Grade 10 Science Karnataka 2020

Time: 3 hours 15 min.   **Max. Marks: 80**

General Instructions to Candidates:

- This Question Paper consists of 38 objective and subjective types of questions.
- This question paper has been sealed by reverse jacket. You have to cut on the right side to open the paper at the time of commencement of the examination. Check whether all the pages of the question paper are intact.
- Follow the instructions given against both the objective and subjective types of questions.
- Figures in the right-hand margin indicate maximum marks for the questions.
- The maximum time to answer the paper is given at the top of the question paper. It includes 15 minutes for reading the question paper.

Q1. Four alternatives are given for each of the following questions / incomplete statements. Choose the correct alternative and write the complete answer along with its letter of alphabet.   **8 x 1 = 8**

1. The inner surface of solar cooker is coated with black paint to

(A) absorb more heat

(B) reflect light

(C) prevent rusting

(D) converge the light rays

Solution:

(A) absorb more heat

Black surfaces are good absorbers of heat, so the inner surface of a solar cooker is coated with black paint to maximize heat absorption and improve cooking efficiency.

2. As the pH value of a neutral solution increases
(A) basic property decreases and number of OH^- ions increases
(B) acidic property increases and number of H^+ ions decreases
(C) basic property increases and number of OH^- ions increases
(D) acidic property decreases and number of H^+ ions increases

Solution:

(C) basic property increases and number of OH^- ions increases

As the pH value increases above 7, the solution becomes more basic, meaning the concentration of OH^- ions increases while the acidic property decreases.

3. In the given figure of Cotyledon the parts labelled as A and B respectively are
(A) fruit, shoot
(B) primary shoot, primary root
(C) secondary root, primary shoot
(D) bud, leaf
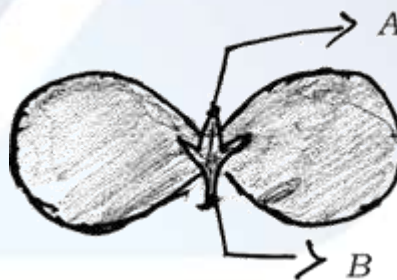
Solution:

(B) primary shoot, primary root

In a germinating seed, the primary shoot (plumule) grows upwards, and the primary root (radicle) grows downwards, forming the first structures of the developing plant.

4. An object is kept at the centre of curvature of a concave mirror. The position and nature of the image formed is

(A) between F and C and inverted

(B) behind the mirror and erect

(C) between F and P and erect

(D) at the centre of curvature and inverted.

Solution:

(D) at the centre of curvature and inverted.

When an object is placed at the centre of curvature (C) of a concave mirror, the image formed is

- At C (same position as the object)
- Inverted
- Real and of the same size as the object

5. The power plant in which natural source of energy is directly used to rotate turbines is

(A) thermal power plant

(B) hydro-electric power plant

(C) nuclear power plant

(D) solar power plant.

Solution:

(B) hydro-electric power plant

In a hydro-electric power plant, flowing water is used to directly rotate the turbines, generating electricity.

6. An example for saturated hydrocarbon is

(A) C_2H_6

(B) C_3H_4

(C) C_2H_2

(D) C_2H_4

Solution:

(A) C_2H_6

Ethane (C_2H_6) is a saturated hydrocarbon as it contains only single bonds between carbon atoms.

7. The incorrect statement related to thyroxine hormone among the following is

(A) it regulates fat metabolism

(B) its deficiency leads to goitre

(C) it is secreted by parathyroid gland

(D) iodine in the food is essential for its production.

Solution:

(C) it is secreted by parathyroid gland

Thyroxine is secreted by the thyroid gland, not the parathyroid gland.

8. The molecular formula of three carbon compounds which are in homologous series are C_2H_6 , C_3H_8 , C_4H_{10} . The suitable general formula for these compounds is

(A) C_nH_{2n}

(B) C_nH_{2n-1}

(C) C_nH_{2n-2}

(D) C_nH_{2n+2}

Solution:

(D) C_nH_{2n+2}

The given compounds (C_2H_6, C_3H_8, C_4H_{10}) belong to the alkane homologous series, which follows the general formula C_nH_{2n+2}.

Q2. Answer the following questions.   **8 x 1= 8**

9. An iron ring is to be coated with copper. How can we do this without using electricity?

Solution:

To coat an iron ring with copper without using electricity, we can use the copper displacement method. In this process, the iron ring is immersed in a solution of copper sulfate ($CuSO_4$). Copper from the solution gets deposited on the surface of the iron ring due to a displacement reaction where iron displaces copper ions from the solution.

10. What is the SI unit of potential difference? Name the device used to measure the potential difference.

Solution:

The SI unit of potential difference is the volt (V).

The device used to measure the potential difference is a voltmeter.

11. "The rate of breathing in aquatic organisms is much faster than that seen in terrestrial organisms." Why?

Solution:

The rate of breathing in aquatic organisms is much faster than in terrestrial organisms because water contains much less oxygen than air. To extract sufficient oxygen, aquatic organisms need to move water over their gills at a faster rate, resulting in faster breathing.

