correct far-sightedness/hypermetropia, an eye defect in which near objects are not clearly visible but long-distance objects are clearly visible

Concave Lens

- ❖ Concave lens is thin at the centre but thick at the corner.
- ❖ It is also known as a divergent lens because it diverges the parallel light rays. Its focal length is negative. Objects appear smaller and farther through the concave lens and their images are virtual.
- ❖ Concave lens is used to correct near-sightedness/myopia, an eye defect in which far objects are not clearly visible but near objects are clearly visible.

Simple mirror

- ❖ A simple mirror reflects light, but it does not cause dispersion of light.
- ❖ When light rays strike a mirror, they undergo reflection, where the angle of incidence equals the angle of reflection.

Q198. At which temperature, the Celsius and Fahrenheit scale coincides? (66th BPSC Re-exam)

- A. 0°
- B. 10°
- C. -40°
- D. 40°

Ans: C. -40°

Formula Used:

$$=^\circ\text{C}100$$

$$\frac{(^{\circ}\text{F}-32)}{180}=\frac{^{\circ}\text{C}}{100}$$

Complete step by step answer:

Celsius scale was introduced by Andres Celsius. In Celsius scale water is taken as the base and certain standard values are set with respect to water, for example the boiling point of water is 100 degree Celsius and melting point of ice is 0 degree Celsius.

The Fahrenheit scale was introduced by Daniel Gabriel Fahrenheit. According to this scale the boiling point of water is taken as 212 degree Fahrenheit and the melting point of ice as 32 degree Fahrenheit. This gives the exact difference of 180.

The relation between the Fahrenheit and Celsius scale is given by the equation.

$$\Rightarrow \frac{(^{\circ}\text{F}-32)}{180}=\frac{^{\circ}\text{C}}{100}$$

Now, let us assume that Fahrenheit and Celsius scale coincide at x°

$$\text{Therefore, } \frac{(^{\circ}\text{x}-32)}{180}=\frac{^{\circ}\text{x}}{100}$$

On solving,

We get,

$$\Rightarrow \frac{5}{9}(^{\circ}\text{x}-32)=^{\circ}\text{x}$$

$$\text{Therefore, } \Rightarrow x=-40^\circ$$

Therefore, Celsius and Fahrenheit scale coincide at -40 degrees.

Q199. The power of lens is measured in (66th BPSC Re-exam)

- A. Watt
- B. dioptre
- C. ampere
- D. volt

Ans: B. dioptre

The power of a lens is measured in Dioptre.

Name	Symbol	Quantity	SI Base Units
hertz	Hz	frequency	s ⁻¹
radian	rad	angle	1
steradian	sr	solid angle	1
newton	N	force	kg·m·s ⁻²
pascal	Pa	pressure	kg·m ⁻¹ ·s ⁻²
joule	J	energy	kg·m ² ·s ⁻²
watt	W	power	kg·m ² ·s ⁻³
coulomb	C	electric charge	s·A
volt	V	voltage or potential difference	kg·m ² ·s ⁻³ ·A ⁻¹
farad	F	electrical capacitance	kg ⁻¹ ·m ⁻² ·s ⁴ ·A ²
ohm	Ω	electrical resistance	kg·m ² ·s ⁻³ ·A ⁻²
siemens	S	electrical conductance	kg ⁻¹ ·m ⁻² ·s ³ ·A ²
weber	Wb	magnetic flux	kg·m ² ·s ⁻² ·A ⁻¹
tesla	T	magnetic flux density	kg·s ⁻² ·A ⁻¹
henry	H	electrical inductance	kg·m ² ·s ⁻² ·A ⁻²
degree Celsius	°C	temperature relative to 273.15 K	K
lumen	lm	luminous flux	cd
lux	lx	illuminance	cd·m ⁻²
becquerel	Bq	radioactive decays per unit time	s ⁻¹
gray	Gy	absorbed dose of ionizing radiation	m ² ·s ⁻²
sievert	Sv	equivalent dose of ionizing radiation	s ⁻¹ ·mol
katal	kat	catalytic activity	s ⁻¹ ·mol

Q200. To diagnose the medical conditions, MRI technique is used. Which is not used in MRI? (66th BPSC Re-exam)

- A. Magnetic field
- B. X-ray
- C. Radio Wave
- D. Gamma ray

Ans: B. X-ray

Magnetic Resonance imaging (MRI) is a non-invasive imaging technology that produces three dimensional anatomical images. It is used for disease detection, diagnosis and treatment monitoring. It is based on sophisticated technology that excites and detects the changes in the direction of rotational axis of protons found in the living tissues which contains Water. MRI Technique generally uses, magnetic field, gamma rays and radio waves. X-rays are not used in MRI.

Q201. When a sound wave goes from one medium to another, the quantity that remains unchanged is (66th BPSC Re-exam)

- A. Frequency
- B. Wavelength
- C. Amplitude

D. Speed

Ans: A. Frequency

When sound waves travel from one medium to another, the frequency never changes. If the wave travel into the dense medium, the speed and wavelength decreases and amplitude increases.

Q202. Light year is a unit of (66th BPSC Re-exam)

- A. Time
- B. Distance
- C. Speed
- D. Force

Ans: B. Distance

- ❖ Light year is a unit of astronomical distances. It is equal to the distance travelled by light in one year. It is equivalent to about 9.46 trillion kilometers.
- ❖ Speed is the distance travelled per unit of time. It is a scalar quantity and its SI unit is metre/second.
- ❖ Distance refers to the separation between two points or objects in physical or abstract terms. Distance can be measured in various units such as meters, kilometers, miles, or astronomical units, depending on the scale being considered. Distance is a scalar quantity, meaning it only considers the magnitude or size of the separation, without any specific direction. In order to measure very large distance (distance of astronomical objects) we use the following units Astronomical unit, Light year, and Parsec.
- ❖ Force is a vector quantity that represents the interaction between two objects, resulting in the ability to change an object's motion or shape. Force can cause an object to accelerate, decelerate, change direction, or deform. Force is measured in units called newtons (N) and is calculated by multiplying mass by acceleration ($F = m \times a$) according to Newton's second law of motion.

Q203. Which particle is free of charge? (66th BPSC Re-exam)

- A. Alpha particle
- B. Electron
- C. Neutron
- D. Proton

Ans: C. Neutron

- ❖ Electron: An electron is negatively charged sub-atomic particle. It can be either free (not attached to any atom) or bound to the nucleus of an atom. Electrons in atoms exist in spherical shells of various radii, representing energy levels. The charge on an electron is (-) 1.6022×10^{-19} coulomb. The electron has a mass that is approximately 1/1837 that of the proton or 9.109×10^{-31} kg. It was discovered by J.J.

Thomson (1897). Atomic mass unit of the electron is 0.0005486.

- ❖ Proton: A proton is a positively charged sub-atomic particle. The charge on a proton is (+) 1.6022×10^{-19} coulomb. Its weight is 1.6726×10^{-27} kg. Its atomic mass unit is 1.00727. It was first discovered by Goldstein as anode rays (1886) and finally identified and named by Rutherford (1919). Note : The number of electrons is equal to the number of protons in an atom with an equal charge of opposite nature. Hence the atom is neutral.
- ❖ Neutron: It is a neutral sub-atomic particle so its name is neutron. Its mass is slightly larger than that of proton i.e 1.0087 amu. It was discovered by James Chadwick (1932). Note : Atomic mass unit (amu) is defined as precisely 1/12 of the mass of an atom of Carbon-12.
- ❖ Alpha particle: An alpha particle consists of two protons and two neutrons. It carries a positive charge of +2e (twice the elementary charge, where e represents the elementary charge). Alpha particles were first discovered by Ernest Rutherford during his experiments on radioactive decay.

Q204. Ohm-meter is unit of (66th BPSC Re-exam)

- A. Resistance
- B. Conductance
- C. Resistivity
- D. Charge

Ans. C. Resistivity

- ❖ Resistivity is a measure of a material's ability to resist the flow of electric current. It is measured in Ohm-meter.
- ❖ Resistance is measured in ohms (Ω).
- ❖ Conductance is measured in siemens (S) or mho (Ω^{-1}).
- ❖ Charge is measured in coulombs (C).

Q205. The chemical formula of sapphire (Ruby) is (66th BPSC Re-exam)

- A. Al_2O_3
- B. Al_3O_2
- C. N_2O
- D. NO_2

Ans. A. Al_2O_3

Sapphire is a variety of Corundum or Aluminum oxide. Its chemical formula is Al_2O_3

Q206. The quality of petrol is expressed by (66th BPSC Re-exam)

- A. Cetane number

- B. Octane number
- C. Butane number
- D. Reynolds number

Ans. B. Octane number

- ❖ Octane number: The ignition quality of petrol is expressed by octane number. It is a value used to rate the fuel's resistance to knocking. Higher the octane number, the more resistant the petrol is to knocking.
- ❖ Cetane number: Cetane number is an indicator of the combustion speed of diesel fuel and compression needed for ignition. It plays a similar role for diesel as octane rating does for gasoline.
- ❖ Reynolds number: In fluid dynamics, the Reynolds number is a dimensionless quantity that helps predict fluid flow patterns in different situations by measuring the ratio between inertial and viscous forces. At low Reynolds numbers, flows tend to be dominated by laminar flow, while at high Reynolds numbers, flows tend to be turbulent.

Q207. Which of the following has the highest melting point? (66th BPSC Re-exam)

- A. Boron
- B. Iron
- C. Silicon
- D. Aluminium

Ans. A. Boron

Out of the given options Boron has higher melting point (2076°C). Due to small atomic size boron forms strong covalent bonds with the neighbouring atoms that is why it has high melting and boiling points.

- ❖ Melting Point of Iron - 1538°C
- ❖ Melting Point of Silicon - 1410°C
- ❖ Melting point of Aluminium - 660.3°C

Boron is used in a variety of applications, including:

- ❖ Production of borosilicate glass, used in laboratory equipment and high-temperature applications.
- ❖ Nuclear industry, where boron compounds are used as neutron absorbers.
- ❖ Semiconductor industry, where boron is used as a dopant in silicon-based devices

Aluminium is a lightweight and corrosion-resistant metal, commonly used in:

- ❖ Construction and architecture, including doors, windows, and roofing.
- ❖ Transportation industry, for manufacturing aircraft, cars, and bicycles.
- ❖ Packaging materials, such as aluminum cans and foils.
- ❖ Electrical industry, for power transmission lines and wiring.

Q208. An example of antibiotic medicine is (66th BPSC Re-exam)

- A. Aspirin
- B. Paracetamol
- C. Chloroquine
- D. Penicillin

Ans. D. Penicillin

Antibiotics are medicines that fight infections caused by bacteria. They work by killing the bacteria or by making it hard for the bacteria to grow or multiply. Out of the given options penicillin is an antibiotic. Aspirin and Paracetamol are antipyretic while chloroquine is antimalarial.

DRUGS

- ❖ **Antipyretics** -Antipyretics are substances that reduce fever.
 - Examples : Aspirin (acetylsalicylic acid), paracetamol, phenacetin.
- ❖ **Analgesics** -The term Analgesics encompasses a class of drugs that are designed to relieve pain without causing the loss of consciousness
 - Example-Aspirin (2- acetoxybenzoic acid) and Paracetamol (2- Acetamidophenol).
- ❖ **Antiseptic** -Antiseptics are antimicrobial substances that are applied to living tissue/skin to reduce the possibility of infection, sepsis or putrefaction (the process of decay or rotting in body).
 - Examples Chlorhexidine, povidone-iodine, chloroxyleneol, isopropyl alcohol, hexachlorophene, benzalkonium chloride, and hydrogen peroxide
- ❖ **Tranquillizer** -A medicinal drug taken to reduce tension or anxiety is known as tranquillizer.
 - Example: iproniazid and phenelzine
- ❖ **Antibiotics** - Antibiotics are such chemicals that inhibit the growth of microorganisms or destroy them. Antibiotics are obtained or formed from living cells. The first antibiotic penicillin was discovered by Alexander Flemming (1929) from *Penicillium notatum*, a fungus. Antibiotics do not work on viruses.

Q209. The major component of CNG is (66th BPSC Re-exam)

- A. CO₂
- B. N₂
- C. H₂
- D. CH₄

Ans. D. CH₄

The major component of CNG (compressed natural gas) is methane (CH₄). When the natural gas is compressed at high pressure, it is termed "compressed natural gas" (CNG).

C.N.G. offers many advantages, such as –

- ❖ It burns cleaner, i.e. it produces very less greenhouse gases when compared to the traditional fuels. Carbon emission produced by it is very less.
- ❖ Since C.N.G. is not toxic, it does not contaminate groundwater.
- ❖ Vehicles operating on CNG fuels produce a lot less noise when compared to gasoline and diesel vehicles, thus reducing noise-pollution.
- ❖ It is also very cost effective.
- ❖ It is also very less flammable and is not a big risk for fire hazards, when compared to other fuels.

Q210. The component (s) of acid rain is/are (66th BPSC Re-exam)

- A. HNO₃
- B. H₂SO₄
- C. CO₂
- D. Both (a) and (b)

Ans. D. Both (a) and (b)

Acid rain or acid deposition is a broad term that includes any form of precipitation with acidic components, such as sulfuric or nitric acid that fall to the ground from the atmosphere in wet or dry forms. This can include rain, snow, fog, hail or even dust that is acidic.

When SO₂ (Sulphur Dioxide) and NO_x (Nitrogen Oxide) combine with water and oxygen in the atmosphere, they form sulfuric acid (H₂SO₄) and nitric acid (HNO₃), respectively.

Q211. The chemical formula for heavy water is (66th BPSC Re-exam)

- A. H₂O
- B. N₂O
- C. D₂O
- D. CuO

Ans. C. D₂O

❖ **D₂O:** Heavy water (D₂O) is basically water composed of deuterium. It is also known as deuterium oxide. Deuterium is the hydrogen isotope with a mass double that of ordinary hydrogen. (Ordinary water is represented by H₂O.) Heavy water has a molecular weight of about 20 (the sum of twice the atomic weight of deuterium, which is 2, in addition to the atomic weight of oxygen that is 16), whereas ordinary water has a molecular weight of about 18 (twice the

atomic weight of ordinary hydrogen, which is 1, plus oxygen, which is 16).

❖ **Uses of Heavy Water**

- Nuclear Magnetic Resonance: Since the signal from H_2O solvent molecules interact and block the signal from the molecule of interest, D_2O is used. D_2O has a different magnetic moment and hence makes it convenient to be used in nuclear magnetic resonance spectroscopy.
- In Organic Chemistry: Specifically labelled isotopologues of organic compounds require deuterium for their preparation. D_2O is often used as a source for Deuterium.
- Neutron Moderator: D_2O is used as a neutron moderator in certain types of nuclear reactors. It helps in slowing down neutrons so that the probability of them reacting with the fissile uranium-235 than with uranium-238 increases. This, in turn, helps in capturing neutrons without fissioning.
- Neutrino Detector: Neutrinos react with heavy water to produce flashes of lights.
- Metabolic Rate Testing in Physiology and Biology: Conducting tests to check the safety of mean metabolic rate in humans and animals requires heavy water as part of a mixture with $H_2^{18}O$.
- Tritium Production: Tritium is created in small amounts in heavy water moderated reactors.

❖ H_2O : This is the chemical formula for water, also known as light water, which consists of two hydrogen atoms and one oxygen atom.

❖ N_2O : This is the chemical formula for nitrous oxide, also known as laughing gas.

❖ CuO : This is the chemical formula for copper (II) oxide, which is a compound formed by the combination of copper and oxygen.

Q212. The pH value of water is (66th BPSC Re-exam)

- A. 4
- B. 7
- C. 12
- D. 18

Ans. B. 7

Pure water has a PH value of about 7. It is considered as neutral because it has neither acidic nor basic properties.

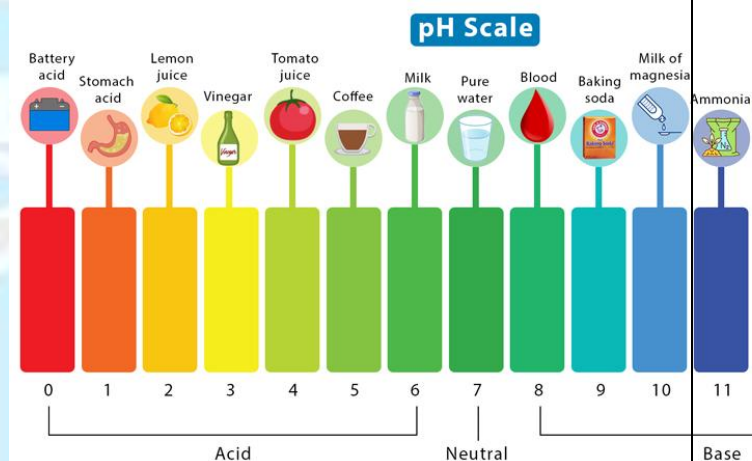
Things to remember about pH Value and concentration

- ❖ An acid solution having low pH is stronger than another solution having higher pH values. A solution having pH of 2 is stronger than a solution having pH of 5.
- ❖ An alkali solution having a higher pH value is stronger than a solution of pH 10.

❖ Very Strong acids solution can have pH values less than zero and very strong basic solutions can pH greater than 14.

pH values of the common substance from our daily life

Solution	pH	Solution	pH
Conic HCl	0	Saliva (before meal)	7.4
Oil HCl	1.0	Saliva (after meal)	5.8
Gastric Juice	1.4	Blood	7.4
Lemon Juice	2.5	Eggs	7.8
Vinegar	4.0	Toothpaste	8.0
Tomato Juice	4.1	Baking Soda Solution	8.5
Coffee	5.0	Washing Soda Solution	9.0
Soft Drink	6.0	Milk of Magnesia	10.5
Milk	6.5	Household Ammonia	11.6
Pure Water	7.0	Dilute Sodium Hydroxide	13.0
		Concentrated Sodium Hydroxide	14



Q213. The Nobel Prize in Chemistry, 2019 was awarded for the development of (66th BPSC Re-exam)

- A. LED
- B. LCD
- C. Lithium-ion-batteries
- D. MRI

Ans. C. Lithium-ion-batteries

- ❖ The Nobel Prize in Chemistry in 2019 was awarded for the development of lithium-ion batteries. John B. Goodenough, M. Stanley Whittingham, and Akira Yoshino received the award for their contributions to advancing the technology of lithium-ion batteries.
- ❖ LED stands for Light-Emitting Diode.
- ❖ LCD stands for Liquid Crystal Display.
- ❖ MRI stands for Magnetic Resonance Imaging.

Q214. Natural rubber is a polymer of (66th BPSC Re-exam)

- A. Isoprene
- B. Vinyl acetate
- C. Styrene
- D. Propene

Ans. A. Isoprene

Natural Rubber

- ❖ Natural rubber is a polymer made up of a chemical molecule called isoprene. Chemical formula of isoprene is C_5H_8 .
- ❖ It is a native of the Amazon basin which was introduced to countries in the tropical belts of Asia and Africa in the late nineteenth century.
- ❖ Climatic conditions required for Rubber
- ❖ Rubber trees require moist and humid climates with heavy rainfall of more than 200 cm.
- ❖ It grows well in equatorial climates and temperatures above 25 degrees Celsius.
- ❖ Rubber trees require well-drained, weathered soils.

Q215. The chemical used for destroying fungi in water tank is (66th BPSC Re-exam)

- A. Nitric acid
- B. Zinc Sulphate
- C. Magnesium Sulphate
- D. Copper Sulphate

Ans. D. Copper Sulphate

Copper sulphate is commonly used as a fungicide in water treatment processes to eliminate fungi in water tanks. It is an effective and widely used chemical due to its antifungal properties.

Nitric Acid

- ❖ Nitric Acid is a inorganic compound with chemical formula HNO_3 .
- ❖ It is a highly corrosive mineral acid, fuming, colourless and plays a important role in the manufacture of fertilisers and explosives.
- ❖ It is also known as the spirit of niter and aqua fortis. In its pure form, it is colourless but as it gets older it turns into a yellow cast. This colour appears due to the decomposition of Nitric acid to oxides of nitrogen and water. It is highly corrosive and toxic. It causes severe skin burn. It reacts with hydroxides, metals, and oxides to form nitrate salts.
- ❖ HNO_3 is used as a strong oxidizing agent. It can be manufactured by the catalytic oxidation of ammonia. It is a common reagent used in laboratories and an important chemical used in industries to manufacture explosives and fertilizers. The PH of Nitric acid is approximately 3.01.
- ❖ **Uses of Nitric Acid**

- It is used to produce ammonium nitrates to manufacture plastic, dye, and fertilizers
- It is used in making explosives such as TNT
- It is used in liquid-fueled rockets as an oxidizer
- In its pure form, it is used in the removal of the wart
- It is used as a chemical doping agent in electrochemistry

Zinc Sulfate

- ❖ $ZnSO_4$ is an inorganic compound with the chemical name Zinc Sulfate.
- ❖ Zinc Sulfate is a dietary supplement. It was historically called white vitriol. It is also known as Zincate, Zinc sulfate (1:1). This compound is listed on the World Health Organization's List of Essential Medicines. You must avoid taking this medication with foods that are high in phosphorus or calcium because it can make it harder for your body to absorb.
- ❖ Zinc Sulfate is odourless and has a white powder appearance. Zinc Sulfate is non-combustible and soluble in water. It emits toxic fumes of zinc oxide and sulphur oxides during decomposition. It is widely used in the prevention and treatment of zinc deficiency.
- ❖ **Zinc Sulfate ($ZnSO_4$) Uses**
 - Medically it is used along with oral rehydration therapy.
 - It acts as a coagulant in the production of rayon.
 - It is used as a preservative for leathers.
 - It is used in zinc electroplating as an electrolyte.
 - It is used as a mordant in dyeing.
 - It is used in the brewing process as a zinc supplement.
 - It is used as an astringent in eye drops and lotions.
 - It is used to treat acne.
 - You can take zinc sulfate with food if you are suffering from stomach upset.

Magnesium Sulphate ($MgSO_4$)

Magnesium Sulphate, also popularly known as Epsom salts, is used in therapeutic baths. Generally, Magnesium Sulphate is a naturally occurring mineral used to regulate lower blood levels of magnesium. Magnesium Sulphate is a white colour crystalline solid which is soluble in water but not soluble in ethanol. The most important utilisation of Magnesium Sulphate is made in agricultural activities to maintain the soil deficient in magnesium. It is used as an essential and effective plant nutrient because magnesium is present in the process of chlorophyll and photosynthesis of plants. Magnesium Sulphate is naturally obtained from natural sources like dry lake beds. After obtaining it from natural sources it goes under various processes where it is made and reacted with other chemicals.

Q216. Which of the following is not a component of chlorophyll? (66th BPSC Re-exam)

- A. Calcium
- B. Carbon
- C. Magnesium
- D. Hydrogen

Ans. A. Calcium

- ❖ Chlorophyll is the main component of the plant cell, it is the green coloured pigment that present in the cell organelle names as plastid and it is specially present on the thylakoids membrane inside the plastid.
- ❖ We chemically study the chemical structure of the chlorophyll then we came to know that the chemical formula of chlorophyll will be $C_{55}H_{72}O_5N_4Mg$. This will be the chemical structure of chlorophyll.
- ❖ From the chemical structure of the chlorophyll we came to know that the chlorophyll has a hydrocarbon chain centrally located with Magnesium (Mg). Along with it have a porphyrin ring in which Mg ion is centrally located.
- ❖ The types of the chlorophyll changed according to the side chain that was present on the porphyrin ring. Here central ion magnesium and the porphyrin ring is the main root of the structure and the rest character gets changed according to the nature of the side chain that is present on the ring.

Q217. Water in plants is transported by (66th BPSC Re-exam)

- A. Xylem
- B. Epidermis
- C. Phloem
- D. Cambium

Ans. A. Xylem

Xylem is the complex tissue of plants that helps in the transportation of water and nutrients in the plant. Phloem refers to the living tissue which helps in the transportation of food and organic materials in the plant.

Epidermis:

- ❖ The epidermis is the outermost cellular layer that covers the whole plant structure, that is, it covers roots, stem, and leaves or the whole animal body.
- ❖ It is composed of a single layer of living cells, even though there are exceptions.

Functions of the Epidermis:

In plants:	In animals:
❖ The epidermal cells will protect the underlying cells.	❖ The outermost layer of the skin, the epidermis, provides a waterproof barrier and creates skin tone.

- ❖ The waxy cuticle will prevent the loss of moisture from the leaves and stems.
- ❖ The transparent epidermal cells will allow sunlight for photosynthesis to pass through the chloroplasts in the mesophyll tissue.
- ❖ The stomata of leaves and stems allow the gaseous exchange to take place which is necessary for photosynthesis and respiration.
- ❖ The water vapour may be given off through the stomata during transpiration.
- ❖ Epidermis is cornified to resist abrasion.
- ❖ Beneath the epidermis, the dermis contains tough connective tissue, hair follicles, and sweat glands
- ❖ Hydration: The outermost layer of the epidermis (stratum corneum) retains moisture, keeping the skin moist and healthy.
- ❖ Generation of new skin cells: New skin cells originate in the lowest layer of the epidermis (basal layer) and migrate up through the other layers with age. It reaches the outermost layer of the epidermis after about a month. There, skin cells slough off the body as new cells develop at the bottom layer.
- ❖ Protection: The epidermis acts like armor to protect the body from damage such as ultraviolet (UV) radiation, pathogens (bacteria, viruses, fungi, parasites), and chemicals.
- ❖ Skin color: The epidermis contains cells called melanocytes, which produce melanin. Melanin is a group of pigments that give skin its color.

- ❖ Cambium tissue is the layer of cells in a plant that provides unspecialized cells to promote growth. Cambium tissues contain, and are instrumental in producing, meristemic cells which are also unspecialized. The cambium tissue layer of cells is located between the xylem and phloem structures of the plant.

Q218. During photosynthesis, green plants absorb (66th BPSC Re-exam)

- A. Oxygen
- B. Nitrogen

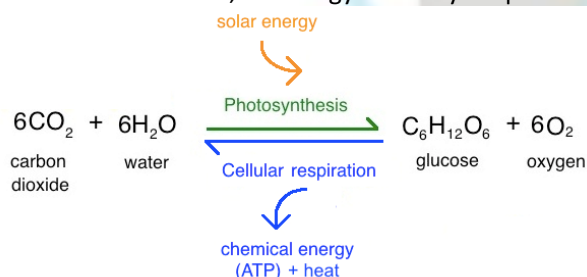
- C. Carbon Monoxide
D. Carbon dioxide

Ans. D. Carbon dioxide

Photosynthesis:

Photosynthesis is the primary source of food, where light energy is transformed into chemical energy. During photosynthesis, green plants capture light energy and use it to convert water, carbon dioxide, and minerals. These components are converted into oxygen and organic compounds. Organic compounds are sugar and energy-rich in nature. Chlorophyll, the green pigment, is essential for the process of photosynthesis. In the Photochemical phase, the following actions take place:

- ❖ **Light absorption:** Chlorophyll absorbs violet-blue and reddish-orange wavelengths of visible light, except for green colour. The green pigment reflects the green and yellow-green wavelengths
- ❖ **Water splitting:** Water is broken down into oxygen and hydrogen in the chloroplast in a chemical reaction. Light energy remains absorbed by chlorophyll
- ❖ **Releasing of Oxygen:** From the water, oxygen is released. Water and carbon dioxide are absorbed during photosynthesis. The water molecules slowly get converted into oxygen and sugar. Sugar molecules provide energy, whereas oxygen gets released into the atmosphere
- ❖ **ATP and NADPH:** The light energy gets converted into chemical energy. In plants, hydrogen is bonded to NADP, which produces NADPH, which generates ATP. A proton is connected to the coenzyme NADP, which becomes NADPH, an energy currency for plants



Q219. Oxygen is absent in _____. (66th BPSC Re-exam)

- A. Glass
B. Soil
C. Cement
D. Kerosene

Ans. D. Kerosene

Out of the given options kerosene does not have oxygen. Its chemical formula is C₁₂H₂₆-C₁₅H₃₂ and is a hydrocarbon while glass [which is based on silica (SiO₂)], soil and cement contain oxygen.

Q220. The source of the enzyme "Lipase" is (66th BPSC Re-exam)

- A. Kidney
B. Pancreas
C. Liver
D. Heart

Ans. B. Pancreas

- ❖ Digestive enzymes are the enzymes that break down polymeric macromolecules into smaller building blocks to facilitate their absorption by the body.
- ❖ Our digestive system does not absorb the food we eat, it absorbs nutrients in the form of simpler molecules. Food needs to be broken down from products like steak and broccoli into amino acids (from proteins), fatty acids and cholesterol (from fats), and sugars (from carbohydrates) along with vitamins, minerals, and a variety of animal and plant compounds.
- ❖ If we don't have sufficient digestive enzymes, our food cannot be broken down. That means that even if we eat well, we aren't absorbing good nutrition.
- ❖ Digestive enzymes convert the food into smaller molecules that your tissues, cells, and organs utilize for many metabolic functions. It takes some time to complete this process and results in amino acids, glycerol, fatty acids and simple sugars. When you chew and break food into small pieces, special enzymes produced in different parts of your digestive region start acting to complete the process.

Amylase

Amylase is defined as a digestive enzyme that breaks starch into small carbohydrate molecules. This enzyme is produced in two areas. Firstly, salivary glands in our mouth generate salivary amylase that starts the process of digestion by breaking down starch and converting it into maltose and smaller carbohydrate. Cells in the pancreas also produce a different type of amylase, known as pancreatic amylase that travels via a duct to reach the small intestine. Pancreatic amylase finishes the digestion of carbohydrates, producing glucose.

Protease

This enzyme breaks down protein into amino acids, which are its building blocks. The three main protease enzymes are trypsin, pepsin, and chymotrypsin. Special cells produce an enzyme, called pepsinogen in your stomach that converts into pepsin when it comes in contact with the acid surrounding the stomach. Pepsin breaks some chemical bonds in the protein, creating smaller molecules known as peptides. The pancreas makes chymotrypsin and trypsin, enzymes that are liberated into the small intestine through the pancreatic duct.

Lipase

Lipase enzyme breaks down dietary fats into smaller molecules known as glycerol and fatty acids. A little

quantity of lipase, known as gastric lipase is produced by the cells of the stomach. This enzyme mainly digests fat present in the food. The pancreas is the primary source of lipase in the digestive tract, which produces pancreatic lipase which acts in the small intestine. The bile produced in the liver and liberated in the intestine transforms dietary fat into small fat globules. Pancreatic lipase acts on these fat globules and converts them into glycerol and fatty acids which are small, energy molecules. Glycerol and fatty acids move in the blood and lymph vessels to move in every part of the body.

Although amylase, lipase, and protease are the major enzymes that your body utilizes to digest food, there are many other specialized enzymes also contributing to the process.

