

Bihar Board Class 10 Science (SET - F) 2025 Question Paper with Solutions

Time Allowed :3 Hours 15 Minutes	Maximum Marks :80	Total Questions :110
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General Instructions

Read the following instructions very carefully and strictly follow them:

1. The test is of 3 hour duration.
2. Candidate must enter his/her Question Booklet Serial No. (10 Digits) in the OMR Answer Sheet.
3. Candidates are required to write their answers in their own words as far as practicable.
4. Figures in the top-hand margin indicate full marks.
5. An extra time of 15 minutes has been allotted for the candidates to read the questions carefully.
6. This question booklet is divided into two sections — Section-A and Section-B.
7. Use of any electronic appliances is strictly prohibited.

Section - A

1. The hormone that controls the symptoms of puberty in adolescents is

- (A) Thyroxine
- (B) Estrogen
- (C) Testosterone
- (D) None of these

Correct Answer: (C) Testosterone

Solution:

Step 1: Understanding the Concept:

Puberty is the stage of development when adolescents undergo physical and hormonal changes leading to sexual maturity. Hormones play a vital role in regulating these changes.

- **Thyroxine:** Controls metabolism and growth but not puberty.
- **Estrogen:** Female hormone responsible for female reproductive development.

- **Testosterone:** Male hormone responsible for secondary sexual characteristics during puberty.

Step 2: Detailed Explanation:

Among these, testosterone is the main hormone responsible for controlling the symptoms of puberty in male adolescents, such as deepening of voice, facial hair growth, and muscle development. Estrogen controls puberty in females, but since the question asks generally, testosterone is considered the key hormone.

Step 3: Final Answer:

The hormone that controls the symptoms of puberty in adolescents is **Testosterone**.

Quick Tip

In humans, puberty is regulated by both testosterone (in boys) and estrogen (in girls). Always check the context of the question for precision.

2. At what stage of foetus does safe abortion occur?

- (A) Blastula
- (B) Organ formation
- (C) Mature embryo
- (D) None of these

Correct Answer: (C) Mature embryo

Solution:

Step 1: Understanding the Concept:

Abortion refers to the medical termination of pregnancy. Safe abortion is allowed and performed under controlled medical conditions up to a certain stage of foetal development.

- **Blastula:** Very early embryonic stage (few days after fertilization).
- **Organ formation:** Happens during early foetal development. Abortion at this stage may cause complications.
- **Mature embryo:** Abortion is performed when the embryo has developed but is still within the legal and safe limit prescribed by medical authorities.

Step 2: Detailed Explanation:

Safe abortion is legally and medically carried out when the embryo has reached a mature but not fully developed stage, typically within the first trimester (up to 12 weeks). Beyond this stage, abortion may pose serious health risks to the mother.

Step 3: Final Answer:

Safe abortion usually occurs at the stage of a **Mature embryo**.

Quick Tip

According to the MTP (Medical Termination of Pregnancy) Act in India, abortion is legally allowed up to 20 weeks under certain conditions, but the safest period is within the first 12 weeks.

3. Which of the following is an artificial ecosystem?

- (A) Park
- (B) Aquarium
- (C) Garden
- (D) All of these

Correct Answer: (B) Aquarium

Solution:

Step 1: Understanding the Concept:

An ecosystem consists of living organisms interacting with each other and with their physical environment. Ecosystems may be natural or artificial.

- **Park and Garden:** Though man-made, they are still considered semi-natural as they use natural plants and soil.
- **Aquarium:** This is a fully artificial ecosystem created and maintained by humans (fish, plants, food, oxygen supply, etc.).

Step 2: Detailed Explanation:

Among the given options, an aquarium is the best example of an artificial ecosystem since it is entirely dependent on humans for maintenance and survival of organisms.

Step 3: Final Answer:

The artificial ecosystem among the given options is **Aquarium**.

Quick Tip

Artificial ecosystems include aquariums, crop fields, and gardens where human involvement is essential for balance.

4. Which substance cannot be decomposed in the environment?

- (A) Dry leaves
- (B) Food
- (C) Dead organism
- (D) Plastic

Correct Answer: (D) Plastic

Solution:

Step 1: Understanding the Concept:

Biodegradable substances can be broken down naturally by microorganisms, while non-biodegradable substances cannot.

- **Dry leaves, food, dead organisms:** All are biodegradable and decompose naturally.
- **Plastic:** Non-biodegradable, cannot be decomposed by natural processes, and remains in the environment for hundreds of years.

Step 2: Detailed Explanation:

Plastic causes long-term environmental pollution as it does not decompose. This leads to land and water pollution and is harmful to living organisms.

Step 3: Final Answer:

The substance that cannot be decomposed in the environment is **Plastic**.

Quick Tip

Always remember: Biodegradable = can be decomposed (like food, leaves). Non-biodegradable = cannot be decomposed (like plastic, glass, metals).

5. The correct food chain is

- (A) Fish → Grass → Cow
- (B) Goat → Grass → Deer

- (C) Grass $\rightarrow$ Deer $\rightarrow$ Lion
(D) Bird $\rightarrow$ Snake $\rightarrow$ Grass

Correct Answer: (C) Grass $\rightarrow$ Deer $\rightarrow$ Lion

Solution:

Step 1: Understanding the Concept:

A food chain represents the flow of energy from one organism to another. It usually starts with producers (plants) followed by herbivores and then carnivores.

- **Grass:** Producer (plants).
- **Deer:** Primary consumer (herbivore).
- **Lion:** Secondary/tertiary consumer (carnivore).

Step 2: Detailed Explanation:

Option (C) shows the correct food chain: plants (producers) $\rightarrow$ herbivores $\rightarrow$ carnivores. The other options are biologically incorrect (fish don't eat grass, birds don't eat snakes followed by grass, etc.).

Step 3: Final Answer:

The correct food chain is **Grass $\rightarrow$ Deer $\rightarrow$ Lion**.

Quick Tip

A food chain always begins with plants (producers) and ends with top carnivores. Energy flow is unidirectional.

6. The substances which get decomposed by biological process are

- (A) Non-biodegradable
(B) Inert
(C) Biodegradable
(D) None of these

Correct Answer: (C) Biodegradable

Solution:

Step 1: Understanding the Concept:

Substances in nature can be classified based on whether microorganisms can break them down.

- **Biodegradable:** Can be decomposed by bacteria, fungi, and other biological processes (e.g., food waste, leaves, paper).
- **Non-biodegradable:** Cannot be decomposed by biological means (e.g., plastic, glass, metals).
- **Inert:** Chemically inactive substances.

Step 2: Detailed Explanation:

Since the question asks about substances that get decomposed by biological processes, the correct answer is "Biodegradable".

Step 3: Final Answer:

The substances that get decomposed by biological processes are **Biodegradable**.

Quick Tip

Always classify waste into biodegradable (like food, paper) and non-biodegradable (like plastic, metals) for better waste management.

7. Waste can be managed by which of the following?

- (A) Burning it out of the city
- (B) Using in filling pits
- (C) Recycling of some wastes
- (D) All of these

Correct Answer: (D) All of these

Solution:**Step 1: Understanding the Concept:**

Waste management involves the safe and efficient handling, recycling, or disposal of waste to reduce pollution and health risks. Methods include:

- **Burning outside the city:** Reduces waste volume but causes air pollution.

- **Filling pits (landfills):** Helps dispose of large quantities of waste.
- **Recycling:** Converts waste into reusable material, reducing environmental harm.

Step 2: Detailed Explanation:

Since all of these methods are ways of managing waste, the correct answer is "All of these". Recycling is the most eco-friendly method, but the question accepts all options.

Step 3: Final Answer:

Waste can be managed by **All of these methods**.

Quick Tip

The 3R principle of waste management is: Reduce, Reuse, Recycle.

8. Which disease may primarily be caused in humans by ultraviolet (UV) rays of the Sun?

- (A) Lung cancer
- (B) Tuberculosis (T.B.)
- (C) Oral cancer
- (D) Skin cancer

Correct Answer: (D) Skin cancer

Solution:

Step 1: Understanding the Concept:

The Sun emits ultraviolet (UV) radiation, which can damage living tissues when exposure is prolonged or intense.

- **Lung cancer:** Caused mainly by smoking or air pollution.
- **Tuberculosis (T.B.):** Caused by bacteria *Mycobacterium tuberculosis*, not UV rays.
- **Blood cancer:** Caused by abnormal growth of blood cells, unrelated to UV rays.
- **Skin cancer:** Caused by harmful UV rays damaging DNA in skin cells.

Step 2: Detailed Explanation:

The major harmful effect of UV rays is skin cancer, especially in people with prolonged sun exposure and less melanin protection.

Step 3: Final Answer:

The disease caused by UV rays is **Skin cancer**.

Quick Tip

The ozone layer protects us from UV radiation. Depletion of ozone increases the risk of skin cancer.

9. Which quantity is electric potential?

- (A) Scalar quantity
- (B) Vector quantity
- (C) Both (A) and (B)
- (D) None of these

Correct Answer: (A) Scalar quantity

Solution:**Step 1: Understanding the Concept:**

Physical quantities are classified as scalar or vector:

- **Scalar quantities:** Have only magnitude (e.g., mass, temperature, electric potential).
- **Vector quantities:** Have both magnitude and direction (e.g., force, velocity, electric field).

Step 2: Detailed Explanation:

Electric potential represents the amount of work done per unit charge in bringing a charge from infinity to a point in an electric field. Since it does not require a direction, it is a scalar quantity.

Step 3: Final Answer:

Electric potential is a **Scalar quantity**.

Quick Tip

Remember: Electric potential is scalar, while electric field and electric force are vectors.

10. The action of an electric motor is based on

- (A) Electric current and magnetic effect
- (B) Rotation of armature
- (C) Both (A) and (B)
- (D) None of these

Correct Answer: (A) Electric current and magnetic effect

Solution:

Step 1: Understanding the Concept:

An electric motor converts electrical energy into mechanical energy. Its working principle is based on the interaction of current and magnetic fields.

- When current flows through a conductor placed in a magnetic field, a force is exerted on it (Fleming's left-hand rule).
- This force produces rotation in the motor's armature.

Step 2: Detailed Explanation:

The primary basis of an electric motor is the magnetic effect of current, not just the mechanical rotation of the armature. The rotation is a result, not the principle. Hence, option (A) is correct.

Step 3: Final Answer:

The action of an electric motor is based on **Electric current and magnetic effect**.

Quick Tip

The principle of motor action is Fleming's Left-Hand Rule: thumb = force, forefinger = magnetic field, middle finger = current.

11. From which of the following does the induced current get direction?

- (A) By Lenz's law
- (B) By left hand rule
- (C) By right hand rule
- (D) By Ohm's law

Correct Answer: (A) By Lenz's law

Solution:

Step 1: Understanding the Concept:

When current is induced in a conductor due to changing magnetic flux, its direction is determined by physical laws.

- **Lenz's Law:** States that the direction of induced current opposes the change in magnetic flux that produces it.
- **Left/Right hand rules:** Help determine direction of force or current in a magnetic field, but not directly for induced current.
- **Ohm's Law:** Relates voltage, current, and resistance, not current direction.

Step 2: Detailed Explanation:

The correct principle for deciding the direction of induced current is Lenz's law.

Step 3: Final Answer:

The induced current gets its direction by **Lenz's law**.

Quick Tip

Remember: Lenz's law is an application of the law of conservation of energy.

12. The frequency of alternating electric current produced in India is

- (A) 80 Hz
- (B) 70 Hz
- (C) 60 Hz
- (D) 50 Hz

Correct Answer: (D) 50 Hz

Solution:

Step 1: Understanding the Concept:

The frequency of alternating current (AC) is standardized differently in different countries:

- India: 50 Hz

- USA and some other countries: 60 Hz

Step 2: Detailed Explanation:

In India, power stations produce alternating current with a frequency of 50 cycles per second (50 Hz). This ensures synchronization of appliances and grids across the country.

Step 3: Final Answer:

The AC frequency in India is **50 Hz**.

Quick Tip

Always note: India uses 50 Hz, while the USA and Canada use 60 Hz.

13. What will be the resistance of the wire when its length increases?

- (A) Decreases
- (B) Increases
- (C) Remains constant
- (D) None of these

Correct Answer: (B) Increases

Solution:

Step 1: Understanding the Concept:

The resistance of a conductor is given by:

$$R = \rho \frac{l}{A}$$

where ρ = resistivity, l = length, A = cross-sectional area.

- If length increases, resistance increases proportionally.
- If area increases, resistance decreases.

Step 2: Detailed Explanation:

Since resistance is directly proportional to the length of the wire, increasing length leads to increased resistance.

Step 3: Final Answer:

When the length of a wire increases, its resistance **Increases**.

Quick Tip

Always remember: $R \propto l$ and $R \propto \frac{1}{A}$.

14. The electrical resistivity of silver at 20°C is

- (A) $49 \times 10^{-6} \Omega m$
- (B) $1.60 \times 10^{-8} \Omega m$
- (C) $10^{12} \Omega m$
- (D) $6.84 \times 10^{-8} \Omega m$

Correct Answer: (B) $1.60 \times 10^{-8} \Omega m$

Solution:

Step 1: Understanding the Concept:

Resistivity is a property of materials that determines how strongly they oppose electric current. Silver is one of the best conductors.

- Metals like copper and silver have very low resistivity (close to $10^{-8} \Omega m$).
- Insulators like rubber and wood have extremely high resistivity (up to $10^{12} \Omega m$).

Step 2: Detailed Explanation:

At 20°C , the resistivity of silver is approximately $1.60 \times 10^{-8} \Omega m$, which is among the lowest for any material. This makes silver an excellent conductor.

Step 3: Final Answer:

The resistivity of silver at 20°C is $1.60 \times 10^{-8} \Omega m$.

Quick Tip

Silver has the lowest resistivity, followed closely by copper, which is more commonly used due to cost.

15. Which gas is not released when fossil fuels are burnt?

- (A) Oxygen gas
- (B) Carbon dioxide gas
- (C) Sulphur dioxide gas

(D) None of these

Correct Answer: (A) Oxygen gas

Solution:

Step 1: Understanding the Concept:

When fossil fuels like coal, petrol, or diesel are burnt, several gases are released due to combustion.