12. Sodium and potassium are placed in the same group of modern periodic table. If the molecular formula of sodium sulphate is Na_2SO_4, then decide the molecular formula of potassium sulphate. Give reason for your answer.

Solution:

The molecular formula of potassium sulphate is $\mathbf{K_2SO_4}$.

Sodium (Na) and potassium (K) both belong to the same group in the modern periodic table (Group 1), which means they both have a single positive charge

(Na^+ and K^+) when they form ions. In sodium sulphate (Na_2SO_4), two Na^+ ions combine with one sulphate ion (SO_4^{2-}). Similarly, for potassium sulphate, two K^+ ions will combine with one sulphate ion (SO_4^{2-}), resulting in the formula K_2SO_4.

13. "Biogas plant is a boon to farmers." Why?

Solution:

A biogas plant is a boon to farmers because it helps in waste management, provides natural fertilizer, and produces energy for cooking and lighting.

14. The gene for brown coloured hair is recessive over gene for black coloured hair. What is the hair colour of a person who has inherited a gene for brown coloured hair from mother and black coloured hair from father ?

Solution:

The person will have black coloured hair because the gene for black coloured hair is dominant over the gene for brown coloured hair.
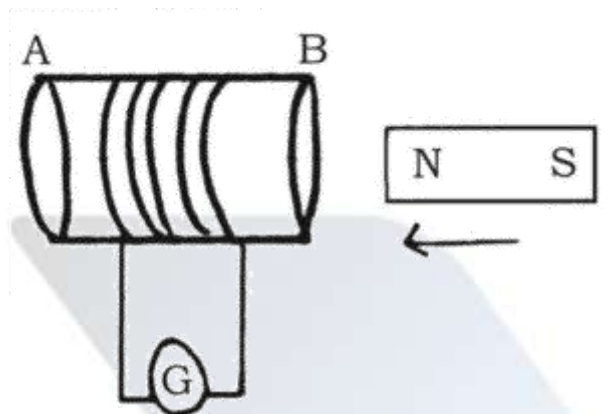
15. $CuO + H_2 \rightarrow Cu + H_2O$
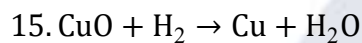
In this reaction name the reactant

i) that is oxidised

ii) that is reduced.

Solution:

i) CuO is oxidised (it loses oxygen to form Cu).

ii) H_2 is reduced (it gains oxygen to form H_2O).

16. Observe the given figure.

What type of current is induced in the coil by doing the experiment related to this figure? Give reason for your answer.

Solution:

The induced current in the coil is alternating current (AC) because a changing magnetic field produces an alternating electromotive force (EMF), which causes the current to alternate direction.

Q3. Answer the following questions.   **8 x 2 = 16**

17. Agricultural scientists have suggested to add a certain amount of lime powder to an agricultural field. What may be the reasons for this? Explain.

Solution:

Agricultural scientists suggest adding lime powder to an agricultural field to neutralize soil acidity. Lime powder, which contains calcium carbonate, helps raise the pH of acidic soils, making it more suitable for plant growth. This improves the availability of essential nutrients to plants and supports healthy root development. It also helps in enhancing the activity of beneficial soil microorganisms.

18. "The body temperature of frogs and lizards depend on temperature in the environment." Justify.
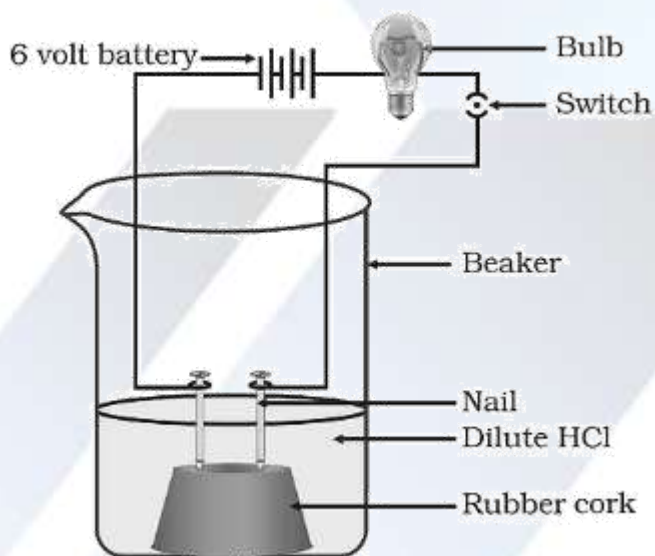
Solution:

Frogs and lizards are **cold-blooded (ectothermic)** animals, meaning their body temperature is regulated by the surrounding environment. They cannot maintain a constant internal temperature like warm-blooded animals. When the environment is warm, their body temperature rises, and when it's cold, their body temperature drops, affecting their activity levels and metabolic processes.