Enzyme	Source	Enzymatic
Invertase	Yeast	Sucrose → Glucose and Fructose
Zymase	Yeast	Glucose → Ethyl alcohol and CO ₂
Diastase	Malt	Starch → Maltose
Maltase	Yeast	Maltose → Glucose
Urease	Soyabean	Urea → Ammonia and CO ₂
Pepsin	Stomach	Proteins → Amino acids

Q221. BCG vaccine is used for the prevention of (66th BPSC Re-exam)

- A. Smallpox
- B. Typhoid
- C. Tuberculosis
- D. Plague

Ans. C. Tuberculosis

Tuberculosis

- ❖ Tuberculosis is a bacterial infection caused by *Mycobacterium tuberculosis*. It can practically affect any organ of the body. The most common ones are the lungs, pleura (lining around the lungs), lymph nodes, intestines, spine, and brain.
- ❖ It is an airborne infection that spreads through close contact with the infected, especially in densely populated spaces with poor ventilation.

BCG Vaccine:

- ❖ BCG was developed by two Frenchmen, Albert Calmette and Camille Guérin, by modifying a strain of *Mycobacterium bovis* (that causes TB in cattle). It was first used in humans in 1921.
- ❖ In India, BCG was first introduced in a limited scale in 1948 and became a part of the National TB Control Programme in 1962.
- ❖ In addition to its primary use as a vaccine against TB, it protects against respiratory and bacterial infections of the newborns, and other

mycobacterial diseases like Leprosy and Buruli's ulcer.

- ❖ It is also used as an immunotherapy agent in cancer of the urinary bladder and malignant melanoma.

Typhoid

- ❖ Typhoid fever is a life-threatening systemic infection caused by the bacterium *Salmonella enterica* serovar Typhi (commonly known as *Salmonella Typhi*) carried only by humans – no other animal carrier has been found.
- ❖ Symptoms and signs of typhoid range from mild to severe, can last for about one month without treatment, and may include: fever, fatigue or tiredness, malaise (general feeling of unwellness), sore throat, persistent cough, headache.

Smallpox

- ❖ About: Smallpox is a contagious disease, caused by the Variola Virus (VARV).
- ❖ Transmission: It transmits through the droplets released from coughing, sneezing, and face to face contact with an infected person.
- ❖ Eradication: One of the deadliest diseases known to mankind, it is also the only one to have been eradicated by vaccination.
 - In 1980, this was declared as completely eradicated after the global immunization campaign led by the World Health Organization (WHO) with the help of the smallpox vaccine.
- ❖ Vaccine: The first effective vaccine was discovered by Edward Jenner in 1796.

Plague

Plague is a class of dangerous, life-threatening and infectious diseases mainly caused by the gram-negative, rod-shaped coccobacillus called *Yersinia pestis*. This bacterium is mainly found in animals like rodents or rats, and then it is transmitted through the insects that feed on the blood of these animals. This disease is called by several names: Black Plague – as the black rats are the carrier of this dangerous disease.

Q222. Which hormone is produced by pancreas? (66th BPSC Re-exam)

- A. Thyroxine
- B. Insulin
- C. Galanin
- D. Gastrin

Ans. B. Insulin

Endocrine Glands and the Hormones Secreted

- ❖ **Hypothalamus:** It controls the body temperature, regulates emotions, hunger, thirst, sleep, moods and allow the production of hormones.

- ❖ **Pineal:** Pineal is also known as the thalamus. It produces serotonin derivatives of melatonin, which affects sleep patterns.
- ❖ **Parathyroid:** This gland helps in controlling the amount of calcium present in the body.
- ❖ **Thymus:** It helps in the production of T-cells, functioning of the adaptive immune system and maturity of the thymus.
- ❖ **Thyroid:** It produces hormones that affect the heart rate and how calories are burnt.
- ❖ **Adrenal:** This gland produces the hormones that control the sex drive, cortisol and stress hormone.
- ❖ **Pituitary:** It is also termed as the “master control gland,”. This is because the pituitary gland helps in controlling other glands. Moreover, it develops the hormones that trigger growth and development.
- ❖ **Pancreas:** This gland is involved in the production of insulin hormones, which plays a crucial role in maintaining blood sugar levels.
- ❖ **Testes:** In men, the testes secrete the male sex hormone, testosterone. It also produces sperm.
- ❖ **Ovaries:** In the female reproductive system, the ovaries release estrogen, progesterone, testosterone and other female sex hormones.

List of Important Hormones

- ❖ **Cortisol** – It has been named as the “stress hormone” as it helps the body in responding to stress. This is done by increasing the heart rate, elevating blood sugar levels etc.
- ❖ **Estrogen**–This is the main sex hormone present in women which bring about puberty, prepares the uterus and body for pregnancy and even regulates the menstrual cycle. Estrogen level changes during menopause because of which women experience many uncomfortable symptoms.
- ❖ **Galanin** is a neuropeptide that acts as a neurotransmitter and hormone in the body. It is widely distributed in the brain and peripheral tissues, where it plays various roles in regulating numerous physiological functions. Galanin is involved in the modulation of pain, regulation of appetite and energy balance, control of hormone release, modulation of sleep and circadian rhythms, and regulation of mood and behavior.
- ❖ **Melatonin** – It primarily controls the circadian rhythm or sleep cycles.
- ❖ **Progesterone** – It is a female sex hormone also responsible for menstrual cycle, pregnancy and embryogenesis.
- ❖ **Testosterone**– This is the most important sex hormone synthesized in men, which cause puberty, muscle mass growth, and strengthen the bones and muscles, increase bone density and controls facial hair growth.

Q223. Which among the following help in circulation of blood? (66th BPSC Re-exam)

- A. Lymphocytes
- B. Monocytes
- C. Erythrocytes
- D. Blood Platelets

Ans. A. Lymphocytes

Lymphocytes are a type of white blood cells that are made in bone marrow and found in the blood and lymph tissue. They are part of lymphatic system that collect excess fluid from cells and tissues and returns it to blood stream, helping in the easy circulation of blood. Therefore, out of the given option lymphocytes help in blood circulation.

Red blood cells (Erythrocytes)

RBCs are biconcave cells without nucleus in humans; also known as erythrocytes. RBCs contain the iron-rich protein called haemoglobin; give blood its red colour. RBCs are the most copious blood cells produced in bone marrows. Their main function is to transport oxygen from and to various tissues and organs.

Monocytes

- ❖ These cells usually have a large bilobed nucleus, with a diameter of 12 to 20 micrometres.
- ❖ The nucleus is generally half-moon shaped or kidney-shaped and it occupies 6 to 8 per cent of WBCs.
- ❖ They are the garbage trucks of the immune system.
- ❖ The most important functions of monocytes are to migrate into tissues and clean up dead cells, protect against bloodborne pathogens and move very quickly to the sites of infections in the tissues.
- ❖ These white blood cells have a single bean-shaped nucleus, hence referred to as Monocytes.

Platelets (Thrombocytes)

- ❖ Thrombocytes are specialized blood cells produced from bone marrow.
- ❖ Platelets come into play when there is bleeding or haemorrhage.
- ❖ They help in clotting and coagulation of blood. Platelets help in coagulation during a cut or wound.

Q224. Angora wool is extracted from (66th BPSC Re-exam)

- A. Rabbit
- B. Fox
- C. Goat
- D. Sheep

Ans. A. Rabbit

Animals Yielding Wool

Wool fibres are obtained from sheep, goat, angora rabbits, goats, alpaca and even camels.

- ❖ Sheep – Most sheep have two types of hair from which the wool is obtained. The outer coarse hair is known as Kemp. The fine, soft undercoat close to the skin is the true wool from which wool fibre is obtained.
- ❖ Cashmere goat – The fine soft fibre obtained from the undercoat of the cashmere goat is called cashmere. The outer coat hair fibres are quite coarse and high quality cashmere is obtained by “dehairing” or combing. Cashmere goats are found only in mountain regions of China.
- ❖ Yak – Yaks are found in Tibet and Ladakh. Their coats consist of outer long coat hair and an undercoat of soft and silky wool. The colour usually ranges from brown to black.
- ❖ Camel – Camel fleece consists of a soft, fine undercoat and an overcoat of long coarse hair that grows up to 15 inches long. Camel wool is considered a healthy natural product. It has excellent thermal insulation properties.
- ❖ Angora rabbit – Soft white fibre called goraw wool is obtained from the angora rabbit. Stiff, long, guard hair growing through the soft coat has to be removed before the fur from these rabbits is combed out. The soft white fur obtained is then spun into yarn that is used to make sweaters.

Q225. The radiation used in the treatment of muscle aches are (66th BPSC exam)

- A. Infrared
- B. Microwave
- C. UV
- D. X-ray

Ans. A. Infrared

Sir Frederick William Herschel discovered infrared radiation. Infrared radiation (IR), sometimes known as infrared light, is electromagnetic radiation (EMR) with wavelengths longer than those of visible light.

Uses, Applications, and Examples of Infrared Radiation

Following are the areas of use of infrared waves:

❖ Heat Source

Two different industries use infrared radiation as a heat source, and they are:

- Medical uses: Infrared radiation finds application as a heating source. There are infrared saunas used to treat high blood pressure and rheumatoid arthritis. Infrared radiation is considered to be one of the safest methods of physiotherapy.
- Manufacturing industries: Industries which concentrate on manufacturing processes such as forming of plastics, curing of coatings, plastic

welding, etc., use infrared heaters in place of contact heating and convection ovens.

❖ Cosmetology Application

- Infrared rays are widely used for cosmetic applications such as treating skin injuries, smoothing wrinkles, reducing the occurrence of dandruff, blackheads, etc. Infrared rays are used because they can penetrate the skin up to 3-4 mm. They also warm the skin resulting in improved blood circulation and a continuous supply of oxygen and other nutrients to the skin.

❖ Astronomy

- Astronomers use optical devices such as mirrors, solid-state digital detectors, and lenses to study objects from space with the help of infrared waves. The images from these optical devices are obtained with the help of an infrared telescope.

❖ Massage Therapy

- Infrared rays are used for warming the skin and for relaxing the muscles. Infrared rays are preferred because of their penetration quality through the skin.

❖ Infrared Photography

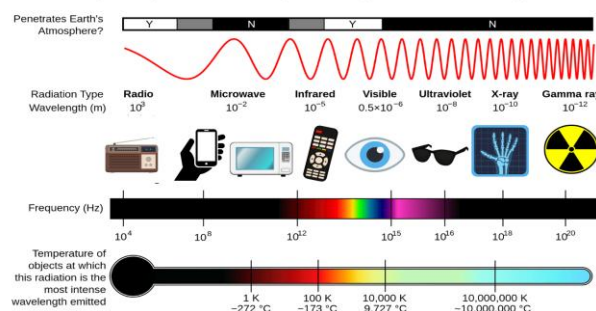
- Infrared filters are used for capturing pictures in infrared photography. This imaging is done for objects that are placed in the near-infrared spectrum. Most digital cameras use infrared blockers making the near-infrared appear as a purple-white colour in the final image.

❖ Infrared Communication

- Data transmission with the help of infrared radiation is very common in short-range communication. For encoding the data, infrared light-emitting diodes are used, which emit infrared radiation and are focused into a narrow beam with the help of a plastic lens. At the receiver end, a photodiode is placed to convert infrared radiation into electric current.

Electromagnetic Spectrum

The electromagnetic spectrum is the range of all frequencies of electromagnetic radiation.



Q226. The total resistance of a circuit having two parallel resistors is 1.403 kilo-ohm. If one of the resistors is 2.0 kilo-ohm, then the other resistor will be (66th BPSC exam)

- A. 1.403 kilo-ohm
- B. 2.0 kilo-ohm
- C. 3.403 kilo-ohm
- D. 4.70 kilo-ohm

Ans. D. 4.70 kilo-ohm

Total Resistance (R) = 1.403 kilo-ohm

$R_1 = 2.0$ kilo-ohm.

1.403 kilo ohm = 1403 ohm

2 kilo ohm = 2000 ohm

Now for parallel combination:

$1/R = 1/R_1 + 1/R_2$

$$\frac{1}{1403} = \frac{1}{2000} + \frac{1}{R_2}$$

$R_2 = 4700.16$ ohm

$R_2 \approx 4.72$ kilo-ohm

Q227. On heating, the resistance of a semiconductor (66th BPSC exam)

- A. Increases
- B. Decreases
- C. First increases then decreases
- D. Remains same

Ans. B. Decreases

When a material is heated the valence band and conduction band moves due to the energy from the heat. In the case of conductors, the valence band and conduction band overlap and resistance increase. In the case of semiconductors, the valence band conduction band has a gap before it is heated. When the semiconductor is heated the gap becomes small and resistance decreases because of the availability of electrons.

Hence when a semiconductor is heated its resistance decreases.

Q228. Faraday constant (66th BPSC exam)

- A. Depends upon the amount of the electrolyte
- B. Depends upon the current passed in the electrolyte
- C. Depends on the volume of the solvent in which the electrolyte is dissolved
- D. Is a universal constant

Ans. D. Is a universal constant

In physics as well as in Chemistry, Faraday represents the magnitude of electric charge per mole of the electron. Faraday is equivalent to the Faraday constant. Denoted by the symbol F. The constant was named after Michael Faraday. It has got plenty of applications in electrolysis.

Q229. Light year is a unit of (66th BPSC exam)

- A. Time
- B. Speed
- C. Distance
- D. Intensity of light

Ans. C. Distance

The light year is a unit of distance: It is defined as the distance that light travels in one year in a vacuum. Since light travels at a constant speed of approximately 299,792,458 meters per second (m/s), the distance covered by light in one year is about 9.46 trillion kilometers (or about 5.88 trillion miles). The light year is commonly used to measure astronomical distances, especially when discussing the vast distances between celestial objects in space.

Intensity of light: Intensity of light refers to the amount of energy carried by a light wave per unit of area and per unit of time. It is commonly measured in units such as watts per square meter (W/m²) or its multiples like kilowatts per square meter (kW/m²).

Q230. The velocity of electromagnetic waves is (66th BPSC exam)

- A. $3 \times 10^8 \text{ ms}^{-1}$
- B. $3 \times 10^7 \text{ ms}^{-1}$
- C. $3 \times 10^6 \text{ ms}^{-1}$
- D. $3 \times 10^5 \text{ ms}^{-1}$

Ans. A. $3 \times 10^8 \text{ ms}^{-1}$

Velocity of an electromagnetic wave is property which is dependent on the medium in which it is travelling. Electromagnetic waves are the composition of oscillating electric and magnetic field. These waves travel with a constant velocity of $3 \times 10^8 \text{ ms}^{-1}$ in a vacuum.

Electromagnetic Waves :

- ❖ Contrast to mechanical waves, some waves need no medium for propagation.
- ❖ These waves are called electromagnetic waves
- ❖ Examples of electromagnetic waves are X-rays, light, radio waves etc.
- ❖ The speed of all electromagnetic waves are the same and all travel equal speed to the speed of light in a vacuum.
- ❖ The electromagnetic spectrum covers electromagnetic waves with frequencies ranging from below one hertz to above 10^{25} hertz, corresponding to wavelengths from thousands of kilometres (10^8 m) to a fraction of the size of an atomic nucleus (10^{-14} m).
- ❖ Electromagnetic waves with the shortest range of wavelength have higher energy while with longest wavelength range have less energy.

Q231. Which one of the following does not change when light travels from one medium to another? (66th BPSC exam)

- A. Velocity
- B. Wavelength
- C. Frequency
- D. Refractive Index

Ans. C. Frequency

Frequency is the property of light that does not change when light travels from one medium to another whereas, wavelength, speed of light, Velocity and Refractive index changes when light travels from one medium to another.

Q232. The first man who placed his foot on the moon is (66th BPSC exam)

- A. Leonov
- B. Neil Armstrong
- C. Michael Collins
- D. James Van Allen

Ans. B. Neil Armstrong

- ❖ Neil Armstrong, became the first man who walked on the moon on 20th July 1969. Neil Armstrong, Edwin Buzz Aldrin and Michael Collins were the astronauts in Apollo 11 space mission conducted by U.S.A.
- ❖ Michael "Mike" Collins was an Italian-American astronaut who flew the Apollo 11 command module Columbia around the Moon in 1969 while his crewmates, Neil Armstrong and Buzz Aldrin, made the first crewed landing on the surface. He was also a test pilot and major general in the U.S. Air Force Reserve.
- ❖ James Alfred Van Allen was an American space physicist at the University of Iowa. He was instrumental in establishing the field of magnetospheric research in space.

Q233. The number of neutrons in the nucleus of plutonium nuclide (${}_{94}\text{Pu}^{242}$) is (66th BPSC exam)

- A. 94
- B. 148
- C. 242
- D. 336

Ans. B. 148

In the case of Plutonium-242 (${}_{94}\text{Pu}^{242}$):

- ❖ The atomic number is 94, indicating that it has 94 protons.
- ❖ The mass number is 242, which represents the total number of protons and neutrons.
- ❖ Number of neutrons = Mass number (protons + neutrons) - Atomic number (protons)
- ❖ Number of neutrons = $242 - 94 = 148$

Q234. The highest viscosity among the following is of (66th BPSC exam)

- A. Water
- B. Air
- C. Blood
- D. Honey

Ans. D. Honey

Viscosity is a measure of a fluid's resistance to flow. As the viscosity increases, the flow rate decreases. All fluids, gases having low density have low viscosities and those having high density have the high viscosity. Among the above given options, honey has highest Viscosity.

The order of viscosity from lowest to highest among the given options is: Air < Water < Blood < Honey

Q235. Milk is a poor source of (66th BPSC exam)

- A. Calcium
- B. Protein
- C. Vitamin C
- D. Carbohydrate

Ans. C. Vitamin C

Milk contains high quantities of vitamins A & B such as thiamine, nicotinic acid and riboflavin, although it is low source of vitamin C & E. Calcium, Sodium, Phosphorus & Potassium are major minerals in milk. It is colloidal suspension of proteins. Lactose is the main carbohydrate. Lactose is disaccharide found only in milk & dairy products.

Q236. Glucose is converted to ethyl alcohol by the enzyme (66th BPSC exam)

- A. Maltase
- B. Invertase
- C. Zymase
- D. Diastase

Ans. C. Zymase

Zymase enzyme converts glucose into ethanol through process of fermentation. This enzyme is used in the preparation of alcoholic beverages commercially.

Ethyl Alcohol (Ethanol) :

- ❖ Ethyl alcohol ($\text{C}_2\text{H}_5\text{OH}$) is commonly called alcohol.
- ❖ It is found in forms of ethyl esters of carboxylic acids in fruits, plants and fragrant oils.
- ❖ It is the main component of all types of wines, so it is called the spirit of wines.
- ❖ It is made from the fermentation or chemical breakdown of sugars by yeast, so it is also called grain alcohol.

Uses of Ethyl Alcohol :

- ❖ Ethanol is present in alcoholic beverages such as beer, wine, whisky, etc. So, it is also called drinking alcohol.
- ❖ Ethanol is used as antiseptic for sterilizing wounds.
- ❖ Ethanol is used in cough syrups, digestive syrups and tonics.
- ❖ Ethanol is being mixed with petrol and is used as motor fuel. This mixture is called power alcohol.
- ❖ A mixture of ethanol and water has a lower freezing point than water. This mixture is known as antifreeze and is used in radiators of vehicles in cold countries and at hill stations.
- ❖ Ethanol is used for the preparation of chloroform, iodoform, etc.
- ❖ Ethanol is used as a hypnotic (induces sleep).
- ❖ Ethanol is used in the preparation of methylated spirit.
- ❖ Ethanol is used to preserve the biological specimens.
- ❖ Ethanol is used in spirit level and alcohol thermometer

Pancreatic juice :

Pancreatic juice is a liquid secreted by the pancreas, which contains a variety of enzymes.

The enzymes present in pancreatic juice are as follows :

- ❖ Amylase— It converts starch into disaccharides.
- ❖ Trypsin— It converts protein into smaller peptides which are then further hydrolyzed into amino acids.
- ❖ Lipase— It converts fat into glycerol and fatty acids.
- ❖ Elastase— It break down proteins.
- ❖ Nuclease— It breaks down the nucleic acid into nucleotide.

Digestion in Ileum :

The ileum is the lower part of the small intestine and the largest section of the alimentary canal. The inner wall of the ileum contains secretory cells, some of which secrete mucus and other secrete an alkaline fluid known as internal juice succus entericus. The arrival of chyme in the ileum stimulates the secretion of intestinal juice.

The juice contains the following enzymes that carry out digestive functions which are as follows—

- ❖ Erepsin—breaks down peptones into amino acids.
- ❖ Lipase—breaks down fats into fatty acid and glycerol.
- ❖ Maltase—breaks down maltose into glucose.
- ❖ Sucrase—speeds up the breakdown of sucrose into glucose and fructose.
- ❖ Nucleotidase—It breaks down the nucleotide into nitrogen base, sugar and phosphoric acid.

Q237. The breath test conducted by police to check drunker driver has which one of the following on filter paper? (66th BPSC exam)

- A. Potassium dichromate-Sulphuric acid
- B. Potassium Permanganate-Sulphuric acid
- C. Silica gel coated with silver nitrate

D. Turmeric

Ans. A. Potassium dichromate-Sulphuric acid

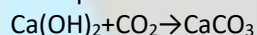
A breath test used by traffic police to check drunken driving uses potassium dichromate-sulphuric acid. When alcohol vapor makes contact with the dichromatic crystals, the colour changes from yellow to green. The degree of colour change is directly related to the level of alcohol in person's breath

Q238. Lime water is turned milky by (66th BPSC exam)

- A. CO
- B. CO₂
- C. O₂
- D. O₃

Ans. B. CO₂

Carbon dioxide is the gas that reacts with calcium hydroxide solution, limewater, to produce a white precipitate of calcium carbonate. Limewater is a solution of calcium hydroxide as mentioned above. When carbon dioxide is bubbled through the limewater solution, the limewater turns milky or cloudy white. Carbon dioxide which is also commonly known by its chemical formula CO₂, is one of the major building blocks of life on earth. CO₂ is consumed by plants in the process of photosynthesis and is produced by animals during respiration. Carbon dioxide is all around us and it is also one of the greenhouse gases which maintain the temperature of the earth. Following is the reaction which takes place when it is added to lime water.



When excess of the gas is passed through the solution the equilibrium shifts backwards and the solution turns colourless again.

Q239. The incomplete burning of petrol and diesel produces (66th BPSC exam)

- A. Nitric Oxide
- B. Nitrogen dioxide
- C. Carbon dioxide
- D. Carbon monoxide

Ans. D. Carbon monoxide

- ❖ Incomplete combustion is called a process in which a reaction occurs between oxygen and fuel (petrol and diesel) giving products carbon monoxide(CO) and water.
- ❖ The general reaction of incomplete combustion can be given as:
Hydrocarbon+Oxygen(O)→CarbonMonoxide(CO)+Carbon(C)+Water(H₂O)
- ❖ Incomplete combustion occurs when combustion occurs without a sufficient supply of oxygen.

- ❖ Incomplete combustion can also produce pure carbon soot, which is messy and can build up in chimneys.

Nitrogen oxide

- ❖ Petrol and diesel are known as carbon-containing hydrocarbons, hence the incomplete combustion of these can generate carbon monoxide as the product.
- ❖ As in hydrocarbons, there is no nitrogen substance present, thus nitrogen oxide does not form as the product in the incomplete combustion.
- ❖ Hence, the given option is the incorrect one.

Carbon dioxide

- ❖ Incomplete combustion of fuel such as petrol and diesel generally gives carbon monoxide as the product, whereas carbon dioxide is not produced during the process.
- ❖ Thus, the given option does not coincide with the correct concept.

Q240. The pH of a solution changes from 3 to 6. The H⁺ ion concentration will (66th BPSC exam)

- A. Increase 3 times
- B. Decreases 3 times
- C. Decrease 10 times
- D. Decrease 1000 times

Ans. D. Decrease 1000 times

We know that pH is the negative logarithm of the hydrogen ion concentration. Thus,
 $\text{pH} = -\log[\text{H}^+]$

Thus,
 $[\text{H}^+] = 10^{-\text{pH}}$

Using the above equation, calculate the concentration of hydrogen ion (H⁺) when the pH of the solution is 3. Thus,
 $[\text{H}^+] = 10^{-3}$

Using the above equation, calculate the concentration of hydrogen ion (H⁺) when the pH of the solution is 6. Thus,
 $[\text{H}^+] = 10^{-6}$

The H⁺ ion concentration of the solution when pH is 3 is 10⁻³ and the H⁺ ion concentration of the solution when pH is 6 is 10⁻⁶. Thus, the pH is reduced by 1000 times. Thus, if the pH of a solution is increased from 3 to 6, then H⁺ ion concentration of the solution will be reduced by 1000 times. Thus, the correct option is (D) reduced by 1000 times.

Q241. A mixture of sand and naphthalene can be separated by (66th BPSC exam)

- A. Sublimation
- B. Distillation
- C. Chromatography
- D. Fractional distillation

Ans. A. Sublimation

Sublimation

Sublimation can be defined as the transition of a substance from solid phase to gaseous phase without changing into liquid phase. This process is an endothermic phase transition. De-sublimation or deposition is the reverse of this process in which a gas is directly converted into solid state.

Elements and compounds mainly possess three different states at various temperatures. The transition from solid state to gaseous state requires transition of solid state to liquid state and liquid state to gaseous state. But some solids can directly convert to their gaseous state. There are various examples of sublimation which are experienced by us in our everyday life.

Best example of sublimation is dry ice which is a frozen form of carbon dioxide. When dry ice gets exposed to air, it directly changes its phase from solid state to gaseous state which is visible as fog. Frozen carbon dioxide in its gaseous state is more stable than in its solid state. Another well-known example of sublimation is naphthalene which is an organic compound. Naphthalene is usually found in pesticides such as mothball. This organic compound sublimes due to the presence of non-polar molecules that are held by Van Der Waals intermolecular forces. At a temperature of 176°F naphthalene sublimes to form vapours. It de-sublimates at cool surfaces to form needle-like crystals. Sublimation finds practical application in forensic sciences. Dye-sublimation printers help in rendering digital pictures in a detailed and realistic fashion which helps in the analysis of substances. Chemists usually prefer sublimation as purification method to purify volatile compounds.

Distillation

- ❖ Distillation refers to the selective boiling and subsequent condensation of a component in a liquid mixture. It is a separation technique that can be used to either increase the concentration of a particular component in the mixture or to obtain (almost) pure components from the mixture. The process of distillation exploits the difference in the boiling points of the components in the liquid mixture by forcing one of them into a gaseous state.
- ❖ Some important applications of distillation are listed below.
 - Distillation plays an important role in many water purification techniques. Many desalination plants incorporate this method in order to obtain drinking water from seawater.
 - Distilled water has numerous applications, such as in lead-acid batteries and low-volume humidifiers.
 - Many fermented products such as alcoholic beverages are purified with the help of this method.
 - Many perfumes and food flavourings are obtained from herbs and plants via distillation.

- Oil stabilization is an important type of distillation that reduces the vapor pressure of the crude oil, enabling safe storage and transportation.
- Air can be separated into nitrogen, oxygen, and argon by employing the process of cryogenic distillation.
- Distillation is also employed on an industrial scale to purify the liquid products obtained from chemical synthesis.

Applications of Chromatography

In bio analytical chemistry, chromatography is mainly used for the separation, isolation and purification of proteins from complex sample matrices. In cells for example, proteins occur alongside numerous other compounds such as lipids and nucleic acids. In order to be analysed, these proteins must be separated from all the other cell components. Then the proteins of interest might have to be isolated from other proteins and purified further.

Chromatography is an essential part of almost any protein purification strategy. A number of different chromatographic techniques are used for the purification and analysis of proteins. They can be classified according to the physical principle involved in the separation process. Typical examples include reversed phase chromatography, ion exchange chromatography, affinity chromatography and size exclusion chromatography.

Applications of Fractional Distillation

- Fractional distillation is used for the purification of water as well as for separating ethanol and water.
- Fractional distillation is used in several industries like oil refineries and chemical plants mainly for purification and separation of many organic compounds.
- Fractional distillation is also used for the separation of (liquefied) air. Components like liquid nitrogen and oxygen as well as concentrated argon are obtained.
- Distillation is used in the production of high-purity silicon from chlorosilanes. The silicon is widely used in semiconductors.

Q242. The numbers of sigma and pi bonds in benzene are: (66th BPSC exam)

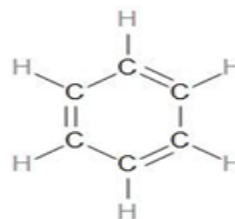
- A. 3, 3
- B. 3, 6
- C. 12, 3
- D. 12, 6

Ans. C. 12, 3

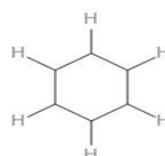
Sigma bond is a chemical bond formed by the linear or co-axial overlapping of the atomic orbitals of two atoms. A pi bond is a type of covalent bond that exists between atoms where the electrons are on top and bottom of the axis connecting the nuclei of the joined atoms. It is formed by

the parallel or lateral overlapping of the atomic orbitals. Benzene is an aromatic compound of carbon and hydrogen. The molecular formula for benzene is C_6H_6 .

Let us draw the structure of Benzene.



To calculate the number of sigma bonds in this, we can draw the skeletal structure by only drawing the sigma bonds –



- As we can see, there are 6 C-H bonds, 6 C-C bonds. Therefore, we can say that there are a total of 12 sigma bonds in benzene. Now, looking at the structure of benzene, we can see that there are 3 C=C bonds. Therefore, there are 12 sigma bonds and 3 pi bonds. Benzene is therefore made up of 15 covalent bonds.
- Therefore, the answer is – option (C) – The number of sigma and pi bonds in benzene are 12 and 3, respectively.
- Additional Information: One single bond contains one sigma bond; a double bond contains one sigma and one pi bond. Similarly, a triple bond contains one sigma and two pi bonds.

Q243. The elements present in urea are (66th BPSC exam)

- A. C, H, O
- B. C, N, O
- C. C, H, N
- D. C, H, N, O

Ans. D. C, H, N, O

Urea Formula

Urea has four elements which are carbon, nitrogen, oxygen, and hydrogen. It has a molar mass of 60.06 g/mole and has two amide groups and a carbonyl group. The structural and chemical formula of urea is discussed in the following points.

Urea Chemical Formula

The molecule of urea has 2 amide groups (i.e. -NH_2) which is joined by a carbonyl group (i.e. C=O). The chemical or molecular formula of urea is written as-
Chemical Formula of Urea: $\text{CO(NH}_2)_2$

Q244. The poorest conductor of heat among the following is (66th BPSC exam)

- A. Copper
- B. Lead
- C. Mercury
- D. Zinc

Ans. B. Lead

The materials which cannot transfer heat are poor conductors. Poor conductors are also called insulators, copper, lead, zinc are the good conductor of heat. Mercury is the poor conductor of heat but a good conductor of electricity. Thermal conductivity of mercury is 8 & thermal conductivity of copper is 385 (w/m.k).