- **Carbon dioxide (CO_2):** Released in large quantities.
- **Sulphur dioxide (SO_2):** Released when fuels contain sulphur.
- **Oxygen (O_2):** Not released; instead, it is consumed during combustion.

Step 2: Detailed Explanation:

Since oxygen is used in burning fossil fuels and not released as a by-product, the correct answer is oxygen gas.

Step 3: Final Answer:

The gas not released during fossil fuel combustion is **Oxygen gas**.

Quick Tip

Burning of fossil fuels consumes oxygen and releases greenhouse gases like CO_2 , CO, and SO_2 .

16. Which of the following is the main component of biogas?

- (A) H_2S
- (B) H_2
- (C) CO_2
- (D) CH_4

Correct Answer: (D) CH_4

Solution:

Step 1: Understanding the Concept:

Biogas is a renewable fuel produced by the anaerobic decomposition of organic matter. Its

composition includes:

- 50–70% methane (CH_4)
- 30–40% carbon dioxide (CO_2)
- Traces of hydrogen sulphide (H_2S) and hydrogen (H_2)

Step 2: Detailed Explanation:

The main component of biogas is methane (CH_4), which is a combustible gas and provides energy when biogas is used as fuel.

Step 3: Final Answer:

The main component of biogas is **Methane (CH_4)**.

Quick Tip

Biogas is an eco-friendly fuel, often used for cooking, lighting, and even generating electricity in rural areas.

17. Tincture iodine solution is prepared in

- (A) Ethyl alcohol
- (B) Chloroform
- (C) Carbon tetrachloride
- (D) Ether

Correct Answer: (A) Ethyl alcohol

Solution:

Step 1: Understanding the Concept:

Tincture iodine is a common antiseptic solution containing iodine dissolved in alcohol.

- **Ethyl alcohol:** Solvent used to dissolve iodine to make tincture iodine.
- **Chloroform / Carbon tetrachloride / Ether:** Not used in the preparation of tincture iodine.

Step 2: Detailed Explanation:

Tincture iodine typically contains 2–7% iodine in ethyl alcohol, sometimes with potassium iodide added for better solubility. It is used as a strong antiseptic for wounds.

Step 3: Final Answer:

Tincture iodine solution is prepared in **Ethyl alcohol**.

Quick Tip

Tincture iodine is widely used as an antiseptic; alcohol acts as the solvent and also enhances antiseptic properties.

18. The IUPAC name of $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ is

- (A) 2-propanol
- (B) Propyl alcohol
- (C) 1-propanol
- (D) 3-propanol

Correct Answer: (C) 1-propanol

Solution:

Step 1: Understanding the Concept:

IUPAC nomenclature rules:

- The longest chain containing the functional group is selected.
- Numbering is done so that the functional group gets the lowest number.
- The suffix “-ol” is used for alcohols.

Step 2: Detailed Explanation:

The given compound $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ has three carbon atoms in a straight chain. The hydroxyl (-OH) group is attached to the first carbon, so its correct name is 1-propanol.

Step 3: Final Answer:

The IUPAC name of $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ is **1-propanol**.

Quick Tip

Remember: CH_3OH is methanol, $\text{CH}_3\text{CH}_2\text{OH}$ is ethanol, and $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ is 1-propanol.

19. Which of the following is liquid at room temperature?

- (A) Ethanol
- (B) Methane
- (C) Ethane
- (D) Ethyne

Correct Answer: (A) Ethanol

Solution:

Step 1: Understanding the Concept:

At room temperature (around 25°C), the physical state of substances depends on their boiling points.

- **Ethanol:** Boiling point $\approx 78^{\circ}\text{C}$, so it exists as a liquid at room temperature.
- **Methane, Ethane, Ethyne:** Have very low boiling points (below 0°C), so they exist as gases at room temperature.

Step 2: Detailed Explanation:

Among the given options, only ethanol remains liquid under normal conditions.

Step 3: Final Answer:

The liquid at room temperature is **Ethanol**.

Quick Tip

Ethanol is a common liquid fuel and solvent, while methane, ethane, and ethyne are gases under normal conditions.

20. Benzene reacts with nitric acid in the presence of concentrated sulphuric acid to form

- (A) Nitrobenzene
- (B) Phenol
- (C) Toluene
- (D) Benzoic acid

Correct Answer: (A) Nitrobenzene

Solution:

Step 1: Understanding the Concept:

The reaction of benzene with concentrated nitric acid in the presence of concentrated sulphuric acid is called **nitration of benzene**.

- H_2SO_4 acts as a catalyst and generates the nitronium ion (NO_2^+).
- Benzene reacts with NO_2^+ to form nitrobenzene.

Step 2: Detailed Explanation:

This is an electrophilic substitution reaction. Benzene's hydrogen atom is replaced by a nitro group ($-\text{NO}_2$), giving nitrobenzene as the main product.

Step 3: Final Answer:

The product of the reaction is **Nitrobenzene**.

Quick Tip

The nitration of benzene is a key step in making explosives like TNT (trinitrotoluene).

21. Which of the following compounds can be used as fuel?

- (A) Ethanol
- (B) Propanol
- (C) Ethanoic acid
- (D) All of these

Correct Answer: (D) All of these

Solution:

Step 1: Understanding the Concept:

Fuels are substances that release energy on burning.

- **Ethanol:** Common biofuel and used in spirit lamps.
- **Propanol:** Can be used as a fuel and solvent.
- **Ethanoic acid (acetic acid):** Though weaker, it can burn and release energy.

Step 2: Detailed Explanation:

All the given organic compounds are combustible and can act as fuels. Ethanol is the most widely used, but technically all listed compounds qualify as fuels.

Step 3: Final Answer:

All of the given compounds can be used as **fuel**.

Quick Tip

Among the given options, ethanol is the most common renewable fuel, also blended with petrol.

22. Which of the following groups form the Dobereiner's triad?

- (A) N, P, As
- (B) F, Cl, Br
- (C) Ca, Sr, Ba
- (D) Be, Mg, Ca

Correct Answer: (C) Ca, Sr, Ba

Solution:**Step 1: Understanding the Concept:**

Dobereiner's triads were groups of three elements with similar properties in which the atomic weight of the middle element is nearly the average of the other two.

Step 2: Detailed Explanation:

The group Ca, Sr, Ba forms a Dobereiner's triad:

$$\text{Atomic weight of Sr} \approx \frac{\text{Atomic weight of Ca} + \text{Atomic weight of Ba}}{2}$$

This relationship holds true for alkaline earth metals Ca, Sr, and Ba.

Step 3: Final Answer:

The correct Dobereiner's triad is **Ca, Sr, Ba**.

Quick Tip

Dobereiner's triads were an early attempt at classifying elements, which later led to the development of the modern periodic table.

23. The molecular formula of ozone is

- (A) O₂
- (B) O₃

- (C) O_4
(D) O_5

Correct Answer: (B) O_3

Solution:

Step 1: Understanding the Concept:

Oxygen exists in different molecular forms (allotropes).

- O_2 : Normal diatomic oxygen we breathe.
- O_3 : Ozone, a triatomic form of oxygen.

Step 2: Detailed Explanation:

Ozone is made up of three oxygen atoms bonded together. It forms naturally in the stratosphere and protects life on Earth by absorbing harmful ultraviolet (UV) radiation.

Step 3: Final Answer:

The molecular formula of ozone is O_3 .

Quick Tip

Ozone is a protective shield in the stratosphere but harmful at ground level, where it acts as a pollutant.

24. How many bonds are found between the two atoms of a molecule of oxygen gas (O_2)?

- (A) 1
(B) 2
(C) 3
(D) None of these

Correct Answer: (B) 2

Solution:

Step 1: Understanding the Concept:

Oxygen (O_2) is a diatomic molecule. Each oxygen atom has 6 valence electrons, and needs 2 more to complete its octet.

Step 2: Detailed Explanation:

To achieve octet stability, two oxygen atoms share two pairs of electrons, forming a **double bond** ($\text{O}=\text{O}$).

Step 3: Final Answer:

There are **2 bonds (a double bond)** between the two atoms of O_2 .

Quick Tip

Always remember: O_2 has a double bond, N_2 has a triple bond, and H_2 has a single bond.

25. Elements from group 13 to 18 are called

- (A) Elements of d-block
- (B) Elements of p-block
- (C) Elements of s-block
- (D) Elements of f-block

Correct Answer: (B) Elements of p-block

Solution:**Step 1: Understanding the Concept:**

The periodic table is divided into blocks based on the type of orbital being filled:

- Groups 1–2: **s-block** elements.
- Groups 3–12: **d-block** (transition elements).
- Groups 13–18: **p-block** elements.
- Inner transition elements: **f-block**.

Step 2: Detailed Explanation:

Elements in groups 13–18 have their outermost electrons entering the p-orbital, hence they are called p-block elements.

Step 3: Final Answer:

Elements from group 13 to 18 are **p-block elements**.

Quick Tip

p-block elements include metals, non-metals, and metalloids — e.g., B, C, N, O, F, and noble gases.

26. Which of the following elements has the highest number of valence electrons?

- (A) Al
- (B) P
- (C) Na
- (D) Si

Correct Answer: (B) P

Solution:

Step 1: Understanding the Concept:

The number of valence electrons is equal to the group number (for main group elements).

- **Aluminium (Al):** Group 13 $\rightarrow$ 3 valence electrons.
- **Phosphorus (P):** Group 15 $\rightarrow$ 5 valence electrons.
- **Sodium (Na):** Group 1 $\rightarrow$ 1 valence electron.
- **Silicon (Si):** Group 14 $\rightarrow$ 4 valence electrons.

Step 2: Detailed Explanation:

Among the given elements, phosphorus has the maximum number of valence electrons (5).

Step 3: Final Answer:

The element with the highest number of valence electrons is **Phosphorus (P)**.

Quick Tip

Valence electrons determine an element's chemical reactivity. More valence electrons (except noble gases) usually mean higher non-metallic character.

27. Which of the following is a pollution-free source of energy?

- (A) Solar energy
- (B) Hydro-electric energy
- (C) Wind energy
- (D) All of these

Correct Answer: (D) All of these

Solution:

Step 1: Conceptual Background:

Energy sources are divided into two categories — renewable (clean) and non-renewable (polluting). Renewable sources like solar, wind, and hydro do not release harmful gases, while non-renewable sources like coal, petroleum, and natural gas emit carbon dioxide, carbon monoxide, sulphur dioxide, and other pollutants.

Step 2: Analysis of Options:

- **Solar energy:** Derived from the sun. No harmful gases are released during its use. Widely used in solar panels, solar cookers, and heaters.
- **Hydro-electric energy:** Generated by flowing water stored in dams. It does not produce greenhouse gases during generation.
- **Wind energy:** Produced by wind turbines. Completely clean and renewable, does not emit pollutants.
- All of these sources are **pollution-free** compared to fossil fuels.

Step 3: Final Answer:

Since solar, hydro-electric, and wind energy are all clean energy sources, the correct answer is **All of these**.

Quick Tip

Renewable energy helps fight climate change by reducing greenhouse gas emissions. India invests heavily in solar and wind power.

28. Which of the following is responsible for the depletion of the ozone layer?

- (A) Sulphur
- (B) Carbon dioxide
- (C) Carbon
- (D) Chlorofluorocarbon

Correct Answer: (D) Chlorofluorocarbon

Solution:**Step 1: Conceptual Background:**

The ozone layer in the stratosphere protects life on Earth by absorbing harmful ultraviolet (UV) radiation. However, human activities have caused its depletion. The major chemicals responsible are chlorofluorocarbons (CFCs), which were widely used in refrigerators, air conditioners, and aerosol sprays.

Step 2: Analysis of Options:

- **Sulphur:** Leads to acid rain but does not affect ozone layer directly.
- **Carbon dioxide (CO₂):** Causes global warming, not ozone depletion.
- **Carbon:** Element itself has no role in ozone destruction.
- **Chlorofluorocarbons (CFCs):** Release chlorine atoms in the stratosphere, which break ozone (O₃) molecules into oxygen (O₂), reducing the protective layer.

Step 3: Detailed Explanation:

Each chlorine atom from CFCs can destroy thousands of ozone molecules. This results in the thinning of the ozone layer, commonly referred to as the “ozone hole”, especially observed over Antarctica.

Step 4: Final Answer:

The chemical mainly responsible for ozone depletion is **Chlorofluorocarbon (CFC)**.

Quick Tip

The Montreal Protocol (1987) was an international treaty to phase out CFCs and protect the ozone layer.

29. ‘Ahar and Pyne’ is the water harvesting system of which state?

- (A) Bihar
- (B) Uttar Pradesh
- (C) Maharashtra
- (D) Madhya Pradesh

Correct Answer: (A) Bihar

Solution:

Step 1: Understanding the Concept:

Traditional water harvesting systems in India vary region to region, depending on rainfall and geography. ‘Ahar’ and ‘Pyne’ are indigenous systems of Bihar, designed to manage flood and drought simultaneously.

Step 2: Detailed Explanation:

- **Ahar:** Reservoirs that store water, constructed with embankments to catch rainwater and floodwater.
- **Pyne:** Channels used to divert water from rivers to agricultural fields.
- Together, they ensure water availability for irrigation in drought-prone regions and control floods during heavy rainfall.

Step 3: Final Answer:

The traditional water harvesting system called 'Ahar and Pyne' belongs to **Bihar**.

Quick Tip

Other examples: Johads (Rajasthan), Kulhs (Himachal Pradesh), Tanks (South India).

30. Which of the following is a natural resource?

- (A) Soil
- (B) Water
- (C) Air
- (D) All of these

Correct Answer: (D) All of these

Solution:**Step 1: Understanding the Concept:**

Natural resources are materials obtained from nature that are used by humans for survival and development. They can be renewable or non-renewable.

Step 2: Analysis of Options:

- **Soil:** Essential for agriculture, supports plant growth, and provides habitat for organisms.
- **Water:** Vital for drinking, irrigation, electricity generation, and ecosystem balance.
- **Air:** Provides oxygen for respiration, carbon dioxide for photosynthesis, and nitrogen for agriculture.

Step 3: Detailed Explanation:

Since all three — soil, water, and air — are naturally available and essential for life, they all qualify as natural resources.

Step 4: Final Answer:

The correct answer is **All of these**.