19. Draw the diagram of the apparatus to show that acid solution in water conducts electricity. Label the following parts :
i) Dil. HCl solution
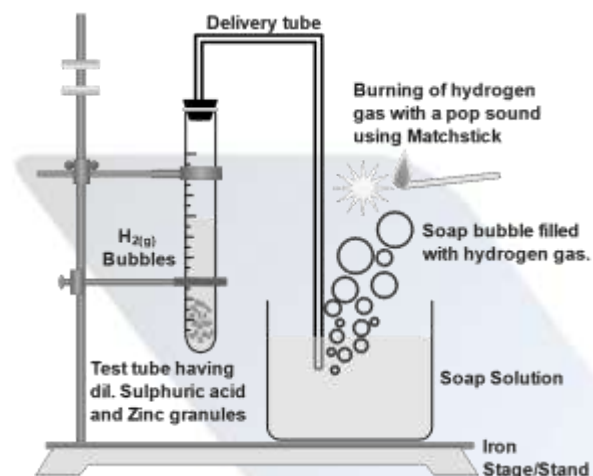ii) Rubber cork.
Solution:

OR

Draw the diagram of arrangement of the apparatus to show the reaction of zinc granules with dilute sulphuric acid and testing hydrogen gas by burning. Label the following parts:
i) Test tube
ii) Soap solution.

Solution:

20. The resistivity of manganese wire of length 1 m is $1.84 \times 10^{-6} \Omega$ m at 20°C. If the diameter of the wire is 3×10^{-4} m, what will be the resistance of the wire at that temperature?

Solution:

To find the resistance R of the manganese wire, we can use the formula for resistance:

$$R = \rho \times \frac{L}{A}$$

Where:

- ρ is the resistivity of the material ($1.84 \times 10^{-6} \Omega$ m),
- L is the length of the wire (1 m),
- A is the cross-sectional area of the wire.

  The cross-sectional area A of a wire with a circular cross-section is given by:

$$A = \pi \times r^2$$

Where r is the radius of the wire, which is half of the diameter. Given the diameter 3×10^{-4} m, the radius r will be:

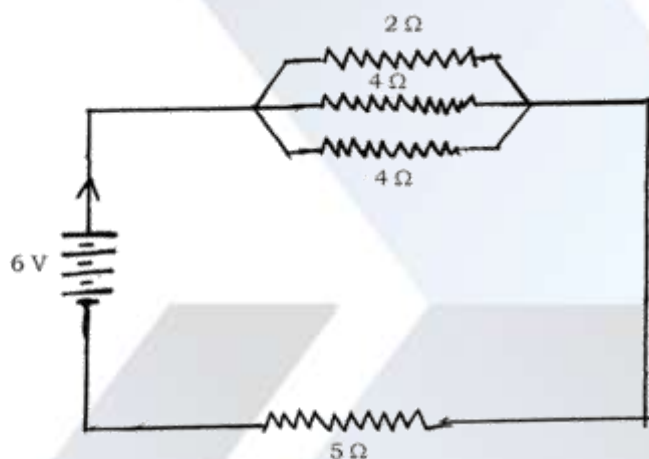$$r = \frac{3 \times 10^{-4}}{2} = 1.5 \times 10^{-4} \text{ m}$$

Now,

$$R = \rho \times \frac{L}{A}$$

$$R = (1.84 \times 10^{-6}) \times \frac{1}{\pi \times (1.5 \times 10^{-4})^2}$$

$$R = 26.03 \, \Omega$$

OR

Observe the given circuit

Calculate the total resistance in the circuit and the total current flowing in the circuit.

Solution:

We are given three resistors connected in parallel:

$R_1 = 2\Omega, R_2 = 4\Omega, R_3 = 4\Omega$

For resistors in parallel, the formula for the equivalent resistance R_{eq} is:

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

$$\frac{1}{R_{eq}} = \frac{1}{2} + \frac{1}{4} + \frac{1}{4}$$

$$\frac{1}{R_{eq}} = 1$$

$$R_{eq} = 1\Omega$$

The total resistance of the circuit is :

$$R_{total} = R_{eq} + R_{series} = 1\Omega + 5\Omega = 6\Omega$$

Now that we have the total resistance, we can calculate the total current using

Ohm's law:

Given, V = 6V, $R_{total} = 6\Omega$

$$I = \frac{V}{R_{total}}$$

$$I = \frac{6\ V}{6\Omega}$$

$$I = 1A$$

So, the total current flowing through the circuit is 1 A.

21. "As energy moves progressively through various trophic levels of food chain it is no longer available to the previous level." Give reasons.

Solution:

As energy moves through different trophic levels of a food chain, it is not fully available to the previous level due to several reasons:

- **Energy Loss as Heat**: When organisms consume food and carry out metabolic activities like respiration, a large portion of the energy is lost as heat, which cannot be transferred to the next trophic level.
- **Inefficient Energy Transfer**: Only about 10% of the energy from one trophic level is transferred to the next. The rest is used by the organism for life processes such as movement, reproduction, and growth, and is lost as heat or in excretory products.
- **Decomposition and Waste**: Not all energy in an organism is absorbed by the consumer. The leftover energy in dead organisms or waste is decomposed by decomposers, but this energy is not available to higher trophic levels.