Good conductors of heat:

- ❖ Materials that allow heat to pass through them easily are called good conductors of heat.
- ❖ The reason metals conduct heat so well is because the electrons in them can move around easily, and they can carry heat from one part to another.
- ❖ Metal atoms are packed more densely and can transmit heat vibrations more readily.
- ❖ While most non-metallic solids are said to be good insulators, having extremely high resistance to the flow of charge through them.
- ❖ Metals like copper and aluminium have the highest thermal conductivity while steel and bronze have the lowest.
- ❖ As copper is an excellent conductor of heat, it is good for heat exchangers also.
- ❖ Example: Gold, Silver, Iron, etc are some examples of good heat conductors and electrical conductors.

Q245. The vitamin which is effective in blood clotting is (66th BPSC exam)

- A. Vitamin-A
- B. Vitamin-B
- C. Vitamin D
- D. Vitamin-K

Ans. D. Vitamin-K

Vitamin K is a responsible factor for blood clotting or coagulation. Without vitamin K, blood coagulation is seriously impaired and uncontrolled bleeding occurs. Vitamin K is known as antihemorrhagic factor.

Q246. The female sex hormone is (66th BPSC exam)

- A. Estrogen
- B. Androgen
- C. Insulin
- D. Oxytocin

Ans. A. Estrogen

- ❖ **Estrogen** : It is a crucial hormone in the process of proliferation. This involves the enlargement of the breasts and uterus, allowing for growth of the fetus and production of breast milk
- ❖ **Oxytocin or Pitocin** : It is also called binding hormone, love hormone, birth hormone etc. It regulates smooth muscle contraction, especially of the uterus during childbirth. It also helps in the secretion of milk in females. It creates a bonding emotion between mother and child, hence known as binding or love hormone. The milkman injects the artificial oxytocin to domestic animals to draw much milk from them. This act is harmful to both domestic animals as well as the person who uses such milk. It may be carcinogenic.
- ❖ **Androgen**: The testes produce androgens which allow for the development of secondary sexual characters and the production of sperm cells. Androgen hormones are secreted mainly by Leydig cells. Leydig cells, also known as interstitial cells of Leydig, are found adjacent to the seminiferous tubules in the testicle.
- ❖ **Pancreas** : It is an exocrine as well as an endocrine gland i.e. mixed gland. As an endocrine gland, it functions mostly to regulate blood sugar levels, secreting the hormones insulin, glucagon, somatostatin and pancreatic polypeptide. As a part of the digestive system, it functions as an exocrine gland secreting pancreatic juice into the duodenum through the pancreatic duct. Its endocrine part is known as islets of Langerhans. Its three types of cells secrete 3 different hormones :
 - Beta (β) cells : Beta cells secrete insulin (a protein) which controls the amount of sugar in the blood. Its hyposecretion leads to diabetes mellitus
 - Alfa (α) cells : Alfa cells secrete glucagon which converts glycogen into glucose.
 - Delta (δ) cells : Delta cells secrete somatostatin which regulates the assimilation process. It acts as an inhibitor of growth hormone (GH), insulin and glucagon.

Q247. The Nobel Prize for developing treatment of Parkinson's disease was given to (66th BPSC exam)

- A. Arvid Carlson
- B. John F Enders
- C. Robert F Laughlin
- D. Walter Kohn

Ans. A. Arvid Carlson

- ❖ Dr Arvid Carlsson, a Swedish Scientist was awarded the Nobel Prize in Medicine in 2000 for research on the brain's chemical signals and the resulting treatment for parkinson's disease.
- ❖ John F Enders received the Nobel Prize in Physiology or Medicine for his work on growing the poliovirus in the laboratory, which led to the development of the polio vaccine.
- ❖ Robert F Laughlin received the Nobel Prize in Physics for his discovery of the fractional quantum Hall effect.
- ❖ Walter Kohn received the Nobel Prize in Chemistry for his development of density-functional theory, used to calculate the properties of molecules and materials.

Q248. The manufacturing of the thyroid gland is due to the deficiency of (66th BPSC exam)

- A. Vitamin A
- B. Calcium
- C. Iodine
- D. Iron

Ans. C. Iodine

Thyroid Gland : The thyroid gland lies in the front of the human neck in a position just below Adam's apple. It is made up of two lobes. These two lobes are joined by a small bridge of thyroid tissue called the isthmus. The thyroid makes three hormones that it secretes into the bloodstream, viz. two thyroid hormones (thyroxine - T_4 and triiodothyronine - T_3) and calcitonin. In the cells and tissues of the body, the T_4 is converted to T_3 . The T_3 is biologically active and influences the activity of all the cells and tissues of the body. T_3 and T_4 are partially composed of iodine. A deficiency of iodine leads to decreased production of T_3 and T_4 . The thyroid hormones primarily influence the metabolic rate and protein synthesis. These hormones also regulate vital body functions, including - differentiation, breathing, heart rate, body temperature, central and peripheral nervous system etc. Calcitonin plays a role in calcium homeostasis. It lowers the level of calcium and phosphate in the blood and promotes the formation of bones.

Disorders of Thyroid Hormone :

- ❖ **Hyposecretion (Hypothyroidism)** - Following disorders occur in case of insufficient production or hyposecretion of thyroxine hormone :

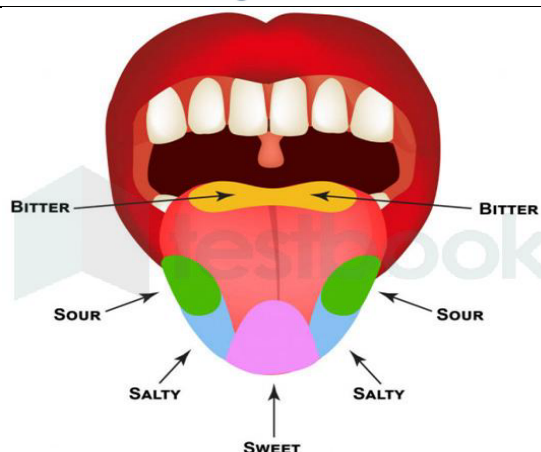
- Cretinism : Physical and mental growth of the child is retarded.
- Myxoedema : Myxoedema is used to describe skin changes in someone - as swelling of the face which can include lips, eyelids and tongue; swelling and thickening of skin anywhere on the body, especially in lower legs.
- Goitre : an abnormal enlargement of thyroid gland. The most common cause of goitre is lack of iodine in diet. Goitre is common in hilly area because of iodine deficiency in water.
- Hashimoto Disease : Hashimoto disease is a condition in which the immune system attacks thyroid resulting in its complete loss. It is also known as the suicide of thyroid gland.
- ❖ **Hypersecretion (Hyperthyroidism)**
 - Thyroxine regulates the behaviour of the person. In a high quantity of secretion, it enhances the mental activity of a person changing his behaviour so thyroid gland is also known as temperament gland.
 - The high secretion of thyroxine is related to exophthalmia (abnormal protrusion of the eyeball or eyeballs) or Grave's disease and Plummer disease (also called toxic multinodular goitre, thyroid condition characterized by marked enlargement of the thyroid gland, firm thyroid nodules and overproduction of thyroid hormone).

Q249. The sensitive area of the human tongue to bitterness is (66th BPSC exam)

- A. Tip
- B. Middle Part
- C. Posterior Part
- D. Edge

Ans. C. Posterior part

Human tongue mainly contains 4 types of taste buds :- Sour, Sweet, Salty & Bitter. The tip of the tongue contains the sweet taste buds while the bitter taste buds are present in posterior part. Sour at the sides of the tongue.



Q250. Ginger is a stem and not root because (66th BPSC exam)

- A. It stores food material
- B. It has nodes and internodes
- C. It grow horizontally in the soil
- D. It lacks chlorophyll

Ans. B. It has nodes and internodes

Ginger is a herbaceous perennial and flowering plant. It grows to about one meter tall and it bears narrow leaf blades. The plant grows from the annual pseudo stems. Pseudo stems are the false stems that are made up of rolled bases of leaves. Ginger is considered as a rhizome and it is the modification of the stem. The stems of ginger are underground stems. These are modified plants and are derived from the stem tissues. The stem exists below the ground level and so it is referred to as the rhizome or rhizome roots. The rhizomes bears reduced scaly leaves. The top of the rhizome can generate leafy stems and produce flowers. They are known to function as storage for the food and other nutrients. Rhizomes are also known as creeping stalks. The rhizomes of ginger are considered as stems and not as roots as it contains nodes and internodes. They are known to lack chlorophyll. The nodes and internodes are able to grow into leaves or stalks of leaves. The nodes may also contain scaly leaves. The rhizome of ginger gives off the aerial leafy shoot and at its base it enlarges to form the rhizome part. This part also stores food and other nutrients. The rhizome moves horizontally below the level of the ground. The underground rhizome of ginger is unable to undertake the process of photosynthesis and as a result they do not contain chlorophylls. The rhizomes are structures that are able to store food and helps in the process of asexual reproduction. They remain protected from desiccation and are able to germinate in the next season.

Q251. The sweetest sugar among the following is (66th BPSC exam)

- A. Fructose
- B. Glucose
- C. Maltase
- D. Sucrose

Ans. A. Fructose

- ❖ Fructose is a type of Sugar, it is also known as fruit sugar because it is primarily found in fruits. Fructose is the sweetest Sugar. It is 1.2-1.8 times sweeter than sucrose.
- ❖ Sucrose is a disaccharide made of glucose and fructose. It's commonly known as "table sugar" but it can be found naturally in fruits, vegetables, and nuts. However, it's also produced commercially from sugar cane and sugar beets through a refinement process.
- ❖ Glucose is an aldohexose [An aldohexose is a hexose with an aldehyde group on one end] and is also known as dextrose. It is the monomer of many of the larger carbohydrates, namely starch, cellulose.
- ❖ Maltase is an enzyme that catalyses the conversion of maltose into glucose. Maltase is an enzyme present in saliva and pancreatic juice that breaks down maltose and related sugars to produce glucose.

Q252. Among the following, which is not a true fruit? (66th BPSC exam)

- A. Apple
- B. Date
- C. Grape
- D. Plum

Ans. A. Apple

All the true fruits develop from ovaries whereas all the false fruits develop from any part of the plant except ovary. Apple does not grow from ovary, so it is a false fruit.

- ❖ **True Fruits:** Fruits which develop from the fertilized ovary of flowers. Example: Peach, Lemon, Watermelon, Grapes, Date, Plum etc.
- ❖ **False Fruits:** Fruits which develop from the fertilized ovary along with some other parts of the flower. Example: Apple, Strawberry, Banana etc.

Q253. Legumes are highly nutritious because they are rich in (66th BPSC exam)

- A. Fat
- B. Protein
- C. Oil
- D. Starch

Ans. B. Protein

Types of Nitrogen Fixing Plants

There are two main types of nitrogen-fixing plants:

- ❖ Legumes: Legumes are a family of plants that includes beans, peas, lentils, peanuts, soybeans, and alfalfa. Legumes have a symbiotic relationship with bacteria called rhizobia, which live in the roots of the plants. The rhizobia bacteria convert atmospheric nitrogen into ammonia, which is then used by the legume plant.
- ❖ Non-legumes: There are also a number of non-leguminous nitrogen-fixing plants, such as actinorhizal plants (e.g., alders) and cyanobacteria (e.g., Nostoc). Actinorhizal plants have a symbiotic relationship with bacteria called Frankia, which live in the roots of the plants. Cyanobacteria are photosynthetic bacteria that can fix nitrogen from the atmosphere.

Here are some examples of nitrogen-fixing plants:

- ❖ Legumes: beans, peas, lentils, peanuts, soybeans, alfalfa, clover, vetch, lupins, chickpeas, cowpeas, mung beans, adzuki beans, lima beans, black-eyed peas
- ❖ Non-legumes: actinorhizal plants (e.g., alders, willows, poplars, sea buckthorn), cyanobacteria (e.g., Nostoc, Anabaena, Oscillatoria), azolla, mosquito fern, Gunnera, Blasia (liverwort), hornworts

Q254. Clove, a spice is obtained from which part of the plant? (66th BPSC exam)

- A. Fruit
- B. Stem
- C. Root
- D. Flower Bud

Ans. D. Flower Bud

Clove is a spice which is obtained from the plant *Syzygium aromaticum*. It is nothing but the aromatic flower buds of the Clove plant. It belongs to the Family Myrtaceae. The plant bears crimson coloured flowers and large leaves. The flower buds change their color turning from pale to green and finally to crimson red at the time of their harvest.

The clove plant consists of a long calyx at the terminal end of which are present four sepals. It also consists of a ball in the center which is made up of closed petals. Since now we are well aware of the structure of the plant and the flower bud clove, therefore, the correct answer to the question is the clove spice represents the flower bud.

Q255. Who is regarded as the “Father of Modern Chemistry”? (65th BPSC exam)

- A. Rutherford
- B. Einstein
- C. Lavoisier

D. C.V Raman

Ans. C. Lavoisier

The Father of Chemistry is the French nobleman and chemist, Antoine Lavoisier. Born on 26th August 1743 in Paris, France, Lavoisier identified elements, characterized properties of matter, and made other significant chemical discoveries. He was dubbed the "Father of Chemistry" to honor his efforts and discoveries in chemistry.

C.V. Raman (1888-1970) :

- ❖ Chandrashekhara Venkata Raman was born at Thiruvanaikaval in Tiruchirappalli in Southern India on Nov. 7, 1888. His father was a Lecturer in Mathematics and Physics so that from childhood he was immersed in an academic atmosphere. He entered Presidency College Madras in 1902 and in 1904 he completed his bachelor's degree winning the first place and the gold medal in Physics and in 1907 he gained his Master degree, obtaining the highest distinctions.
- ❖ His earliest researches in optics and acoustics-the two fields of investigation to which he has dedicated his entire career were carried out while he was a student.
- ❖ Since at that time a scientific career did not appear to present the best possibilities, Raman joined the Indian Finance Department in 1907, though the duties of his office took most of his time, Raman found opportunities for carrying on experimental research in the laboratory of the Indian Association for the Cultivation of Science at Calcutta (now Kolkata) of which he became Honorary Secretary in 1909.
- ❖ In 1917 he was offered the newly endowed Palit Chair of Physics at Calcutta University and decided to accept it. After 15 years at Calcutta he became Professor at the Indian Institute of Science at Bangalore.
- ❖ He was elected a Fellow of the Royal Society early in his career (1924) and was Knighted in 1929. In 1930 he was awarded Nobel Prize for his work Raman-Effect.

Q256. The number of electrons and neutrons in an element is 18 and 20 respectively. Its mass number is (65th BPSC exam)

- A. 22
- B. 2
- C. 38
- D. 20

Ans. C. 38

Formula $\Rightarrow$ Mass Number = The number of Electrons + The number of Neutrons.

$$= 18 + 20$$

$$\text{Mass Number} = 38.$$

Q257. Which of the following is also known as laughing gas? (65th BPSC exam)

- A. Nitric Oxide
- B. Nitrous Oxide
- C. Nitrogen Peroxide
- D. Nitrogen

Ans. B. Nitrous Oxide

Nitrous oxide(N₂O)

- ❖ Nitrous oxide, commonly known as laughing gas or happy gas, is a colourless, odourless, and non-flammable gas.
- ❖ While nitrous oxide is not flammable, it supports combustion to the same extent as oxygen.
- ❖ It leads to a state of euphoria, explaining its nickname, 'laughing gas.'
- ❖ It is soluble in water. Its vapours are heavier than air.
- ❖ **Applications:**
 - It is commonly used by dentists and medical professionals to sedate patients undergoing minor medical procedures.
 - The gas is also used as a propellant in food aerosols.
 - It is used in the automotive industry to enhance engine performance.

Nitric Oxide (NO)

- ❖ Nitric oxide is a reactive gas that plays a crucial role in atmospheric chemistry.
- ❖ It is involved in the formation of smog and contributes to air pollution.
- ❖ In the atmosphere, nitric oxide reacts with oxygen to form nitrogen dioxide (NO₂), which is a component of photochemical smog

Nitrogen Peroxide (N₂O₂)

Dinitrogen dioxide (N₂O₂), also known as nitrogen peroxide or nitrous oxide, is a reddish-brown gas composed of two nitrogen atoms bonded to two oxygen atoms. It is used as an oxidizing agent and has applications in rocket propellants.

Nitrogen

- ❖ Nitrogen is the most prevalent element in living organisms. It is a constituent of amino acids, proteins, hormones, chlorophylls, and many vitamins.
- ❖ There is an inexhaustible supply of nitrogen (N₂) in the atmosphere, but most living organisms cannot use the elemental form directly.
- ❖ Nitrogen must be 'fixed' (converted to ammonia, nitrites, or nitrates) before plants can take it up.

Other compounds of nitrogen

Compound	Source	Benefits	Effects
Di-Nitrogen (N₂)	Makes up 78% of the air we breathe	Maintains a stable atmosphere for life on Earth	Harmless and chemically unreactive
Ammonia (NH₃)	Manure, urine, fertilisers, biomass burning	Foundation for amino acids, proteins, and enzymes- Commonly used as fertiliser	Causes eutrophication and affects biodiversity, Forms particulate matter in the air, affecting health by causing shortness of breath, affecting lung function, and exacerbating respiratory diseases such as asthma
Nitrate (NO₃)	Wastewater, agriculture, oxidation of NOx	Widely used in fertilisers and explosives	Forms particulate matter in the air and affects health when ending up in groundwater, causing what's known as blue baby syndrome, Leads to eutrophication in water bodies
Nitric Oxide and Nitrogen Dioxide	Combustion from transport, industry, energy sector	Essential in human physiology (NO)	Major air pollutant, contributing to heart disease and respiratory illness

Q258. Which of the following is not a type of element? (65th BPSC exam)

- A. Metals
- B. Non-metals
- C. Metalloids
- D. Gases

Ans. D. Gases

Gas is a state of matter, it is not type of element.

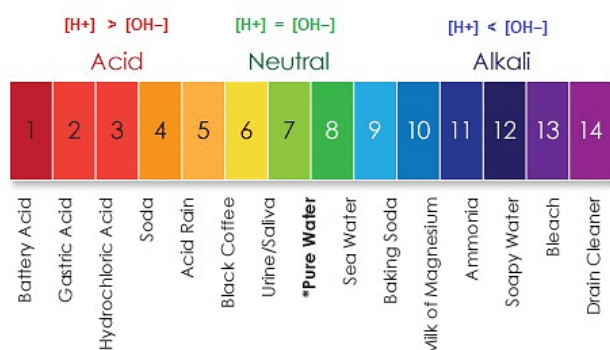
Note - Elements are chemically the simplest substances and hence cannot be broken down using chemical reactions; element can only be changed into other elements using nuclear methods

Q259. The pH value of water is (65th BPSC exam)

- A. 4
- B. 7
- C. 12
- D. 18

Ans. B. 7

The pH value of water is 7 pH is a quantitative, measure of the acidity or basicity of aqueous or other liquid solution. A solution with a pH less than 7 is considered acidic, a solution with a pH greater than 7 is considered basic, or alkaline.



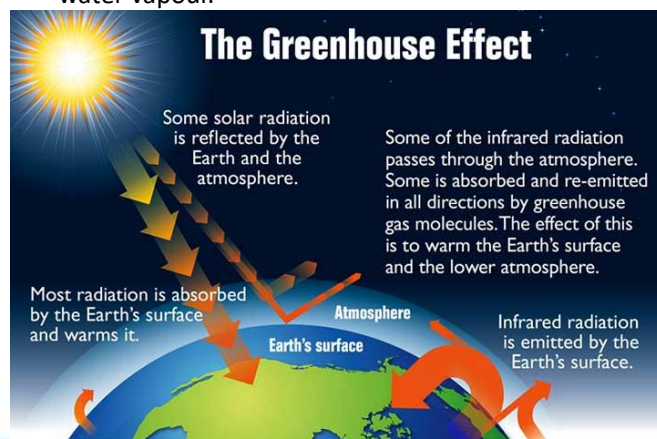
Q260. The main component of greenhouse gases is (65th BPSC exam)

- A. Carbon dioxide
- B. Methane
- C. Nitrous oxide
- D. Ozone

Ans. A. Carbon dioxide

- ❖ Greenhouse gases (GHGs) are a group of naturally occurring and human-generated gases present in the Earth's atmosphere.
- ❖ These gases have the unique property of absorbing and emitting heat, trapping thermal energy within the atmosphere.
- ❖ They act as a thermal blanket, allowing sunlight to enter the atmosphere while preventing a significant portion of the absorbed heat from escaping back into space.
- ❖ This phenomenon, known as the greenhouse effect, helps regulate the Earth's temperature, making it habitable for life.
- ❖ However, human activities, such as burning fossil fuels, deforestation and industrial processes, have significantly increased the concentration of these gases, amplifying the greenhouse effect and leading to global warming and subsequent climate change.

- ❖ Some major greenhouse gases include: Carbon Dioxide(79%), Methane(11%), Nitrous Oxide and water vapour.



Q261. Oxygen is absent in (65th BPSC exam)

- A. Kerosene
- B. Glass
- C. Soil
- D. Cement

Ans. A. Kerosene

Oxygen is absent in kerosene. It is called paraffin or paraffin oil. It is a flammable hydrocarbon liquid commonly used as a fuel. Kerosene, is typically pale yellow or colourless liquid and has a not unpleasant characteristic odour. It is obtained from petroleum and used for burning in kerosene lamps and domestic heater or furnaces.

Q262. Natural rubber is a polymer of (65th BPSC exam)

- A. Isoprene
- B. Styrene
- C. Vinyl acetate
- D. Propene

Ans. A. Isoprene

Isoprene

- ❖ Isoprene is a colourless, volatile liquid hydrocarbon.
- ❖ It is the most abundant non-methane VOC emitted into the atmosphere.
- ❖ Sources:
 - Biogenic Sources: Most isoprene is produced by plants and by some algae and bacteria. It is also produced in small amounts by humans and other animals.
 - Anthropogenic sources: It is also released by activities like the combustion of fossil fuels, production of petroleum products and synthetic rubber, etc.

- ❖ Uses: Isoprene is used in natural and synthetic rubber, adhesives, pharmaceuticals, and fragrances.
- ❖ It is the main component of natural rubber.

Styrene

- ❖ Styrene is an organic compound with the formula C_8H_8 .
- ❖ It is a derivative of benzene (C_6H_6).
- ❖ It is stored in factories as a liquid, but evaporates easily, and has to be kept at temperatures under $20^\circ C$.
- ❖ Sources: Styrene is found in vehicle exhaust, cigarette smoke, and in natural foods like fruits and vegetables.
- ❖ Uses: It is a flammable liquid that is used in the manufacturing of polystyrene plastics, fiberglass, rubber, and latex.
- ❖ Risk of Exposure:
 - Short Term Exposure: It can result in respiratory problems, irritation in the eyes, irritation in the mucous membrane, and gastrointestinal issues.
 - Long-Term Exposure: It could drastically affect the central nervous system and lead to other related problems like peripheral neuropathy. It could also lead to cancer and depression in some cases. However, there is no sufficient evidence of an association between styrene exposure and an increased risk of leukemia and lymphoma.

Vinyl acetate

Vinyl acetate is an organic compound with the formula $CH_3CO_2CH=CH_2$. This colorless liquid is the precursor to polyvinyl acetate, ethene-vinyl acetate copolymers, polyvinyl alcohol, and other important industrial polymers.

Propene

- ❖ Polymer Name: Polypropylene
- ❖ Uses: Packaging materials, textiles, automotive components, household products, pipes, electrical insulation, and various plastic products.

Q263. What is the formula of glucose? (65th BPSC exam)

- A. $C_6H_{22}O_6$
- B. $C_6H_{10}O_5$
- C. $C_6H_{12}O_6$
- D. $C_6H_6O_6$

Ans. C. $C_6H_{12}O_6$

Glucose is a simple sugar with six carbon atoms and one aldehyde group. This monosaccharide has a chemical formula $C_6H_{12}O_6$.

It is also known as dextrose. It is referred to as aldohexose as it contains 6 carbon atoms and an aldehyde group. It exists in two forms, open-chain or ring structure. It is synthesized in the liver and kidneys of animals. In plants, it is found in fruits and in different parts of plants. D-glucose is the naturally occurring form of glucose. It can occur

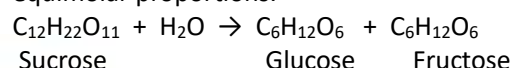
either in solid or liquid form. It is water-soluble and is also soluble in acetic acid. It is odourless and sweet to taste. In the year 1747, Andreas Marggraf, a German chemist, isolated glucose from raisins. In the year 1838, Jean Baptiste Dumas coined the word glucose.

Preparation Of Glucose ($C_6H_{12}O_6$)

Sucrose (cane sugar) and starch are the two major sources of Glucose.

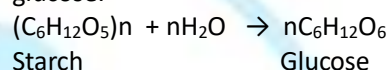
Preparation from sucrose or cane sugar:

Sucrose is a disaccharide with the formula $C_{12}H_{22}O_{11}$. On boiling an aqueous solution of sucrose with dilute HCl or dilute H_2SO_4 , Glucose and Fructose are formed in equimolar proportions.



Preparation from starch:

It is a polysaccharide that when boiled with dilute H_2SO_4 at 393 K under 2 to 3 atmosphere pressure, gives glucose.



Uses Of Glucose

- ❖ It is used in the treatment of hypoglycemia (low blood sugar)
- ❖ It is given to patients who are very sick and cannot eat as it provides carbohydrate calories
- ❖ It is used in the treatment of increased potassium levels in the blood (hyperkalemia)
- ❖ It is used as a precursor for the synthesis of substances.

Q264. What is the bond order of the CO group? (65th BPSC exam)

- A. 1
- B. 2.5
- C. 3.5
- D. 3

Ans. D. 3

The Bond Order Formula can be defined as half of the difference between the number of electrons in bonding orbitals and antibonding orbitals.

$$\text{Bond order} = \frac{1}{2} [N_b - N_a]$$

Where,

N_b is the number of bonding electrons

N_a is the number of antibonding electrons

in CO the number of bonding electron is 10 and no. of anti bonding electron is 4.

$$\text{Bond order} = \frac{10-4}{2} = 3$$

The bond order of the CO group is 3. A bond order of 3 indicates a strong and stable bond between the carbon and oxygen atoms in CO

Carbon monoxide (CO)

- ❖ It is a colourless, odourless, and tasteless gas that is slightly less dense than air.
- ❖ Sources of CO: CO is a byproduct of the incomplete combustion of hydrocarbons. Common sources include burning fossil fuels like natural gas, petrol, coal and oil, wood smoke, car and truck exhausts etc.
- ❖ It is toxic to humans insofar as it forms a complex thereby displacing oxygen from the haemoglobin of the blood.
- ❖ In the atmosphere CO is short lived because of the role it plays in the formation of ground-level ozone.

Q265. The book “The Origin of Species” was written by (65th BPSC exam)

- A. Linnaeus
- B. Lamarck
- C. Mendel
- D. Darwin

Ans. D. Darwin

The book, The Origin of Species was written by Charles Darwin. Charles Robert Darwin (1809-1882) was an English naturalist whose scientific theory of evolution by natural selection became the foundation of modern evolutionary studies.

Linnaeus: Carl Linnaeus is known as the father of taxonomy. Carl Linnaeus (1707 - 1778) was a Swedish botanist who devised the binomial classification system, a two-part naming system to identify, classify and name organisms from bacteria to the elephant.

Lamarck: Jean Baptiste Lamarck (1744-1829) is one of the best-known early evolutionists. Unlike Darwin, Lamarck believed that living things evolved in a continuously upward direction, from dead matter, through simple to more complex forms, toward human "perfection." Species didn't die out in extinctions, Lamarck claimed.

Mendel: Johan Gregor Mendel, also known as the “father of genetics”, started a decade-long research project in 1856 to study the patterns of inheritance. He carried out his experiments on inheritance with the common pea plant taking 7 features of the plant.

Q266. The interaction between algae and fungi to form lichen is called (65th BPSC exam)

- A. Parasitism
- B. Mutualism
- C. Commensalism
- D. Conversion

Ans. B. Mutualism

Mutualism is a relationship between a host and a symbiont, where both organisms benefit and none is harmed. This relationship can be either long-term or

short-term. The smaller partner is referred to as the mutualist, while the larger partner is the host.

Parasitism: Parasitism is a biological relationship where one organism, known as the parasite, lives on or in another organism, known as the host, causing it some degree of harm.

Commensalism

It is an imbalanced type of interaction wherein one entity benefits while the other is neither harmed nor benefited. There are four types of commensal associations.

- ❖ Inquilinism – An entity occupies living habitat of another species (burrow, nest)
- ❖ Chemical commensalism – A bacteria produces a chemical which nurtures another bacteria
- ❖ Phoresy – An organism tentatively attaches itself to another entity for transportation requirements.
- ❖ Metabiosis – One entity is dependant on the other for survival

Q267. The actual location or place where an organism lives is called (65th BPSC exam)

- A. Habitat
- B. Ecosystem
- C. Niche
- D. Biome

Ans. A. Habitat

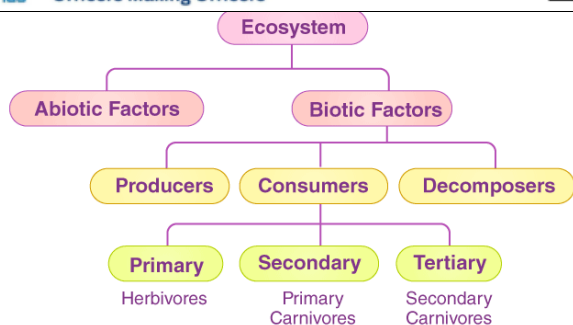
Habitat

❖ The place where organisms live is called habitat. Habitat means a dwelling place (a home). The habitat provides food, water, air, shelter and other needs to organisms. Several kinds of plants and animals live in the same habitat. Terrestrial habitat and aquatic habitat are the two main types of habitats and they are further divided.

- Terrestrial habitat: Desert, Mountain and Grassland
- Aquatic habitat: Ponds, Lakes and Oceans

Ecosystem

An ecosystem is a structural and functional unit of ecology where the living organisms interact with each other and the surrounding environment. In other words, an ecosystem is a chain of interactions between organisms and their environment. The term “Ecosystem” was first coined by A.G. Tansley, an English botanist, in 1935.



Biotic Components

Biotic components refer to all living components in an ecosystem. Based on nutrition, biotic components can be categorised into autotrophs, heterotrophs and saprotrophs (or decomposers).

- ❖ Producers include all autotrophs such as plants. They are called autotrophs as they can produce food through the process of photosynthesis. Consequently, all other organisms higher up on the food chain rely on producers for food.
- ❖ Consumers or heterotrophs are organisms that depend on other organisms for food. Consumers are further classified into primary consumers, secondary consumers and tertiary consumers.
 - Primary consumers are always herbivores as they rely on producers for food.
 - Secondary consumers depend on primary consumers for energy. They can either be carnivores or omnivores.
 - Tertiary consumers are organisms that depend on secondary consumers for food. Tertiary consumers can also be carnivores or omnivores.
 - Quaternary consumers are present in some food chains. These organisms prey on tertiary consumers for energy. Furthermore, they are usually at the top of a food chain as they have no natural predators.
- ❖ Decomposers include saprophytes such as fungi and bacteria. They directly thrive on the dead and decaying organic matter. Decomposers are essential for the ecosystem as they help in recycling nutrients to be reused by plants.