Quick Tip

Natural resources are the foundation of life. Their conservation is necessary for sustainable development.

31. Which of the following is a forest-based industry?

- (A) Lac industry
- (B) Paper industry
- (C) Timber industry
- (D) All of these

Correct Answer: (D) All of these

Solution:

Step 1: Understanding the Concept:

A forest-based industry is one that depends on raw materials derived directly from forests. These industries utilize forest products like wood, bamboo, resins, lac, and leaves either as primary raw materials or as secondary support.

Step 2: Analysis of Options:

- **Lac industry:** Lac is a resinous substance secreted by insects found on trees. It is processed into shellac, varnishes, and sealing wax. Clearly dependent on forests.
- **Paper industry:** Requires wood pulp, bamboo, and other forest-based raw materials for manufacturing paper.
- **Timber industry:** Completely dependent on forest wood for furniture, construction, and other uses.

Step 3: Detailed Explanation:

Since all three options (lac, paper, and timber industries) rely heavily on forests, the correct answer is that all of them are forest-based.

Step 4: Final Answer:

The forest-based industries include **Lac, Paper, and Timber industries**, so the correct answer is **All of these**.

Quick Tip

Forest-based industries are important for rural employment but must be balanced with sustainable forestry to prevent deforestation.

32. We can get iodine in adequate quantity from which of the following?

- (A) Rice
- (B) Salt
- (C) Sugar
- (D) None of these

Correct Answer: (B) Salt

Solution:

Step 1: Understanding the Concept:

Iodine is an essential micronutrient required for the production of thyroid hormones (thyroxine). Deficiency of iodine causes goitre and other metabolic disorders.

Step 2: Analysis of Options:

- **Rice:** Provides carbohydrates, but not iodine.
- **Salt:** Iodized salt is fortified with iodine to prevent deficiency diseases. This is the main dietary source of iodine for humans.
- **Sugar:** Energy source, but contains no iodine.

Step 3: Detailed Explanation:

To combat iodine deficiency disorders, governments across the world promote the use of iodized salt. This ensures the population receives adequate iodine intake daily.

Step 4: Final Answer:

The primary source of iodine in adequate quantity is **Salt**.

Quick Tip

Always use iodized salt in diet — it helps prevent goitre and maintains proper thyroid function.

33. Which of the following is the primary source of energy in fossil fuels?

- (A) Moon
- (B) Nuclear fusion
- (C) Sun
- (D) None of these

Correct Answer: (C) Sun

Solution:

Step 1: Understanding the Concept:

Fossil fuels (coal, petroleum, natural gas) are formed from dead plants and animals buried under the Earth millions of years ago. The energy stored in them ultimately comes from sunlight, because plants used sunlight to carry out photosynthesis.

Step 2: Analysis of Options:

- **Moon:** Provides no energy for fossil fuel formation.

- **Nuclear fusion:** Occurs inside the Sun but is not directly cited as the process here.
- **Sun:** Plants captured solar energy through photosynthesis, and this energy got stored in biomass, which eventually turned into fossil fuels.

Step 3: Detailed Explanation:

Thus, when we burn coal, oil, or gas, we are actually releasing ancient solar energy stored in chemical bonds. This is why the Sun is considered the original source of fossil fuel energy.

Step 4: Final Answer:

The primary source of energy in fossil fuels is the **Sun**.

Quick Tip

All conventional fuels (wood, coal, petrol, gas) trace back to solar energy, showing the Sun is the ultimate source of energy on Earth.

34. In which of the following forms is energy available in the oceans?

- (A) Tidal energy
- (B) Wave energy
- (C) Oceanic thermal energy
- (D) All of these

Correct Answer: (D) All of these

Solution:

Step 1: Conceptual Understanding:

Oceans cover about 70% of the Earth's surface and store a vast amount of energy in different forms. Scientists have developed technologies to harness these various forms of ocean energy.

Step 2: Analysis of Options:

- **Tidal energy:** Produced due to gravitational attraction of the Moon and the Sun, which creates tides. By building tidal barrages, this energy can be converted into electricity.
- **Wave energy:** Generated by wind blowing across the surface of the oceans. Wave energy converters are designed to capture and transform this motion into electricity.
- **Oceanic thermal energy (OTEC):** The temperature difference between warm surface water and cold deep water in tropical oceans can be used to generate electricity.

Step 3: Detailed Explanation:

Since all three (tidal, wave, and ocean thermal) are available in oceans, energy can be harnessed in multiple ways. Therefore, the correct option is all of these.

Step 4: Final Answer:

The forms of energy available in oceans are **Tidal energy, Wave energy, and Oceanic**

thermal energy, i.e., All of these.

Quick Tip

Ocean energy is renewable and pollution-free but still under development due to high costs and limited technology.

35. In which state is Tarapur Nuclear Power Plant located?

- (A) Rajasthan
- (B) Gujarat
- (C) Maharashtra
- (D) Bihar

Correct Answer: (C) Maharashtra

Solution:

Step 1: Background Knowledge:

Nuclear power plants use controlled nuclear fission to generate electricity. Tarapur Atomic Power Station (TAPS) is one of the earliest and most important nuclear power plants in India.

Step 2: Detailed Explanation:

- Tarapur Nuclear Power Plant is located in Maharashtra, near Mumbai.
- It was the first commercial nuclear power station in India, established with US assistance under the 1960s Indo-US agreement.
- It uses boiling water reactors and pressurized heavy water reactors for power generation.
- The electricity produced here supplies Maharashtra and neighboring states.

Step 3: Final Answer:

The Tarapur Nuclear Power Plant is located in **Maharashtra**.

Quick Tip

India has several nuclear power plants like Rawatbhata (Rajasthan), Kakrapar (Gujarat), Kalpakkam (Tamil Nadu), and Kudankulam (Tamil Nadu).

36. The substances that take part in a reaction are called

- (A) Reducing agents
- (B) Reactants
- (C) Oxidising agents
- (D) Products

Correct Answer: (B) Reactants

Solution:

Step 1: Understanding the Concept:

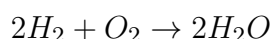
In any chemical reaction, the substances that undergo change are called reactants. They interact with each other, rearrange atoms, and form new substances called products.

Step 2: Analysis of Options:

- **Reducing agents:** Specific type of reactants that reduce other substances by donating electrons.
- **Oxidising agents:** Specific type of reactants that oxidize other substances by accepting electrons.
- **Reactants:** General term for all starting materials of a reaction.
- **Products:** The substances formed after the chemical reaction.

Step 3: Detailed Example:

In the reaction:



Hydrogen (H₂) and oxygen (O₂) are **reactants**, while water (H₂O) is the **product**.

Step 4: Final Answer:

The substances that take part in a reaction are called **Reactants**.

Quick Tip

Always remember: Reactants are present on the left-hand side of a chemical equation, while products are on the right-hand side.

37. The reaction, in which heat is also generated along with the formation of product, is called

- (A) Endothermic
- (B) Oxidation
- (C) Photosynthesis
- (D) Exothermic

Correct Answer: (D) Exothermic

Solution:

Step 1: Conceptual Background:

Chemical reactions can be broadly classified into two types based on heat energy:

- **Exothermic reactions:** Reactions that release energy (mainly heat) to the surroundings. These reactions feel warm/hot.
- **Endothermic reactions:** Reactions that absorb energy from the surroundings. These feel cool as they consume heat.

Step 2: Analysis of Options:

- (A) Endothermic → Absorbs heat, so incorrect.
- (B) Oxidation → Can be exothermic, but not the general classification term here.
- (C) Photosynthesis → Endothermic process as it requires sunlight (energy input).
- (D) Exothermic → Correct, since the question specifically asks about heat being generated during product formation.

Step 3: Examples:

- Combustion of fuels:



- Neutralization reaction (acid + base):



Step 4: Final Answer:

The reaction in which heat is produced along with the product is called an **Exothermic reaction**.

Quick Tip

Exothermic reactions release energy, while endothermic reactions absorb energy. Combustion, respiration, and neutralization are classic exothermic reactions.

38. Oxidation is a reaction in which there is

- (A) Dissociation of hydrogen
- (B) Loss of electrons
- (C) Addition of oxygen

(D) All of these

Correct Answer: (D) All of these

Solution:

Step 1: Conceptual Background:

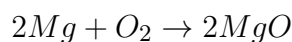
Oxidation is one of the fundamental concepts in chemistry, and its definition has evolved over time:

- **Classical definition:** Oxidation means the **addition of oxygen** or the **removal of hydrogen**.
- **Modern definition:** Oxidation refers to the **loss of electrons**.
- It is always coupled with reduction (gain of electrons) in a redox reaction.

Step 2: Analysis of Options:

- (A) Dissociation/removal of hydrogen → Yes, this is oxidation.
- (B) Loss of electrons → Yes, modern definition of oxidation.
- (C) Addition of oxygen → Yes, classical definition.
- (D) All of these → Since all above are valid, this is correct.

Step 3: Example:



Here, magnesium undergoes oxidation as it loses electrons and combines with oxygen.

Step 4: Final Answer:

Oxidation can involve **loss of hydrogen, loss of electrons, or addition of oxygen**, so the correct answer is **All of these**.

Quick Tip

Remember: Oxidation and reduction always occur together. If one substance is oxidized, another is reduced.

39. Which of the following is a synthetic indicator?

- (A) Turmeric
- (B) Litmus paper
- (C) Methyl orange
- (D) Red cabbage

Correct Answer: (C) Methyl orange

Solution:

Step 1: Conceptual Background:

Indicators are substances that change color in acidic or basic solutions, helping identify the pH of a solution. They are classified as:

- **Natural indicators:** Obtained from plants (e.g., turmeric, red cabbage, litmus).
- **Synthetic indicators:** Man-made in laboratories (e.g., phenolphthalein, methyl orange, methyl red).

Step 2: Analysis of Options:

- (A) Turmeric → Natural indicator, turns red in base.
- (B) Litmus paper → Natural indicator obtained from lichens.
- (C) Methyl orange → Synthetic indicator, orange in neutral, red in acid, yellow in base.
- (D) Red cabbage → Natural indicator, shows a variety of colors depending on pH.

Step 3: Detailed Explanation:

Since methyl orange is lab-made and widely used in titrations to detect endpoints, it qualifies as a synthetic indicator.

Step 4: Final Answer:

The synthetic indicator among the given options is **Methyl orange**.

Quick Tip

In titrations: Methyl orange is preferred for strong acid–weak base reactions, while phenolphthalein is used for strong base–weak acid reactions.

40. Which substance turns red litmus paper blue in aqueous solution?

- (A) Alkali
- (B) Acid
- (C) Salt
- (D) None of these

Correct Answer: (A) Alkali

Solution:

Step 1: Conceptual Background:

Litmus paper is a common natural indicator used to test whether a solution is acidic or basic.

- Acids turn blue litmus red.
- Bases (alkalis) turn red litmus blue.

Step 2: Analysis of Options:

- **Alkali:** A soluble base, e.g., NaOH, KOH. It turns red litmus blue, confirming alkalinity.
- **Acid:** Does the opposite — turns blue litmus red.
- **Salt:** Most salts are neutral and do not change litmus color.

Step 3: Example:

When red litmus paper is dipped in sodium hydroxide solution (alkali), it turns blue, indicating a basic solution.

Step 4: Final Answer:

The substance that turns red litmus paper blue is an **Alkali**.

Quick Tip

Litmus paper is a quick test, but for accuracy, synthetic indicators like phenolphthalein and methyl orange are also used.

41. Oiled paper is

- (A) Opaque
- (B) Transparent
- (C) Translucent
- (D) None of these

Correct Answer: (C) Translucent

Solution:

Step 1: Conceptual Understanding:

Objects are classified based on how much light they allow to pass through:

- **Transparent:** Allow almost all light to pass (glass, clean water).
- **Opaque:** Do not allow light to pass (wood, metal).
- **Translucent:** Allow partial light to pass, objects appear blurred (frosted glass, butter paper, oiled paper).

Step 2: Detailed Explanation:

Oiled paper scatters light as it passes through. Some light is transmitted but not clearly, so objects cannot be seen distinctly. Therefore, it is translucent.

Step 3: Final Answer:

Oiled paper is **Translucent**.

Quick Tip

Remember: Transparent = clear, Opaque = blocked, Translucent = blurred.

42. Which of the following is the beam of light coming from the Sun?

- (A) Converged light beam
- (B) Parallel light beam
- (C) Diverged light beam
- (D) All of these

Correct Answer: (B) Parallel light beam

Solution:

Step 1: Conceptual Background:

Sunlight travels as rays of light through space. Because the Sun is very far from Earth (about 150 million km), the rays reaching Earth are nearly parallel to each other.

Step 2: Analysis of Options:

- (A) Converged beam: Rays meeting at a single point — not correct for sunlight.
- (B) Parallel beam: Rays remain parallel — correct for sunlight.
- (C) Diverged beam: Rays spread outward — also not true for sunlight reaching Earth.

Step 3: Example:

This is why shadows of objects on Earth appear sharp and straight, as the incoming light is parallel.

Step 4: Final Answer:

The beam of light coming from the Sun is a **Parallel light beam**.

Quick Tip

Parallel rays are assumed in ray optics for sunlight because the Sun is extremely far away.

43. Which of the following is the imaginary (virtual) image formed in a convex mirror?

- (A) Inverted and magnified
- (B) Straight and small
- (C) Straight and magnified
- (D) None of these

Correct Answer: (B) Straight and small

Solution:

Step 1: Understanding the Concept:

Convex mirrors are curved outward and always produce virtual images. These images cannot be projected on a screen because the light rays do not actually meet but appear to diverge from a point.

Step 2: Characteristics of Image in Convex Mirror:

- Always virtual (imaginary).
- Always erect (straight).
- Always diminished (smaller than the object).

Step 3: Final Answer:

Thus, a convex mirror forms an image that is **Straight and small**.

Quick Tip

Convex mirrors are used as rear-view mirrors in vehicles because they provide a wider field of view.

44. Which of the following is the mirror formula?

- (A) $\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$
- (B) $\frac{1}{f} + \frac{1}{u} = \frac{1}{v}$
- (C) $\frac{1}{f} - \frac{1}{v} = \frac{1}{u}$
- (D) $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$

Correct Answer: (D) $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$

Solution:

Step 1: Formula Background:

In spherical mirrors, the relationship between focal length (f), object distance (u), and image distance (v) is expressed by the mirror formula.