As a result, energy becomes less available to organisms in lower trophic levels as it moves up the food chain, with significant energy losses at each step.

22. Which physical properties of metals are used in the following situations ?

i) Gold is used to make ornaments

ii) Nickel is used in strings of guitar.

Solution:
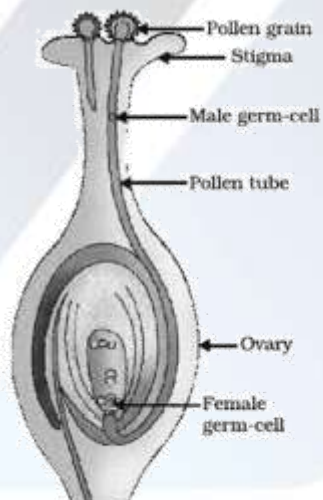
i) Gold used to make ornaments:

- **Malleability**: Gold can be easily shaped into jewelry.
- **Luster**: It has a shiny, attractive appearance.

ii) Nickel used in guitar strings:

- **Strength**: Nickel is durable and strong.
- **Elasticity**: It allows the strings to vibrate and produce sound.

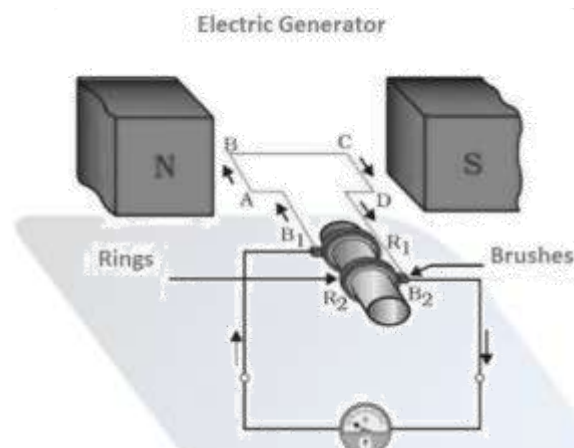23. Draw the diagram showing the germination of pollen on stigma and label the pollen tube.

Solution:

24. Draw the diagram of a simple electric generator. Label the following parts :

i) Brushes

ii) Rings.

Solution:

Q4. Answer the following questions. $9 \times 3 = 27$

25. State Joule's law of heating. Explain the working of electric filament bulb.

Solution:

Joule's Law of Heating states that the heat produced in a conductor when an electric current flows through it is directly proportional to the square of the current (I^2), the resistance (R) of the conductor, and the time (t) for which the current flows. Mathematically, it is given by:

$$H = I^2 Rt$$

An electric filament bulb works on the principle of Joule's law of heating. When the electric current passes through the filament (usually made of tungsten), the filament's resistance causes it to heat up. As the temperature increases, the filament starts to glow, producing visible light. The filament is designed to have a high resistance to convert most of the electrical energy into heat, which then results in the emission of light. The glass bulb surrounding the filament is filled with an inert gas (like argon) to prevent the filament from burning out due to oxidation.

Glass bulb
Glass filling
Tungsten filament
Support wires
Lead wires
Dumet wire
Stem
Cap

OR

State Ohm's law. How ammeter and voltmeter should be connected in electric circuit? What is the use of these instruments, in the circuit?

Solution:

Ohm's Law states that the current (I) flowing through a conductor is directly proportional to the voltage (V) across it and inversely proportional to its resistance (R). Mathematically, it is expressed as:

$$V = IR$$

Ammeter:

- The ammeter should be connected in series with the circuit to measure the current flowing through it.
- It has very low resistance, so it does not affect the current in the circuit.

Voltmeter:

- The voltmeter should be connected in parallel across the component (like a resistor) whose voltage you want to measure.
- It has very high resistance to prevent it from drawing current and altering the circuit.

The uses of these instruments are –

- **Ammeter**: Measures the current flowing through the circuit or a component. It helps in determining the amount of current in various parts of the circuit.
- **Voltmeter**: Measures the potential difference (voltage) across a component in the circuit. It helps in understanding how much energy is being used by each component.

26. The reaction of Barium chloride with Aluminium sulphate solution is an example for which type of chemical reaction? Why? Write the balanced chemical equation for this reaction.
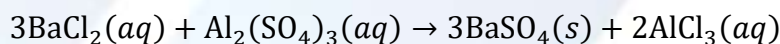
Solution:

The reaction of Barium chloride ($BaCl_2$) with Aluminium sulfate ($Al_2(SO_4)_3$) is an example of a **double displacement reaction** (also known as a precipitation reaction).

In this reaction, the cations (Ba^{2+} from $BaCl_2$ and Al^{3+} from $Al_2(SO_4)_3$) and the anions (Cl^- from $BaCl_2$ and $SO_4{}^{2-}$ from $Al_2(SO_4)_3$) exchange places. This results in the formation of two new compounds.