Abiotic Components

Abiotic components are the non-living component of an ecosystem. It includes air, water, soil, minerals, sunlight, temperature, nutrients, wind, altitude, turbidity, etc.

Niche

Joseph Grinnel coined the term "Niche". He described a niche as the distributional unit specific to each species. He emphasised that no two species living in the same territory can occupy the same ecological niche for long. The ecological niche not only involves the physical space occupied by an organism but also describes the functional role or place of a species in its community structure. This includes everything related to how it influences a

community, i.e. what it eats, where it lives, what it does, the trophic position occupied, etc. Niche describes how a species contributes to the system's energy flow and how it gains energy and supplies it further in an ecosystem.

Biome

A biome can be defined as a large biological community or an ecosystem where different types of living organisms including plants, animals, birds, insects, and humans are used to living in a certain type of climate. The world comprises a huge diversity of the types of environments which are divided and grouped into different types of biomes and are mainly based on the adaptations, range of temperature, weather, and climatic conditions.

The word "Biome" was suggested by an ecologist Frederic Edward Clements in the year 1916 which referred to the word biotic community.

Q268. Solar energy is converted into ATP in (65th BPSC exam)

- A. Mitochondria
- B. Chloroplast
- C. Ribosome
- D. Peroxisome

Ans. B. Chloroplast

- ❖ The cycle of photosynthesis in plants includes a progression of steps and reactions that utilizes sun based energy, water, and carbon dioxide to deliver certain compounds and oxygen. There are two primary arrangements of reactions: energy-transduction reactions (regularly called light responses) and carbon-fixation reactions (ordinarily called dark responses).
- ❖ In the energy-transduction reactions, sunlight based energy is changed over into substance energy as two energy-carrying molecules, ATP and NADPH. At the point when sun powered energy arrives at plant cells and energizes unique chlorophyll particles, they discharge a high-energy electron. The arrival of this electron sets off a chain of electron-exchanging and energy-moving occasions between a few mediator atoms, and the last particle to frame and hold the electrons in this chain is NADPH.
- ❖ The energized chlorophyll atom's electrons should be supplanted, and these electrons originate from water. With the assistance of catalysts and sun oriented energy, water is parted (photolysis) into electrons, protons (H⁺), and oxygen. The electrons go to the chlorophyll, while the protons add to a proton gradient that is utilized to control the amalgamation of a subsequent energy-conveying atom, ATP. The oxygen is a by-product of the entire cycle.

- ❖ The compound energy in NADPH and ATP is then used to control steps in the further carbon fixation reactions.

Mitochondria

- ❖ Mitochondria are membrane-bound semi-autonomous cell organelles and are often referred to as the powerhouses of the cell.
- ❖ They generate most of the chemical energy needed to power the cell's biochemical reactions.
- ❖ Chemical energy produced by the mitochondria is stored in the form of Adenosine Triphosphate (ATP).
- ❖ Mitochondria contain their own Deoxyribonucleic Acid (DNA). Generally, mitochondria, and therefore mitochondrial DNA, are inherited only from the mother in almost all multicellular organisms.
- ❖ Mitochondria in mammalian sperm are usually destroyed by the egg cell after fertilization.
- ❖ The mitochondria are present at the base of the sperm's tail, which is used for propelling the sperm cells; sometimes the tail is lost during fertilization.

Ribosomes

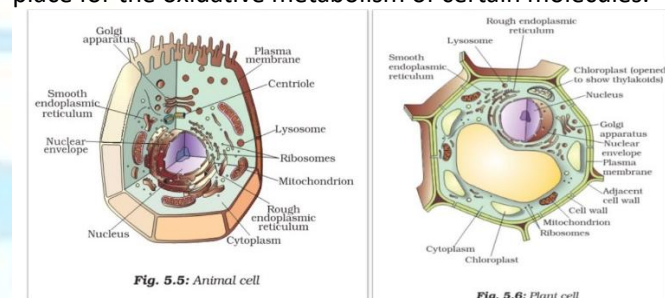
- ❖ Ribosomes are non-membrane-bound cell organelles made of RNA and proteins.
- ❖ They are found in both prokaryotic and eukaryotic cells.
 - In eukaryotic organisms, ribosomes are found in the cytoplasm, mitochondria, and chloroplast.
 - All prokaryotic ribosomes are found free in the cytoplasm of the cell.
- ❖ Ribosomal structure and function are strikingly similar in all organisms and organelles.
- ❖ They are made of two subunits, the large and the small subunit which comprises ribosomal RNA (rRNA) and proteins.
- ❖ Primary Function:
 - They are complex molecular machines that make proteins from amino acids in a process called protein synthesis, or translation.
 - Every cell needs ribosomes to manufacture proteins.
 - The ribosome reads the messenger RNA (mRNA) sequence and translates that genetic code into a specified string of amino acids, which grow into long chains that fold to form proteins.
 - The newly formed proteins detach themselves from the ribosome site and migrate to other parts of the cell for use.

Peroxisome

Peroxisome, membrane-bound organelle occurring in the cytoplasm of eukaryotic cells. Peroxisomes play a crucial role in the oxidation of different biomolecules. They also contribute to the biosynthesis of membrane lipids known as plasmalogens. In-plant cells, peroxisomes perform additional functions, including the recycling of

phosphoglycolate carbon during photorespiration. Specialized types of peroxisomes have been identified in plants, including glyoxysomes, which function in the conversion of fatty acids to carbohydrates.

Peroxisomes contain enzymes that oxidize certain molecules normally found in the cells, especially fatty acids and amino acids. These oxidation reactions produce hydrogen peroxide, which is the basis of the name peroxisome. However, hydrogen peroxide is potentially harmful to the cell as it is capable of interacting with many other molecules. Peroxisomes therefore also contain enzymes such as catalase, which convert hydrogen peroxide to water and oxygen, thereby neutralizing toxicity. Throughout this way, peroxisomes offer a safe place for the oxidative metabolism of certain molecules.



Q269. The byproduct of photosynthesis is (65th BPSC exam)

- A. CO₂
- B. O₂
- C. Energy
- D. Sugar

Ans. B. O₂

Oxygen (O₂) is the by-product of photosynthesis. Photosynthesis, is the process by which green plants and certain other organisms transform light energy into chemical energy. During photosynthesis in green plants, light energy is captured and used to convert water, carbon dioxide, into oxygen and energy rich organic compound i.e. glucose

Q270. The study of bones is done under the branch of science called (65th BPSC exam)

- A. Geology
- B. Serology
- C. Orology
- D. Osteology

Ans. D. Osteology

- ❖ Osteology is the detailed study of the structure of bones skeletal elements, teeth etc.
- ❖ Geology is the study of rocks, and of the way they are formed.

- ❖ Orology is the study of mountain especially the study of how mountains are formed.
- ❖ Serology is the scientific study or diagnostic examination of blood serum, especially with regard to the response of the immune system to pathogen or introduced substances.

Q271. Which of the following does not have any enzyme in its cells? (65th BPSC exam)

- A. Lichen
- B. Virus
- C. Bacteria
- D. Algae

Ans. B. Virus

Virus does not have any enzyme in its cells. Viruses are non-cellular microscopic infection agents that can only replicate in host cell. Viruses lack most of the basic cellular structures that are responsible for enzyme formation.

Lichen: A lichen is not a single organism but a symbiosis among different organisms like fungus and a cyanobacterium or algae. Cyanobacteria are also referred to as blue-green algae despite the fact of being distinct from algae.

Bacteria: Bacteria are unicellular organisms that belong to the prokaryotic category. Their size ranges between 1 and 10 micrometres. They reproduce by a process called binary fission. Bacteria are known to be the earliest forms of life to ever exist on Earth. They obtain necessary nutrients by decomposition of waste, photosynthesis, or chemical breakdown of compounds. Gram-positive and gram-negative bacteria are subdivisions of bacteria. A separate discipline called bacteriology deals with detailed research of bacteria.

Algae: Algae exist in environments ranging from oceans, rivers, and lakes to ponds, brackish waters and even snow. Algae are usually green, but they can be found in a variety of different colours. For instance, algae living in snow contain carotenoid pigments in addition to chlorophyll, hence giving the surrounding snow a distinctive red hue.

Q272. In which organ of the human body are the lymphocytes formed? (65th BPSC exam)

- A. Liver
- B. Bone marrow
- C. Spleen
- D. Pancreas

Ans. B. Bone marrow

- ❖ The Bone marrow is a soft tissue present inside certain bones of the body harbouring stem cells for the generation of the red blood cells (RBCs), white blood cells (WBCs) and the platelets responsible for the oxygen transport, immunity and blood clotting

respectively. Since lymphocytes are a type of WBCs, they are also formed in the bone marrow. Therefore, this is the correct option.

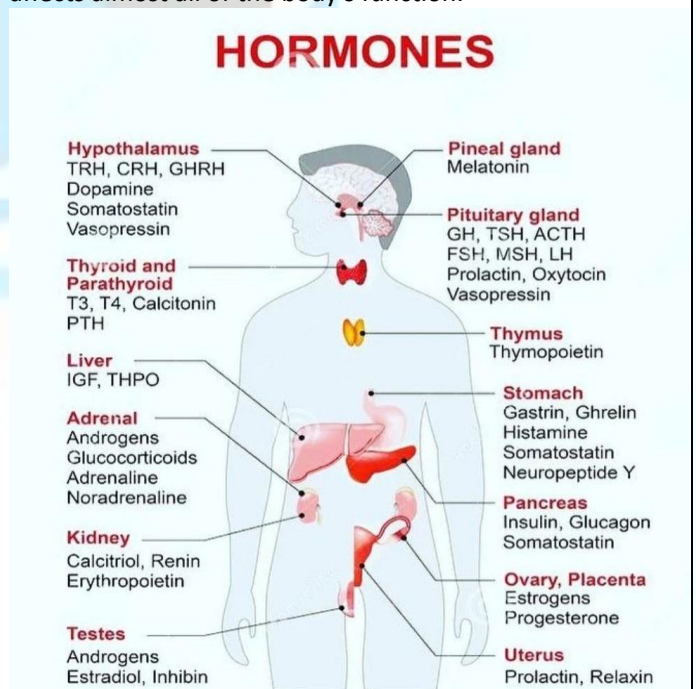
- ❖ The spleen is a fist sized organ present in the abdomen responsible for filtering the blood. This organ is specialized for recognizing and removing old or malformed red blood cells (RBCs) from the circulatory system. Evidence suggesting the formation of lymphocytes in the spleen does not exist. Therefore, this option is incorrect.
- ❖ The liver is a vital organ involved in various metabolic processes and detoxification, but it is not the primary site of lymphocyte formation. Therefore, this option is incorrect.
- ❖ The pancreas is primarily responsible for producing digestive enzymes and regulating blood sugar levels, and it is not involved in lymphocyte formation. Therefore, this option is incorrect.

Q273. Which of the following hormones contains "iodine"? (65th BPSC exam)

- A. Testosterone
- B. Adrenaline
- C. Thyroxine
- D. Insulin

Ans. C. Thyroxine

There are two iodine containing hormones in the human body Tri-iodothyronine (T3) and Thyroxine (T4). Thyroxine plays a crucial role in heart and digestive function, metabolism, brain development and muscle control. It affects almost all of the body's function.



Q274. AIDS is caused by (65th BPSC exam)

- A. Helminth
- B. Bacteria
- C. Fungus
- D. Virus

Ans. D. Virus

HIV/AIDS Disease

- ❖ **About:** Human immunodeficiency virus (HIV) is an infection that attacks the body's immune system. AIDS is the late stage of HIV infection that occurs when the body's immune system is badly damaged because of the virus. HIV attacks CD4, a type of White Blood Cell (T cells) in the body's immune system. T cells are those cells that move around the body detecting anomalies and infections in cells. After entering the body, HIV multiplies itself and destroys CD4 cells, thus severely damaging the human immune system. Once this virus enters the body, it can never be removed. The CD4 count of a person infected with HIV reduces significantly. In a healthy body, CD4 count is between 500- 1600, but in an infected body, it can go as low as 200.
- ❖ **Transmission:** HIV can spread through multiple sources, by coming in direct contact with certain body fluids from a person infected with HIV, who has a detectable viral load. It can be blood, semen, rectal fluid, vaginal fluid or breast milk.
- ❖ **Symptoms:** Once HIV converts into AIDS then it may present in initial symptoms like unexplained fatigue, fever, sores around genitals or neck, pneumonia etc.

Q275. The unit of pressure is (65th BPSC exam)

- A. Kg/cm²
- B. Kg/cm
- C. Kg/cm⁻¹
- D. Kgh/cm³

Ans. A. Kg/cm²

The basic unit of pressure is pascal which is defined as the pressure exerted by a force of one Newton perpendicularly upon an area of one square meter. Out of the given options Kg/cm² is a unit of pressure
1 kg/cm² = 98066.5 pascals.

Now, let's study the differences between force and pressure from the below table:

Basis of Force comparison		Pressure	
Definition	Force is a pull or push that forces an object to change its shape or motion.		The force applied to an object/fluid in a perpendicular direction on its surface is pressure.
Nature	Force is a vector quantity as it possesses both magnitude and direction.		Pressure is a scalar quantity i.e. it only has magnitude without any specific direction.

Formula	Force is calculated as the product of mass of object and acceleration that it gets after application of force. $F = m \times a$ Where 'm' is the mass of the object and 'a' is acceleration.
Units	Newton is the SI unit of force
Direction	Force can accelerate, change direction, decelerate or deform an object as per its magnitude and direction.
Application	Force and its principles are relevant to concepts and principles of Physics such as dynamics, kinematics, mechanics, and other principles of Physics.
Examples	The bullock pulling a cart Pushing a static object Pulling a rope

Q276. The sunlight from the Sun to the Earth reaches in (65th BPSC exam)

- A. 5 minutes approx
- B. 6 minutes approx
- C. 8 minutes approx
- D. 10 minutes approx

Ans. C. 8 minutes approx

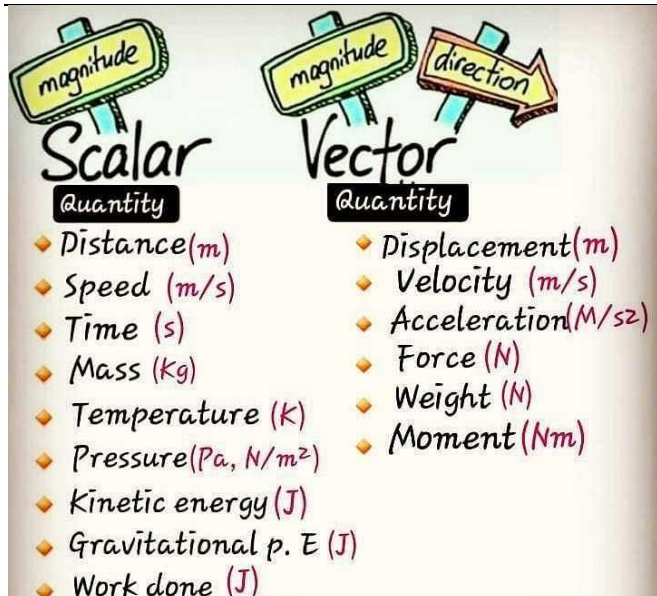
The sunlight from the Sun takes approximately 8 minutes to reach the Earth. This time is known as the "light travel time" or "solar transit time." It is the time it takes for light to travel the average distance from the Sun to the Earth, which is about 93 million miles (150 million kilometers).

Q277. Which one of the following is a scalar quantity? (65th BPSC exam)

- A. Force
- B. Velocity
- C. Pressure
- D. Acceleration

Ans. C. Pressure

A scalar quantity is defined as the physical quantity with magnitude and no direction as- Mass, Speed, Distance, Time, Area, Volume, Density, Temperature, Pressure, etc. A vector quantity is a physical quantity that has both magnitude and direction. Examples: Velocity, Angular Velocity, Force, Displacement, Acceleration, Momentum, Magnetic Field and Angular Velocity etc.



Q278. Which one of the following quantities does not have unit? (65th BPSC exam)

- A. Stress
- B. Force
- C. Strain
- D. Pressure

Ans. C. Strain

- ❖ Strain is a measure of the deformation or change in shape experienced by a material in response to applied stress. It is a dimensionless quantity and does not have a specific unit associated with it.
- ❖ Some examples of quantities that are dimensionless and do not have units are Mass fraction, Molar fraction, Relative humidity, Mach number, Specific gravity etc.

Other options are as stated:

- ❖ Stress is measured in pascals (Pa) or newtons per square meter (N/m²).
- ❖ Force is measured in newtons (N).
- ❖ Pressure is measured in pascals (Pa) or newtons per square meter (N/m²).

Q279. Sound wave in air is (65th BPSC exam)

- A. Transverse
- B. Longitudinal
- C. Electromagnetic
- D. Polarized

Ans. B. Longitudinal

Sound waves in any fluid medium or in air are longitudinal waves. In longitudinal waves particles of the medium through which the waves travelled vibrate parallel to the direction of the wave movement.

Difference Between Transverse and Longitudinal Waves

Transverse Waves	Longitudinal Waves
Particles vibrate at right angles to the direction of propagation of the wave.	Particles vibrate back and forth along the direction of propagation of the wave.
Can be propagated through solids only	Can be propagated through all states of matter
Generally slower in nature	Generally faster than the transverse waves
Contains crests and troughs	Contains compressions and rarefactions
Position of particles is measured through time.	Pressure variation is measured through time.
Light waves are transverse	Sound waves are longitudinal

Did You Know?

- ❖ Electromagnetic waves do not require a medium to travel and that is how we receive light from the sun.
- ❖ The human ear is sensitive to only pressure variations and thus sound waves are longitudinal in nature.
- ❖ Dogs can hear higher frequency sounds and therefore can hear noises we humans cannot hear.
- ❖ Light travels with a speed of 3,00,000 km/sec through the air.
- ❖ The velocity of light is the fastest and no particle could travel faster than it.
- ❖ The speed of sound in water is about 4 times the speed of sound in air.
- ❖ Light behaves both as a wave and as a particle from time to time.
- ❖ Supersonic planes are aircraft that travel faster than the speed of sound and cause shock waves.
- ❖ Opera singers sing in very high-frequency waves and hence can shatter a glass.
- ❖ Waves traveling in the same medium superimpose and the net displacement of the particle is the sum of individual displacements of the waves.

Q280. The value of 50°C in Fahrenheit scale is (65th BPSC exam)

- A. 104°F
- B. 122°F
- C. 100°F
- D. 75°F

Ans. B. 122°F

To convert 50°C to Fahrenheit, we can use the following formula:

$$^{\circ}\text{F} = (^{\circ}\text{C} \times 9/5) + 32$$

Putting in the value of 50°C:

$$^{\circ}\text{F} = (50 \times 9/5) + 32 \quad ^{\circ}\text{F} = (90) + 32$$

°F = 122°F

Q281. What is measured in hertz? (65th BPSC exam)

- A. Frequency
- B. Energy
- C. Heat
- D. Quality

Ans. A. Frequency

Hertz is the SI unit of frequency. One hertz is equal to one cycle per second.

$$\text{Formula } F = \frac{1}{T}$$

Energy: Energy is the ability to perform work. Energy can neither be created nor destroyed, and it can only be transformed from one form to another. The unit of Energy is the same as of Work, i.e. Joules. Energy is found in many things, and thus there are different types of energy. All forms of energy are either kinetic or potential. The energy in motion is known as Kinetic Energy, whereas Potential Energy is the energy stored in an object and is measured by the amount of work done.

Heat: According to heat definition, it is one of the essential forms of energy for the survival of life on earth. Transfer of heat takes place from one body to another due to differences in temperature as per thermodynamics. We use heat energy for various activities like cooking, ironing, transportation, recreation, etc. This form of energy also plays a vital role in nature. The occurrence of the wind, rain, change of seasons, etc., depends on the gradient created due to uneven heating of different regions.

Heat Transfer Occurs by Three Mechanisms

- ❖ **Conduction:** It is the method in which the transfer of heat takes place between atoms and molecules in direct contact.
- ❖ **Convection:** It is the method in which the transfer of heat happens by the movement of the heated substance.
- ❖ **Radiation:** It is the method in which the transfer of heat takes place by electromagnetic waves.

Q282. Body temperature is regulated by (65th BPSC exam)

- A. Medulla
- B. Thalamus
- C. Hypothalamus
- D. Cerebellum

Ans. C. Hypothalamus

Thalamus

This is a part of the forebrain that is located above the brainstem. It is a small structure responsible for conveying sensory information from the various sense organs. It also helps in overall coordination and movement by

transmitting motor information. The thalamus is contained within the cerebrum, in the limbic system, which helps in memory retention.

Hypothalamus

The hypothalamus is located below the thalamus and is a small yet essential part of the human brain. It is considered as the primary area of the brain performing the following functions:

- ❖ The body temperature is regulated by the hypothalamus.
- ❖ It receives impulses from various parts of the body.
- ❖ Controls the emotional quotient and mood.
- ❖ Controls the sense of smell and taste.
- ❖ Controls blood pressure, appetite, heart rate, and peristalsis.

Cerebellum

- ❖ It is the second-largest part of the brain located in the posterior area of the pons and the medulla. The transverse fissure and the tentorium cerebelli separate the cerebrum and the cerebellum. The outer surface of the cerebellum is the cortex; two hemispheres- the gray cortex on the outer portion and the white medulla inside make up the cerebellum.
- ❖ The cerebellum also consists of cerebellar nuclei, cerebellar peduncles, and the anterior and posterior lobes. The cerebellum performs important functions like:
 - Transfer of information
 - Coordination of eye movement
 - Sense of equilibrium
 - Controlling the voluntary movements of the body
 - Coordination of skeletal movements that are directly related to the anterior and posterior lobes

Medulla

The medulla oblongata is in the lowest area of the brain. It is a small structure that controls the body's autonomic functions like digestion, heartbeat. It also connects the cerebral cortex and the spinal cord and helps control the human body reflexes.

Q283. The device to measure electric current is (65th BPSC exam)

- A. Ammeter
- B. Voltmeter
- C. Voltmeter
- D. Potentiometer

Ans. A. Ammeter

Ammeter, is an instrument for measuring either direct or alternating electric current in amperes. An ammeter can measure a wide range of current values because at high

values only a small portion of the current is directed through the meter mechanism.

IMPORTANT MEASURING DEVICES	
Devices/Equipments	Uses
Accumulator	It serves as a kind of electrical energy storage.
Altimeter	It is used in aeroplanes to measure altitude.
Ammeter	Electric current strength is measured by this instrument (in amperes).
Anemometer	It calculates the wind's speed and force.
Audiometer	It gauges the intensity of sound.
Audiphones	It is used for improving the imperfect sense of hearing.
Barograph	It is utilised for continuous atmospheric pressure recording.
Barometer	It is used to measure atmospheric pressure. It is used in weather forecasting.
Binocular	It is utilised to see faraway objects.
Bolometer	It measures heat radiation
Calorimeter	It is used to gauge how much heat a material emits or absorbs. It is employed in thermodynamics and chemistry.
Carburettor	It is used in an internal combustion engine for charging the air with petrol vapour.
Cardiogram	It tracks the heart's motion as it is captured on a cardiograph.
Chronometer	It establishes a location's longitude on a ship.
Cinematography	It is a tool used in filmmaking to project an enlarged picture of the photograph on the screen.
Colorimeter	a device for contrasting hue intensity.
Commutator	An instrument to change or remove the direction of an electric current, in dynamo is used to convert alternating current into direct current.

Cresco graph	It measures the growth in plants.
Cyclotron	It is a charged particle accelerator that is capable of raising the energy of charged particles.
Dynamo	Mechanical energy is transformed into electrical energy by it.
Dynamometer	It computes power, torque, and force.
Electroscope	It detects the presence of an electric charge.
Endoscope	It looks at the body's interior organs.
Eudiometer	a glass tube used to measure volume changes in gas chemical processes.
Fathometer	It computes the ocean's depth.
Galvanometer	It measures small-amplitude electric currents.
Hydrometer	It computes the liquids' specific gravities.
Hydrophone	It gauges underwater sound.
Hygrometer	It gauges the air's humidity.
Kymograph	It graphically records physiological movements (Blood pressure and heartbeat).
Lactometer	It determines the purity of milk.
Manometer	Gas pressure is measured by it.
Mariner's compass	It is a tool that sailors use to identify the direction.
Microphone	It amplifies the sound and changes the sound waves into electrical vibrations
Microscope	It is used to view small objects or organisms that cannot be seen with the naked eye. It is used in biology, medicine, and research.
Odometer	An instrument by which the distance covered by wheeled vehicles is measured.
Periscope	It is used to view objects above sea level (used in submarines)

Photometer	The instrument compares the luminous intensity of the source of light
Potentiometer	It is used for comparing the electromotive force of cells.
Pyrometer	It measures very high temperatures.
Quartz Clock	A highly accurate clock used in astronomical observations and other precision work
Radar	Radio, angle, detection and range is used to detect the direction and range of an approaching aeroplane by means of radio microwaves
Radiometer	It measures the emission of radiant energy.
Rain Gauge	An apparatus for recording rainfall at a particular place.
Rectifier	An instrument used for the conversion of AC into DC.
Refractometer	It measures the refractive index.
Saccharimeter	It measures the amount of sugar in the solution.
Salinometer	It determines the salinity of the solution.
Seismograph	It measures the intensity of earthquake shocks.
Sextant	This is used by navigators to find the latitude of a place by measuring the elevation above the horizon of the sun or another star.
Spectrometer	It is used to measure the intensity of light absorbed by a substance. It is used in chemistry and biology.
Spectroscope	An instrument used for spectrum analysis
Speedometer	It is an instrument placed in a vehicle to record its speed.
Spherometer	It measures the curvatures of surfaces.
Sphygmomanometer	It measures blood pressure.
Stereoscope	It is used to view two-dimensional pictures.
Stroboscope	It is used to view rapidly moving objects.

Tachometer	An instrument used in measuring the speeds of aeroplanes and motor boats.
Teleprinter	This instrument receives and sends typed messages from one place to another.
Telescope	It is used to view distant objects in space. It is used in astronomy.
Theodolite	It measures horizontal and vertical angles.
Thermometer	It is used to measure temperature. It is used in medicine, meteorology, and other fields that require temperature measurement.
Thermostat	It regulates the temperature at a particular point.
Transistor	A small device which may be used to amplify currents and perform other functions usually performed by a thermionic valve
Udometer	It is used to measure the amount of liquid precipitation over a set period of time. It is also called Rain Gauge.
Vernier	An adjustable scale for measuring small subdivisions of scale
Viscometer	It measures the viscosity of liquids.
Voltmeter	It measures the electric potential difference between two points.

Q284. The unit of electric power is (65th BPSC exam)

- A. Ampere
- B. Volt
- C. Coulomb
- D. Watt

Ans. D. Watt

- ❖ Electric current → Ampere
- ❖ Electrical potential → Volt
- ❖ Electric power → Watt
- ❖ Electric charge → Coulomb.

- ❖ The unit of electric power is called watts, which is equal to one ampere under the pressure of one volt ($P = V \times I$). The name Watt is given to honor James Watt

Q285. Visual Impairment "Myopia, is known as?(65th BPSC Re-exam)

- A. Hypermetropia
- B. Presbyopia
- C. Glaucoma
- D. Cataract
- E. None of the above/more than one of the above

Ans. E. None of the above

The visual impairment or Myopia, also known as nearsightedness, is a very common vision disorder that is usually diagnosed before age 20. In Myopia the eyeball is too long for the normal focusing power of the eye, as a result images of distant objects appear blurred.

Q286. With reference to LED (Light Emitting Diode) which statement is not correct? (65th BPSC Re-exam)

- A. LED light sources consume less Energy
- B. LED are more durable than light bulbs
- C. LED contain mercury which is harmful to humans
- D. LED is used in traffic signal lights

LED contain mercury which is harmful to humans

The term LED stands for Light Emitting Diode. It is a source of less energy consuming. It is more durable and has extended life span than light bulbs. LED's are mostly used in Automotive lightening and traffic signal lights. LED is a semiconductor device that emits light when electric current is passed through it. It does not contain mercury. Hence, option C is not correct

Q287. Which of the following is used in Solar furnace? (65th BPSC Re-exam)

- A. Plane mirror
- B. Concave mirror
- C. Convex mirror
- D. Concave Lens

Ans. B. Concave mirror

Concave mirror converges the parallel sun rays at a point. It helps to increase the temperature of the furnace that can reach up to 3500°C. So concave mirror is basically used in the designing of solar furnace.

Q288. What is the optical instrument used to see minimal objects?(65th BPSC Re-exam)

- A. Microscope
- B. Electroscope
- C. Spectroscopy
- D. Stethoscope

Ans. A. Microscope

A microscope can be used to see minimal (Small/micro) objects. It gets a clear magnified view of microorganisms like cells, bacteria and amoeba. Two Dutch spectacle makers, Hans and his son Zacharias Janssen, create the first microscope in the late 16th century. Antonie van Leeuwenhoek was the first to observe bacteria under microscope

Q289. Ultrasonic waves are? (65th BPSC Re-exam)

- A. Frequency of Sound wave, less than 20 kHz
- B. Frequency of Sound wave, more than 20 kHz
- C. Frequency of Sound wave, between 20 Hz and 20kHz
- D. Electro-magnetic waves

Ans. B. Frequency of Sound wave, more than 20 kHz

Ultrasonic waves are the frequency of sound wave which are greater than the audible range for human (more than 20 kHz).

Q290. Which of the following metals has the highest electrical conductivity? (65th BPSC Re-exam)

- A. Gold
- B. Silver
- C. Copper
- D. Iron

Ans. B. Silver

Silver has the highest electrical conductivity. It is the most electrically conductive metal on the Earth. Second most electrically conductive metal is Copper.

Type of Materials	Electrical conductivity, σ ($\Omega \cdot m$) ⁻¹
Silver	6.3×10^7
Copper	5.8×10^7
Gold	4.2×10^7
Aluminum	3.4×10^7
Germanium	2.2
Silicon	4.3×10^{-4}
Polyethylene	10^{-14}
Diamond	10^{-14}

Q291. The element commonly used to generate electricity from nuclear fission in nuclear reactor is? (65th BPSC Re-exam)

- A. Radium
- B. Plutonium
- C. Uranium

D. Deuterium

Ans. C. Uranium

The fuel pellets of Uranium (U_{235}) is used to produce electricity in nuclear reactor by nuclear fission. U_{235} is bombarded with neutron particles and nucleus breaks down into two nuclei then more neutron particles are used to break more uranium atoms resultantly chain reaction occurs which helps to generate electricity.