Step 2: Standard Formula:

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$$

Step 3: Explanation:

This equation is valid for both concave and convex mirrors, provided proper sign conventions are followed (distances measured from pole, sign convention based on direction).

Step 4: Final Answer:

The correct mirror formula is $\frac{1}{f} = \frac{1}{v} + \frac{1}{u}$.

Quick Tip

Always use sign convention: distances measured against incoming light are negative, along light are positive.

45. How does a virtual image look like?

- (A) Inverted
- (B) Erect
- (C) Both (A) and (B)
- (D) None of these

Correct Answer: (B) Erect

Solution:**Step 1: Understanding the Concept:**

Virtual images are formed when light rays appear to diverge from a point behind the mirror or lens. Unlike real images, they cannot be projected onto a screen.

Step 2: Key Characteristics:

- Virtual images are always upright (erect).
- They are usually smaller (as in convex mirrors) but can also be larger (as in magnifying lenses).
- They appear behind the reflecting/refracting surface.

Step 3: Examples:

- Image in a plane mirror $\rightarrow$ always virtual and erect.

- Image in a convex mirror $\rightarrow$ always virtual, erect, and diminished.

Step 4: Final Answer:

A virtual image always appears **Erect**.

Quick Tip

Real images are inverted and projectable; virtual images are erect and non-projectable.

46. Which of the following mirrors has a positive focal length?

- (A) Convex mirror
- (B) Plane mirror
- (C) Concave mirror
- (D) None of these

Correct Answer: (C) Concave mirror

Solution:

Step 1: Conceptual Understanding:

The focal length (f) of a mirror is the distance between the pole and the focus. The sign convention determines whether f is positive or negative.

- **Concave mirror:** Focus is in front of the mirror $\rightarrow$ focal length is positive.
- **Convex mirror:** Focus lies behind the mirror $\rightarrow$ focal length is negative.
- **Plane mirror:** Focal length is considered infinite.

Step 2: Application:

Concave mirrors converge parallel rays to a real focus in front of them. Thus, according to the sign convention, their focal length is positive.

Step 3: Final Answer:

The mirror with positive focal length is the **Concave mirror**.

Quick Tip

Concave mirrors are used in torches, headlights, and solar cookers because they converge light at a real focus.

47. Which of the following is the focal length of a convex mirror whose radius of curvature is 32 cm?

- (A) -8 cm
- (B) +8 cm
- (C) -16 cm
- (D) +16 cm

Correct Answer: (A) -16 cm

Solution:

Step 1: Formula:

For spherical mirrors, the relationship between focal length (f) and radius of curvature (R) is:

$$f = \frac{R}{2}$$

Step 2: Substitution:

Here, $R = 32$ cm, so:

$$f = \frac{32}{2} = 16 \text{ cm}$$

Step 3: Sign Convention:

For a convex mirror, the focal length is always taken as **negative** (because the focus lies behind the mirror). Thus:

$$f = -16 \text{ cm}$$

Step 4: Final Answer:

The focal length of the convex mirror is **-16 cm**.

Quick Tip

Concave mirrors have positive focal length, convex mirrors have negative focal length as per sign convention.

48. Which of the following is a magnifying glass?

- (A) Concave mirror
- (B) Concave lens
- (C) Convex lens
- (D) None of these

Correct Answer: (C) Convex lens

Solution:

Step 1: Conceptual Understanding:

A magnifying glass is an optical device used to see small objects clearly by producing an enlarged image.

Step 2: Lens Behavior:

- A **concave lens** always produces diminished images, so it cannot magnify.
- A **concave mirror** can magnify when the object is placed between pole and focus, but it is not commonly used as a magnifying glass.
- A **convex lens** (converging lens) produces a virtual, erect, and magnified image when the object is placed between the focus and the lens. This is exactly the working principle of a magnifying glass.

Step 3: Example:

The convex lens bends parallel rays inward, making objects appear larger. This is why it is used in magnifying glasses and microscopes.

Step 4: Final Answer:

The magnifying glass is a **Convex lens**.

Quick Tip

Convex lenses are converging lenses. When used properly, they enlarge small objects for detailed viewing.

49. The chemical formula of bleaching powder is

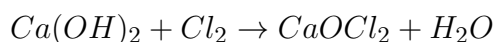
- (A) CaO
- (B) CaCl₂
- (C) CaOCl
- (D) CaOCl₂

Correct Answer: (D) CaOCl₂

Solution:

Step 1: Preparation:

Bleaching powder is produced by passing chlorine gas over dry slaked lime (Ca(OH)₂):



Step 2: Chemical Identity:

The compound formed is calcium oxychloride, whose formula is **CaOCl₂**.

Step 3: Uses:

- Used for bleaching cotton and paper.
- Used as a disinfectant in water treatment.

- Used as an oxidizing agent in industries.

Step 4: Final Answer:

The chemical formula of bleaching powder is **CaOCl₂**.

Quick Tip

Bleaching powder is also called calcium oxychloride and is widely used for purification and disinfection.

50. The ratio of HCl and HNO₃ in aqua regia is

- (A) 2 : 2
- (B) 1 : 2
- (C) 1 : 3
- (D) 3 : 1

Correct Answer: (D) 3 : 1

Solution:

Step 1: What is Aqua Regia?

Aqua regia (Latin for “royal water”) is a highly corrosive mixture of concentrated hydrochloric acid (HCl) and concentrated nitric acid (HNO₃). It is called “royal water” because it can dissolve noble metals like gold and platinum, which neither acid alone can dissolve.

Step 2: Ratio of Mixing:

The standard composition of aqua regia is:



That is, three parts of concentrated HCl mixed with one part of concentrated HNO₃.

Step 3: Chemistry Behind:

- HNO₃ acts as a strong oxidizing agent, producing nascent chlorine.
- Reaction:



- Here, chlorine gas and nitrosyl chloride (NOCl) are formed, which help dissolve noble metals.

Step 4: Final Answer:

The ratio of HCl and HNO₃ in aqua regia is **3 : 1**.

Quick Tip

Aqua regia must be prepared fresh because it loses reactivity quickly as chlorine escapes.

51. What type of salt is $\text{Pb}(\text{OH})\text{NO}_3$?

- (A) Common salt
- (B) Mixed salt
- (C) Acidic salt
- (D) Basic salt

Correct Answer: (D) Basic salt

Solution:

Step 1: Understanding Salts:

Salts are classified into different categories depending on their composition:

- **Normal salt:** Neutral salts formed by complete neutralization (e.g., NaCl).
- **Acidic salt:** Formed when a strong acid and weak base react; contains replaceable H^+ (e.g., NaHSO_4).
- **Basic salt:** Formed when a strong base and weak acid react; contains OH^- ions (e.g., $\text{Pb}(\text{OH})\text{NO}_3$).
- **Mixed salt:** Contains two different cations/anions (e.g., CaOCl_2).

Step 2: Analysis:

- $\text{Pb}(\text{OH})\text{NO}_3$ contains hydroxyl (OH^-) groups along with nitrate ion (NO_3^-).
- Presence of OH^- means it is a **basic salt**.

Step 3: Final Answer:

$\text{Pb}(\text{OH})\text{NO}_3$ is classified as a **Basic salt**.

Quick Tip

Basic salts are often formed when incomplete neutralization occurs between a weak acid and strong base.

52. The ratio of nitrogen and hydrogen atoms in one molecule of ammonia is

- (A) 1 : 3
- (B) 3 : 1
- (C) 1 : 2
- (D) 2 : 1

Correct Answer: (A) 1 : 3

Solution:

Step 1: Molecular Formula of Ammonia:

Ammonia is represented as NH_3 . This means:

- 1 atom of nitrogen (N).
- 3 atoms of hydrogen (H).

Step 2: Ratio:

Thus, the ratio of nitrogen to hydrogen is:

$$N : H = 1 : 3$$

Step 3: Importance:

- Ammonia is widely used in fertilizers (urea, ammonium nitrate).
- It plays a major role in the nitrogen cycle in nature.
- The ratio 1 : 3 also shows the covalent bonding between N and three H atoms.

Step 4: Final Answer:

The ratio of nitrogen and hydrogen atoms in NH_3 is **1 : 3**.

Quick Tip

Remember: Water (H_2O) = 2:1 (H:O), Carbon dioxide (CO_2) = 1:2 (C:O), Ammonia (NH_3) = 1:3 (N:H).

53. Which of the following is the most acidic oxide?

- (A) CaO
- (B) MgO
- (C) Na_2O
- (D) SO_2

Correct Answer: (D) SO_2

Solution:

Step 1: Classification of Oxides:

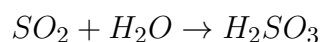
Oxides can be broadly classified as:

- **Basic oxides:** Formed by metals; react with acids (e.g., CaO, Na₂O, MgO).
- **Acidic oxides:** Formed by non-metals; react with bases to form salts and water (e.g., SO₂, CO₂).
- **Amphoteric oxides:** Show both acidic and basic behavior (e.g., Al₂O₃, ZnO).

Step 2: Analysis of Options:

- **CaO:** Strongly basic oxide.
- **MgO:** Basic oxide.
- **Na₂O:** Strongly basic oxide.
- **SO₂:** Acidic oxide, reacts with water to form sulphurous acid (H₂SO₃).

Step 3: Example Reaction:



Step 4: Final Answer:

The most acidic oxide among the given is **SO₂**.

Quick Tip

Rule of thumb: Metal oxides are generally basic; non-metal oxides are generally acidic.

54. Which of the elements represented by the following symbols is a metal?

- (A) ${}^{16}_8A$
- (B) ${}^{19}_9B$
- (C) ${}^{24}_{12}C$
- (D) ${}^{12}_6D$

Correct Answer: (C) ${}^{24}_{12}C$

Solution:

Step 1: Understanding Atomic Symbols:

The notation A_ZX represents:

- A = Mass number (protons + neutrons)

- Z = Atomic number (number of protons = number of electrons in neutral atom)
- X = Symbol of the element

Step 2: Analyzing Each Option:

- (A) ${}^8_8A \rightarrow$ Atomic number 8 $\rightarrow$ Oxygen $\rightarrow$ Non-metal.
- (B) ${}^9_9B \rightarrow$ Atomic number 9 $\rightarrow$ Fluorine $\rightarrow$ Non-metal.
- (C) ${}^{24}_{12}C \rightarrow$ Atomic number 12 $\rightarrow$ Magnesium $\rightarrow$ Metal.
- (D) ${}^{12}_6D \rightarrow$ Atomic number 6 $\rightarrow$ Carbon $\rightarrow$ Non-metal.

Step 3: Final Answer:

Among the given, the metal is **Magnesium** (${}^{24}_{12}C$).

Quick Tip

Metals are usually found on the left side of the periodic table, while non-metals are on the right.

55. An alloy of mercury and another metal is called

- (A) Bronze
- (B) Solder
- (C) Brass
- (D) Amalgam

Correct Answer: (D) Amalgam

Solution:

Step 1: Concept of Alloys:

An alloy is a homogeneous mixture of two or more metals, or a metal and a non-metal, designed to improve strength, durability, or resistance.

Step 2: Explanation of Options:

- **Bronze:** Alloy of copper and tin.
- **Solder:** Alloy of lead and tin.
- **Brass:** Alloy of copper and zinc.
- **Amalgam:** An alloy in which mercury (Hg) is one component, mixed with another metal (e.g., silver, tin).

Step 3: Uses of Amalgam:

- Used in dental fillings (silver amalgam).
- Used in extraction of gold and silver from ores.

Step 4: Final Answer:

The alloy of mercury with another metal is called an **Amalgam**.

Quick Tip

Amalgams are unique because mercury is liquid at room temperature, allowing easy mixing with other metals.

56. Which of the following is an allotrope of carbon?

- (A) Diamond
- (B) Fullerene
- (C) Graphite
- (D) All of these

Correct Answer: (D) All of these

Solution:

Step 1: Concept of Allotropy:

Allotropy is the property of an element to exist in two or more different physical forms in the same physical state. Carbon shows a wide variety of allotropes due to its versatile bonding ability.

Step 2: Explanation of Options:

- **Diamond:** Each carbon atom forms four covalent bonds (sp^3 hybridization). Hardest natural substance, used in cutting tools.
- **Graphite:** Each carbon atom bonds with three others (sp^2 hybridization). Conducts electricity due to free electrons. Used in pencils and lubricants.
- **Fullerene (C_{60}):** Carbon atoms arranged in a soccer-ball-like structure. Used in nanotechnology.

Step 3: Conclusion:

Since all these are known forms of carbon, they are allotropes.

Step 4: Final Answer:

The correct answer is **All of these**.

Quick Tip

Other allotropes of carbon include carbon nanotubes and graphene, both important in modern materials science.

57. In which lens can both real and virtual images be formed?

- (A) Convex lens
- (B) Concave lens
- (C) Both (A) and (B)
- (D) None of these

Correct Answer: (A) Convex lens

Solution:

Step 1: Lens Types and Their Images:

Lenses bend light rays due to refraction. Their ability to form images depends on their shape.

- **Convex lens (converging lens):** Can form both real and virtual images depending on the object's position.
- **Concave lens (diverging lens):** Always forms virtual, erect, and diminished images.

Step 2: Behavior of Convex Lens:

- If the object is placed **beyond $2F$** , the image is real, inverted, and smaller.
- If the object is at **$2F$** , the image is real, inverted, and same size.
- If the object is between **F and $2F$** , the image is real, inverted, and magnified.
- If the object is between **F and the lens**, the image is virtual, erect, and magnified.

Step 3: Conclusion:

Thus, only convex lenses can form both types of images (real & virtual).

Step 4: Final Answer:

The correct lens is the **Convex lens**.

Quick Tip

Convex lenses are used in cameras, projectors (real images) and magnifying glasses (virtual images).

58. How many colours are there in white light?

- (A) 1
- (B) 3
- (C) 5
- (D) 7

Correct Answer: (D) 7

Solution:

Step 1: Concept of White Light:

White light is a combination of multiple colours of light that can be separated by dispersion (passing through a prism).