One of these new compounds, Barium sulfate ($BaSO_4$), is insoluble in water and precipitates out of the solution, while the other, Aluminium chloride ($AlCl_3$), remains in solution.

The balanced chemical reaction is –

$$3BaCl_2(aq) + Al_2(SO_4)_3(aq) \rightarrow 3BaSO_4(s) + 2AlCl_3(aq)$$

27. Explain the significant function of each structure in human male reproductive system.

Solution:

The significant functions of each structure in the human male reproductive system are as follows:

- **Testes**: The testes are responsible for producing sperm (male gametes) and the hormone testosterone, which regulates the development of male secondary sexual characteristics like body hair and deepening of the voice.
- **Vas Deferens**: The vas deferens is a tube that transports mature sperm from the epididymis to the urethra during ejaculation. It also helps in storing and concentrating sperm.
- **Seminal Vesicles, Prostate Gland, and Bulbourethral Glands:** These glands produce seminal fluid, which nourishes and protects the sperm, helping them survive in the female reproductive tract. The prostate also helps in maintaining the pH balance of semen.
- **Penis:** The penis is the external organ that delivers sperm into the female reproductive tract during sexual intercourse.
- **Urethra:** The urethra serves dual functions; it carries urine from the bladder and semen from the reproductive system, though not at the same time.

These structures work together to produce and deliver sperm for reproduction.
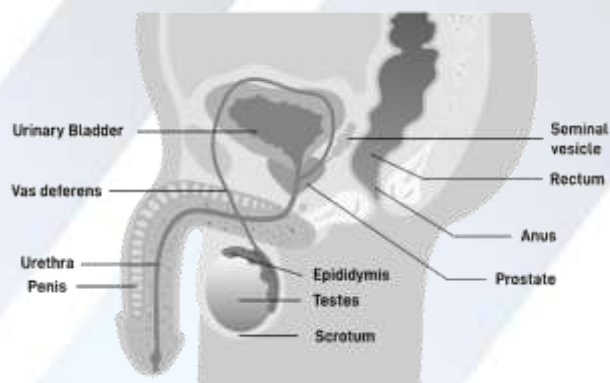
Fig. The male reproductive system

OR

Explain the structure and important role of placenta during pregnancy period of woman.

Solution:

The placenta is a temporary organ that forms in the uterus during pregnancy. It is crucial for the development of the fetus and the overall success of pregnancy. The placenta is usually disc-shaped, and it is attached to the inner wall of the uterus. It consists of both fetal and maternal tissues. The fetal part is derived from the chorion (outer layer of the embryo), and the maternal part is derived from the endometrium (the inner lining of the uterus).The placenta has a rich supply of blood vessels that connect to the fetus via the umbilical cord, carrying blood to and from the fetus.

The importance of placenta during pregnancy period of woman are –

1. **Nutrient and Gas Exchange**: The placenta facilitates the transfer of nutrients, oxygen, and other vital substances from the mother to the fetus. It also removes waste products, such as carbon dioxide, from the fetal blood.

2. **Hormonal Function**: The placenta secretes essential hormones, such as human chorionic gonadotropin (hCG), progesterone, and estrogen, which maintain pregnancy, prevent ovulation, and help in fetal development.

3. **Protection**: The placenta acts as a barrier, protecting the fetus from harmful substances and infections, though it is not completely impermeable.

4. **Immune Function**: The placenta provides some degree of immune protection by transferring maternal antibodies to the fetus, helping the newborn develop immunity before birth.

Thus, the placenta is vital for the growth, nourishment, and protection of the developing fetus throughout pregnancy.

28. Explain the addition and substitution reaction with the help of examples. C_2H_6 undergoes substitution reaction but not addition reaction. Why?

Solution:

In an addition reaction, two or more molecules combine to form a single product. This type of reaction typically occurs in unsaturated compounds (like alkenes and alkynes) that contain double or triple bonds.

Example: When ethene (C_2H_4) reacts with hydrogen (H_2), an addition reaction takes place, resulting in ethane (C_2H_6):

$$C_2H_4 + H_2 \rightarrow C_2H_6$$
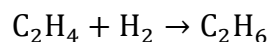
In this reaction, the double bond in ethene is broken, and hydrogen atoms are added to the molecule.

In a substitution reaction, one atom or group of atoms is replaced by another atom or group in a molecule. This usually occurs in saturated compounds like alkanes.

Example: When methane (CH_4) reacts with chlorine (Cl_2) in the presence of sunlight, a substitution reaction occurs, replacing a hydrogen atom with a chlorine atom:

$$CH_4 + Cl_2 \xrightarrow{sunlight} CH_3Cl + HCl$$

In this reaction, one hydrogen atom is substituted by a chlorine atom, forming chloromethane (CH_3Cl).

Ethane (C_2H_6) is a saturated compound (alkane) with only single bonds between carbon atoms. Addition reactions typically require the presence of double or triple bonds, which are broken to add new atoms or groups. Since ethane already has single bonds, it cannot undergo an addition reaction.