Q292. Boiling point of liquids at high altitude? (65th BPSC Re-exam)

- A. Increases
- B. Decreases
- C. Remain constant
- D. Decrease after increasing

Ans. B. Decreases

At higher altitude where the atmospheric pressure is lower, the Vapour pressure is also lower which in turn creates a lower boiling point (decrease). Cooking at high altitude takes more time than cooking at surface (sea level).

Q293. According to Chemistry, which of the following is an example of physical change?(65th BPSC Re-exam)

- A. Rusting of iron
- B. Boiling of water
- C. Burning of wood
- D. Green levelling on copper utensils

Ans. B. Boiling of water

Physical Changes are the reversible process. In Physical change, the substances involved do not change their original form. They can be easily returned to their original form by some physical changes for example- freezing of water, boiling of water, making a solution, etc.

Q294. Which of the following is a non-ferrous metallic mineral? (65th BPSC Re-exam)

- A. Manganese
- B. Nickel
- C. Cobalt
- D. Tin
- E. None of the above/more than one of the above

Ans. E. None of the above/more than one of the above

There are several kind of mineral, basically ferrous minerals and non-ferrous minerals. Ferrous minerals are metallic minerals containing iron. Example: Manganese, Nickel, cobalt, Tin, Iron etc, and Nonferrous Metallic minerals are that do not contain iron example - Gold, copper, zinc, etc.

Q295. The glass which is used in tube lights and test tubes, is made up of ? (65th BPSC Re-exam)

- A. Silica
- B. Calcium Carbonate
- C. Sodium Carbonate
- D. Pieces of Glass
- E. None of the above/more than one of the above

Ans. E. None of the above/more than one of the above

The tube lights and test tubes are made up from expansion resistant type glasses, mostly Borosilicate (Silica + boron trioxide) glass or fused quartz. Borosilicate glasses are more durable and resistant to heat. It is used in higher temperature lamp

Q296. Alcohol can be converted into carboxylic acid by? (65th BPSC Re-exam)

- A. Only by Oxidation
- B. Only by Reduction
- C. By esterification
- D. Both Oxidation and Reduction

Ans. A. Only by Oxidation

Alcohols are converted into carboxylic acid by the process of oxidation. Primary alcohols are oxidized to carboxylic acids in two stages, first to an Aldehyde and then to the acid.

Q297. Which one of the following is the best fire extinguisher? (65th BPSC Re-exam)

- A. Soil
- B. Water
- C. Oxygen
- D. Carbon dioxide

Ans. D. Carbon dioxide

Carbon dioxide is the best fire extinguisher. It displaces oxygen from the air or takes away the oxygen element from the fire triangle which helps in extinguishing the fire.

Q298. Fullerene or Bucky balls are, composed of how many carbon atoms? (65th BPSC Re-exam)

- A. 20
- B. 40
- C. 45
- D. 50
- E. None of the above/more than one of the above

Ans. E. None of the above/more than one of the above

Fullerenes belong to the carbon-only molecules family, and it is composed of 60 carbon atoms (C_{60}) in form of a ball like structure. They are cluster of carbon. Fullerene was discovered by Richard E. Smalley and F. Curl of Rice

University, Houston and Harold W. Kroto of University of Sussex, USA in 1985. Fullerenes are also known as Bucky ball and carbon nanotubes.

Q299. Which of the following phenomenon increase oxygen level in the carbon cycle taking place on earth? (65th BPSC Re-exam)

- A. Respiration
- B. Volcanic Eruption
- C. Decay of Organic Matter
- D. Photosynthesis

Ans. D. Photosynthesis

The leading producers of oxygen are plants and sunlight by the process of photosynthesis. It is a biological process in which green plants synthesize their food in presence of Sunlight and produce energy and oxygen

Q300. Which of the following is a vascular plant? (65th BPSC Re-exam)

- A. Moss
- B. Liverwort
- C. Hornwort
- D. Fern

Ans. D. Fern

Vascular Plants are also called Tracheophytes, which means duct or vessel in Plants. The vascular plants have vascular tissues including xylem (Conducting water) and Phloem (integrating food). Vascular plants include all the seed containing plants as: Ferns, Angiosperms and Gymnosperms.

Q301. Which of the following is a perfect example of Organic fertilizer: (65th BPSC Re-exam)

- 1) Mycorrhizal fungi
 - 2) Blue Green Algae
 - 3) Bacillus thuringiensis
- A. Only I
 - B. Only I and II
 - C. Only II
 - D. Only III

Ans. B. Only I and II

Organic fertilizers are the by-product of plant and animal manures. Organic fertilizers are substances that contain microbes. It Comprises of living organisms which include Mycorrhizal fungi, Blue Green Algae and Cyno bacteria. Bacillus thuringiensis is Pesticide. Hence, option (b) only statement I and II are correct.

Q302. Which of the following plants has modified its stem to store food materials?(65th BPSC Re-exam)

- A. Ginger
- B. Radish
- C. Beet
- D. Carrot

Ans. A. Ginger

The plants which store food in their stem are ginger, onion, banana, potato, bamboo, pineapple, cactus etc.

Note: Plants that produce underground modifications of stem utilize it for permeation and storage of food.

Q303. Which of the following cell organelles destroy bacteria entering the cell? (65th BPSC Re-exam)

- A. Ribosome
- B. Golgi body
- C. Lysosome
- D. Endoplasmic Reticulum

Ans. C. Lysosome

- ❖ A Lysosome is a membrane-bound cell organelle that contains digestive enzyme. It involves in various cell processes. Lysosome destroys invading viruses and bacteria. Lysosomes are known as Suicide Bags of the cell.
- ❖ The endoplasmic reticulum (ER) is a large organelle composed of membranous sheets and tubules that start near the nucleus and stretch throughout the cell. The endoplasmic reticulum produces, packages, and secretes many of the products a cell creates.
- ❖ The Golgi apparatus has multiple names such as Golgi complex or Golgi body. The name is given on the name of the scientist, who discovered the organelle, i.e. Camillo Golgi. It is found in all the eukaryotic cells, plants as well as animals. They are membrane-bound organelle present in the cytosol of the cell.
- ❖ Ribosomes are non-membrane-bound cell organelles made of RNA and proteins.

Q304. Iron deficiency causes in the body? (65th BPSC Re-exam)

- A. Anaemia
- B. Scurvy
- C. Osteoporosis
- D. Skin disease

Ans. A. Anaemia

Anaemia is a condition in which the number of Red Blood Cells or their oxygen carrying capacity is reduced. Basically Anaemia is caused by the deficiency of Iron. Some other factors also causes Anaemia i.e. deficiency of vitamin B₁₂, folate and vitamin B₉.

Q305. Ideal temperature of Human body is (65th BPSC Re-exam)

- A. 99.6°F
- B. 97.4°F
- C. 98.6°F
- D. 95.6°F

Ans. C. 98.6°F

In general, average normal body temperature of human body is considered as 98.6°F or 37°C. In adult, the average of human body temperature is 97°F to 99°F

Q306. Which organ of the human body affected by typhoid disease? (65th BPSC Re-exam)

- A. Lung
- B. Spinal cord
- C. Body Joints
- D. Intestine

Ans. D. Intestine

Typhoid is a bacterial disease that mainly spreads by contaminated water and food. Intestine (small intestine) of the human body is affected by Typhoid disease.

Q307. In which organ of Human body is epithelial cells are found? (65th BPSC Re-exam)

- A. Hair
- B. Nose
- C. Lungs
- D. Pancreas
- E. None of the above/more than one of the above

Ans. E. None of the above/more than one of the above

Epithelium is one of the body cell that forms the covering on all internal and external surfaces of body. There are various kinds of epithelial tissue throughout the body. Which are - outer layer of skin (epidermis), Intestine, Lining of respiratory tract, abdominal cavity and etc.

Q308. Which of the following has pH value 7? (64th BPSC exam)

- A. Pure water
- B. Neutral Solution
- C. Basic Solution
- D. Acidic Solution

Ans. A. Pure water

Solution Type	pH Value	Hydrogen Ion Concentration (H ⁺)
Pure Water	7	Equal to Hydroxide Ion Concentration (OH ⁻)
Neutral Solution	7	Equal to Hydroxide Ion Concentration (OH ⁻)

Basic Solution	Greater than 7	Lower than Hydroxide Ion Concentration (OH ⁻)
Acidic Solution	Less than 7	Higher than Hydroxide Ion Concentration (OH ⁻)

Q309. Which of the following elements does not contain neutrons? (64th BPSC exam)

- A. Oxygen
- B. Nitrogen
- C. Hydrogen
- D. Copper

Ans. C. Hydrogen

- ❖ Hydrogen has mass number one and its atomic number is also one. It does not contain neutrons.
- ❖ Oxygen (O) has 8 protons and 8 neutrons.
- ❖ Nitrogen (N) has 7 protons and 7 neutrons.
- ❖ Copper (Cu) has 29 protons and 35 neutrons.

Q310. Angstrom is a unit of (64th BPSC exam)

- A. Wavelength
- B. Energy
- C. Frequency
- D. Velocity

Ans. A. Wavelength

- ❖ Wavelength is the distance between two consecutive crests or two consecutive troughs in a transverse wave. Wavelength also represents a repeating pattern of any traveling energies, such as light or sound. Wavelength is usually expressed by the units of nanometres (nm) or micrometres (μm). It is represented by the symbol λ which is read as lambda.
- ❖ Energy is commonly measured in joules (J) or electron volts (eV).
- ❖ Frequency is typically measured in hertz (Hz)
- ❖ Velocity is commonly measured in meters per second (m/s).

Q311. Who discovered DNA? (64th BPSC exam)

- A. James Watson and Francis Crick
- B. Gregor Mendel
- C. Johannsen
- D. Hargovind Khurana

Ans. A. James Watson and Francis Crick

Deoxyribonucleic Acid (DNA)

- ❖ Deoxyribonucleic acid (DNA) is an organic molecule with a complex molecular structure.
- ❖ DNA molecule's strands are made up of a long chain of monomer nucleotides. It is arranged in a double helix structure.

- ❖ James Watson and Francis Crick discovered that DNA is a double-helix polymer in 1953.
- ❖ It is essential for the transfer of the genetic characteristic of the living being from one generation to the other generation.
- ❖ The majority of DNA is found in the cell nucleus so it is called nuclear DNA.

Associated Terms	Inventors
Vitamins	Hopkins
Antigen	Landsteiner
DNA	Watson & Crick
DDT	Paul Muller
Homeopathy	Samuel Hahnemann
Polio Vaccine	J. E. Salk
TB Bacteria	Robert Koch
BCG	Calmette and Guerin
Bacteria	Leeuwenhoek
Open Heart Surgery	Walton Lillehei
Streptomycin	Waksman
Stethoscope	Rene Laennec
Penicillin	A. Fleming
RNA	Watson & Arthur
Microbes of Malaria	Charles Laveran
Kidney Machine	Dr. Willem Kolff
Heart Transplantation	Christiaan Barnard
Anti-pregnancy pills	Pincus
Genetic Code	Har Gobind Khorana
First Test tube baby	Edwards & Steptoe
Blood Circulation	William Harvey
Bacteria of Leprosy	Henson
Vaccination	Edward Jenner
Polio Drop	Albert Sabin
Gene of Cancer	Robert Weinberg
Chloroform	Harrison & Simpson
Rh factor, blood replacement	Charles Landsteiner
Sex Hormones	Eugen Stainak
Sperm	Humm & Leeuwenhoek
Spleen-Functions	Barcroft
Streptomycin – antibiotic	Selman Waksman
Sulpha drugs	Domagk G.
Three-Kingdom Classification	Ernest Haeckel
Thyroxin	Edward Calvin
Turner's Syndrome	Turner
Cancer	Robert Wellberg
X-rays	Roentgen
Zymase, the first enzyme	Edward Buchner
ABA (Absciscic acid)	Addicott
Amoeba	Roesel Von Rosenhof
Animal Cloning-First (frogs from tadpole cells)	Robert Briggs and Thomas King
Antibody against Rabies	Louis Pasteur

Antitoxin against Diphtheria	Won Berring
Artificial Heart	Michael Dibake
Aspirin	Dresser
ATP	Lohmann K
Bacteriophage	Towrt and De Herelle
Biocatalysts	Bushner
Biochemical Evolution	Wald
Blood Capillaries	Marcello Malpighi
Blood Circulation	William Harvey
Blood Coagulation-Explained	Moravits
Blood Group (AB)	De Castello and Sturli
Blood Group (O)	De Castello and Sturli
Blood Group (A, B and O)	Carl Land Steiner
Blood Pressure- Measured	Stephen Hales
Carbon Dating	Libby W.F
Cell	Robert Hooke
Cell Division	Hofmeister
Cell Theory	Schleiden and Schwann
Chemotherapy	Paul Erlich
Chloroform	James Simpson
Chloromycetin (antibiotic)	Burk Holder
Chloroplast	Schimper
Cholera Bacteria	Robert Koch
Chromatin	Fleming W
Chromatography	Michael Tswett
Chromosomes (Nuclear Filaments)-described	Anton Schneider
Colour Blindness (Daltonism)	Hornerd
Compound Microscope	Zacharias Janssen
Contraceptive Pills	Pincus
Cortisone	Edward Calvin
CT Scan (Computer Assisted Tomography (CAT)	Allan Mcleod Cormack and God Frey Newbold Hounsfield
Cyclosis	Amici G.B.
ECG (Electrocardiogram) Mechanism	Einthoven
Electron Microscope	Knoll M. and Ruska E.
Endoplasmic Reticulum	Porter K.R, Claude and Fullman
Evolution of man	Leakey
Five Kingdom Classification	Whittaker R.H
Flower-its reproductive parts	Grew
Foot and Mouth Disease-First viral disease of animals	Loeffler F. and Frosch A.
Four-Kingdom Classification	Copeland
Glycolysis (EMP pathway)	Embden, Meyerhof and Parnas
Glyoxysomes	Breidenbach
Golgi bodies	Camillo Golgi

Green Revolution	Norman E. Borlaug
Haemophilia	John C. Otto
Heart transplantation Surgery	Christian Bernard
HIV	Luc Montagnier
Hormones	Bayliss and Starling
Human Gene Therapy	Martin Clive
Insulin	Sir Frederick Grant Branding; J.J.R Macleod

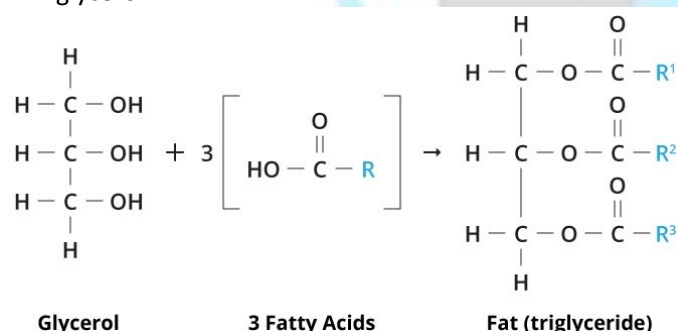
Q312. What is Triglyceride? (64th BPSC exam)

- A. Protein
- B. Carbohydrate
- C. Fat
- D. Mineral

Ans. C. Fat

Fats

- ❖ Fat is one of the three main macronutrients: fat, carbohydrate, & protein.
- ❖ Fat is a major source of energy & helps your body absorb vitamins.
- ❖ Fat has the most calories compared to any other nutrient.
- ❖ Controlling fat intake is important for maintaining weight & preventing or delaying type 2 diabetes.
- ❖ Fats, also known as triglycerides, are esters of three fatty acid chains & the alcohol glycerol.



- ❖ Fats are solids at room temperature.
- ❖ Oil refers to a fat with unsaturated fatty acid chains that is liquid at room temperature.
- ❖ Fats, like other lipids, are generally insoluble in water.

Q313. Electroencephalogram is used in monitoring (64th BPSC exam)

- A. Heart
- B. Liver
- C. Pancreas
- D. Brain

Ans. D. Brain

Electroencephalogram (EEG): An EEG is a recording of brain activity. It is a test that detects abnormalities in

your brain waves, or in the electrical activity of your brain.

Liver: The liver is the largest solid organ in the body. It removes toxins from the body's blood supply, maintains healthy blood sugar levels, regulates blood clotting, and performs hundreds of other vital functions. It is located beneath the rib cage in the right upper abdomen.

Heart: The heart's primary function is to pump blood throughout the body. It supplies oxygen and nutrients to the tissues and removes carbon dioxide and waste from the blood. It also helps to maintain adequate blood pressure throughout the body. Heart pumps the blood throughout the body, hence playing an important role in maintaining body temperature.

Pancreas Function

- ❖ **Exocrine Function:** The pancreas consists of exocrine glands that produce enzymes trypsin and chymotrypsin that are essential for digestion. These enzymes contain chymotrypsin and trypsin to digest proteins, amylase for the digestion of carbohydrates and lipase to break down fats. These pancreatic juices are liberated into the system of ducts and culminated in the pancreatic duct when the food enters the stomach.
- ❖ **Endocrine Function:** The endocrine part of the pancreas comprises Islets of Langerhans that release insulin and glucagon directly into the bloodstream. They help in regulating the blood sugar levels of the body.

Q314. Body temperature is regulated by (64th BPSC exam)

- A. Thalamus
- B. Hypothalamus
- C. Cerebellum
- D. Medulla

Ans. B. Hypothalamus

The hypothalamus is a tiny gland located towards the base of the brain and lies above the pituitary gland. The function of hypothalamus in the brain is a vital one; it forms a direct link between the endocrine system and the nervous system through the pituitary gland.

The role of hypothalamus is an essential one and includes these following activities:

- ❖ Maintaining sleep cycles
- ❖ Connects the nervous and endocrine systems
- ❖ Balances body fluids
- ❖ Regulates blood pressure and heart rate
- ❖ Autonomic function control
- ❖ Maintains homeostasis, such as regulating body temperature, appetite and body weight, heart rate and blood pressure, etc.

- ❖ Motor function check
- ❖ Eating and Drinking
- ❖ Emotion control

Q315. Choose the correct statement(64th BPSC exam)

- A. Wavelength of red light is less than violet light
- B. Wavelength of red light is more than violet light
- C. Wavelength of violet light is more than green light
- D. Wavelength of yellow light is more than yellow light

Ans. B. Wavelength of red light is more than violet light

Table of the Wavelengths of Various Colours, and Their Frequencies:

Colour	Wavelength in nm	Frequency in THz
Red	750 - 610	480 - 405
Orange	610 - 590	510 - 480
Yellow	590 - 570	530 - 510
Green	570 - 500	580 - 530
Blue	500 - 450	670 - 600
Indigo	450 - 425	600 - 700
Violet	425 - 400	700 - 790

- ❖ White Light: White light's wavelength extends from 400 to 750 nm. When the white colour is passed through the prism, the light spectrum is formed due to refraction of different wavelengths through different angles.
- ❖ Ultraviolet Light: Ultraviolet light extends from the end of the visible region and the X-ray region in the electromagnetic spectrum. It gets its name as it is the light closest to the violet portion of the visible light and is in the range of 10 to 400 nm.
- ❖ Infrared Light: Infrared radiation has a longer wavelength than visible light and is close to the red portion of the visible spectrum of light. It extends from 750 nm to 1 mm. Infrared radiation cannot be seen but can be felt in the form of heat.
- ❖ Red Light and Orange Light: Red light and orange lights whose wavelength lies between 750 to 610 nm and 610 to 590 nm respectively are best viewed naturally during sunrise and sunset. This is because the associated wavelengths of red and orange from sunlight are not properly scattered by the atmosphere during these times.
- ❖ Yellow Light: Yellow light has a wavelength between 590 and 570 nm. Yellow light is emitted by low-pressure sodium lamps.
- ❖ Green Light: Green colour, whose wavelength extends from 570 to 500 nm, can be prominently seen in grass and leaves. Grass reflects green wavelength and absorbs all other wavelengths and thus appears green.
- ❖ Blue Light: Blue light has a wavelength ranging from 500 to 450 nm. The atmosphere scatters shorter

wavelengths efficiently and thus the wavelength corresponding to the colour blue is scattered efficiently by the atmosphere. That's why the sky appears blue when we look up at it.

- ❖ Indigo Light Violet Light: With a wavelength between 450 and 425 nm, indigo is a colour which is between the primary colour blue and the colour violet in the colour wheel. Violet with a wavelength of 425 to 400 nm is the visible light with the shortest wavelength. It has a shorter wavelength and is hence scattered more effectively by the atmosphere. But since our eyes are sensitive to blue colour, the sky appears blue rather than indigo or violet colour.

Q316. The value of 40°C in Fahrenheit scale is (64th BPSC exam)

- A. 104°F
- B. 100°F
- C. 102°F
- D. 75°F

Ans. A. 104°F

To convert Celsius (°C) to Fahrenheit (°F), you can use the formula: $^{\circ}\text{F} = (^{\circ}\text{C} \times 9/5) + 32$

Let's calculate the value of 40°C in Fahrenheit:

$$^{\circ}\text{F} = (40 \times 9/5) + 32^{\circ}\text{F}$$

$$^{\circ}\text{F} = (72) + 32^{\circ}\text{F}$$

$$^{\circ}\text{F} = 104$$

Therefore, the value of 40°C in Fahrenheit scale is 104°F.

Q317. The unit of electric power is (64th BPSC exam)

- A. Ampere
- B. Volt
- C. Coulomb
- D. Watt

Ans. D. Watt

In physics, electric power measures the rate of electrical energy transfer by an electric circuit per unit of time. Denoted by P and measured using the SI unit of power which is watt or one joule per second. Electric power is commonly supplied by electric batteries and produced by electric generators.

Q318. In electrical motor (64th BPSC exam)

- A. Heat is converted into electrical energy
- B. Electrical energy is converted into heat
- C. Electrical energy is converted into mechanical energy
- D. Mechanical energy is converted into electrical energy

Ans. C. Electrical energy is converted into mechanical energy

Name of apparatus	Transformation of energy
Dynamo	Conversion of mechanical energy into electric energy
Electric motor	Conversion of electrical energy into mechanical energy
Microphone	Conversion of sound energy into electrical energy
Loudspeaker	Conversion of electric energy into sound energy
Solar cell	Conversion of solar energy into electrical energy
Tubelight	Conversion of electric energy into light energy
Electric bulb	Conversion of electric energy into heat and light energy
Electric cell	Conversion of chemical into electric energy
Candle	Conversion of chemical energy into heat and light energy
Sitar	Conversion of mechanical energy into sound energy

Q319. Human body contains (64th BPSC exam)

- A. About 70% water
- B. 20-30% water
- C. 10-20% water
- D. 30-40% water

Ans. A. About 70% water

Our body contains about 70% of water by weight. Most organs, skins, muscles and even bones are made primarily from water.

Q320. Einstein got the Nobel Prize for (64th BPSC exam)

- A. Relativity
- B. Bose-Einstein condensation
- C. Mass-energy equivalence
- D. Photoelectric effect

Ans. D. Photoelectric effect

Some inventions and contributions of Einstein are Avogadro's Number, Quantum Theory of Light, General Theory of Relativity, Special Theory of Relativity, The Photoelectric Effect, Wave-Particle Duality, Brownian movement, the relationship between mass and energy, Bose-Einstein Condensate, and many more.

Avogadro's Number

- ❖ Avogadro's number is a concept in chemistry that defines that the number of units in one mole of a substance is equal to $6.022140857 \times 10^{23}$

- ❖ The Avogadro constant is named after the Italian scientist Amedeo Avogadro. It is the proportionality factor defined by Albert Einstein to relate the number of constituent particles like molecules, ions, and atoms in a sample with the amount of substance in that sample. The numeric value of the Avogadro constant is expressed as the reciprocal of mole.
- ❖ When Einstein was working on Brownian motion to explain the erratic movement of particles in a fluid, he came up with an expression for the quantity of Avogadro's number in terms of measurable quantities. This leads to a path to determine the mass of an atom, or the molar mass for each element on the periodic table. Albert Einstein presented a new way of calculating Avogadro's number and the size of molecules.

Brownian Movement

The Brownian movement is one of the significant contributions of Albert Einstein. While studying the molecular theory of liquids, he tried to explain the motion of particles through Brownian motion. This theory explains the random movement of particles in a fluid or gas. Einstein explained the zigzag movement of particles in suspension, and this study aimed to prove the existence of molecules and atoms in particles.

Quantum Theory of Light

Einstein was the key person behind the quantum theory of light. He proposed and explained that light consists of packets of energy known as photons in 1905. He gave the physical interpretation to Planck's mathematics when he proposed that electromagnetic radiation itself is granular, consisting of quanta with an energy hf . He also explained the emission of electrons from metals when hit with large electric pulses, like lightning.

Special Theory of Relativity

- ❖ The Special Theory of Relativity is also known as special relativity. It is a theory regarding the relationship between time and space. This theory is based on two postulates.
- ❖ The laws of physics are the same for all, irrespective of the velocity of the observer.
- ❖ The speed of light is always constant, regardless of the motion of the light source or the motion of the observer.
- ❖ This theory is one of the reasons to explain the origin of the most famous equation $E=mc^2$
- ❖ When we hear the mass and energy relationship equation $E=mc^2$, we remember the great scientist Einstein instantaneously.

Photoelectric Effect

In 1905, Albert Einstein proposed this theory, which is the base of modern Physics. It is the phenomenon that occurs when the material absorbs electromagnetic radiations and electrically charged particles are released from or within it. In this process, electrons are emitted from the

metal plate when light falls on it. The emitted electrons are known as photoelectrons.

Wave-Particle Duality

Einstein explained that light consists of photons, which are considered packets of energy. This concept was explained and demonstrated in the quantum theory of light. Einstein stressed that light should be treated as both a wave and a particle. He explained that photons in light can behave both as particles and waves at the same time. This concept is known as wave-particle duality. Through a two-slit apparatus experiment, he proved the dual nature of light.

General Theory of Relativity

The general theory of relativity generalizes the concepts of Special Relativity, Newton's Law of Universal Gravitation, describing gravity as a property of space and time. It is the geometric theory of gravitation, published in the year 1915. The General Theory of Relativity is also known as General relativity. The general theory of relativity gives the current description of gravitation in modern physics.

Bose-Einstein Condensate

The great Indian physicist and mathematician Satyendra Nath Bose with Albert Einstein developed the concept, which helped to understand light as a gas. The Bose-Einstein concept proposed and demonstrated that when atoms are cooled very close to absolute zero, they hardly move in relation to one another. These atoms form clusters or clumps and enter into the same energy states. Hence, they concluded that the group of atoms behaves and display the characteristics of a single atom.

Q321. The powerhouse of cell is (64th BPSC exam)

- A. Cell Wall
- B. Mitochondria
- C. Ribosome
- D. Nucleus

Ans. B. Mitochondria

Mitochondria are membrane-bound organelles found in the cells of most eukaryotic organisms.

They are often referred to as the "powerhouses" of cells because they generate the majority of the cell's energy in the form of adenosine triphosphate (ATP).

Functions: Mitochondria carry out cellular respiration, a process that converts nutrients into ATP. Mitochondria convert energy from carbohydrates, fats, and proteins into a usable form for the cell. They metabolize glucose to produce ATP, which powers various cellular processes. Mitochondria participate in cell signaling pathways, influencing processes like cell growth, differentiation, and apoptosis.

Inheritance: Mitochondria have their own DNA, known as mitochondrial DNA (mtDNA), which encodes a small

number of essential proteins. In most animals, mtDNA is inherited solely from the mother. Mutations in mtDNA can lead to mitochondrial disorders and various health conditions.

Q322. Which instrument is used to measure humidity? (64th BPSC exam)

- A. Hydrometer
- B. Hygrometer
- C. Pyrometer
- D. Lactometer

Ans. B. Hygrometer

- ❖ Hygrometer is an instrument used to measure the humidity or moisture content in the air. It provides a quantitative measurement of the amount of water vapor present in the atmosphere.
- ❖ Hydrometer is an instrument used to measure the density or specific gravity of a liquid.
- ❖ Pyrometer is an instrument used to measure high temperatures, typically without direct contact with the object being measured.
- ❖ Lactometer is an instrument used to measure the specific gravity or density of milk. It is primarily used to determine the quality and composition of milk, including its fat content.

Q323. What is the unit of pressure? (64th BPSC exam)

- A. Newton/sq meter
- B. Newton-meter
- C. Newton
- D. Newton/meter

Ans. A. Newton/sq meter

- ❖ Newton/square meter, which is also known as Pascal (Pa) is the unit of pressure.
- ❖ Newton-meter (Nm) is the unit of torque or moment of force.
- ❖ Newton (N) is the unit of force
- ❖ The unit "Newton/meter" (N/m) is the unit of surface tension.

Q324. Quartz Crystals used in clocks are (63rd BPSC exam)

- A. Sodium Silicate
- B. Silicon dioxide
- C. Germanium Oxide
- D. Titanium Dioxide

Ans. B. Silicon dioxide

Quartz crystals used in clocks are silicon dioxide. Almost every modern clock that's made nowadays has a quartz crystal-based oscillator inside them. Quartz has

piezoelectric property, which means that it generates a small voltage when pressure is applied on it. The reverse of this is also true, where a voltage applied to the crystal causes it to vibrate at a specific frequency

Uses of Sodium silicate ((Na₂O)_x·SiO₂)

- ❖ Sodium silicate is used in wastewater treatment plants as an iron flocculant and an alum coagulant.
- ❖ It is used as hand-dyeing as a fixative.
- ❖ It is used in Pottery.
- ❖ It is widely used in food preservation, homebrewing, and aquaculture.

Germanium

Germanium is a silvery-grey metalloid that is used for night vision and thermographic cameras. It forms amphoteric oxides. It can be in an amorphous or crystalline form. There is a hexagonal and tetragonal structure in the case of GeO₂. Silica-germania, a compound formed by silicon dioxide and germanium dioxide, is used for optical fibres.

Titanium dioxide

Titanium dioxide is composed of a titanium cation and a sulfate anion. The sulfur is attached to four oxygen atoms. TiO₂ is a sulfate salt of titanium and is found as the mineral barite. It is a crystalline solid white in colour which is insoluble in water and alcohol but soluble in concentrated acids. It is odourless.

Titanium dioxide is an alkaline, divalent metal. It is non-toxic and safe for medical use. It is widely used in the production of oil and natural gas to get high-density drilling fluids by keeping the boreholes free of rock.

Q325. Bromine is a (63rd BPSC exam)

- A. Colourless Gas
- B. Brown Solid
- C. Highly inflammable gas
- D. Red liquid

Ans. D. Red liquid

Bromine is a chemical element as of halogen group. It is brown-red liquid at room temperature which evaporates readily to form similarly colored vapour

Uses of Bromine

- ❖ Bromine is a good oxidising agent like other chlorine water and is more useful as it does not decompose readily.
- ❖ It also liberates free iodine from iodide- containing solutions and sulphur from hydrogen sulphide.
- ❖ Sulphurous acid is oxidised to sulphuric acid by bromine water.

Properties Of Bromine

- ❖ The electron affinity of this metal is very high and much similar to the chlorine.