Step 2: Newton's Prism Experiment:

Isaac Newton showed that white light splits into a spectrum of 7 colours when passed through a glass prism. This is called the VIBGYOR spectrum.

Step 3: Colours in White Light:

The seven colours are:

Violet, Indigo, Blue, Green, Yellow, Orange, Red

Step 4: Final Answer:

White light contains **7 colours**.

Quick Tip

Mnemonic for 7 colours of spectrum: VIBGYOR = Violet, Indigo, Blue, Green, Yellow, Orange, Red.

59. Which colour of white light bends the least after passing through a prism?

- (A) Blue
- (B) Red
- (C) Violet
- (D) Yellow

Correct Answer: (B) Red

Solution:

Step 1: Concept of Dispersion:

When white light passes through a prism, different colours bend by different amounts because each wavelength has a different refractive index in glass.

Step 2: Bending Order:

- **Violet:** Has the shortest wavelength, highest frequency, and bends the most.
- **Red:** Has the longest wavelength, lowest frequency, and bends the least.

Step 3: Example:

This is why in a rainbow, red appears at the top (least deviation) and violet at the bottom (most deviation).

Step 4: Final Answer:

The colour that bends the least through a prism is **Red**.

Quick Tip

Bending is inversely proportional to wavelength: shorter wavelength → more bending, longer wavelength → less bending.

60. Which of the following controls the size of the pupil?

- (A) Eye lens
- (B) Retina
- (C) Iris
- (D) Ciliary muscles

Correct Answer: (C) Iris

Solution:

Step 1: Role of Pupil and Iris:

The pupil is the small opening in the center of the eye that regulates the amount of light entering the eye. Its size is controlled by the **iris**, which is the coloured part of the eye.

Step 2: Function of Iris:

- In bright light → Iris contracts the pupil to reduce light entry.
- In dim light → Iris dilates the pupil to allow more light.

Step 3: Analysis of Options:

- Eye lens: Helps in focusing light, not controlling pupil size.
- Retina: Converts light into nerve impulses.
- Ciliary muscles: Change lens curvature, not pupil size.
- Iris: Controls pupil size. (Correct)

Step 4: Final Answer:

The **Iris** controls the size of the pupil.

Quick Tip

The iris acts like the diaphragm of a camera, controlling the amount of light that enters the eye.

61. Which lens is used in nearsightedness (myopia)?

- (A) Convex lens
- (B) Cylindrical lens
- (C) Concave lens
- (D) None of these

Correct Answer: (C) Concave lens

Solution:**Step 1: Understanding Myopia (Nearsightedness):**

Myopia is an eye defect in which a person can see nearby objects clearly but distant objects appear blurred. This happens because the image is formed in front of the retina instead of on it.

Step 2: Cause:

- Eyeball becomes elongated, or
- Lens becomes too curved, causing excessive convergence.

Step 3: Correction:

- To fix myopia, we use a **concave lens** (diverging lens).
- It diverges incoming rays before they enter the eye, so that the final image shifts backward onto the retina.

Step 4: Other Lenses:

- Convex lens → Used in hypermetropia (farsightedness).
- Cylindrical lens → Used in astigmatism.

Step 5: Final Answer:

Myopia is corrected using a **Concave lens**.

Quick Tip

Remember: Concave lens $\rightarrow$ Myopia, Convex lens $\rightarrow$ Hypermetropia, Cylindrical lens $\rightarrow$ Astigmatism.

62. Which of the following is the formula to find the resistance of a coil?

- (A) $R = V - I$
- (B) $R = \frac{V}{I}$
- (C) $R = V \times I$
- (D) $R = \frac{I}{V}$

Correct Answer: (B) $R = \frac{V}{I}$

Solution:

Step 1: Ohm's Law:

According to Ohm's law, the relationship between voltage (V), current (I), and resistance (R) is:

$$V = I \times R$$

Step 2: Rearranging:

$$R = \frac{V}{I}$$

Step 3: Explanation:

- $R = V - I \rightarrow$ Incorrect, subtraction is meaningless here.
- $R = V \times I \rightarrow$ Incorrect, this gives power ($P = VI$).
- $R = \frac{I}{V} \rightarrow$ Incorrect, reciprocal of resistance, not resistance.
- $R = \frac{V}{I} \rightarrow$ Correct formula for resistance.

Step 4: Example:

If a coil has $V = 10\text{ V}$ and $I = 2\text{ A}$, then:

$$R = \frac{10}{2} = 5\ \Omega$$

Step 5: Final Answer:

The resistance of a coil is given by $R = \frac{V}{I}$.

Quick Tip

Ohm's law: $V = IR$ is fundamental. Use $R = V/I$ to calculate resistance in any circuit.

63. The SI unit of resistance is

- (A) coulomb
- (B) joule
- (C) ampere
- (D) ohm

Correct Answer: (D) ohm

Solution:

Step 1: Definition of Resistance:

Resistance is the property of a conductor that opposes the flow of electric current. It is denoted by R .

Step 2: SI Unit:

According to Ohm's law:

$$R = \frac{V}{I}$$

where,

- V = Potential difference (in volts, V)
- I = Current (in amperes, A)

Thus,

$$\text{Unit of } R = \frac{\text{volt}}{\text{ampere}} = \Omega \text{ (ohm)}$$

Step 3: Analysis of Other Options:

- Coulomb $\rightarrow$ unit of charge.
- Joule $\rightarrow$ unit of energy.
- Ampere $\rightarrow$ unit of electric current.
- Ohm $\rightarrow$ correct SI unit of resistance.

Step 4: Final Answer:

The SI unit of resistance is **ohm** (Ω).

Quick Tip

One ohm is the resistance when a potential difference of 1 volt produces a current of 1 ampere.

64. Which of the following is the commercial unit of electrical energy?

- (A) watt/hour
- (B) unit
- (C) watt
- (D) none of these

Correct Answer: (B) unit

Solution:

Step 1: Basic Unit of Electrical Energy:

The SI unit of electrical energy is the joule (J).

$$1 \text{ joule} = 1 \text{ watt} \times 1 \text{ second}$$

Step 2: Commercial Unit:

In practice, energy consumed in households and industries is very large. So, the commercial unit is taken as:

$$1 \text{ unit} = 1 \text{ kWh} = 1000 \text{ watt} \times 3600 \text{ seconds} = 3.6 \times 10^6 \text{ joules}$$

Step 3: Analysis of Options:

- watt/hour $\rightarrow$ rate, not energy.
- watt $\rightarrow$ unit of power, not energy.
- unit $\rightarrow$ correct commercial unit.

Step 4: Final Answer:

The commercial unit of electrical energy is **unit (kWh)**.

Quick Tip

Electricity bills are calculated in units, where 1 unit = 1 kilowatt-hour.

65. Which of the following is a vestigial organ in the human alimentary canal?

- (A) Appendix
- (B) Colon
- (C) Caecum
- (D) Rectum

Correct Answer: (A) Appendix

Solution:

Step 1: Concept of Vestigial Organs:

Vestigial organs are body parts that have lost their original function through evolution but remain present in reduced form.

Step 2: Appendix in Humans:

The appendix is a small, finger-like projection attached to the caecum of the large intestine.

- In herbivorous animals, it helps in digesting cellulose.
- In humans, it has no significant digestive role and is considered vestigial.

Step 3: Analysis of Options:

- Colon → actively absorbs water and salts.
- Caecum → small pouch, but not vestigial.
- Rectum → stores feces before excretion.
- Appendix → vestigial organ.

Step 4: Final Answer:

The vestigial organ in the alimentary canal is the **Appendix**.

Quick Tip

Appendicitis is the inflammation of the appendix, sometimes requiring surgical removal.

66. The length of the small intestine in herbivorous animals is

- (A) Small
- (B) Medium
- (C) Longer
- (D) None of these

Correct Answer: (C) Longer

Solution:

Step 1: Digestion in Animals:

The length of the alimentary canal is related to the type of diet.

Step 2: Herbivores:

- Herbivores eat plant material rich in cellulose.
- Cellulose is difficult to digest, requiring more time.
- Therefore, herbivores have a much longer small intestine for effective digestion and absorption.

Step 3: Comparison:

- Carnivores → shorter small intestine because meat is easier to digest.
- Omnivores → medium length intestine.

Step 4: Final Answer:

The small intestine of herbivorous animals is **longer**.

Quick Tip

Length of intestine: Herbivores (longest), Omnivores (medium), Carnivores (shortest).

67. The completely digested food in the small intestine is called

- (A) Chyme
- (B) Chyle
- (C) Chylomicron
- (D) None of these

Correct Answer: (B) Chyle

Solution:

Step 1: Food Digestion Stages:

- In the stomach, partially digested food mixed with gastric juice is called **chyme**.
- In the small intestine, bile, pancreatic juice, and intestinal juice complete digestion.
- The final digested food in the small intestine is in the form of a whitish fluid called **chyle**.

Step 2: Composition of Chyle:

Chyle consists of simple sugars, amino acids, fatty acids, glycerol, vitamins, minerals, and water.

Step 3: Analysis of Options:

- Chyme → semi-digested food in stomach (not correct here).
- Chyle (Chyle) → completely digested food in small intestine (correct).

- Chylomicron → microscopic fat droplets formed during absorption, not the entire digested food.

Step 4: Final Answer:

Completely digested food in the small intestine is called **Chyle**.

Quick Tip

Remember: Chyme (stomach), Chyle (small intestine).

68. By which method is water absorbed by root hairs?

- (A) Transfer
- (B) Diffusion
- (C) Osmosis
- (D) Both (A) and (B)

Correct Answer: (C) Osmosis

Solution:

Step 1: Role of Root Hairs:

Root hairs are thin-walled extensions of root epidermal cells. They increase surface area for water absorption from soil.

Step 2: Mechanism:

- Soil solution has higher water concentration (low solute).
- Cell sap inside root hairs has lower water concentration (high solute).
- Due to this concentration gradient, water moves from soil into root hairs through **osmosis**.

Step 3: Why Not Other Options?

- Transfer → Not a scientific absorption method.
- Diffusion → Applies to gases/solutes, but water absorption in plants occurs via osmosis.
- Osmosis → Movement of water across a semi-permeable membrane, correct here.

Step 4: Final Answer:

Water is absorbed by root hairs through **Osmosis**.

Quick Tip

Osmosis is the passive movement of water from high concentration to low concentration across a semi-permeable membrane.

69. The condition of high blood pressure is called

- (A) Paralysis
- (B) Hypotension
- (C) Hypertension
- (D) None of these

Correct Answer: (C) Hypertension

Solution:

Step 1: Understanding Blood Pressure:

Blood pressure is the force exerted by circulating blood on the walls of arteries. It is measured in mmHg and expressed as:

$$\text{Normal BP} = 120/80 \text{ mmHg}$$

Step 2: Condition of High Blood Pressure:

When blood pressure is consistently above normal (e.g., 140/90 mmHg or more), the condition is called **Hypertension**.

Step 3: Why Other Options are Wrong:

- Paralysis → Loss of muscle control, unrelated to blood pressure.
- Hypotension → Low blood pressure, opposite condition.
- Hypertension → High blood pressure (correct).

Step 4: Risks of Hypertension:

Prolonged high blood pressure can lead to:

- Heart attack
- Stroke
- Kidney damage

Step 5: Final Answer:

The condition of high blood pressure is called **Hypertension**.

Quick Tip

“Hypo” = low, “Hyper” = high. Hypertension = high BP, Hypotension = low BP.

70. How many pairs of respiratory pores are found in a cockroach?

- (A) 2
- (B) 6
- (C) 8
- (D) 10

Correct Answer: (D) 10

Solution:

Step 1: Cockroach Respiratory System:

Cockroaches breathe through small openings on the sides of their body called **spiracles** (respiratory pores).

Step 2: Arrangement of Spiracles:

They are paired and arranged laterally on the thorax and abdomen. In total, there are 20 spiracles present, i.e. **10 pairs**.

Step 3: Function:

Spiracles are connected to a network of tracheae and tracheoles, which carry oxygen directly to body tissues without blood circulation involvement.

Step 4: Final Answer:

Cockroaches have **10 pairs of respiratory pores (spiracles)**.

Quick Tip

Insects breathe through spiracles, not lungs. Gas exchange occurs via tracheal tubes.

71. The flow of blood in the heart is

- (A) From left atrium to left ventricle
- (B) From right atrium to right ventricle
- (C) From right atrium to left ventricle
- (D) Both (A) and (B)

Correct Answer: (D) Both (A) and (B)

Solution:

Step 1: Structure of Heart:

The human heart has four chambers:

- Right atrium

- Right ventricle
- Left atrium
- Left ventricle

Step 2: Flow of Blood:

- Blood flows from **left atrium** → **left ventricle**.
- Blood flows from **right atrium** → **right ventricle**.
- Blood never flows directly from right atrium to left ventricle.

Step 3: Conclusion:

Therefore, correct blood flow includes both options (A) and (B).

Step 4: Final Answer:

Blood flows **from left atrium to left ventricle and from right atrium to right ventricle**.

Quick Tip

Remember: Atrium always pumps blood into the ventricle on the same side of the heart.

72. Blood is

- (A) Nervous tissue
- (B) Epithelial tissue
- (C) Connective tissue
- (D) Muscular tissue

Correct Answer: (C) Connective tissue

Solution:

Step 1: Definition of Connective Tissue:

Connective tissue connects, supports, and binds other tissues of the body. It usually has a matrix in which cells are embedded.

Step 2: Why Blood is a Connective Tissue:

- Blood has a fluid matrix called **plasma**.
- Plasma carries cells like RBCs, WBCs, and platelets.
- Blood transports nutrients, gases, hormones, and waste, thus connecting all organs.

Step 3: Other Options:

- Nervous tissue → transmits impulses.
- Epithelial tissue → protective covering.
- Muscular tissue → responsible for movement.

Step 4: Final Answer:

Blood is a type of **Connective tissue**.

Quick Tip

Blood connects different parts of the body by transporting oxygen, nutrients, and waste products.

73. Which blood group is known as universal donor?

- (A) A
- (B) B
- (C) O
- (D) AB

Correct Answer: (C) O

Solution:

Step 1: Concept of Blood Groups:

Human blood groups are classified into A, B, AB, and O based on the presence or absence of antigens on RBCs.