However, ethane can undergo a substitution reaction because the hydrogen atoms in ethane can be replaced by other atoms (like halogens) in the presence of appropriate conditions, such as heat or light.

OR

Explain how soap cleans clothes. More amount of soap is required to clean the clothes in hard water. Why?

Solution:

Soap cleans clothes by forming **micelles**, where the hydrophobic (water-hating) tails of soap molecules trap dirt and grease, while the hydrophilic (water-loving) heads interact with water. This allows dirt to be lifted from the fabric and washed away.

Hard water contains calcium (Ca^{2+}) and magnesium (Mg^{2+}) ions, which react with soap to form **insoluble salts** (like calcium soap). These salts reduce the soap's effectiveness, so more soap is needed in hard water to clean clothes.

29. "Building crescent shaped earthen embankment in level terrain is better than the construction of large dams across the river to store water." Analyse this statement with their effects.

Solution:

Building a crescent-shaped earthen embankment is more cost-effective and environmentally friendly than large dams. It has lower environmental impact, as it doesn't disrupt ecosystems or displace populations. However, it may store less water and is prone to failure due to erosion or heavy rainfall.

On the other hand, large dams can store significant amounts of water, useful for irrigation and power generation. But they are expensive, resource-intensive, and can harm ecosystems, displace communities, and cause long-term ecological imbalances. Dams also carry a risk of catastrophic failure.

In conclusion, earthen embankments are better for smaller-scale projects with minimal environmental disruption, while large dams are suited for areas needing significant water storage, despite their higher costs and risks.

30. An object is kept on the principal axis of a concave mirror of focal length 12 cm . If the object is at a distance of 18 cm from the mirror, calculate the image distance. Determine the nature of the image formed by calculating the magnification produced by the mirror.

Solution:

To calculate the image distance and magnification produced by a concave mirror, we can use the mirror formula and magnification formula.

Given:

- Focal length (f) = -12 cm

- Object distance (u) = -18 cm (object distance is negative for real objects placed in front of the mirror)

Mirror formula:

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

$$\frac{1}{-12} = \frac{1}{v} + \frac{1}{-18}$$

$$\frac{1}{v} = \frac{1}{18} - \frac{1}{12}$$

$$\frac{1}{v} = -\frac{1}{36}$$

$$v = -36 \text{ cm}$$

The image distance is v = -3.6 cm.

Magnification is given by –

$$M = \frac{\text{Image height}}{\text{Object height}} = -\frac{v}{u}$$

$$M = -\frac{v}{u} = -\frac{-36}{-18} = -2$$

The magnification is -2, meaning the image is real, inverted and magnified.

OR

A doctor prescribes a corrective lens of power -0.5 D to a person. Find the focal length of the lens. Is this lens diverging or converging ? Give reason.

How does the property of this lens can be used to correct eye defects?

Solution:

Given:

Power of the lens (P) = -0.5 D

The power P of a lens is related to its focal length f by the formula:

$$P = \frac{1}{f}$$

where f is in meters, and P is in diopters (D).

On rearranging –

$$f = \frac{1}{P}$$

$$f = \frac{1}{-0.5} = -2m$$

The focal length of the lens is -2 meters.

Since the focal length is negative, this is a diverging lens. Diverging lenses have negative focal lengths, and they spread light rays apart.

A diverging lens is used to correct myopia (nearsightedness). In myopia, the image of distant objects is formed in front of the retina because the eye's focal length is too short. The diverging lens helps by spreading the light rays before they enter the eye, allowing the image to focus correctly on the retina. This correction enables the person to see distant objects clearly.

31. Draw the diagram showing the schematic sectional view of the human heart. Label the following parts:
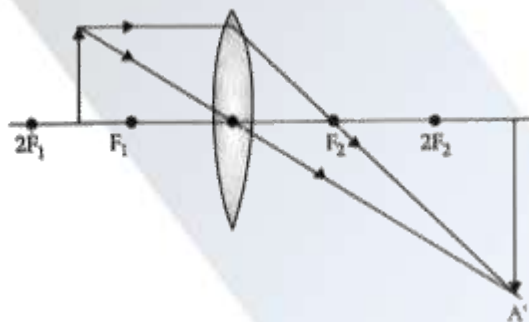
i) Aorta