- ❖ It is a less powerful oxidising agent as compared to the chloride ion and that too because of weaker hydration of the bromide ion.
- ❖ The electron affinity of this metal is very high and much similar to chlorine.
- ❖ It is a less powerful oxidising agent as compared to the chloride ion and that too because of weaker hydration of the bromide ion.
- ❖ A metal-bromine bond is also weaker than the corresponding metal-chlorine bond.

Certain Facts About Bromine

- ❖ This element is bleach and is poisonous in fluid form, the vapours of it are dangerous for human skin, eyes, and the respiratory tract.
- ❖ It can also cause severe burn, a concentration of 1 ppm can lead to eye-watering and one can start to cough when inhalation of concentration below 10 ppm occurs.

Q326. Gases used in welding are (63rd BPSC exam)

- A. Oxygen and Hydrogen
- B. Oxygen and Nitrogen
- C. Oxygen and Acetylene
- D. Hydrogen and Acetylene

Ans. C. Oxygen and acetylene

Gases used in welding process include:

- ❖ Shielding gases such as carbon dioxide, argon, helium etc.
- ❖ Fuel gases such as acetylene, propane, butane etc.
- ❖ Oxygen used with fuel gases and also in small amounts in same shielding gas mixture.

Q327. Galvanized iron pipes have a coating of (63rd BPSC exam)

- A. Zinc
- B. Mercury
- C. Lead
- D. Chromium

Ans. A. Zinc

Galvanizing, or galvanization, is a manufacturing process where a coating of zinc is applied to steel or iron to offer protection and prevent rusting. There are several galvanizing processes available, but the most commonly offered and used method is called hot-dip galvanizing.

Q328. The wavelength of visible spectrum is in the range (63rd BPSC exam)

- A. 1300-3900 Angstrom
- B. 3900-7600 Angstrom
- C. 7800-8200 Angstrom

D. 8500-9800 Angstrom

Ans. B. 3900-7600 Angstrom

- ❖ Visible spectrum is a field of the electromagnetic spectrum that is visible to the human eye. The wavelength of electromagnetic radiation visible to the human eye is called visible light or simply light. Wavelengths of the range of between 380 to 740 nanometers are perceivable to human eyes. Considering the frequency, this corresponds to a band frequency between 405 to 790 THz.
- ❖ Here, the spectrum doesn't contain the entire colors, which can be distinguished by the human visual system.
- ❖ For example, unsaturated colors like pink, or purple variations like magenta are absent because these colors can only be made from a mixture of multiple wavelengths. The colors which contain only one wavelength are called pure colors or spectral colors.
- ❖ Electromagnetic radiations are transmitted in the form of waves of different wavelengths and frequencies. This broad range of wavelengths of the electromagnetic radiations is called the electromagnetic spectrum.
- ❖ Electromagnetic spectrum is divided into seven regions in the increasing order of frequency and decreasing order of wavelength. These are radio waves, microwaves, infrared (IR), visible light, ultraviolet (UV), X-rays, and gamma-rays.
- ❖ The visible light falls between the range of the ultraviolet and infrared regions. The frequency of visible light varies from 4×10^{14} to 8×10^{14} Hz, and the wavelength of visible light varies from 380 nanometers to 740 nanometers.

Q329. Detergents used for cleaning clothes are (63rd BPSC exam)

- A. Carbonates
- B. Bicarbonates
- C. Bismuthates
- D. Sulfonates

Ans. D. Sulfonates

As we all know, detergents are water soluble cleaning agents that combine with impurities and dirt to make them more soluble. They are sodium salt of long chain benzene sulphonic acid or the sodium salt of a long chain alkyl hydrogen sulphate. Furthermore detergents are classified into three categories. Anionic detergents are mainly alkylbenzenesulfonates and in this type of detergent the alkyl benzene portion of these anions is lipophilic and the sulfonate part is hydrophilic.

Cationic detergents are very similar to anionic detergents. The cationic surfactants have ammonium ion as the polar end

instead of the anionic sulfonate group. So detergent used for cleaning purposes mainly contains sulphonates.

Q330. The elements excreted through human sweat is (63rd BPSC exam)

- A. Sulphur
- B. Magnesium
- C. Iron
- D. Zinc
- E. None of the above/More than one of the above

Ans. E. None of the above/More than one of the above

Sweating is the release of liquid from body's sweat glands. Sweat is made up of several chemicals mainly consists of water, minerals, lactic and Urea. The sodium potassium, calcium and magnesium are the minerals composition of sweat. Some traces of metals that the body excretes in sweat are zinc, copper, iron, chromium, Nickel and Lead.

Q331. Blue vitriol is chemically (63rd BPSC exam)

- A. Copper Sulphate
- B. Nickel Sulphate
- C. Sodium Sulphate
- D. Iron sulphate

Ans. A. Copper Sulphate

- ❖ The blue vitriol is also known as the Copper Sulphate pentahydrate or crystalline copper sulphate. The chemical formula for blue vitriol is $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$. Applications of blue vitriol: It is used as a herbicide and a fungicide. It is used as an analytical reagent. It is used as battery electrolytes. It is used as a mordant during a vegetable dyeing process
- ❖ Iron Sulphate is also known as Green vitriol
- ❖ Zinc Sulphate is also known as White vitriol

Q332. The positively charged part at the centre of an atom is called as (63rd BPSC exam)

- A. Proton
- B. Neutron
- C. Electron
- D. Nucleus

Ans. D. Nucleus

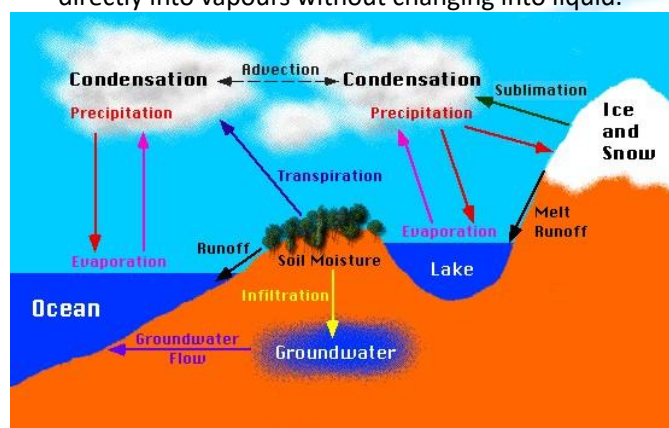
The positively charged parts at the centre of an atom is nucleus. A nucleus of an atom has proton and neutrons. As we know that a proton has charge of +1 while a neutron has no charge, or zero. So the nucleus of an atom will always have positive charge.

Q333. The conversion of a solid directly into gas is called as (63rd BPSC exam)

- A. Sublimation
- B. Condensation
- C. Evaporation
- D. Boiling

Ans. A. Sublimation

- ❖ In the process of evaporation, matter changes from a state of liquid to a gas.
- ❖ In the process of condensation, the matter changes from a state of gas to a liquid.
- ❖ Boiling is a common physical process in which a liquid substance is heated to its boiling point, at which it turns into a gas.
- ❖ Sublimation is a process in which a solid transforms directly into vapours without changing into liquid.



Q334. In human system, insulin controls the metabolism of (63rd BPSC exam)

- A. Fats
- B. Carbohydrates
- C. Proteins
- D. Nucleic Acids

Ans. B. Carbohydrates

Insulin is an anabolic hormone which is used for promoting the uptakes of glucose, glycogenesis, lipogenesis, and protein synthesis that take place in the skeletal muscle and fat tissue. In human system, insulin controls the metabolism of carbohydrates. It inhibits hepatic glucose production, promotes glucose storage in the liver and glucose uptake and storage in muscles and adipose tissues.

Q335. Which of the following is mostly carbohydrate? (63rd BPSC exam)

- A. Wheat
- B. Barley
- C. Rice

D. Maize

Ans. C. Rice

Rice is primarily composed by Carbohydrate. Carbohydrates are macro nutrients. These are compounds of oxygen, hydrogen and carbon. Carbohydrates are essential nutrients which include sugars, fibre and starches.

Q336. The heaviest metal among the following is (63rd BPSC exam)

- A. Gold
- B. Silver
- C. Mercury
- D. Platinum

Ans. D. Platinum

The heaviest metal among the options is Platinum. The mass of an atom or a molecule is referred to as the atomic mass. Atomic mass increases from left to right and from top to bottom of the Periodic Table.

Metal	grams/cm ³
Osmium	22.6
Iridium	22.4
Platinum	21.45
Neptunium	20.2
Plutonium	19.84
Tungsten	19.35
Gold	19.32
Uranium	18.95
Tantalum	16.4
Americium	13.67
Mercury	13.546
Thallium	11.8
Thorium	11.7
Lead	11.3
Silver	10.5

Q337. The antibiotic among the following is (63rd BPSC exam)

- A. Penicillin
- B. Aspirin
- C. Paracetamol
- D. Sulfadiazine
- E. None of the above/ more than one of the above

Ans. E. None of the above/ more than one of the above

- ❖ Among the options listed, the antibiotics are Penicillin and Sulfadiazine.
- ❖ Paracetamol is not an antibiotic. It is used to treat fever and mild to moderate pain.
- ❖ Aspirin is an antipyretic. It is not an antibiotic, as it does not kill any microorganisms.

Q338. Stainless steel is an alloy of (63rd BPSC exam)

- A. Iron and Nickel
- B. Iron and Chromium
- C. Copper and Chromium
- D. Iron and Zinc
- E. None of the above/More than one of the above

Ans. E. None of the above/More than one of the above

Stainless steel is a corrosion - resistant alloy of iron, chromium and in some cases, nickel and other metals. Chromium play an important role in production of stainless steel. It gives the hardness to the stainless steel and makes it tough.

S. No	Alloy	Composition	Uses
1	Brass	Cu & Zn (Copper and Zinc)	Decorative articles, taps etc.
2	Bronze	Cu & Sn (Copper and Tin)	Statues and medals
3	Solder	Pb & Sn (Lead and Tin)	Soldering electronic circuits
4	Stainless Steel	Fe, C, Cr and Ni (Iron, carbon, Chromium and Nickel)	Utensils, Surgical instrument
5	German Silver	Cu, Ni, Zn (Copper, Nickel and Zinc)	Artificial jewellery
6	Gun metal	Cu, Sn & Zn (Copper, Tin & Zinc)	Guns and frames of spectacles
7	Duralumin	Al, Mg, Cu & Mn (Aluminium, Magnesium, Copper & Manganese)	Bodies of aircraft
8	Magnalium	Al & Mg (Aluminium & Magnesium)	Kitchen wares
9	Steel	Fe & C (Iron and Carbon)	Ship construction etc

Q339. To protect broken bones, plaster of Paris is used. It is (63rd BPSC exam)

- A. Slaked Lime
- B. Calcium Carbonate
- C. Calcium Oxide
- D. Gypsum

Ans. D. Gypsum

Plaster of Paris is a white coloured powder. It is made up of gypsum. The plaster gets its name because, its main ingredient gypsum is found abundantly in Paris. The white powder will form a paste when it is mixed with water and it will harden into solid structures when dried. Thus, Plaster of Paris is used to make casts and moulds.

Some of its Uses are as follows:

- ❖ Plaster of Paris is a building material that is used as a protective coating on walls and ceilings.
- ❖ It is also used as a moulding and casting agent for decorative elements.
- ❖ It is used to give aesthetic finishing touches to the buildings.
- ❖ In the medical department, plaster is used in orthopaedics to put casts around fractured bones. This stiff casts will help the bone heal and become like earlier.

- ❖ It is used to make historical monuments and structures.
- ❖ It is also used in the fresco painting. It is used to make replicas as it will not shrink even when it is sunk in water.
- ❖ Plaster of Paris is used to make sculptures and metal castings used as decorative in buildings.
- ❖ It is also used in buildings to avoid fire hazards as Plaster of Paris is fire resistant.
- ❖ It is used as a coating on wood and metal structures to avoid any fire accidents.
- ❖ Plaster is used to prepare for radiotherapy during production of individualized immobilization shells for patients.
- ❖ It is also used in dentistry to make moulds of the teeth to be replaced.
- ❖ Plaster is used by funeral homes to recreate destroyed tissue and reconnect severed limbs to the dead bodies in case of accidents. It is also used to fill wounds during murder or accident.

Q340. A hydrocarbon in which two carbon atoms are joined by a double bond is called as an (63rd BPSC exam)

- A. Alkane
- B. Alkene
- C. Alkyne
- D. Ionic Bond

Ans. B. Alkene

Alkanes (Saturated):

- ❖ Structure: Consists of single bonds between carbon atoms.
- ❖ General Formula: C_nH_{2n+2} . Examples: Methane (CH_4) and ethane (C_2H_6).
- ❖ Properties: Non-reactive; used primarily as fuels.

Alkenes (Unsaturated with Double Bonds):

- ❖ Structure: Contain at least one double bond between carbon atoms.
- ❖ General Formula: C_nH_{2n} . Examples: Ethylene (C_2H_4) and propylene (C_3H_6).
- ❖ Properties: More reactive than alkanes due to the double bond; used in chemical synthesis and as a precursor for plastics.

Alkynes (Unsaturated with Triple Bonds):

- ❖ Structure: Contain at least one triple bond between carbon atoms.
- ❖ General Formula: C_nH_{2n-2}
- ❖ Examples: Acetylene (C_2H_2).
- ❖ Properties: Extremely reactive; used in welding (oxy-acetylene torches) and as a chemical building block.

Ionic bond

The electrostatic force of attraction which holds the two oppositely charged ions together is called the ionic bond.

Q341. The chemical name for vinegar is (63rd BPSC exam)

- A. Methanol
- B. Ethanol
- C. Acetic Acid
- D. Ethyl Acetate

Ans. C. Acetic Acid

The chemical name for vinegar is acetic acid (CH_3COOH).

Methanol

- ❖ Methanol is a low carbon, hydrogen carrier fuel produced from high ash coal, agricultural residue, CO_2 from thermal power plants and natural gas.
- ❖ Methanol, also known as methyl alcohol or wood alcohol, is a colorless, flammable liquid.
- ❖ It is the simplest alcohol.
- ❖ Methanol is commonly used as an industrial solvent, antifreeze, and fuel, but it is perhaps best known for its use as an alcohol fuel in racing cars and as a feedstock for the production of chemicals and plastics.
- ❖ Applications:
 - Fuel: Methanol can be used as an alternative fuel or fuel additive. It is often blended with gasoline to improve combustion and reduce emissions. Methanol is also used in the production of biodiesel. Methanol can be produced from renewable sources like biomass and can be used as a potential energy carrier or fuel in fuel cells and other energy applications.
 - Solvent: Methanol is a versatile solvent used in various industrial processes, including chemical manufacturing, pharmaceuticals, and the production of paints, varnishes, and coatings.
 - Antifreeze: Methanol is used as an antifreeze in automotive applications, particularly in windshield washer fluid.
 - Chemical Feedstock: Methanol serves as a crucial feedstock for the production of various chemicals, including formaldehyde, acetic acid, and methyl tert-butyl ether (MTBE).

Ethanol

- ❖ Ethanol is an organic compound which is a clear, colorless liquid that is flammable and has a characteristic odour.
- ❖ Production: It can be produced through the fermentation of sugars by yeast, a process that is used in the production of alcoholic beverages. It can also be synthesized through chemical processes, such as hydration of ethylene.
- ❖ Uses:
 - Beverages: Ethanol is the type of alcohol found in alcoholic beverages. It is consumed socially in various forms, such as beer, wine, and spirits.
 - Fuel: It is used as a biofuel and is often mixed with gasoline to produce ethanol-blended fuels.
 - Industrial Solvent: Due to its ability to dissolve a wide range of substances, ethanol is used as a solvent in the manufacturing of pharmaceuticals, perfumes, and other products.
 - Medical and Laboratory Uses: Ethanol is used as an antiseptic, disinfectant, and a preservative in medical and laboratory settings.
 - Chemical Feedstock: It serves as a feedstock for the production of various chemicals.

Ethyl acetate

Ethyl acetate is a very useful organic compound. Large-scale production of ethyl acetate, itself shows its importance in the industry. A few of its uses are listed below –

- ❖ It is primarily used as solvent and diluent.
- ❖ It is used in the decaffeination of coffee beans and tea leaves.
- ❖ It is used in paints as an activator and hardener.
- ❖ Due to its fruity smell, it is used in perfumes, jelly etc.
- ❖ It is an important laboratory reagent.
- ❖ It is used in column chromatography and extractions as solvent.
- ❖ It is used in wines.

Q342. The acid used in a car battery is (63rd BPSC exam)

- A. Acetic Acid
- B. Hydrochloric Acid
- C. Nitric Acid
- D. Sulphuric Acid

Ans. D. Sulphuric Acid

Name	Type	Chemical Formula	Where found or used
Carbonic acid	Mineral acid	H_2CO_3	In soft drinks and lends fizz, In stomach as gastric juice, used in tanning industry
Nitric acid	Mineral acid	HNO_3	Used in the manufacture of explosives (TNT, Nitroglycerine) and fertilizers (Ammonium nitrate, Calcium nitrate, Purification of Au, Ag.

Hydrochloric acid	Mineral acid	HCl	In purification of common salt, in textile industry as bleaching agent, to make aqua regia.
Sulphuric acid	Mineral acid	H ₂ SO ₄	Commonly used in car batteries, in the manufacture of fertilizers (Ammonium sulphate, super phosphate) detergents etc, in paints, plastics, drugs, in manufacture of artificial silk, in petroleum refining.
Phosphoric acid	Mineral acid	H ₃ PO ₄	Used in antirust paints and in fertilizers.
Formic acid	Organic acid	HCOOH(CH ₂ O ₂)	Found in the stings of ants and bees, used in tanning leather, in medicines for treating gout.
Acetic acid	Organic acid	CH ₃ COOH(C ₂ H ₄ O ₂)	Found in vinegar, used as solvent in the manufacture of dyes and perfumes.
Lactic acid	Organic acid	CH ₃ CH(OH)COOH (C ₃ H ₆ O ₃)	Responsible for souring of milk in curd.
Benzoic acid	Organic acid	C ₆ H ₅ COOH	Used as a food preservative.
Citric acid	Organic acid	C ₇ H ₆ O ₂	Present in lemons, oranges and citrus fruits.
Tartaric acid	Organic acid	C ₄ H ₆ O ₆	Present in tamarind

Q343. The gas, which comes out on opening a soda water bottle is (63rd BPSC exam)

- A. Carbon Dioxide
- B. Hydrogen
- C. Nitrogen
- D. Sulphur dioxide

Ans. A. Carbon Dioxide

The gas which comes out on opening a soda bottle is carbon dioxide. Soda water, like other carbonate beverage, contains carbon dioxide that has dissolved under pressure upto 1200 pounds per square inch. When the pressure is released by opening the soda container, the liquid cannot hold as much carbon dioxide, so the excess bubbles out of the solution.

Q344. Which of the following is responsible for controlling hereditary characters of the living cells? (60-62nd BPSC exam)

- A. Enzyme
- B. Hormone
- C. RNA
- D. DNA

Ans. D. DNA

DNA is responsible for controlling the hereditary character of living cells. DNA is the hereditary material found in almost in living organisms. It is made up of molecules called nucleotides.

- ❖ **Enzymes:** Enzymes create chemical reactions in the body. They actually speed up the rate of a chemical reaction to help support life. The enzymes in the body help to perform very important tasks. These include building muscle, destroying toxins, and breaking down food particles during digestion.
- ❖ **Hormones:** Hormones are chemical substances that are secreted from endocrine glands or endocrine systems. Hormones are responsible for controlling various body actions; they also control the onset of puberty and maturity of the reproductive parts.
- ❖ **RNA:** Ribonucleic acid (RNA) is a nucleic acid found in all living cells, often single-stranded, made of nucleotides containing ribose sugars, nitrogenous bases, and phosphate groups. It comes in three types: messenger RNA (mRNA), ribosomal RNA (rRNA), and transfer RNA (tRNA). Some RNAs regulate gene expression, while viruses may use RNA as their genetic material. RNA's main role is to create proteins through translation and serves as the primary genetic material for viruses.

Q345. Which of the following pairs is not correctly matched? (60-62nd BPSC exam)

- A. Vitamin B₁: Oranges
- B. Vitamin D: Cod Liver Oil
- C. Vitamin E: Wheat Germ Oil
- D. Vitamin K: Alfa-Alfa
- E. None of the above/More than one of the above

Ans. E. None of the above/More than one of the above

Oranges are a rich source of Vitamin C, in addition to Vitamin C, oranges provide smaller amount of other nutrients, including calcium, potassium and Vitamin B₁ (Thiamine). Alfalfa contains Vitamin K, Cod liver Oil contains Vitamin D and Wheat germ Oil is the richest natural source of Vitamin E. Hence all the above given pairs are correctly matched.

Q346. Teflon is a polymer of which of the following monomers? (60-62nd BPSC exam)

- A. Tetrafluoroethylene
- B. Vinyl Chloride
- C. Chloroprene
- D. Acetylene dichloride

Ans. A. Tetrafluoroethylene

- ❖ Tetrafluoroethylene is the monomer from which Teflon, also known as polytetrafluoroethylene (PTFE), is derived. Teflon is chemically inert and highly resistant to corrosive reagents.
- ❖ It is utilized in the production of oil seals and gaskets due to its exceptional chemical resistance. Teflon is also commonly employed as a non-stick coating for utensils, providing a convenient and easy to clean cooking surface.

Monomer	Polymer
Vinyl Chloride	Polyvinyl Chloride (PVC)
Chloroprene	Polychloroprene (Neoprene)
Acetylene dichloride	Polyvinylidene Chloride (PVDC)

Q347. Bakelite is formed by the condensation of (60-62nd BPSC exam)

- A. Urea and Formaldehyde
- B. Phenol and Formaldehyde
- C. Phenol and acetaldehyde
- D. Melamine and Formaldehyde

Ans. B. Phenol and Formaldehyde

Bakelite is a polymer made up of the monomers phenol and formaldehyde. It is the world's first man-made polymer. It was invented by Leo Hendrik Baekeland.

Q348. Which of the following vitamins is known as ergocalciferol? (60-62nd BPSC exam)

- A. Vitamin D₂
- B. Vitamin D₃
- C. Vitamin B₁₂
- D. Vitamin B₆

Ans. A. Vitamin D₂

Vitamin D₂ is also known Ergocalciferol. It is used to treat hypoparathyroidism and rickets. Ergocalciferol is obtained from plant source or dietary supplements derived from irradiated fungi.

Q349. Which of the following pairs is not correctly matched? (60-62nd BPSC exam)

- A. Retinol-Xerophthalmia
- B. Tocopherol-Beri Beri
- C. Cyanocobalamin-Anaemia
- D. Ergocalciferol-Rickets

Ans. B. Tocopherol-Beri Beri

Vitamin E is also known as Tocopherol. Vitamin E deficiency causes mild haemolytic anaemia and nonspecific neurologic deficits. Whereas Beriberi is caused by the deficiency of Vitamin B₁ or Thiamine. Rest all pairs are correctly matched

Name	Food Sources
Vitamin A	Green leafy vegetables, ripe yellow fruits, guava, milk, liver, nuts, tomatoes, oranges, carrots, broccoli, watermelon etc.
Vitamin B ₁ (Thiamine)	Fresh fruits, potatoes, sweet potatoes, peas, corn, cashew nuts, wheat, milk, black beans, dates etc.
Vitamin B ₂ (Riboflavin)	Banana, dates, mushrooms, grapes, mangoes, peas, pumpkin, popcorn etc.
Vitamin B ₃ (Niacin)	Meat, fish, eggs, milk products, cereals, mushroom, guava etc.
Vitamin C	Fresh fruits, black currant, broccoli, goat milk and chestnuts.
Vitamin D	Fish, egg, liver, beef, cod, chicken breast etc.
Vitamin E	Potatoes, pumpkin, guava, mango, milk, nuts, seeds etc.
Vitamin K	Tomatoes, broccoli, chestnuts, cashew nuts, beef, lamb, mangoes, grapes etc.

Q350. Insulin is a (60-62nd BPSC exam)

- A. Fat
- B. Vitamin
- C. Carbohydrate
- D. Protein

Ans. D. Protein

Insulin is a protein. It is a peptide hormone produced by beta cells of the pancreatic islets. There are 51 amino acid in an insulin molecule

Q351. Which of the following is antibiotic drug? (60-62nd BPSC exam)

- A. Quinine
- B. Sulphaguanidine
- C. Chloramphenicol
- D. Aspirin
- E. None of the above/ more than one of the above

Ans. E. None of the above/ more than one of the above
Chloramphenicol is an antibiotic. It is useful for the treatment of a number of bacterial infection. Sulphaguanidine is also an antibiotics, it is used for the treatment of Bacillary dysentery. Hence option (e) will be correct. However BPSC had considered option (c) as correct.

Q352. Which of the following hormones play a role in release of milk from mammary glands? (60-62nd BPSC exam)

- A. Adrenaline
- B. Thyroxine
- C. Progesterone
- D. Oxytocin

Ans. D. Oxytocin

- ❖ Oxytocin is a peptide hormone and neuropeptide normally produced in the hypothalamus and released by the posterior pituitary. Present in animals since early stages of evolution, in humans it plays roles in behaviour that include social bonding, love, reproduction, childbirth, and the period after childbirth.
- ❖ Adrenaline, also known as epinephrine, is a hormone and medication which is involved in regulating visceral functions. It appears as a white microcrystalline granule. Adrenaline is normally produced by the adrenal glands and by a small number of neurons in the medulla oblongata.
- ❖ The thyroid gland secretes the thyroxine hormone in the bloodstream. Thyroxine hormone acts as a regulator of the metabolic rate of the body. Its primary function is to stimulate the metabolism of carbohydrates, proteins, and fats in the cells to produce energy. It also plays a role in digestion, brain development, control of muscles, and bone health.
- ❖ Progesterone (P4) is an endogenous steroid and progestogen sex hormone that has a role in human menstruation, pregnancy, and embryogenesis. It belongs to the progestogen family of steroid hormones and is the body's major progestogen.

Q353. The gas used in the manufacture of Vanaspati Ghee from Vanaspati oil is? (60-62nd BPSC exam)

- A. Hydrogen
- B. Oxygen
- C. Nitrogen
- D. Carbon dioxide

Ans. A. Hydrogen

Hydrogen (H₂) gas is used in the manufacture of Vanaspati Ghee from Vegetable Oil. This process is called 'hydrogenation'. At high pressure, in the presence of nickel catalyst, hydrogen is mixed with vegetable oils which turn them into Vegetable ghee.

Q354. LPG used as domestic fuel chiefly contains (60-62nd BPSC exam)

- A. Methane
- B. Propane
- C. Ethylene
- D. Butane

Ans. D. Butane

LPG (Liquefied Petroleum Gas) used as domestic fuel chiefly composed of propane and butane, it also contain propane. LPG is an odourless and colourless gas. Ethyl Mercaptan is the odourance added to make LPG and natural gas smell. However BPSC had considered option (E) as correct.

Q355. Soap removes grease by (60-62nd BPSC exam)

- A. Emulsification
- B. Coagulation
- C. Adsorption
- D. Osmosis

Ans. A. Emulsification

- ❖ Soap removes grease by the process of emulsification. Emulsification is defined as the process of dispersing one immiscible liquid in another immiscible liquid
- ❖ Adsorption refers to the adhesion of atoms, ions, or molecules from a gas, liquid, or dissolved solid to the surface of a material. It is considered a surface phenomenon that creates a film of the adsorbate on the surface of the adsorbent (a solid material, for instance).
- ❖ Coagulation happens when the positively and negatively charged particles are chemically attracted. They can then accumulate (a process called flocculation) to form larger and heavier particles called flocs. The flocs can be settled out or removed by filtration.
- ❖ Osmosis is a process of movement of solvents through a semi-permeable membrane from a region

of lower solute concentration to higher solute concentration.

Q356. Which of following vitamins is used as an antidote to anticoagulant poisons? (60-62nd BPSC exam)

- A. Vitamin A
- B. Vitamin D
- C. Vitamin E
- D. Vitamin K

Ans. D. Vitamin K

Vitamin K is the vitamin that is used as an antidote to anticoagulant poisons. Anticoagulant poisons, such as rodenticides, work by inhibiting the action of vitamin K, which is essential for blood clotting.

Q357. In human body, Vitamin A is stored in (60-62nd BPSC exam)

- A. Liver
- B. Skin
- C. Lung
- D. Kidney

Ans. A. Liver

Most of the human body's Vitamin A is stored in the liver. Vitamin A is fat soluble Vitamin. It is also known as retinol. The liver is the largest gland in an animal or human body and the viscera of the body. In the carnivorous, omnivorous, and herbivorous, different sizes of the liver can be observed, due to the difference of role in metabolism. The weight as per body weight is more in young animals, as it changes with age. In the fetal stage, the liver is derived from the endoderm epithelium on the ventral duodenum. The liver produces red and white blood cells during the fetal state. The main function of a liver is to produce bile and metabolism of protein, fat, and carbohydrates.

Q358. Which of the following radio-isotopes is used in the treatment of blood cancer (Leukemia)? (60-62nd BPSC exam)

- A. Iodine-131
- B. Sodium-24
- C. Phosphorus-32
- D. Cobalt-60

Ans. D. Cobalt-60

❖ Cobalt-60 is a radioactive isotope. Cobalt-60 is extensively employed as a radiation source to arrest cancer development. The treatment of cancer by using radioactive radiation is called radiotherapy.

- ❖ Iodine-131 is used to treat some diseases of the thyroid gland. Iodine-131 is widely used in imaging the thyroid and in treating thyroid cancer and other abnormal conditions such as hyperthyroidism. It also used to diagnose abnormal liver function, renal (kidney) blood flow and urinary tract obstruction.
- ❖ Sodium-24 is used to detect leak in industrial pipelines and in oil well studies, Study blood circulation
- ❖ Phosphorus-32 is used to cure polycythemia. It is a disease caused due to the increase of red blood cells count in the body.

Q359. Iodised salt contains (60-62nd BPSC exam)

- A. Free iodine
- B. Calcium iodide
- C. Magnesium Iodide
- D. Potassium iodide

Ans. D. Potassium iodide

Iodized salt is salt that contains small amounts of sodium iodide or potassium iodide. It's normal salt that has been sprayed with potassium iodate.

Q360. Which of the following is present in maximum amount in acid rain? (60-62nd BPSC exam)

- A. HCl
- B. HNO₃
- C. H₂SO₄
- D. H₂CO₃

Ans. C. H₂SO₄

Sulphuric Acid (H₂SO₄) is present in maximum amount when sulfur dioxide is released into the air it reacts with water and oxygen to form sulfuric acid, H₂SO₄. Sulfuric acid is a strong acid. 'Acid Rain'. H₂SO₄ represents about 60% of all acid rain with HNO₃ at about 25% and HCl 15%. Acid rain is caused by a chemical reaction that begins when compounds like sulfur dioxide and nitrogen oxides are released into the air.