Step 2: Universal Donor:

- Blood group O has no antigens (A or B) on its RBC surface.
- Hence, it can be safely donated to people of any other blood group.
- Therefore, O group is called the **universal donor**.

Step 3: Universal Recipient:

- AB group contains both A and B antigens but no antibodies.
- Therefore, AB group can receive blood from any group and is called the **universal recipient**.

Step 4: Final Answer:

The universal donor blood group is **O**.

Quick Tip

Blood group O → Universal donor. Blood group AB → Universal recipient.

74. The process of purification of blood by dialysis machine is called

- (A) Dialyzer
- (B) Haemodialysis
- (C) Dialysate
- (D) Cellophane

Correct Answer: (B) Haemodialysis

Solution:

Step 1: Kidney Function:

Kidneys remove nitrogenous wastes (like urea) and maintain water and salt balance. When kidneys fail, these wastes accumulate in the body, which can be life-threatening.

Step 2: Dialysis:

- Dialysis is an artificial process of purifying blood when kidneys cannot function properly.
- The process using a dialysis machine is specifically called **Haemodialysis**.

Step 3: Explanation of Options:

- Dialyzer → The actual machine used in dialysis.
- Haemodialysis → Correct name of the purification process.
- Dialysate → The fluid used in dialysis.
- Cellophane → Material used in dialysis membrane.

Step 4: Final Answer:

The purification of blood by dialysis machine is called **Haemodialysis**.

Quick Tip

Dialysis is a life-saving process for kidney patients. Transplantation is the permanent solution, but dialysis keeps the body functioning meanwhile.

75. How do protozoans expel excretory substances?

- (A) By absorption
- (B) By expulsion
- (C) By osmosis
- (D) By diffusion

Correct Answer: (D) By diffusion

Solution:

Step 1: Protozoans and Excretion:

Protozoans like Amoeba are unicellular organisms without specialized excretory organs.

Step 2: Mechanism:

- Nitrogenous wastes like ammonia are soluble in water.
- They are removed from the body by **simple diffusion** across the cell membrane.
- Sometimes contractile vacuoles also help in regulating excess water and excretion.

Step 3: Why Not Other Options?

- Absorption → Brings substances in, not excretion.
- Expulsion → Active removal, not suitable for unicellular organisms.
- Osmosis → Refers to water movement, not excretion of wastes.
- Diffusion → Correct, since waste moves from high to low concentration.

Step 4: Final Answer:

Protozoans expel excretory substances by **diffusion**.

Quick Tip

Small unicellular organisms rely on diffusion for respiration and excretion as they lack specialized organs.

76. Which excretory substance is mainly released from acacia plants?

- (A) Resin
- (B) Tannin
- (C) Latex
- (D) Gum

Correct Answer: (D) Gum

Solution:

Step 1: Plant Excretory Products:

Plants also produce waste products, which they store or release in different forms such as resins, gums, latex, and tannins.

Step 2: Acacia Plants:

- Acacia species (like babool, kikar) produce a large amount of **gum**.
- Gum is a byproduct formed due to the breakdown of plant cell walls and is released through stems.

Step 3: Use of Gum:

Gum from Acacia is commercially used in adhesives, medicines, and food industries.

Step 4: Final Answer:

The main excretory substance released from acacia plants is **Gum**.

Quick Tip

Resin → released from pine trees; Latex → rubber plants; Tannin → tea and bark; Gum → Acacia plants.

77. Which is the largest part of the human brain?

- (A) Cerebellum
- (B) Cerebrum
- (C) Medulla oblongata
- (D) None of these

Correct Answer: (B) Cerebrum

Solution:

Step 1: Structure of Brain:

The human brain has three main parts:

- Cerebrum
- Cerebellum
- Medulla oblongata (part of brainstem)

Step 2: Cerebrum:

- Largest part of the brain, occupying nearly 80% of its weight.

- Divided into left and right hemispheres.
- Controls intelligence, memory, reasoning, emotions, and voluntary activities.

Step 3: Other Parts:

- Cerebellum → controls posture, balance, coordination.
- Medulla → controls involuntary actions (heartbeat, breathing).

Step 4: Final Answer:

The largest part of the human brain is the **Cerebrum**.

Quick Tip

Cerebrum = intelligence center, Cerebellum = balance, Medulla = involuntary actions.

78. Testosterone is secreted by

- (A) Ovary
- (B) Testis
- (C) Kidney
- (D) None of these

Correct Answer: (B) Testis

Solution:

Step 1: About Testosterone:

Testosterone is the primary male sex hormone responsible for the development of male reproductive tissues and secondary sexual characteristics (e.g., facial hair, deep voice, muscle growth).

Step 2: Organ of Secretion:

- In males, it is secreted by the **Leydig cells** present in the testis.
- In females, ovaries secrete small amounts of testosterone, but in very low concentration.

Step 3: Other Options:

- Ovary → secretes estrogen and progesterone (female hormones).
- Kidney → secretes erythropoietin, not testosterone.

Step 4: Final Answer:

Testosterone is secreted by the **Testis**.

Quick Tip

Leydig cells in testes are the main source of testosterone in males.

79. Hormone that stops cell division in plants is called

- (A) Auxin
- (B) Ethylene
- (C) Cytokinin
- (D) Absciscic acid

Correct Answer: (D) Absciscic acid

Solution:

Step 1: Plant Hormones and Their Roles:

- Auxin → promotes cell elongation.
- Cytokinin → promotes cell division.
- Ethylene → helps in ripening of fruits.
- Absciscic acid (ABA) → inhibits growth and stops cell division.

Step 2: Function of Absciscic Acid:

- ABA is known as the **stress hormone** in plants.
- It prevents cell division and growth during unfavorable conditions (e.g., drought).
- It also induces stomatal closure to prevent water loss.

Step 3: Final Answer:

The hormone that stops cell division in plants is **Absciscic acid**.

Quick Tip

Cytokinin promotes cell division, while Absciscic acid inhibits it.

80. The male reproductive organ of a flower is called

- (A) Gynoecium
- (B) Petal
- (C) Stamens
- (D) None of these

Correct Answer: (C) Stamens

Solution:

Step 1: Structure of a Flower:

A typical flower consists of:

- Sepals (Calyx)
- Petals (Corolla)
- Stamens (Androecium → male part)
- Carpel/Gynoecium (female part)

Step 2: Stamens:

- Each stamen has two parts: - **Anther:** Produces pollen grains (male gametes). - **Filament:** Supports the anther.

Step 3: Other Options:

- Gynoecium → female reproductive organ (carpel/pistil).
- Petals → colorful structures, attract pollinators.

Step 4: Final Answer:

The male reproductive organ of a flower is **Stamens**.

Quick Tip

Remember: Androecium = male part (stamens), Gynoecium = female part (carpel/pistil).

Section - B(Physics)

1. What is light beam? How many types of it are there?

Solution:

Step 1: Definition of Light Beam

A **light beam** is defined as a collection or bundle of light rays that travel in the same region of space. Unlike a single ray, which is only an idealized line showing the direction of light, a beam is a practical and visible stream of light that we observe in daily life. For example, when sunlight enters a dark room through a small hole, we can see a clear beam of light with dust particles floating in it.

Step 2: Physical Explanation

Light beams are formed because light rays emerging from the same source usually travel together. Their paths may either be straight, converging at a point, or diverging from a point. This allows us to classify beams into categories.

Step 3: Types of Light Beams

- **Parallel Beam:** All rays are parallel to each other. Such beams do not meet and remain equidistant. Example: Rays coming from the Sun are nearly parallel when they reach Earth.
- **Convergent Beam:** The rays move closer and meet at a single point. Example: A convex lens focusing sunlight on paper produces a convergent beam.
- **Divergent Beam:** The rays spread outward from a point. Example: A torch, bulb, or the headlight of a car produces a divergent beam.

Step 4: Real-Life Importance

Beams of light are important in optics for designing instruments like projectors, microscopes, telescopes, and even in lasers where a very fine parallel beam is produced for medical and industrial applications.

Final Answer:

A light beam is a group of light rays, and it can be of three types: **parallel, convergent, or divergent**.

Quick Tip

Remember: Lasers produce a highly parallel (collimated) beam, while a torch produces a divergent beam. Lenses are used to convert one form of beam into another.

2. Why does the coin placed in water appear raised?

Solution:

Step 1: Refraction of Light

When light passes from one medium to another (for example, from water to air), its speed changes because the optical density of the medium changes. This bending of light rays at the interface is called **refraction**.

Step 2: Coin Example

A coin placed at the bottom of a glass of water sends light rays upwards. As these rays pass from water (denser medium) to air (rarer medium), they bend away from the normal.

Step 3: Virtual Image Formation

The refracted rays do not come from the actual position of the coin but appear to be coming from a point slightly above it. To the observer's eye, the coin seems to be raised. This shifted position is called a **virtual image**.

Step 4: Scientific Explanation

The apparent depth of the coin is less than the real depth because of refraction. This is why swimming pools look shallower than they really are.

Step 5: Real-Life Applications

- This principle is used in designing lenses and optical instruments.
- Fishermen often notice that fish inside water do not appear at their actual position; they appear raised. That is why aiming directly at the fish misses the target.

Final Answer:

The coin appears raised due to the **refraction of light** at the boundary of water and air, which shifts its apparent position upward.

Quick Tip

Formula for apparent depth: $\text{Apparent depth} = \frac{\text{Real depth}}{\text{Refractive index}}.$

3. Write the main differences between stars and planets.**Solution:****Step 1: Definition of Stars**

Stars are luminous celestial objects that generate their own light and heat by nuclear fusion reactions taking place in their core. Example: the Sun.

Step 2: Definition of Planets

Planets are non-luminous celestial bodies that revolve around stars. They shine by reflecting the light of the star they orbit. Example: Earth, Mars, Jupiter.

Step 3: Key Differences in a Table

Stars	Planets
Self-luminous, produce their own light and heat.	Non-luminous, reflect light from stars.
Fixed position in sky relative to each other.	Change position with respect to stars.
Massive size and very high temperature.	Smaller in size and relatively cooler.
Examples: Sun, Sirius, Polaris.	Examples: Earth, Venus, Saturn.

Step 4: Real-Life Importance

- Stars help us study the universe and understand nuclear fusion.
- Planets provide suitable conditions for life (like Earth).

Final Answer:

Stars emit their own light and energy, while planets are non-luminous bodies that revolve around stars and shine only by reflecting light.

Quick Tip

A star like the Sun has a lifespan of billions of years, while planets have no internal source of energy.

4. How does an electromagnet work?

Solution:

Step 1: Introduction

An **electromagnet** is a type of temporary magnet which is formed by passing electric current through a coil wound around a soft iron core. Unlike permanent magnets, its magnetism can be turned on and off.

Step 2: Principle

It works on the principle of **electromagnetism**, discovered by Hans Christian Oersted. According to this principle, whenever current flows through a conductor, it produces a magnetic field around it.

Step 3: Construction

- A long insulated copper wire is wound around a soft iron rod.
- The ends of the wire are connected to a battery or power source.
- When current flows, the iron core becomes magnetized and acts as a magnet.

Step 4: Working

- When the circuit is switched ON, the current generates a strong magnetic field.
- The soft iron core concentrates this magnetic field and becomes a powerful magnet.
- When the circuit is switched OFF, the magnetism disappears almost completely.

Step 5: Factors Affecting Strength

- Number of turns of the coil.
- Magnitude of current.
- Nature of the core material.

Step 6: Applications

- Used in electric bells and buzzers.
- Used in electric motors, relays, transformers.
- Used in cranes to lift heavy iron objects in junkyards.

Final Answer:

An electromagnet works because **electric current produces a magnetic field**. The iron core enhances this field, making it strong enough for practical uses.

Quick Tip

Permanent magnets cannot be switched off, but electromagnets can — making them more useful in industries and machines.

5. What is nuclear fusion?

Solution:

Step 1: Definition

Nuclear fusion is a process in which two or more light atomic nuclei combine to form a heavier and more stable nucleus. During this process, a tremendous amount of energy is released.

Step 2: Scientific Explanation

- Fusion generally occurs with isotopes of hydrogen, such as Deuterium (2_1H) and Tritium (3_1H).
- When these nuclei fuse under extremely high temperature and pressure, they form Helium (4_2He) and release a large amount of energy in the form of light and heat.

Step 3: Fusion Reaction Equation



Step 4: Where Does It Occur?

- **In Stars:** The Sun and other stars shine due to nuclear fusion reactions occurring at their core.
- **In Hydrogen Bombs:** Human technology has used uncontrolled fusion for weapons.

Step 5: Importance

- Fusion produces much more energy than nuclear fission.
- It is considered the ultimate source of renewable energy if controlled fusion can be achieved on Earth.

Final Answer:

Nuclear fusion is the process of combining lighter nuclei (like hydrogen isotopes) to form a heavier nucleus (helium), releasing a huge amount of energy.

Quick Tip

Fusion requires extremely high temperature (about 10^7 K) and pressure, which is why it is very hard to achieve on Earth.

6. What is electric current? Write its equation and unit.

Solution:

Step 1: Definition

Electric current is defined as the rate of flow of electric charge through a conductor in a given time. In metals, the charges are carried by electrons.

Step 2: Formula of Current

If Q is the amount of charge flowing through a conductor in time t , then:

$$I = \frac{Q}{t}$$

Step 3: SI Unit of Current

The SI unit of electric current is the **Ampere (A)**.

- 1 Ampere = Flow of 1 Coulomb of charge in 1 second.
- $1 A = \frac{1C}{1s}$

Step 4: Equation by Ohm's Law

According to Ohm's Law, the current can also be written as:

$$I = \frac{V}{R}$$

where V is potential difference and R is resistance.

Step 5: Importance in Daily Life

- Electric current powers household appliances, lights, fans, refrigerators, etc.
- It is the basis of modern technology — computers, communication systems, medical equipment all rely on controlled electric currents.

Final Answer:

Electric current is the rate of flow of charges. Its formula is $I = \frac{Q}{t}$ and its SI unit is Ampere (A).

Quick Tip

Remember: Current is a scalar quantity, but it has direction defined as the flow of positive charges (conventional current).