ii) Pulmonary veins

Solution:
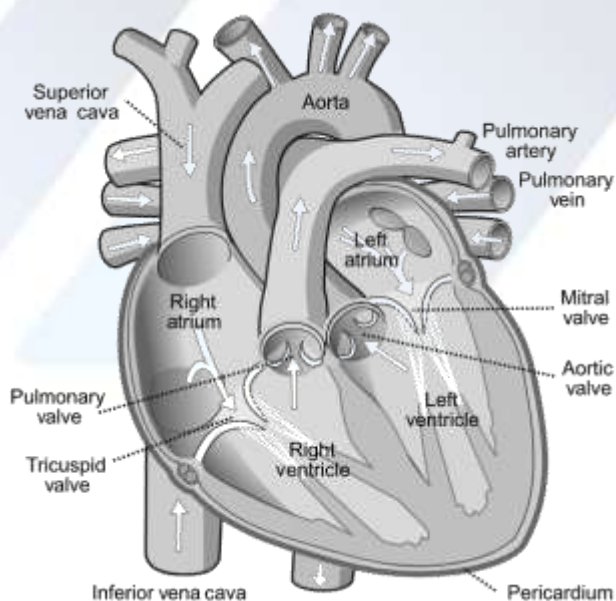
A Human Heart

32. Draw the ray diagram when the object is kept between F_1 and $2F_1$ of the convex lens. With the help of the diagram mention the position and nature of the image formed. [F_1 : Principal focus of the lens]

Solution:

When the object is placed between the principal focus (F_1) and twice the focal length ($2F_1$) of a convex lens, the position and nature of the image are-

Position: The image is formed beyond $2F_2$ (on the opposite side of the object).

Nature: The image is real, inverted, and magnified (larger than the object).

33. The atomic numbers of two elements are 8 and 16 respectively. Write the electronic configuration of these two elements. Do you keep these two elements in the same group of the modern periodic table? Justify your answer. Find out which of these two elements is more electronegative. Give reason for your answer.

Solution:

Element with Atomic Number 8 (Oxygen):

- Atomic Number $= 8 \rightarrow$ Oxygen (O).
- Electronic Configuration: $1s^2 2s^2 2p^4$.

Element with Atomic Number 16 (Sulfur):

- Atomic Number $= 16 \rightarrow$ Sulfur (S).
- Electronic Configuration: $1s^2 2s^2 2p^6 3s^2 3p^4$.

Both oxygen and sulfur belong to the same group (Group 16) in the modern periodic table, known as the chalcogens. This is because they both have 6 electrons in their outermost shell, which makes them part of the same group, despite oxygen

being in the second period and sulfur in the third period. Elements in the same group share similar chemical properties due to their similar valence electron configurations.

Electronegativity increases as you move across a period (from left to right) and decreases as you move down a group. Since oxygen is in the second period and sulfur is in the third period, oxygen is smaller in size and its valence electrons are closer to the nucleus, resulting in a stronger attraction for bonding electrons. In contrast, sulfur has a larger atomic radius and its valence electrons are farther from the nucleus, leading to a weaker attraction for bonding electrons. Therefore, oxygen is more electronegative than sulfur.

Q5.   Answer the following questions.   **4 x 4 = 16**

34. Name the given structure. What is its general function? Mention the function of the parts labelled as A and B. These structures in animals are said to be more efficient to give quick responses. Why?
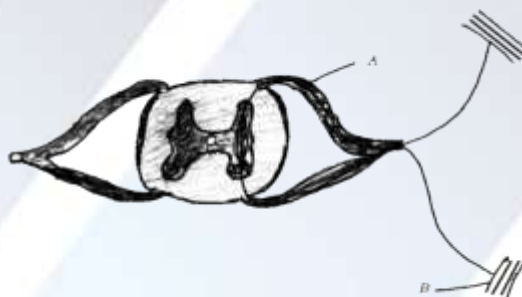
Solution:

The general function of this structure is to transmit signals between the sensory organs (such as skin, eyes, ears) and the muscles or glands, enabling quick responses to stimuli. This is part of the nervous system that helps organisms respond rapidly to their environment.

Function of Parts:

A - Sensory Neuron:

The sensory neuron receives stimuli from sensory receptors (e.g., skin, eyes) and transmits this information to the central nervous system (CNS), such as the brain or spinal cord.

B - Motor Neuron:

The motor neuron carries the response signal from the CNS to the effector organs (e.g., muscles or glands), which execute the response (e.g., contracting muscles).

Efficiency of these Structures:

These structures are more efficient in animals because reflex actions involve a very short and direct pathway (sensory neuron → spinal cord → motor neuron) that bypasses the brain, allowing for quick, involuntary responses to stimuli without waiting for the brain to process the information. This is crucial for survival, enabling rapid reactions to potentially dangerous stimuli.

35. Mention the difference between calcination and roasting. How these processes are used in the extraction of zinc? Explain with the help of chemical equations. After these processes, is reduction necessary to obtain zinc? Why?
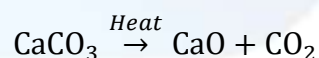
Solution:

Calcination:

Calcination is the heating of an ore in the absence of air or with a limited supply of air.

It is used to remove volatile impurities like water, carbon dioxide, or other volatile substances from the ore, typically converting carbonates into oxides.

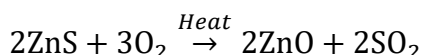Example: Heating limestone (calcium carbonate) to produce lime (calcium oxide)

$$CaCO_3 \xrightarrow{Heat} CaO + CO_2$$

Roasting:

Roasting is the heating of an ore in the presence of excess air (oxygen).

It is used to convert metal sulfides into metal oxides and remove sulfur as sulfur dioxide.