Q361. God Particle is (60-62nd BPSC exam)

- A. Neutrino
- B. Higgs Boson
- C. Meson
- D. Positron

Ans. B. Higgs Boson

❖ **Higgs Boson** is also known as God Particle. These particles are the fundamental particles that provide mass to other particles. It is the elementary particle that decays quickly. It is found in Higgs field.

- ❖ **Neutrinos** are the second most abundant particles in the Universe after photons (light particles), produced in copious amounts in the cores of stars.
- ❖ In particle physics, a **meson** is a type of hadronic subatomic particle composed of an equal number of quarks and antiquarks, usually one of each, bound together by the strong interaction.
- ❖ **Positron** is a subatomic particle whose mass is the same as that of an electron and numerically equal but positively charged particle. The positron was discovered in 1932.

Q362. Match List I with List II and select the correct answer using the codes given below the lists (60-62nd BPSC exam)

List I

- A. Skin Cancer
- B. Noise Pollution
- C. Global Warming
- D. Ozone Hole

List II

- 1. Chlorofluorocarbons
- 2. Ultraviolet light
- 3. Decibel
- 4. Carbon dioxide

- a. (A-1) (B-2) (C-3) (D-4)
- b. (A-2) (B-3) (C-4) (D-1)
- c. (A-2) (B-3) (C-1) (D-4)
- d. (A-4) (B-3) (C-2) (D-1)

Ans. B. (A-2) (B-3) (C-4) (D-1)

Skin Cancer is associated with Ultraviolet light. Chlorofluorocarbons contribute to the Ozone Hole. Noise Pollution is measured using Decibels. Global Warming is influenced by Carbon dioxide emissions.

Q363. Match List I with List II and select the correct answer using the codes given below the lists (60-62nd BPSC exam)

List I

- A. Aspartame
- B. Freon
- C. Neoprene
- D. Benadryl

List II

- 1. Synthetic Rubber
- 2. Anti-Histamine
- 3. Artificial Sweetener
- 4. Refrigerant

- a. (A-1) (B-3) (C-4) (D-2)
- b. (A-2) (B-4) (C-1) (D-3)
- c. (A-3) (B-4) (C-1) (D-2)
- d. (A-3) (B-1) (C-2) (D-4)

Ans. C. (A-3) (B-4) (C-1) (D-2)

- ❖ Aspartame is an artificial sweetener sold in the market. It consists of amino acids and provides calories like other amino acids. Yet, it is used as a low-calorie sweetening agent in food items. Aspartame is several times sweeter than table sugar, hence food items made with small quantities of aspartame yield fewer calories on oxidation.

- ❖ Freons are the CFC compounds of methane and ethane. Chlorofluorocarbons have many applications because of their low toxicity and non-flammability. These are usually produced for aerosol propellants, refrigeration, and air conditioning purposes. Dichlorodifluoromethane (CCl_2F_2) also known as Freon 12, is widely used as a refrigerant in refrigerators and air conditioners.
- ❖ Neoprene is sold either as solid rubber or in latex form and is used in a wide variety of commercial applications, such as laptop sleeves, orthopaedic braces (wrist, knee, etc.), electrical insulation, medical gloves, liquid and sheet-applied elastomeric membranes or flashings, and automotive fan belts.
- ❖ Antihistamines like Benadryl are used to relieve allergy symptoms, such as sneezing, itching, watery eyes, and runny nose. They work by blocking the effects of histamine, a substance released during allergic reactions. Benadryl can also have sedative effects, making it useful for treating mild sleep disorders or as a sleep aid.

Q364. Cloves are obtained from which of the following parts of the plant? (56-59th BPSC exam)

- A. Dried Leaves
- B. Dried Stems
- C. Dried Seeds
- D. Dried Flower buds

Ans. D. Dried Flower buds

Cloves are obtained from Dried flower buds of *Syzygium aromaticum*.

Q365. Oncogenes are associated with (56-59th BPSC exam)

- A. Tuberculosis
- B. Hepatitis
- C. Cancer
- D. Typhoid

Ans. C. Cancer

A mutated (Changed) form of a type of gene called a proto-oncogene, which is involved in normal cell growth and division. When a proto-oncogene is changed so that too many copies are made or it becomes more active than normal, it is called an oncogene. An oncogene is a when mutated has the potential to cause cancer.

Q366. Which is the most reactive metal? (56-59th BPSC exam)

- A. Sodium

- B. Calcium
C. Iron
D. Potassium

Ans. D. Potassium

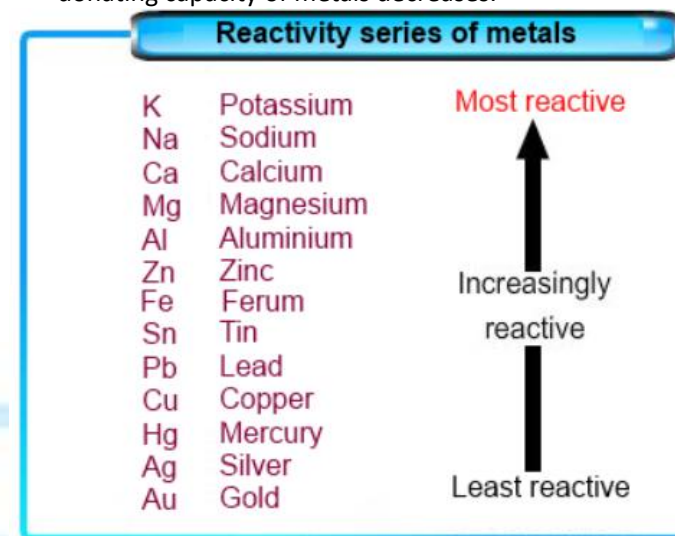
Metals from potassium to calcium are highly reactive and even react with water. While metals from magnesium to lead can react with acids. Metals from copper to platinum are highly unreactive and don't react with any other substance in normal conditions. This is the reason why platinum and gold don't get corrode easily and don't form oxides. While metals such as zinc, aluminium, magnesium, calcium, etc. form oxides readily. Hydrogen is a non-metal but still, it has been included in the reactivity series as it helps in the comparison of reactivity of metals.

Salient Features of reactivity series

- ❖ Metals present at the top of the reactivity series are highly electropositive metals. The electropositive character of metals decreases as we go down the series.
- ❖ The reducing power of metals decreases as we go down the series. Thus, potassium is the strongest reducing agent.
- ❖ As we go down the reactivity series, the ability of metals to remove hydrogen from hydrides decreases.
- ❖ Metals present in the reactivity series above hydrogen can remove hydrogen ions from dilute HCl or Dilute sulphuric acid.
- ❖ The metal which is more reactive than other metals can remove less reactive metal from its salt. Thus, metals placed at the top of the reactivity series can remove the metals which are present at the bottom of the series from their salts.
- ❖ The metals which are placed above in the series can be extracted by electrolysis. While metals from Zinc

to Hg can be extracted by simply reducing their oxides, which is an inexpensive method.

- ❖ When we move down the series the electron-donating capacity of metals decreases.



Q367. Who synthesized the DNA 'in vitro'? (56-59th BPSC exam)

- A. Arthur Kornberg
B. Robert Hooke
C. Edward Jenner
D. Joseph Lister

Ans. A. Arthur Kornberg

Arthur Kornberg was an American scientist who was awarded Nobel Prize in Medicine for his discovery of Synthesizing DNA in Vitro.

Associated Terms	Inventors	Associated Terms	Inventors
Vitamins	Hopkins	Sperm	Humm & Leeuwenhoek
Antigen	Landsteiner	Spleen-Functions	Barcroft
DNA	Watson & Crick	Streptomycin – antibiotic	Selman Waksman
DDT	Paul Muller	Sulpha drugs	Domagk G.
Homeopathy	Samuel Hahnemann	Three- Kingdom Classification	Ernest Haeckel
Polio Vaccine	J. E. Salk	Thyroxin	Edward Calvin
TB Bacteria	Robert Koch	Turner's Syndrome	Turner
BCG	Calmette and Guerin	Cancer	Robert Wellberg
Bacteria	Leeuwenhoek	X-rays	Roentgen
Open Heart Surgery	Walton Lillehei	Zymase, the first enzyme	Edward Buchner
Streptomycin	Waksman	ABA (Absciscic acid)	Addicott
Stethoscope	Rene Laennec	Amoeba	Roesel Von Rosenhof
Penicillin	A. Fleming	Animal Cloning-First (frogs from tadpole cells)	Robert Briggs and Thomas King
RNA	Watson & Arthur	Antibody against Rabies	Louis Pasteur

Microbes of Malaria	Charles Laveran	Antitoxin against Diphtheria	Won Berring
Kidney Machine	Dr. Willem Kolff	Artificial Heart	Michael Dibake
Heart Transplantation	Christiaan Barnard	Aspirin	Dresser
Anti-pregnancy pills	Pincus	ATP	Lohmann K
Genetic Code	Har Gobind Khorana	Bacteriophage	Towrt and De Herelle
First Test tube baby	Edwards & Steptoe	Biocatalysts	Bushner
Blood Circulation	William Harvey	Biochemical Evolution	Wald
Bacteria of Leprosy	Henson	Blood Capillaries	Marcello Malpighi
Vaccination	Edward Jenner	Blood Circulation	William Harvey
Polio Drop	Albert Sabin	Blood Coagulation- Explained	Moravits
Gene of Cancer	Robert Weinberg	Blood Group (AB)	De Castello and Sturli
Chloroform	Harrison & Simpson	Blood Group (O)	De Castello and Sturli
Rh factor, blood replacement	Charles Landsteiner		Carl Land Steiner
Sex Hormones	Eugen Stainak	Blood Gropus (A, B and O)	Stephen Hales
Green Revolution	Norman E. Borlaug	Blood Pressure- Measured	Libby W.F
Haemophilia	John C. Otto	Carbon Dating	Robert Hooke
Heart transplantation Surgery	Christian Bernard	Cell	Hofmeister
HIV	Luc Montagnier	Cell Division	Schleiden and Schwann
Hormones	Bayliss and Starling	Cell Theory	Paul Erlich
Human Gene Therapy	Martin Clive	Chemotherapy	James Simpson
Chloromycetin (antibiotic)	Burk Holder	Contraceptive Pills	Pincus
Chloroplast	Schimper	Cortisone	Edward Calvin
Cholera Bacteria	Robert Koch	CT Scan (Computer Assisted Tomography (CAT))	Allan Mcleod Cormack and God Frey Newbold Hounsfield
Chromatin	Fleming W	Cyclosis	Amici G.B.
Chromatography	Michael Tswett	ECG (Electrocardiogram) Mechanism	Einthoven
Chromosomes (Nuclear Filaments)-described	Anton Schneider	Electron Microscope	Knoll M. and Ruska E.
Colour Blindness (Daltonism)	Hornerd	Endoplasmic Reticulum	Porter K.R, Claude and Fullman
Compound Microscope	Zacharias Janssen	Evolution of man	Leakey
Five Kingdom Classification	Whittaker R.H	Glycolysis (EMP pathway)	Embden, Meyerhof and Parnas
Flower-its reproductive parts	Grew		
Foot and Mouth Disease- First viral disease of animals	Loeffler F. and Frosch A.	Glyoxysomes	Breidenbach
Four-Kingdom Classification	Copeland	Golgibodies	Camillo Golgi

|

Q368. What was the fissionable material used in the bombs dropped at Nagasaki (Japan) in the year 1945? (56-59th BPSC exam)

- A. Sodium
- B. Potassium
- C. Plutonium
- D. Uranium

Ans. C. Plutonium

The fissionable material used in the bomb dropped on Nagasaki, Japan, in 1945 was Plutonium. The atomic bomb, codenamed "Fat Man," utilized a plutonium core as its fissile material. This plutonium-based implosion-type bomb was one of the two nuclear weapons used during World War II, the other being the uranium-based bomb dropped on Hiroshima.

Q369. The scientist who first discovered that the Earth revolve around the Sun was ? (56-59th BPSC exam)

- A. Newton
- B. Dalton
- C. Copernicus
- D. Einstein

Ans. C. Copernicus

- ❖ Scientist Copernicus gave heliocentric astronomical model and discovered that the earth revolves around the Sun.
- ❖ Isaac Newton : Law of Motion
- ❖ John Dalton : Atom
- ❖ Albert Einstein : Theory of General Relativity, Mass-Energy Equivalence

Indian Physicists	Invention
C.V Raman	Raman Effect
Jagdish Chandra Bose	Crescograph
Satyendranath Bose	Bose-Einstein Statistics and Bose-Einstein Condensate
Meghnad Saha	Thermal Ionization Equation
Subrahmanyan Chandrasekhar	Colliding gravitational waves and stellar evolution
Vaina Bappu	Wilson-Bappu Effect
G. N. Ramachandran	Computerized Axial Tomography, or CAT
E.C. George Sudarshan	Quantum representation of coherent light
J.V. Narlikar	Hoyle-Narlikar Theory
Ashoke Sen	Sen conjecture

Q370. Cosmic Rays (56-59th BPSC exam)

- A. Are charged particles
- B. Are uncharged particles
- C. Can be charged as well as uncharged

D. None of the above

Ans. A. Are charged particles

Cosmic Rays

- ❖ Cosmic rays are atom fragments that rain down on the Earth from outside of the solar system. Cosmic rays are high energy charged particles which are mainly proton and atomic nuclei.
- ❖ Though cosmic rays were discovered in 1912 but still the origins of the highest energy cosmic rays remains unknown and a topic of much research, most scientists suspect their origins are related to supernovas (star explosions)
- ❖ Cosmic rays travels at the speed of light and have been blamed for electronics problems in satellites and other machinery.

Q371. Which of the following elements is found in all organic compounds? (56-59th BPSC exam)

- A. Carbon
- B. Calcium
- C. Nitrogen
- D. Oxygen

Ans. A. Carbon

Carbon is found in all organic compounds. The Carbon atoms are bound to one another and to other atoms by covalent bonds.

Q372. Which of the following can cause cancer as well as cure it depending upon its intensity and use? (56-59th BPSC exam)

- A. Tobacco
- B. Alcohol
- C. Ionized radiation
- D. Ultraviolet rays

Ans. C. Ionized radiation

- ❖ Ionizing radiation can cause cancer as well as cure it depending upon its intensity and use. Ionizing radiation is typical energy that is released by atoms that would travel in the form of electromagnetic waves like X- rays and gamma ones or alpha, neutrons, or beta particles.
- ❖ Ultraviolet (UV) rays, primarily from sunlight and tanning beds, can cause skin damage and increase the risk of skin cancer, including melanoma.
- ❖ Tobacco use, particularly smoking, is a known cause of various types of cancers, including lung, throat, mouth, and more. It is not used as a treatment for cancer.
- ❖ Excessive alcohol consumption is associated with an increased risk of developing certain types of cancer (such as liver, throat, and breast cancer), it is not used as a treatment for cancer.

Q373. The total volume of blood in a normal adult human being is (56-59th BPSC exam)

- A. 5-6 litres
- B. 3-4 litres
- C. 8-10 litres
- D. 10-12 litres

Ans. A. 5-6 litres

The amount of blood circulating within an individual depends on their size and weight, but average human adult has nearly 5 litres of circulating blood.

Blood is the body's fluid connective tissue, and it forms a vital part of the human circulatory system. Its main function is to circulate nutrients, hormones, minerals and other essential components to different parts of the body. Blood flows through a specified set of pathways called blood vessels. The organ which is involved in pumping blood to different body parts is the heart. Blood cells, blood plasma, proteins, and other mineral components (such as sodium, potassium and calcium) constitute human blood.

Blood is composed of:

- ❖ Plasma – the fluid part of the blood and is composed of 90% of water.
- ❖ Red blood cells, white blood cells and platelets constitute the solid part of blood.

Q374. Typhoid and Cholera are typical examples of – (56-59th BPSC exam)

- A. Infectious diseases
- B. Airborne diseases
- C. Waterborne diseases
- D. None of these

Ans. C. Waterborne diseases

Cholera

- ❖ Cholera, a water-borne disease primarily caused by the bacteria *Vibrio cholerae* strains O1 and O139, poses a significant public health challenge worldwide. Strain O1 is the predominant cause of outbreaks, with O139 occurrences being rare and mostly confined to Asia. It is an acute diarrheal illness caused by infection of the intestine. The infection is often mild or without symptoms, but sometimes can be severe.
- ❖ Symptoms: Profuse watery diarrhoea, Vomiting, Leg cramps
- ❖ Transmission: A person may get cholera by drinking water or eating food contaminated with the cholera bacterium. The disease can spread rapidly in areas with inadequate treatment of sewage and drinking water.

- ❖ Vaccine: Currently there are three WHO pre-qualified Oral Cholera Vaccines (OCV), Dukoral, Shanchol, and Euvichol-Plus. All three vaccines require two doses for full protection.

Typhoid

- ❖ Typhoid fever is a life-threatening infection caused by the bacterium *Salmonella Typhi*. It is usually spread through contaminated food or water.
- ❖ It is transmitted by the faecal-oral route, through ingestion of contaminated food or water.
- ❖ Once the bacteria is ingested, it multiplies and spreads into the bloodstream.
- ❖ Urbanisation and climate change have the potential to increase the global burden of typhoid.
- ❖ Symptoms: It encompasses fever, fatigue, gastrointestinal problems, headache, and occasionally a rash.

Common Infectious Diseases

The table below gives an idea about various common infectious diseases caused by different pathogens.

Infectious Diseases	Pathogen
Common cold, influenza, AIDS, dengue fever	Viruses
Typhoid, Cholera	Bacteria
Kala-azar	Leishmania
Acne	Staphylococcus
Sleeping sickness	Trypanosoma
Elephantiasis	Worms

Air-borne diseases

Air-borne diseases are the diseases that are transmitted through the air caused by pathogens. The pathogen may travel as air droplets when the infected person coughs, sneezes, spits or talks. Example: Common cold, Tuberculosis, Influenza etc.

Q375. Energy is stored in liver and muscles in the form of (56-59th BPSC exam)

- A. Carbohydrate
- B. Fat
- C. Protein
- D. Glycogen

Ans. D. Glycogen

Glucose is the main source of fuel for our cells. When the body does not need to use the glucose for energy, it stores it in the liver and muscles. This stored form of glucose is made up of many connected glucose molecules and is called glycogen.

Q376. Who discovered Bacteria? (56-59th BPSC exam)

- A. Fleming
- B. Lamble
- C. Temin

D. Leeuwenhoek

Ans. D. Leeuwenhoek

Bacteria are the single-cell organisms. These are categorized into the category of the microorganism because of their small size. They can be found inside and outside of the body. They can survive in a wide range of environments.

In 1670, bacteria were first discovered by Antony Van Leeuwenhoek. He observed many large bacteria while he was looking into pond water with his magnifying lens. Then he used a compound microscope to study the structure of these organisms.

Q377. The reason for large scale diversity among the organism is (56-59th BPSC exam)

- A. Adaptation
- B. Cooperation
- C. Mutation
- D. Polyploidy

Ans. A. Adaptation

The reason for large scale diversity among the organisms is adaption. Adaption is Behavioural change to suit natural environment.

Polyploidy is a condition where an organism has more than two complete sets of chromosomes. Polyploidy can occur through errors in cell division or through hybridization events.

Mutations are changes in the genetic material of an organism that can lead to variations in traits.

Q378. What is Vermiculture? (56-59th BPSC exam)

- A. The science of raising worms.
- B. The science of studying animals.
- C. The science of studying fishes
- D. The science of killing worms

Ans. A. The science of raising worms.

Vermiculture is a technique based on utilizing some species of earthworms to convert organic waste into Vermicompost which is again, the product of decomposition by various worms. It is a practice of harvesting worms that take part in decomposing organic waste and turning it into nutrient-rich fertilizer. The worms consume the decomposing organic material and flush it out of their system, which is referred to as worm manure.

Earthworms that are commonly used in Vermiculture are, Eisenia Andrei, Eisenia fetida, and Lumbricus rubellus horticultural in temperate climates and Pheretima Perionyx Hawanya Excavatus and Eudrilus Eugeniae and in the tropical areas.

In short, Vermiculture and Vermicomposting are the cultivation of earthworms and the use of earthworms to decompose organic wastes into nutrient-rich fertilizers.

SR.NO	Branches of Biology	Fathers
1.	Biology	Aristotle
2.	Botany	Theophrastus
3.	Paleontology	Leonardo di Vinci
4.	Eugenics	Francis Galton
5.	Modern Botany	Linnaeus
6.	Immunology	Edward Jenner's
7.	Genetics	Gregor Mendel
8.	Modern Genetics	Thomas Hunt Morgan
9.	Cytology	Robert Hooke
10.	Botanical Illustrations	Krateuas
11.	Plant Anatomy	Nehemiah Grew
12.	Zoology	Aristotle
13.	Taxonomy	Carl Linnaeus
14.	Medicine	Hippocrates
15.	Histology	Marie François Xavier Bichat
16.	Mutation Theory	Hugo de Vries
17.	Comparative Anatomy	Georges Cuvier
18.	Mycology	Pier Antonio Micheli
19.	Plant Physiology	Stephen Hales
20.	Bacteriology	Louis Pasteur
21.	Microbiology	Antonie Van Leeuwenhoek
22.	Indian Mycology	Edwin John Butler
23.	Indian Bryology	Shiv Ram Kashyap
24.	Indian Ecology	Ramdeo misra
25.	Indian Phycology	Parthasarthy Iyengar
26.	Modern Embryology	Karl Ernst von Baer

Q379. The smallest organism, capable of autonomous growth and reproduction is (56-59th BPSC exam)

- A. Virus
- B. Bacteria
- C. Mycoplasma
- D. Bacteriophage

Ans. C. Mycoplasma

Virus and viroids are obligate parasites that cannot exhibit functions of the living organisms as growth and reproduction. Mycoplasma is the smallest bacteria that does not possess a cell wall. The organism is living and can perform functions like growth and reproduction through binary fission.

Q380. The first human heart transplant was performed in (56-59th BPSC exam)

- A. America
- B. England
- C. South Africa
- D. France

Ans. C. South Africa

On December 3, 1967, 53-year-old Louis Washkansky receives the first human heart transplant at Groote Schuur Hospital in Cape Town, South Africa.

Q381. The average blood flow through kidneys per minute is (56-59th BPSC exam)

- A. 1000 cc
- B. 1200 cc
- C. 200 cc
- D. 500 cc

Ans. B. 1200 cc

Kidney

Function

- ❖ The most important function of the kidney is to filter the blood for urine formation.
- ❖ It excretes metabolic wastes like urea and uric into the urine.
- ❖ It secretes a number of hormones and enzymes such as:
 - Erythropoietin: It is released in response to hypoxia
 - Renin: It controls blood pressure by regulation of angiotensin and aldosterone
 - Calcitriol: It helps in the absorption of calcium in the intestines
- ❖ It maintains the acid-base balance of the body by reabsorbing bicarbonate from urine and excreting hydrogen ions and acid ions into the urine.
- ❖ It also maintains the water and salt levels of the body by working together with the pituitary gland.

Diseases related to Kidneys

Uremia: In uremia, the kidneys are damaged, and there is a buildup of urea and other toxins in the blood, which is fatal and can cause kidney failure. Patients may experience fatigue, itching, muscle twitching, and loss of mental concentration. The urea can be removed by the process of hemodialysis.

Renal Calculi: Commonly called kidney stones, these are deposits of salt and minerals in our body. Symptoms include severe abdominal pain and nausea. The stones can be dissolved with medicines, or it passes with urine by improving diet and water intake.

Glomerulonephritis: It is the inflammation of the glomerulus. Symptoms include pink urine, oedema or swelling on the face and high blood pressure. It requires medical attention for prevention.

Q382. A plant bud is (56-59th BPSC exam)

- A. An embryonic shoot
- B. An embryonic leaf
- C. An endosperm
- D. A seed

Ans. A. An embryonic shoot

Buds are small outgrowth present terminally on the stem or in the axil of leaves. They are derived from meristematic tissues and develop into leaf, shoot or flower.

Q383. Which of the following gases is used in cigarette lighters? (56-59th BPSC exam)

- A. Butane
- B. Methane
- C. Propane
- D. Radon

Ans. A. Butane

- ❖ **Butane:** It is typically used as fuel for cigarette lighters and portable stoves, a propellant in aerosols, a heating fuel, a refrigerant, and in the manufacture of a wide range of products. Butane is also found in Liquefied Petroleum Gas (LPG).
- ❖ **Methane:** It is used primarily as fuel to make heat and light. It is also used to manufacture organic chemicals. Methane can be formed by the decay of natural materials and is common in landfills, marshes, septic systems and sewers
- ❖ **Propane:** Its main uses include home and water heating, cooking and refrigerating food, clothes drying, and powering farm and industrial equipment. The chemical industry also uses propane as a raw material for making plastics and other compounds.
- ❖ **Radon:** Radon decays into radioactive polonium and alpha particles. This emitted radiation made radon useful in cancer therapy. Radon was used in some hospitals to treat tumours by sealing the gas in minute tubes, and implanting these into the tumour, treating the disease in situ.

Q384. The visible range of solar radiation is (53-55th BPSC exam)

- A. 100-400 nm
- B. 400-700 nm
- C. 740-10000 nm
- D. None of these

Ans. B. 400-700 nm

The visible range of Solar radiation is 380 nm to 720 nm

Q385. Plants which grow on saline soils are called (53-55th BPSC exam)

- A. Xerophytes
- B. Hydrophytes
- C. Halophytes
- D. Succulents

Ans. C. Halophytes

- ❖ Halophytes are plants that can tolerate and grow in saline or salty environments. They have adapted mechanisms to deal with high salt concentrations in the soil or water, allowing them to thrive in such challenging conditions.
- ❖ Succulents are plants that have the ability to store water in their leaves, stems, or roots, allowing them to survive in arid conditions. While they have adaptations to conserve water, they are not specifically adapted to saline soils.

Hydrophytes vs Mesophytes vs Xerophytes

Hydrophytes	Mesophytes	Xerophytes
Definition		
Plants that can survive in aquatic environments are called hydrophytes.	Plants that can survive in moderate climates are called mesophytes.	Plants that can survive in physiologically dry conditions are called xerophytes.
Zone		
In plenty of moisture and watery conditions.	Semi-arid zone	Arid zone
Adaptations Required		
It requires a lot of adaptation.	It requires no adaptations.	It requires little adaptation.
Plant Structure		
The plant structure is not well differentiated.	The plant is well differentiated into roots and shoots.	The plant is well differentiated into roots and shoots.
Presence of Cuticle		
They lack cuticles.	They have thin cuticles.	They have thick cuticles to avoid loss of water.
Leaves		
They have long fine dissected petioles.	They have large, broad green leaves.	They have fleshy leaves that are small.

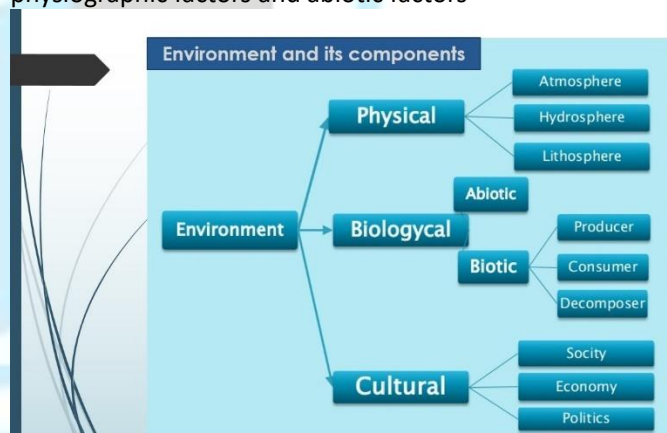
Stomata		
Stomata are usually absent.	They have exposed stomata on the leaf surfaces.	They have very less stomata that are sunken.
Examples		
Vallisneria, hydrilla	Rose, squash	Cacti, agave

Q386. Environment is a composite state of (53-55th BPSC exam)

- A. Biotic factors
- B. Physiographic factors
- C. Abiotic factors
- D. All of these

Ans. D. All of these

Environment is the natural component in which biotic (living) and abiotic (non-living) factors interact among themselves and with each other. These interactions shape the habitat and ecosystem of an organism. Hence, environment is a composite state of all biotic factors, physiographic factors and abiotic factors



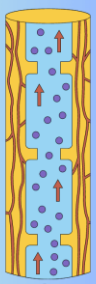
Q387. Water is conducted in vascular plants by (53-55th BPSC exam)

- A. Phloem tissue
- B. Parenchyma tissue
- C. Meristems
- D. Xylem tissue

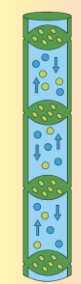
Ans. D. Xylem tissue

Xylem and Phloem Plant Vascular System

- Transports water and minerals
- One-way (upward) flow
- Transport is bulk flow due to negative pressure
- Hollow dead cells
- No end walls
- Form center of the vascular bundle
- Rich in lignin, which supports the plant



Xylem



Phloem

- Transports food in the form of sugars
- Two-way flow
- Transport is by osmosis/turgor pressure
- Live cells with no nucleus
- Perforated end walls
- Outside edge of vascular bundle
- Also transports amino acids, mRNA, and hormones

- ❖ **Parenchyma Tissue:** Parenchyma tissue consists of simple, undifferentiated plant cells. These cells have various functions, including storage, photosynthesis, and support.
- ❖ **Meristems:** Meristems are regions of actively dividing cells in plants. They contribute to plant growth and development by producing new cells that differentiate into various plant tissues, including vascular tissues like xylem and phloem.

Q388. Which components of plants receive stimulus for flowering? (53-55th BPSC exam)

- A. Stems
- B. Branches
- C. Leaves
- D. Roots

Ans. C. Leaves

Leaves are component of plants, which receive stimulus for flowering. Apart from light and chemical stimulus for flowering, temperature is also important stimulus

Q389. Minerals are (53-55th BPSC exam)

- A. Liquids
- B. Inorganic solids
- C. Gases
- D. All of these

Ans. B. Inorganic solids

A mineral is a naturally occurring inorganic solids with a definite chemical composition and an ordered atomic arrangement. As liquid and gases have not crystalline structure they are not considered as minerals.

Q390. Development of the natural systems is described as (53-55th BPSC exam)

- A. Functions of systems
- B. Evolution of the systems
- C. Self-sustained process of the systems
- D. None of the above

Ans. C. Self-sustained process of the systems

Self - Sustained process of the systems is known as development of the natural system. In Self sustained process organism nourishes itself rather than relying on another organism.

Q391. Genetics deals with (53-55th BPSC exam)

- A. Mendel's laws
- B. organic evolution
- C. DNA structure
- D. heredity and variations

Ans. D. heredity and variations

Genetics is a branch of biology in which we study about genes, genetic variation and heredity in organism.

Key Points on Mendel's Laws

- ❖ The law of inheritance was proposed by Gregor Mendel after conducting experiments on pea plants for seven years.
- ❖ Mendel's laws of inheritance include law of dominance, law of segregation and law of independent assortment.
- ❖ The law of segregation states that every individual possesses two alleles and only one allele is passed on to the offspring.
- ❖ The law of independent assortment states that the inheritance of one pair of genes is independent of inheritance of another pair.