7. What is fossil fuel? Write with example.

Solution:

Step 1: Definition

Fossil fuels are natural fuels that are formed from the remains of dead plants and animals buried deep inside the Earth for millions of years. Due to high pressure and temperature, these remains are converted into carbon-rich substances.

Step 2: Types of Fossil Fuels

- **Coal:** Solid fossil fuel mainly made of carbon.
- **Petroleum:** Liquid fossil fuel, also called crude oil, refined into petrol, diesel, kerosene.
- **Natural Gas:** Gaseous fossil fuel consisting mainly of methane (CH_4).

Step 3: Examples

- Coal used in thermal power plants.
- Petrol and diesel used in vehicles.
- CNG (Compressed Natural Gas) used in buses and cars.

Step 4: Importance

Fossil fuels are the primary source of energy for industries, transport, and electricity production. However, their overuse causes pollution and global warming.

Final Answer:

Fossil fuels are energy-rich substances formed from dead organisms over millions of years. Examples: coal, petroleum, natural gas.

Quick Tip

Fossil fuels are non-renewable — once exhausted, they cannot be quickly replenished.

8. What are renewable and non-renewable sources?

Solution:

Step 1: Renewable Sources

These are sources of energy that can be naturally replenished within a short period of time. They are sustainable and eco-friendly. Examples: Solar energy, wind energy, hydro power, biomass, geothermal energy.

Step 2: Non-Renewable Sources

These are sources of energy that cannot be replenished quickly. They take millions of years to form and will eventually be exhausted. Examples: Coal, petroleum, natural gas, nuclear fuels.

Step 3: Comparison Table

Renewable Sources	Non-Renewable Sources
Inexhaustible and sustainable.	Limited and exhaustible.
Do not pollute the environment.	Cause pollution and greenhouse gases.
Examples: Sunlight, wind.	Examples: Coal, petroleum.

Step 4: Importance

- Renewable sources are the key to sustainable development.
- Non-renewable sources currently supply most of the world's energy but are causing climate change.

Final Answer:

Renewable sources are naturally replenished energy sources like solar and wind, while non-renewable sources are limited and include coal, petroleum, and natural gas.

Quick Tip

Future energy security depends on shifting from non-renewable to renewable sources.

9. Describe Oersted's experiment to show that a magnetic field is produced around a current carrying conductor wire.

Solution:

Step 1: Background

Before Oersted's discovery (1820), electricity and magnetism were considered two separate

phenomena. Hans Christian Oersted's experiment showed for the first time that an electric current can produce a magnetic field, thus linking electricity and magnetism.

Step 2: Apparatus Required

- A straight conducting wire.
- A stand to hold the wire horizontally.
- A battery to pass current.
- A key (switch).
- A magnetic compass needle.

Step 3: Procedure

1. Place the straight conducting wire above a magnetic compass needle.
2. Connect the wire to the battery and key.
3. When no current flows, the compass needle points in the north-south direction (Earth's magnetic field).
4. Now close the key to allow current through the wire.
5. It is observed that the compass needle gets deflected from its north-south direction.
6. The deflection changes when the direction of current is reversed.

Step 4: Observation

The compass needle is deflected only when current flows through the wire. This proves that a magnetic field is produced around the conductor. The direction of this magnetic field depends on the direction of current.

Step 5: Conclusion

Oersted concluded that **electric current produces a magnetic field around the conductor**. The direction of this field is given by the **Right-Hand Thumb Rule**.

Step 6: Real-Life Applications

- Basis of electromagnets and electric motors.
- Principle of transformers and generators.
- Used in MRI scanners and loudspeakers.

Final Answer:

Oersted's experiment demonstrated the fundamental principle of electromagnetism — a current carrying conductor produces a magnetic field around it.

Quick Tip

Right-Hand Thumb Rule: If the thumb points in the direction of current, the curled fingers show the direction of magnetic field lines.

10. Describe a method to find the focal length of a convex lens.

Solution:

Step 1: Background

The focal length of a convex lens is the distance between its optical centre and the principal focus (the point where parallel rays of light converge after refraction). Finding the focal length is important for optical instruments such as cameras, microscopes, and telescopes.

Step 2: Apparatus Required

- Convex lens.
- Lens holder.
- Screen (white paper or cardboard).
- A distant object (like the Sun or a tree).
- Scale or ruler.

Step 3: Procedure

1. Fix the convex lens in the lens holder.
2. Place the screen behind the lens.
3. Focus the lens on a distant object (for better accuracy, the Sun can be used).
4. Adjust the position of the screen until a sharp and inverted image of the object is obtained.
5. Measure the distance between the lens and the screen using a scale.

Step 4: Observation

When the sharp image is formed, the distance between the lens and the screen gives the **focal length of the convex lens**.

Step 5: Formula

In general, the lens formula can also be used:

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$

where f = focal length, v = image distance, u = object distance.

Step 6: Real-Life Applications

- Used in the design of eyeglasses for correcting vision.
- Essential in optical devices like projectors, cameras, and microscopes.
- Helps determine magnification power of the lens.

Final Answer:

The focal length of a convex lens can be found by focusing a distant object onto a screen and measuring the distance between the lens and the screen. This distance is equal to the focal length.

Quick Tip

While using the Sun for the experiment, avoid looking directly through the lens as it may harm the eyes.

Chemistry

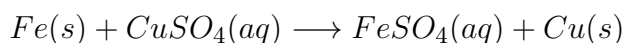
11. Why does the colour of the solution change when a piece of iron is added to copper sulphate solution?

Solution:**Step 1: Background**

Copper sulphate solution is blue in colour due to the presence of Cu^{2+} ions. When a piece of iron is dipped into it, a chemical reaction occurs which changes the colour of the solution.

Step 2: Reaction Explanation

Iron is more reactive than copper (higher in the reactivity series). Hence, iron displaces copper from copper sulphate solution:

**Step 3: Observation**

- Blue colour of $CuSO_4$ solution fades gradually and turns green due to the formation of ferrous sulphate ($FeSO_4$).
- Brownish-red copper metal deposits on the iron strip.

Step 4: Scientific Reason

This is a **displacement reaction**, where a more reactive metal (iron) replaces a less reactive metal (copper) from its compound.

Final Answer:

The colour changes from blue to green because iron displaces copper from $CuSO_4$ solution, forming green $FeSO_4$.

Quick Tip

This experiment is used to demonstrate reactivity series of metals.

12. Why is it necessary to keep the plaster of Paris away from moisture? Explain.

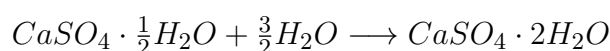
Solution:

Step 1: Definition of Plaster of Paris (POP)

Plaster of Paris is chemically $CaSO_4 \cdot \frac{1}{2}H_2O$. It is obtained by heating gypsum ($CaSO_4 \cdot 2H_2O$).

Step 2: Reaction with Moisture

POP easily absorbs moisture from air. In presence of water, it gets converted back into gypsum:



Step 3: Reason for Storage Precaution

If POP absorbs moisture, it loses its setting property and hardens prematurely, making it useless for practical applications.

Step 4: Applications of POP

- Used in surgical bandages (fractures).
- Used for making decorative materials and false ceilings.
- Used for smooth finishing of walls.

Final Answer:

POP must be kept away from moisture because it reacts with water and becomes gypsum, losing its usability.

Quick Tip

POP is always stored in airtight containers to prevent contact with moisture.

13. What are acids? Give any two examples. Explain the effect of an acid on an indicator.

Solution:

Step 1: Definition

Acids are substances which produce hydrogen ions (H^+ or H_3O^+) in aqueous solution.

Step 2: Examples

- Hydrochloric acid (HCl)
- Sulphuric acid (H_2SO_4)

Step 3: Effect on Indicators

Acids change the colour of indicators:

- **Litmus:** Turns blue litmus to red.

- **Methyl Orange:** Turns orange to red.
- **Phenolphthalein:** Remains colourless in acids.

Step 4: Scientific Reason

Indicators are weak organic dyes whose molecular structure changes in presence of H^+ ions, leading to colour change.

Step 5: Applications

Acid-base indicators are widely used in chemical laboratories, titrations, and testing soil pH.

Final Answer:

Acids release hydrogen ions in solution. Examples: HCl , H_2SO_4 . They turn blue litmus red and show distinct colour changes with indicators.

Quick Tip

Strong acids release more H^+ ions, while weak acids release fewer ions in solution.

14. Why is sodium metal kept immersed in kerosene?

Solution:

Step 1: Reactivity of Sodium

Sodium is a very highly reactive alkali metal. It reacts vigorously with oxygen, water, and even moisture in the air.

Step 2: Reaction with Oxygen and Water



This reaction is so violent that it may cause explosion due to heat and hydrogen gas.

Step 3: Storage Method

To prevent accidental reaction, sodium is stored under kerosene. Kerosene is an organic liquid that does not react with sodium and isolates it from moisture and air.

Step 4: Applications of Sodium

- Used in making soaps and detergents.
- Used in sodium vapour lamps.
- Used as a reducing agent in chemical industries.

Final Answer:

Sodium is kept in kerosene to prevent violent reactions with air or water, which could cause fire or explosions.

Quick Tip

Other highly reactive alkali metals like potassium are also stored in kerosene for safety.

15. Which metallic property does graphite exhibit despite being a non-metal?

Solution:

Step 1: Nature of Graphite

Graphite is an allotrope of carbon. Chemically it is a non-metal, but it shows one important property of metals.

Step 2: Structure of Graphite

Graphite has a layered structure. Each carbon atom is covalently bonded to three other carbon atoms forming hexagonal sheets. The fourth electron of each carbon atom is free and delocalised.

Step 3: Metallic Property Exhibited

Due to the presence of free electrons, graphite is a good conductor of electricity, which is a property normally associated with metals.

Step 4: Applications of Conductivity

- Graphite is used as an electrode in electrolysis.
- It is used in batteries and arc lamps.
- It is also used in making brushes for electric motors.

Final Answer:

Although graphite is a non-metal, it exhibits the **metallic property of electrical conductivity**.

Quick Tip

Diamond, another allotrope of carbon, is an insulator, showing how properties can differ among allotropes.

16. What are aliphatic compounds?

Solution:

Step 1: Definition

Aliphatic compounds are organic compounds in which carbon atoms form open chains (straight or branched), rather than closed rings.

Step 2: Types of Aliphatic Compounds

- **Alkanes:** Saturated hydrocarbons with single bonds (e.g., methane CH_4 , ethane C_2H_6).
- **Alkenes:** Unsaturated hydrocarbons with double bonds (e.g., ethene C_2H_4).
- **Alkynes:** Unsaturated hydrocarbons with triple bonds (e.g., ethyne C_2H_2).

Step 3: Examples

- Butane (C_4H_{10}) – used as LPG fuel.
- Propene (C_3H_6) – used in making plastics.

Step 4: Importance

Aliphatic compounds form the backbone of petroleum products, fuels, and many synthetic materials.

Final Answer:

Aliphatic compounds are open-chain organic compounds, which include alkanes, alkenes, and alkynes.

Quick Tip

The opposite of aliphatic compounds are **aromatic compounds**, which contain benzene rings.

17. What do you understand by homologous series? Write with examples.

Solution:

Step 1: Definition

A homologous series is a group of organic compounds having the same general formula, similar chemical properties, and successive members differing by a $-CH_2$ group (methylene group).

Step 2: Characteristics of Homologous Series

- All compounds show similar chemical behaviour.
- Physical properties vary in a regular manner (boiling point, melting point, solubility).
- Each member differs from the next by $-CH_2$ group or 14 units of molecular mass.
- They have the same functional group.

Step 3: Examples

- **Alkane Series:** CH_4 (Methane), C_2H_6 (Ethane), C_3H_8 (Propane).
- **Alkene Series:** C_2H_4 (Ethene), C_3H_6 (Propene).
- **Alcohol Series:** C_2H_5OH (Ethanol), C_3H_7OH (Propanol).

Step 4: Importance

The concept of homologous series simplifies the study of organic chemistry because it groups compounds systematically.

Final Answer:

A homologous series is a family of organic compounds with the same functional group, general formula, and successive members differing by a $-CH_2$ unit. Examples: alkanes, alkenes, alcohols.

Quick Tip

Homologous series helps in predicting properties of unknown compounds belonging to the same group.

18. What are the benefits of a dam?**Solution:****Step 1: Definition of a Dam**

A dam is a large barrier constructed across rivers to store water and control its flow. The stored water forms a reservoir.

Step 2: Benefits of a Dam

- **Irrigation:** Water stored in dams is used to irrigate agricultural fields during dry seasons.
- **Hydroelectricity:** Dams produce electricity by using stored water to rotate turbines.
- **Flood Control:** Dams help in controlling floods by regulating water flow.
- **Drinking Water:** Reservoirs provide water supply for domestic and industrial use.
- **Fishery and Tourism:** Dams support fishing activities and boost tourism in nearby areas.

Step 3: Environmental Note

While dams are beneficial, they also cause ecological disturbances like displacement of people and loss of forests, hence they must be planned carefully.

Final Answer:

The main benefits of dams include irrigation, electricity generation, flood control, water supply, and support for fisheries and tourism.

Quick Tip

Bhakra Nangal Dam (India) and Hoover Dam (USA) are examples of multipurpose dams.

19. Explain the importance of pH in daily life.**Solution:**

Step 1: What is pH?

pH is a scale used to measure the concentration of hydrogen ions (H^+) in a solution. It indicates whether a substance is acidic, neutral, or basic.

$$pH = -\log[H^+]$$

The pH scale ranges from 0 to 14.

- $pH < 7$: Acidic
- $pH = 7$: Neutral
- $pH > 7$: Basic (alkaline)

Step 2: Importance of pH in Daily Life

1. **In our Digestive System:** Human stomach secretes hydrochloric acid (HCl) to help in digestion of food. The pH is around 1.5–3.5. Sometimes excess acid causes indigestion, which is treated using antacids like magnesium hydroxide that neutralise excess acidity.
2. **In Tooth Decay:** Tooth enamel is made of calcium phosphate. When bacteria in our mouth produce acids by degrading sugar, the pH of the mouth falls below 5.5. This corrodes the enamel and causes tooth decay. Using toothpaste (basic in nature) helps neutralise the acids.
3. **In Soil for Plants:** Plants require soil with proper pH for healthy growth. Some crops grow better in slightly acidic soil (pH 6–6.5), while others need slightly alkaline conditions. Farmers use lime ($CaCO_3$) to neutralise acidic soil.
4. **In Aquatic Life:** Aquatic organisms can survive only within a narrow pH range. Acid rain lowers the pH of rivers and lakes, making the water unsuitable for aquatic life. Hence monitoring pH of water is very important.
5. **In Everyday Products:**
 - Shampoos, soaps, and detergents are manufactured with balanced pH so that they do not harm skin or hair.
 - Blood in humans has a pH range of about 7.35–7.45, and even small changes can be life-threatening.