Q392. Embryo is found in (53-55th BPSC exam)

- A. Flowers
- B. Leaves
- C. Seeds
- D. Buds

Ans. C. Seeds

The embryo is found inside the seed of a plant. It is the fertilized ovule that develops into a new plant.

Q393. What soil particles are present in loamy soils? (53-55th BPSC exam)

- A. Sand particles
- B. Clay particles
- C. Silt particles
- D. All types of particles

Ans. D. All types of particles

In a loamy soils all types of particles like sand particles, clay particles and silt particles are present.

Q394. A single type of atom is found in – (53-55th BPSC exam)

- A. Compounds of minerals

- B. Mixture of minerals
- C. Native elements
- D. None of these

Ans. C. Native elements

Native element are those elements in nature that are un-combined with other elements. These are minerals that are composed of atoms from a single element.

Q395. Soil's water available to plants is maximum in (53-55th BPSC exam)

- A. Clayey soil
- B. Silty soil
- C. Sandy soil
- D. Loamy soil

Ans. A. Clayey soil

- ❖ Water holding capacity is highest in clayey soil due to the large surface area as well as tightly packed particles that restrict the water from percolating. BPSC had accepted (d) as right answer.
- ❖ Water holding capacity of a soil is the amount of water that a soil can hold. It is mainly important in agriculture, where field capacity is defined as the water holding capacity of the entire soil in the field has reached a maximum. Water holding capacity is highest in soil with fine particles like that of silt and clay-sized particles, as they have a larger surface area that allows the soil to hold a larger quantity of water.
- ❖ Thus, the water holding capacity for the above-mentioned soil decreases in the following order: Clay (with maximum water holding capacity) > Silt > Loam > Sand

Q396. Capillaries are most effective in (53-55th BPSC exam)

- A. Clayey Soil
- B. Silty soil
- C. Sandy Soil
- D. Loamy Soil

Ans. A. Clayey Soil

Capillarity is the phenomenon by which water rises in a cylindrical column. The narrower the column the higher the capillarity; similarly the denser the substratum present in the column the higher the capillary effect. Thus, capillarity effect is most effective in clayey soil followed by loamy soil. BPSC had accepted (d) as right answer.

Q397. Photosynthesis occurs in (53-55th BPSC exam)

- A. Nucleus
- B. Mitochondria
- C. Chloroplast
- D. Peroxisome

Ans. C. Chloroplast

Photosynthesis is a process by which green plants use sunlight, water and carbon dioxide to create oxygen and energy in the form of sugar. The process of photosynthesis occurs in chloroplast

Q398. Table salt is a product of (53-55th BPSC exam)

- A. Strong acid and strong base.
- B. Weak acid and weak base.
- C. Weak acid and strong base
- D. Strong acid and weak base

Ans. A. Strong acid and strong base.

Table salt, which is sodium chloride (NaCl), is a product of a strong acid and a strong base. When hydrochloric acid (HCl), a strong acid, reacts with sodium hydroxide (NaOH), a strong base, sodium chloride is formed along with water (H₂O).

Type	Acid	Base	Salt
Weak acid and weak base	Acetic acid	Ammonia	Ammonium acetate
Weak acid and strong base	Carbonic acid	Sodium hydroxide	Sodium carbonate
Strong acid and weak base	Hydrochloric acid	Ammonia	Ammonium chloride

Q399. Sexual reproduction causes genetic variation because of (53-55th BPSC exam)

- A. Blending of genes
- B. Chromosomal changes
- C. Shuffling of genes
- D. All of these

Ans. D. All of these

Sexual reproduction causes genetic variation through a combination of processes, including blending of genes, chromosomal changes, and shuffling of genes.

Q400. Which of the following Human organs is affected by the consumption of Aflatoxin in food adulterants? (48-52nd BPSC exam)

- A. Heart
- B. Lungs
- C. Kidney
- D. Liver

Ans. D. Liver

Aflatoxin food poisoning in humans commonly affects the liver.

Q401. Who was the inventor of Radar? (48-52nd BPSC exam)

- A. Robert Watson
- B. Fleming
- C. Bush Wall
- D. Austin

Ans. A. Robert Watson

The inventor of radar is Sir Robert Watson. Radar stands for "Radio Detection and Ranging." It is a technology that uses radio waves to detect, locate, and measure the distance and velocity of objects in its vicinity.

Q402. Which of the following instruments measures blood pressure? (48-52nd BPSC exam)

- A. Spherometer
- B. Anemometer
- C. Ammeter
- D. Sphygmomanometer

Ans. D. Sphygmomanometer

A Sphygmomanometer is an instrument that is used to measures arterial blood pressure. It also consists of a mercury or aneroid manometer to measure the pressure. It is also known as blood pressure gauge, blood pressure monitor and blood pressure meter.

Q403. Which of the following vitamins contain Cobalt? (48-52nd BPSC exam)

- A. Vitamin B₆
- B. Vitamin B₂
- C. Vitamin B₁
- D. Vitamin B₁₂

Ans. D. Vitamin B₁₂

Vitamin B₁₂ is chemically named as Cyanocobalamine which contains Cobalt. It is also an essential trace element for humans. It is found at the centre of Vitamin B₁₂ and a range of other co-enzymes called Cobalamines

Q404. People get skin burns in a swimming pool due to (47th BPSC Exam)

- A. infrared ray
- B. chlorine
- C. heat
- D. ultraviolet ray

Ans. B. chlorine

Skin burn in Swimming pool is caused due to presence of Chlorine in water.

Chlorine is a chemical widely used in personal and public swimming pools. Chlorine is added to the water to kill germs. When it is added to swimming pool, it forms a weak acid called hypochlorous acid that kills bacteria like Salmonella and E Coli, as well as germs that cause viruses such as diarrhoea & swimmer's ear.

Q405. When electrical energy is converted into motion (47th BPSC Exam)

- A. there is no heat loss
- B. heat loss is 50%
- C. heat loss is 30%
- D. heat loss is 80%

Ans. A. there is no heat loss

As per principle of Conservation of Energy "energy can neither be created nor be destroyed, but only be transferred from one form to another. Hence when electrical energy is converted into motion then there is no loss of heat.

Dynamo converts mechanical energy into electrical energy

Q406. Fermentation of sugar leads to (47th BPSC Exam)

- A. Ethyl alcohol
- B. Methyl alcohol
- C. Acetic acid
- D. Chlorophyll

Ans. A. Ethyl alcohol

Fermentation is an anaerobic process in which energy can be released from glucose even if Oxygen is not available. Fermentation of Sugar (glucose) leads to Ethyl alcohol (ethanol). Ethanol Fermentation converts glucose (sugar) into cellular energy, Producing ethanol and carbondioxide as a by - product.

Q407. Myoglobin contains the metal (47th BPSC Exam)

- A. Copper
- B. Silver
- C. Gold
- D. Iron

Ans. D. Iron

Myoglobin is an iron-containing protein with a molecular mass of 18 kDa. It resembles hemoglobin but binds one rather than four molecules of oxygen. Its binding characteristics are such that it takes up oxygen from hemoglobin in the blood and releases it for use into the mitochondria where oxidative reactions occur.

Q408. Aspirin is obtained from (47th BPSC Exam)

- A. petroleum
- B. earth
- C. tree
- D. chemical reaction of acids

Ans. D. chemical reaction of acids

Aspirin is one of the group of drugs called non-steroidal anti-inflammatory. It is used to reduce pain and high temperature. Aspirin is prepared by chemical synthesis from salicylic acid through acetylation with acetic anhydride

Q409. For wheat cultivation which fertilizer is used? (47th BPSC Exam)

- A. Nitrogen
- B. Potassium
- C. Copper
- D. Iron

Ans. A. Nitrogen

Nitrogen fertilizer is used for wheat cultivation. Granular Urea and Urea ammonium nitrate solution are the two most common nitrogen fertilizer used for wheat cultivation. Nitrogen is one of the Primary nutrients for plant growth.

Q410. Which metal can be used for producing electricity? (47th BPSC Exam)

- A. Uranium
- B. Iron
- C. Copper
- D. Aluminium

Ans. A. Uranium

Nuclear energy is generated by the splitting of Uranium atoms, this process is called fission. This generates heat to produce steam, which is used by a turbine generator to produce electricity.

Q411. The time-period of a pendulum (47th BPSC Exam)

- A. Depends on the mass
- B. Depends on its length
- C. Depends on time
- D. Depends on temperature

Ans. B. Depends on its length

Pendulum is based on the principle that when it is moved or displaced sideways from its resting equilibrium position, it is subjected to a restoring force due to gravity. Due to this force the pendulum is accelerated back towards its equilibrium position. Time period of a pendulum is defined as the time taken by the

pendulum to make a complete oscillation. Time period of a pendulum is given by,

$$T = 2\pi \sqrt{\frac{l}{g}}$$

Where, T is the time period, l is the length of the string, g is the acceleration due to gravity. From the above equation, it is evident that the time period of the pendulum is dependent on the length of the string and acceleration due to gravity. Thus, the period of the pendulum depends upon length.

Q412. Brass is made from (47th BPSC Exam)

- A. Copper and Nickel
- B. Nickel and Zinc
- C. Magnesium and Zinc
- D. Copper and Zinc

Ans. D. Copper and Zinc

Brass is an alloy of Copper and Zinc. The composition of Brass, generally is 66% Copper and 34% Zinc. Bronze is an alloy of 88% Copper and 12% Tin.

Q413. Light is made of seven colours. What is the method of separating the colours? (47th BPSC Exam)

- A. The colours can be separated by a prism
- B. The colours can be separated by a filter
- C. The colours can be separated by plants
- D. The colours cannot be separated

Ans. A. The colours can be separated by a prism

A prism separates white light into a group of seven colors called a spectrum. These seven colors are always in the same order. The colors of the spectrum are red, orange, yellow, green, blue, indigo, and violet

Q414. Cooling is done by (47th BPSC Exam)

- A. Flow of water
- B. Release of compressed gas
- C. Cooking gas
- D. Melting the solid

Ans. B. Release of compressed gas

A room can be cooled by release of compressed gas. Most of the air conditioners use compressed gas, which can cool the room or other closed places. Compressed gas is released by absorbing surroundings heat or temperature. Hence causes cooling.

Q415. Most commonly used safety fuse wire is made of (46th BPSC Exam)

- A. Tin

- B. Lead
- C. Nicked
- D. An alloy of tin and lead

Ans. D. An alloy of tin and lead

A fuse in an electrical safety device that operates to provide over current protection of an electrical circuit. It is used in a series of equipment as a safety device. The material used for making a fuse wire is become an alloy of lead and tin which has very low melting point.

Q416. A rock is through from the surface of the Moon to Earth. Then, (46th BPSC Exam)

- A. Its mass will change
- B. Its weight will change but not mass
- C. Both mass and its weight will change
- D. Neither mass nor weight would change

Ans. B. Its weight will change but not mass

The weight of an object is defined as the force of gravity on the object. i.e. $w = mg$.

Where

m = mass of the object

g = acceleration due to gravity

If a rock is brought from the surface of the moon to the earth, its weight will change but mass remains unchanged because mass of a body is always constant.

Q417. Sweetest among all sugars is (46th BPSC Exam)

- A. Fructose
- B. Glucose
- C. Sucrose
- D. Lactose

Ans. A. Fructose

Fructose is the sweetest naturally occurring sugar, estimated to be twice as sucrose. Fructose is also derived from the digestion of sucrose, a disaccharide consisting of glucose and fructose that is broken down to glycoside hydrolyses enzymes during digestion. Hence, fructose is the sweetest of all carbohydrates that do occur naturally.

Q418. You are standing in a lift. The force on the floor of the lift due to your weight will (46th BPSC Exam)

- A. Become zero when the lift moves up with an acceleration of 9.8 ms^{-2}
- B. Become zero when the lift moves down with an acceleration of 9.8 ms^{-2}
- C. Become zero when the lift moves with an acceleration of 9.8 ms^{-2} in any direction
- D. Remain unchanged whatever the rate of acceleration of the lift be

Ans. B. Become zero when the lift moves down with an acceleration of 9.8 ms^{-2}

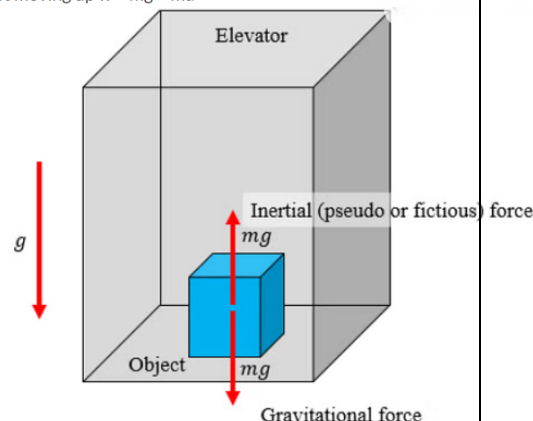
Weight of a body in a lift, while moving down

$$w = mg - ma,$$

$$\text{If } a = g, \text{ then } w = mg - mg \Rightarrow 0$$

$$\text{where } g = 9.8 \text{ m/s}^2$$

weight of a body in a lift moving up $w = mg + ma$



Q419. The metal ion present in chlorophyll is (46th BPSC Exam)

- A. Iron
- B. Magnesium
- C. Zinc
- D. Cobalt

Ans. B. Magnesium

Chlorophyll plays an important role in the process of Photosynthesis. Since it allows the plants to absorb energy from the sunlight. The element, Magnesium is an essential component of the green pigment present in the plants called Chlorophyll.

Q420. Which of the following is not a vestigial organ in man? (46th BPSC Exam)

- A. Nictitating membrane
- B. Auricular muscles of Pinna
- C. Incisors
- D. Vermiform appendix

Ans. C. Incisors

Vestigial organs are those organs which are no longer in use but are still present in our body. A few example of Vestal organs in human are outer rim of the ear, the Vermiform appendix wisdom tooth and Nictitating Membrane. Incisors in not a vestigial organ in human body

Q421. What is dry ice? (46th BPSC Exam)

- A. Solid ice
- B. Solid carbon dioxide
- C. Solid ammonia

D. Solid sulphur dioxide

Ans. B. Solid carbon dioxide

Dry ice is just cooled and condensed carbon dioxide. It sublimates directly into carbon dioxide gas when it reaches room temperature and pressure and expands. Dry ice is manufactured by compressing and cooling gaseous CO₂ under high pressure to initially produce liquid CO₂ and pumping it into a storage tank, where it freezes at -109°F and is compacted into solid ice

Q422. Evolution proceeds on account of (46th BPSC Exam)

- A. Fossils
- B. Struggle for existence
- C. Adaptation through generations
- D. Inheritance

Ans. C. Adaptation through generations

The reason for Evolution is – orderly changes the process of origin of new organism, species, classes etc. From ancient organism through which as a result more complex organism are born from simpler organism or it results out by the adoption through generations, and inheritance – transmission of traits from parents to offspring or new generation body.

Q423. In the process of electroplating a utensil with zinc (46th BPSC Exam)

- A. The utensil is made the cathode
- B. Pure zinc is made the anode
- C. The utensil is made the cathode and pure zinc is made the anode
- D. The utensils made the anode and pure zinc is made the cathode

Ans. C. The utensil is made the cathode and pure zinc is made the anode

In the process of electroplating a utensil with zinc, the utensil is made as cathode charge and pure zinc is made as the anode charge so that the zinc layer can be easily electroplated on the utensil. Thus zinc serves as a sacrificial anode so that it catholically protects exposed still.

Q424. The noble gas not present in the air is (46th BPSC Exam)

- A. Helium
- B. Neon
- C. Argon
- D. Radon

Ans. D. Radon

Radon is the only radioactive out of all noble gases. Radon it is not present in the atmosphere. Radon is usually

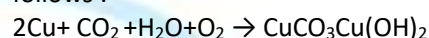
isolated from the radioactive decay of the dissolved radium, thorium or uranium compounds

Q425. A metal when left exposed to air for sometimes, gets coated with green basic carbonate. The metal is (46th BPSC Exam)

- A. Copper
- B. Silver
- C. Nickel
- D. Zinc

Ans. A. Copper

When copper is exposed to atmosphere, a green coating of basic copper carbonate gets deposited over its surface. This is called corrosion of copper the Reaction is as follows :-



copper from a rich variety of compounds with oxidation states +1 and +2 which are often called cuprous and cupric respectively.

Q426. The gas used for artificial ripening of fruits is (46th BPSC Exam)

- A. Ammonia
- B. Acetylene
- C. Carbon monoxide
- D. Ethylene

Ans. D. Ethylene

Among all the hormones, ethylene is responsible for the faster ripening of the fruit because it helps in increasing the rate of respiration, change in colour, odour and taste. Here, ethylene is produced naturally by the plants but for the artificial ripening of fruit, we use acetylene gas.

Q427. The explosive nitro-glycerine is (46th BPSC Exam)

- A. A salt
- B. A nitro hydrocarbon
- C. A complex hydrocarbon
- D. An ester

Ans. D. An ester

Nitro-glycerine is an ester. Esters are chemical compounds that are derived from acids (organic or inorganic). Trinitroglycerin is a colourless oily liquid. It is used to make dynamite. It is prepared by reacting concentrated sulphuric acid and concentrated nitric acid with glycerine

Q428. While tinning of brass utensils the ammonium chloride powder used to clean the hot utensil, produces fumes of (46th BPSC Exam)

- A. Ammonia
- B. Carbon monoxide
- C. Hydrochloric acid
- D. Ammonia and hydrochloric acid

Ans. D. Ammonia and hydrochloric acid

While tinning of brass utensils the ammonium chloride powder used to clean the hot utensil, produces fumes of ammonia and hydrochloric acid

Q429. The end product of alcoholic fermentation is (46th BPSC Exam)

- A. Pyretic acid
- B. Acetaldehyde
- C. Ethyl alcohol
- D. Formic acid

Ans. C. Ethyl alcohol

Fermentation is anaerobic respiration and occurs in the absence of oxygen. During alcoholic fermentation, pyruvic acid (the end product of glycolysis) is first converted into acetaldehyde by pyruvate decarboxylase and CO₂ is released. Acetaldehyde is further reduced to alcohol by the enzyme alcohol dehydrogenate. Therefore the end products of alcoholic fermentation are carbon dioxide and ethanol (CO₂ and C₂H₅OH), Ethanol is also known as ethyl alcohol.

Q430. Hydrofluoric acid is not kept in glass bottles because it reacts with (46th BPSC Exam)

- A. Visible light
- B. Sodium oxide of glass
- C. Aluminium oxide of glass
- D. Silicon dioxide of glass

Ans. D. Silicon dioxide of glass

Hydrofluoric acid is normally handled in metal apparatus made of copper and is always stored in plastic bottles. Therefore, hydrofluoric acid (HF) cannot be stored in the glasses because they corrode the silicates of glass and dissolve in the hydrofluoric acid

Q431. Who invented aeroplane? (45th BPSC Exam)

- A. Wright Brothers
- B. James Watt
- C. Humphrey Davy
- D. Von Brown

Ans. A. Wright Brothers

Wright Brothers invented aeroplane. On 17th December, 1903, the Wright brothers made first successful flight in history

Q432. How many pairs of nerves arise from the spinal cord? (45th BPSC Exam)

- A. 13
- B. 31
- C. 33
- D. 12

Ans. B. 31

The nerves arising directly from the spinal cord are called the spinal nerves. There are 31 pairs of spinal nerves in humans: 8 cervical, 12 thoracic, 5 lumbar, 5 sacral, and 1 coccygeal.

Q433. Where is the governing centre of reflex action located? (45th BPSC Exam)

- A. In cerebrum
- B. In cerebellum
- C. In spinal cord
- D. In nerve cells

Ans. C. In spinal cord

Governing centre of reflex action is located in spinal cord.

Q434. An element X has four element in its outermost orbit. What will be the formula of its compounds with hydrogen? (45th BPSC Exam)

- A. X₄H
- B. X₄H₄
- C. XH₃
- D. XH₄

Ans. D. XH₄

An element X having four elements in its outer most orbit means the element X has its four valency to add four atoms of other element having the valency one. It may be CH₄(XH₄).

Q435. What is the shape of sulphur hexafluoride molecule? (45th BPSC Exam)

- A. Trigonal pyramid
- B. Octahedral
- C. Planar
- D. Tetrahedral

Ans. B. Octahedral

Sulfur hexafluoride molecule or SF₆ is an inorganic, greenhouse gas. It is non-flammable, odorless, and colourless, and is an excellent insulator. SF₆ molecule has an octahedral shape. The central atom bonds with six fluorine atoms and make 8 faces thus the shape of SF₆ is octahedral.

Q436. Which scientist discovered telescope? (45th BPSC Exam)

- A. Newton
- B. James Watt
- C. Rutherford
- D. Galileo

Ans. D. Galileo

It is not clear who invented telescope however first person to apply for a patent on telescope was Hans Lippershey in the Netherlands in 1608. After learning the new device, the great Italian scientist Galileo Galilei designed and built his own telescope

List of Inventions & Discoveries

Invention/Discovery	Name of the Inventor	Year of Invention
Automatic Calculator	Wilhelm Schickard	1623
Air Conditioner	Willis Carrier	1902
Anemometer	Leon Battista Alberti	1450
Animation	J. Stuart Blackton	—
Atom Bomb	Julius Robert Oppenheimer	1945
Aspirin	Dr. Felix Hoffman	1899
Airplane	Wilber and Orville Wright	1903
Adhesive tape	Richard G. Drew	1923
Bifocal Lens	Benjamin Franklin	1779
Barometer	Evangelista Torricelli	1643
Barbed Wire	Joseph F. Glidden	1873
Blood Group	Karl Landsteiner	1900s
Ball Point Pen	John Loud	—
Bicycle Tyres	John Boyd Dunlop	1888
Pedal Driven Bicycle	Kirkpatrick Macmillan	1839
Celluloid	Alexander Parkes	1861
Chloroform	Sir James Young Simpson	—
Cine Camera	Wm. Friese-Greene	1889
Circulation of blood	William Harvey	1628
Clock Mechanical	Hsing and Ling-Tsan	1725
Diesel Engine	Rudolf Diesel	1892
Centigrade Scale	Anders Celsius	1742
Chlorine	Carl Wilhelm Scheele	1774
Dynamite	Alfred B. Nobel	1867
Diesel Engine	Rudolf Diesel	1895
Electric stove/cooker	William S. Hadaway	1896
Electroscope	William Gilbert	1600s
Electric Fan	Schuyler Wheeler	1882

Electric Battery	Volta	1800
Elevator	Elisha G. Otis	1852
Electric Motor (DC)	Thomas Davenport	1873
Electromagnet	William Sturgeon	1824
Fountain Pen	Petrache Poenaru	1827
Fluorine	André-Marie Ampère	1810
Gramophone	Thomas Edison	1878
Hydrogen	Henry Cavendish	1766
Helicopter	Igor Sikorsky	1939
Hovercraft	Christopher Cockerell	1959
Hot Air Balloon	Josef & Etienne Montgolfier	1783
Helium	Jules Janssen	1868
Insulin	Sir Frederick Banting	1923
Jet Engine	Hans Von Ohain	1936
Lightning Conductor	Benjamin Franklin	1752
Locomotive	George Stephenson	1804
Laser	Theodore Maiman	1960
Light Bulb	Thomas Edison	1854
Motorcycle	Gottlieb Daimler	1885
Microscope	Zacharis Janssen	1590
Microphone	Alexander Graham Bell	1876
Machine Gun	Richard Gatling	1861
Neon Lamp	Georges Claude	1915
Oxygen	Joseph Priestley	1774
Ozone	Christian Schonbein	1839
Piano	Bartolomeo Cristofori	1700
Printing Press	Johannes Gutenberg	1440
Parachute	Louis-Sebastien Lenormand	1783
Polio Vaccine	Jonas Edward Salk	—
Periodic Table	Dmitri Mendeleev	1869
Penicillin	Alexander Fleming	1928
Pacemaker	Rune Elmquist	1952
Petrol for Motor Car	Karl Benz	1885
Refrigerator	William Cullen	1748
Radium	Marie & Pierre Curie	1898
Rubber (vulcanized)	Charles Goodyear	1841
Rocket Engine	Robert H. Goddard	1926
Radio	Guglielmo Marconi	1894
Richter Scale	Charles Richter	1935
Ship (Turbine)	Charles Parsons	1894
Steam Ship	Robert Fulton	1807
Steam Boat	Robert Fulton	1786

Submarine	Cornelis Drebbel	1620
Stethoscope	Rene Laennec	1816
Saxophone	Adolphe Sax	1846
Sewing Machine	Elias Howe	1846
Steam-Powered Airship	Henri Giffard	1852
Soft Contact lenses	Otto Wichterle	1961
Synthesizer	Dr. Robert Arthur Moog	1964
Thermometer	Galileo	1593
Theory of Evolution	Charles Darwin	1858
Typewriter	Christopher Latham Sholes	—
Transistors	John Bardeen, William Shockley & Walter Brattain	1948
Telephone	Graham Bell	1874
Valve. Radio	Sir J.A Fleming	1904
Vacuum Cleaner	Hubert Cecil Booth	1901
Vitamin A	Frederick Gowland Hopkins	1912
Vitamin B	Christiaan Eijkman	1897
Vitamin C	Albert Szent-Gyorgi	—
Vitamin K	Henrik Dam	1929
Vitamin E	Herbert McLean Evans & Katherine Scott Bishop	
Windshield wipers	Mary Anderson	1903
World Wide Web	Tim Berners Lee with Robert Cailliau	1989
X-ray	Wilhelm Conrad Roentgen	1895
Xerox Machine	Chester Carlson	1928

Q437. Which of the following is the electronic configuration of a metallic element? (45th BPSC Exam)

- A. 2,8
- B. 2,8,7
- C. 2,8,8
- D. 2,8,8,2

Ans. D. 2,8,8,2

The electronic configuration of an element is a symbolic notation of the manner in which the electrons of its atoms are distributed over different atomic orbitals. While writing electron configurations, a standardized notation is followed in which the energy level and the type of orbital are written first, followed by the number of electrons present in the orbital written in superscript. For example, the electronic configuration of carbon (atomic number: 6) is $1s^2 2s^2 2p^2$.

The three rules that dictate the manner in which electrons are filled in atomic orbitals are:

- ❖ **The Aufbau principle:** electrons must completely fill the atomic orbitals of a given energy level before occupying an orbital associated with a higher energy level. Electrons occupy orbitals in the increasing order of orbital energy level.
- ❖ **Pauli's exclusion principle:** states that no two electrons can have equal values for all four quantum numbers. Consequently, each subshell of an orbital can accommodate a maximum of 2 electrons and both these electrons MUST have opposite spins.
- ❖ **Hund's rule of maximum multiplicity:** All the subshells in an orbital must be singly occupied before any subshell is doubly occupied. Furthermore, the spin of all the electrons in the singly occupied subshells must be the same (in order to maximize the overall spin).

Q438. What is the usual property of oxides of Group III and IV? (45th BPSC Exam)

- A. Basic and Acidic (i.e., Amphoteric)
- B. Basic
- C. Acidic
- D. Neutral

Ans. A. Basic and Acidic

The usual characteristics of oxides of Group III and IV of the periodic table is that they are Amphoteric i.e. they can able to react both as base and acid.

Periodic table showing element groups (1-18) and periods (1-7). The table is color-coded: s-block (blue), f-block (green), d-block (yellow), and p-block (orange). Some elements near the dashed staircase are labeled as metalloids. The noble gases are shown in a separate column on the right.

Q439. The vitamin which is found in citrus fruits and is necessary for maintaining healthy skin is (44th BPSC Exam)

- A. Vitamin A
- B. Vitamin B
- C. Vitamin C
- D. Vitamin D

Ans. C. Vitamin C

Vitamin C is found in citrus fruits. It plays an important role in maintaining skin health. Vitamin C is also known as

Ascorbic Acid. It is water soluble, lack of vitamin C is caused Scurvy.



Q440. Which of the following metals is used as filament in lighting bulbs? (44th BPSC Exam)

- A. Iron
- B. Molybdenum
- C. Silver
- D. Tungsten

Ans. D. Tungsten

- ❖ Tungsten metal is used as filament materials in lighting bulb because it has a very high melting point. Due to this high melting point, the tungsten filament can be kept white hot without melting away. Tungsten has very high resistivity so it does not burn easily at room temperature.
- ❖ Most molybdenum is used to make alloys. It is used in steel alloys to increase strength, hardness, electrical conductivity and resistance to corrosion and wear. These 'moly steel' alloys are used in parts of engines. Other alloys are used in heating elements, drills and saw blades.
- ❖ Silver holds an excellent electrical conductivity, making it the number one choice for electronics or anything electrical such as printed circuit boards, switches, TV screens, telephones, microwave ovens, children's toys and computer keyboards.
- ❖ Iron is used to make alloy steels like carbon steels with additives such as nickel, chromium, vanadium, tungsten, and manganese. These are used to make bridges, electricity pylons, bicycle chains, cutting

tools and rifle barrels. Cast iron contains 3–5% carbon. It is used for pipes, valves, and pumps.

Q441. Turbines and dynamos are used to convert which energy to electrical energy? (44th BPSC Exam)

- A. Chemical energy
- B. Solar energy
- C. Mechanical
- D. Magnetic energy

Ans. C. Mechanical

Turbines and Dynamos are used to convert mechanical energy into electrical energy. A wind turbine transforms the mechanical energy of wind into electrical energy. Dynamo is an electrical generator that create direct current using a commutator. It uses rotating coils of wire and magnetic fields to convert mechanical rotations into a pulsing direct electric current

Q442. Which of the following carries a negative charge? (45th BPSC Exam)

- A. X-rays
- B. Alpha particles
- C. Beta particles
- D. Gamma rays

Ans. C. Beta particles

Beta particles (β) are high energy, high speed electrons (e^-) or positrons (β^+) ejected from the nucleus during radioactive decay. However, X ray, and Gamma rays are neutral and alpha particles carry positive charge

Q443. Which one of the following metals is liquid at room temperature? (44th BPSC Exam)

- A. Lead
- B. Mercury
- C. Nickel
- D. Tin

Ans. B. Mercury

- ❖ Mercury is the only metal which is liquid at room temperature. Rest all the given metals are in solid form at room temperature.
- ❖ Lead is still widely used for car batteries, pigments, ammunition, cable sheathing, weights for lifting, weight belts for diving, lead crystal glass, radiation protection and in some solders. It is often used to store corrosive liquids.
- ❖ Nickel steel is used for armour plating. Other alloys of nickel are used in boat propeller shafts and turbine blades. Nickel is used in batteries, including

rechargeable nickel-cadmium batteries and nickel-metal hydride batteries used in hybrid vehicles. Nickel has a long history of being used in coins.

- ❖ Tin is widely used for plating steel cans used as food containers, in metals used for bearings, and in solder. The origins of tin are lost in antiquity. Bronzes, which are copper-tin alloys, were used by humans in prehistory long before pure tin metal itself was isolated.



Pram IAS



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