Final Answer:

The concept of pH plays a vital role in digestion, tooth health, agriculture, aquatic life, and even in the maintenance of human blood. Proper control of pH is essential for sustaining life and the environment.

Quick Tip

Mnemonic: “**D-T-S-A-B**” → Digestion, Teeth, Soil, Aquatic life, Blood are main fields where pH is important.

20. What should be done for water conservation and water management?

Solution:

Step 1: Importance of Water

Water is essential for survival of all living beings. Only about 1% of Earth's water is directly usable for human needs. Due to population growth, urbanisation, and climate change, water scarcity has become a major issue. Therefore, water conservation and proper water management are crucial.

Step 2: Methods of Water Conservation and Management

1. **Rainwater Harvesting:** Collecting rainwater from rooftops and storing it in tanks or allowing it to recharge groundwater. This reduces dependence on municipal water supply and increases groundwater levels.
2. **Efficient Irrigation Practices:** Traditional irrigation wastes a lot of water. Methods like drip irrigation and sprinkler systems deliver water directly to the roots of crops, reducing wastage.
3. **Construction of Dams and Reservoirs:** Large dams store water for irrigation, electricity generation, and drinking purposes. Multipurpose dams also help in flood control.
4. **Preventing Water Pollution:** Avoiding the discharge of untreated sewage and industrial waste into rivers and lakes keeps water resources clean and reusable.
5. **Afforestation and Soil Conservation:** Planting trees prevents soil erosion, increases groundwater recharge, and helps maintain the water cycle.
6. **Public Awareness:** Educating people to use water wisely at homes, offices, and industries—for example, fixing leaking taps, reusing water for gardening, and avoiding overuse of water in daily chores.
7. **Recycling and Reuse:** Wastewater from industries and domestic use can be treated and reused for purposes like gardening and cooling in factories.

Step 3: Examples of Water Management in India

- Traditional systems like “Ahar-Pyne” in Bihar, “Khadins” in Rajasthan, and “Tankas” in Gujarat.
- Modern projects like Bhakra Nangal Dam and Tehri Dam.

Final Answer:

Water can be conserved and managed through rainwater harvesting, efficient irrigation, building dams, preventing pollution, afforestation, awareness programs, and recycling. These methods ensure sustainable use of water for future generations.

Quick Tip

“**R-E-D-P-A-R**” → Rainwater harvesting, Efficient irrigation, Dams, Pollution control, Afforestation, Recycling.

Biology

21. Write four main characteristics of living beings.

Solution:

Living beings are organisms that show unique features distinguishing them from non-living objects. The four main characteristics are:

1. **Growth and Development:** All living beings grow in size and mass by cell division. They also develop new structures and functions during their lifespan. For example, a child grows into an adult, and a seed grows into a plant.
2. **Reproduction:** Living beings have the ability to reproduce, i.e., produce offspring of their own kind. This can be sexual (e.g., humans, animals) or asexual (e.g., amoeba divides by binary fission).
3. **Metabolism:** All living beings carry out chemical reactions inside their cells. These reactions involve breakdown (catabolism) and synthesis (anabolism) of molecules to provide energy for life processes.
4. **Response to Stimuli (Irritability):** Living organisms can sense changes in their surroundings and respond accordingly. For example, humans feel hot and start sweating, plants bend towards light (phototropism).

Final Answer:

Growth, reproduction, metabolism, and response to stimuli are the four main characteristics of living beings.

Quick Tip

Mnemonic: “**G-R-M-R**” → Growth, Reproduction, Metabolism, Response.

22. Why does continuous running cause cramps to a person's muscles?

Solution:

Step 1: Normal condition

Normally, our muscles obtain energy by breaking down glucose in the presence of oxygen. This is called **aerobic respiration**, which produces carbon dioxide, water, and a large amount of energy (38 ATP per glucose).



Step 2: During continuous running

When a person runs continuously, the demand for energy in the muscles increases rapidly. The oxygen supply through blood becomes insufficient.

Step 3: Anaerobic respiration in muscles

In the absence of sufficient oxygen, muscles switch to **anaerobic respiration**, where glucose breaks down incompletely to form lactic acid and less energy.

**Step 4: Reason for cramps**

The accumulation of lactic acid in muscles causes stiffness and pain, which we feel as cramps. After rest, oxygen supply is restored, lactic acid is broken down, and cramps disappear.

Final Answer:

Continuous running causes cramps due to the accumulation of lactic acid in muscles as a result of anaerobic respiration.

Quick Tip

Cramps → “**Lactic Acid Buildup**” due to lack of oxygen.

23. What is the importance of blood platelets?**Solution:****Step 1: What are platelets?**

Blood platelets (also called thrombocytes) are small, colourless cell fragments present in blood. They are formed in the bone marrow.

Step 2: Importance of Platelets

1. **Blood Clotting:** When an injury occurs, blood platelets rupture and release clotting factors. These factors activate fibrinogen present in plasma to form fibrin threads, which trap red blood cells and form a clot. This prevents excess blood loss.
2. **Wound Healing:** Platelets release growth factors that help in tissue repair and healing at the site of injury.
3. **Defence Mechanism:** By preventing excessive bleeding, platelets protect the body from infections that might enter through open wounds.

Step 3: Medical Importance

A low platelet count (thrombocytopenia) is dangerous as it can lead to uncontrolled bleeding, as seen in diseases like dengue.

Final Answer:

Blood platelets are essential for blood clotting, wound healing, and prevention of excessive bleeding and infections.

Quick Tip

Platelets → “**C-H-D**” → Clotting, Healing, Defence.

24. Write the names of some excretory substances of plants.

Solution:

Step 1: Excretion in plants

Plants also produce waste materials during metabolic activities such as photosynthesis and respiration. Since plants do not have special excretory organs like animals, they remove wastes by different methods.

Step 2: Main Excretory Substances in Plants

1. **Oxygen:** Released during photosynthesis as a by-product.
2. **Carbon dioxide:** Released during respiration, especially at night.
3. **Water vapour:** Removed through transpiration via stomata.
4. **Gums and Resins:** Stored in old xylem vessels and eventually removed.
5. **Latex:** A milky secretion found in rubber plants.
6. **Alkaloids:** Such as quinine, morphine, nicotine, which are metabolic waste products.

Step 3: Examples

- **Neem tree** produces bitter alkaloids.
- **Acacia tree** excretes gum.
- **Rubber plant** produces latex.

Final Answer:

Plants excrete substances like oxygen, carbon dioxide, water vapour, gums, resins, latex, and alkaloids as their waste products.

Quick Tip

Plants' wastes → “**O-C-W-G-L-A**” = Oxygen, CO₂, Water, Gums, Latex, Alkaloids.

25. Write the names of endocrine glands found in humans.

Solution:

Step 1: Concept of Endocrine Glands

Endocrine glands are also called **ductless glands** because they do not have ducts to release their secretions. Instead, they release hormones directly into the bloodstream. These hormones regulate various body functions such as growth, metabolism, reproduction, and homeostasis.

Step 2: Names of Endocrine Glands in Humans

1. **Pituitary gland:** Known as the “master gland,” it controls other endocrine glands.
2. **Pineal gland:** Secretes melatonin which regulates sleep-wake cycles.
3. **Thyroid gland:** Produces thyroxine which controls metabolism.
4. **Parathyroid glands:** Regulate calcium and phosphate balance in the body.
5. **Adrenal glands:** Produce adrenaline and cortisol for stress response and metabolism.
6. **Pancreas (Islets of Langerhans):** Produces insulin and glucagon to regulate blood sugar.
7. **Thymus gland:** Important in early life for immunity (T-cell maturation).
8. **Gonads (Testes in males and Ovaries in females):** Produce sex hormones (testosterone, estrogen, progesterone).

Final Answer:

The main endocrine glands in humans are: Pituitary, Pineal, Thyroid, Parathyroid, Adrenal, Pancreas, Thymus, Testes, and Ovaries.

Quick Tip

Mnemonic: “**3P-TAPTO**” → Pituitary, Pineal, Parathyroid, Thyroid, Adrenal, Pancreas, Thymus, Ovaries/Testes.

26. What is the difference between menarche and menopause?

Solution:

Step 1: Menarche

- Menarche is the **first occurrence of menstruation** in females.
- It usually occurs between the ages of 11–14 years.
- It signifies the beginning of reproductive age in a female.
- Hormones like estrogen and progesterone play a major role.

Step 2: Menopause

- Menopause is the **permanent cessation of menstruation**.

- It usually occurs between 45–55 years of age.
- It marks the end of reproductive capability in females.
- There is a decline in estrogen and progesterone production.

Step 3: Difference Table

Menarche	Menopause
<i>First menstrual cycle in females</i>	<i>Last menstrual cycle in females</i>
<i>Occurs at puberty (11–14 years)</i>	<i>Occurs at 45–55 years</i>
<i>Marks start of reproductive life</i>	<i>Marks end of reproductive life</i>
<i>Hormones increase</i>	<i>Hormones decrease</i>

Final Answer:

Menarche is the beginning of the menstrual cycle at puberty, while menopause is the permanent end of menstruation at old age.

Quick Tip

Menarche → “**M = Start**” and Menopause → “**P = Pause/End**”.

27. What is the meaning of biological evolution?

Solution:

Step 1: Definition

Biological evolution refers to the **gradual change in living organisms over generations**, leading to the formation of new species. It is driven by genetic variations, natural selection, and adaptation to the environment.

Step 2: Key Points

- Proposed by Charles Darwin in his book “Origin of Species.”
- Explains how simple life forms gradually developed into more complex organisms.
- Involves mechanisms like mutation, variation, natural selection, survival of the fittest.

Step 3: Examples

1. Evolution of giraffes – from short neck ancestors to long-necked giraffes due to selection pressure.
2. Evolution of humans – from ape-like ancestors to modern Homo sapiens.
3. Development of antibiotic resistance in bacteria.

Final Answer:

Biological evolution means the slow and continuous change in organisms over generations, leading to the origin of new species.

Quick Tip

Think of evolution as: “**Change + Time = New Species**”.

28. What is the role of decomposers in the ecosystem?**Solution:****Step 1: Concept of Decomposers**

Decomposers are organisms like bacteria and fungi that feed on dead and decaying plants and animals. They are the final link in the food chain.

Step 2: Roles in the Ecosystem

1. **Decomposition of organic matter:** They break down complex organic matter into simpler inorganic substances like carbon dioxide, water, and nutrients.
2. **Recycling of nutrients:** The nutrients released (nitrogen, phosphorus, etc.) are reused by plants, maintaining soil fertility.
3. **Cleaning of environment:** They prevent the accumulation of dead bodies and wastes in nature.
4. **Energy flow:** They release energy stored in dead matter back into the ecosystem.

Step 3: Examples

- Fungi like Rhizopus, Mushrooms.
- Bacteria like Pseudomonas, Bacillus.

Final Answer:

Decomposers recycle nutrients, clean the environment, and maintain the balance of the ecosystem by breaking down dead organic matter.

Quick Tip

Without decomposers → ecosystem = “**garbage dump**”.

29. Draw a neat labelled diagram of the respiratory organs of human being.**Solution:**

Step 1: Concept of Human Respiratory System

The human respiratory system is responsible for the exchange of gases – mainly oxygen (O₂) and carbon dioxide (CO₂). It consists of several organs that work together to ensure proper breathing and cellular respiration. The main organs include the nose, pharynx, larynx, trachea, bronchi, lungs, and alveoli.

Step 2: Diagram (to be drawn by student)

A neat labelled diagram should include the following:

- Nose/Nasal cavity – entry point of air.
- Pharynx – common passage for air and food.
- Larynx – voice box.
- Trachea – windpipe with cartilaginous rings.
- Bronchi – two branches leading into lungs.
- Lungs – main site of respiration.
- Bronchioles – smaller branches inside lungs.
- Alveoli – tiny air sacs where gas exchange occurs.
- Diaphragm – muscular sheet controlling breathing.

Step 3: Final Note

The diagram must be **neat, clearly labelled, and proportionate**. Marks are awarded for correctness and neatness.

Quick Tip

Remember: The **alveoli** are the actual site of gas exchange, not the lungs as a whole.

30. Write the functions of liver.

Solution:

Step 1: Introduction

The liver is the **largest gland** in the human body. It is located in the upper right side of the abdomen, just below the diaphragm. It plays a vital role in digestion, metabolism, detoxification, and regulation of many substances in the blood.

Step 2: Functions of Liver

1. **Production of bile:** Helps in the emulsification and digestion of fats.
2. **Metabolism of carbohydrates:** Converts excess glucose into glycogen (glycogenesis) and stores it; breaks down glycogen into glucose (glycogenolysis).
3. **Metabolism of proteins:** Deamination of amino acids and production of urea.

4. **Metabolism of fats:** Breaks down fats and synthesizes cholesterol.
5. **Detoxification:** Removes harmful substances like alcohol, drugs, and toxins from the blood.
6. **Storage:** Stores vitamins (A, D, E, K, B12), iron, and glycogen.
7. **Blood purification:** Removes damaged red blood cells and maintains composition of blood.
8. **Synthesis of plasma proteins:** Produces albumin, fibrinogen, and prothrombin which are essential for blood clotting and osmotic balance.
9. **Heat production:** Maintains body temperature by continuous chemical activity.

Step 3: Final Answer

The liver is a multifunctional gland that helps in digestion (bile secretion), metabolism (carbohydrates, fats, proteins), detoxification, storage of nutrients, synthesis of plasma proteins, and maintenance of blood composition.

Quick Tip

Mnemonic for liver functions: “**DMS-BDSH**” → Digestion, Metabolism, Storage, Blood purification, Detoxification, Synthesis, Heat production.