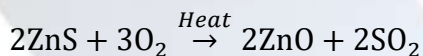Example: Heating zinc sulfide (zinc blende) in the presence of oxygen:

$$2ZnS + 3O_2 \xrightarrow{Heat} 2ZnO + 2SO_2$$

Use in the Extraction of Zinc are **-**

Zinc Ore (Zinc Blende, ZnS): Zinc is primarily extracted from zinc blende (ZnS), which is a **sulfide ore**.
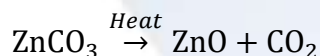
- **Roasting**:

The zinc sulfide (ZnS) is heated in excess air (roasting) to convert it into zinc oxide (ZnO) and sulfur dioxide (SO_2):

$$2ZnS + 3O_2 \xrightarrow{Heat} 2ZnO + 2SO_2$$

- **Calcination**:

If the ore contains **carbonates** (such as zinc carbonate, $ZnCO_3$), it is heated in the absence of air (calcination) to convert it into zinc oxide (ZnO):

$$ZnCO_3 \xrightarrow{Heat} ZnO + CO_2$$

Yes, reduction is necessary to obtain pure zinc from zinc oxide (ZnO), because zinc oxide is an oxide and needs to be reduced to metallic zinc.

Reduction Process:

Zinc oxide (ZnO) is reduced using carbon (as coke or coal) in a high-temperature furnace to produce zinc metal:

$$ZnO + C \xrightarrow{Heat} Zn + CO$$
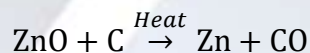
This reduction step is crucial because zinc oxide is an oxidized form of zinc, and zinc metal must be obtained through the removal of oxygen.

36. How do you trace the magnetic field lines around a bar magnet using compass needle? Explain. Write the properties of magnetic field lines.

Solution:

To trace the magnetic field lines around a bar magnet, follow these steps:

1. Place the Bar Magnet on a Flat Surface: Lay the bar magnet on a flat surface and mark its two poles (north and south).
2. Position a Compass: Place a small compass needle near the north pole of the magnet. The north pole of the compass needle will point towards the south pole of the magnet (since opposite poles attract).

3. Mark the Direction of the Needle: Observe and mark the position of the compass needle. The needle will align itself along the magnetic field lines.

4. Move the Compass: Slowly move the compass around the magnet, marking the direction of the needle at several points. Connect these points smoothly to trace the magnetic field line.

5. Repeat the Process: Trace multiple field lines around the magnet by repeating this process at different positions, ensuring that you trace lines from the north pole to the south pole of the bar magnet.

By connecting the marked points, you will have traced the magnetic field lines that emerge from the north pole and enter the south pole.

Properties of Magnetic Field Lines:

1. **Magnetic field lines always form closed loops**: Magnetic field lines are continuous and do not have any beginning or end. They form closed loops, emerging from the north pole and returning to the south pole outside the magnet. Inside the magnet, the lines run from the south pole to the north pole.

2. **Direction of magnetic field lines**: Outside a magnet, the magnetic field lines point from the north pole to the south pole. Inside the magnet, the field lines point from the south pole to the north pole.

3. **Magnetic field lines never intersect**: Magnetic field lines do not cross each other. If they did, it would imply that the magnetic field has two directions at the same point, which is not possible.

4. **Density of lines represents strength**: The closer the magnetic field lines are to each other, the stronger the magnetic field in that region. In regions where the lines are farther apart, the magnetic field is weaker.

These properties help in visualizing the behavior and strength of magnetic fields in different regions around a magnet.

37. The plants bearing round yellow coloured (RrYy) seeds are self pollinated. Represent the result obtained in the F_2 generation of dihybrid cross with the help of a checker board. Mention the varieties of plants obtained in F_2 generation.

Solution:

In a dihybrid cross between two plants with the genotype RrYy (round, yellow seeds), the possible gametes are:

RY (round, yellow)

Ry (round, green)

rY (wrinkled, yellow)

ry (wrinkled, green)

Punnett Square (4x4):

	RY	Ry	rY	ry
RY	RRYY	RRYy	RrYY	RrYy
Ry	RRYy	RRyy	RrYy	Rryy
rY	RrYY	RrYy	rrYY	rrYy
ry	RrYy	Rryy	rrYy	rryy

Varieties in the F_2 Generation:

- Round, Yellow Seeds: RRYY, RRYy, RrYY, RrYy
- Round, Green Seeds: RRyy, Rryy
- Wrinkled, Yellow Seeds: rrYY, rrYy
- Wrinkled, Green Seeds: rryy

The F_2 generation includes plants with four different varieties based on the combination of dominant and recessive alleles for round/wrinkled seeds and yellow/green seeds.

OR

What is evolution? Explain the three evidences for evolution.

Solution:

Evolution is the process by which species of organisms change over time through gradual changes in their genetic makeup, leading to the development of new

species from common ancestors. This process is driven by factors such as natural selection, mutations, gene flow, and genetic drift.

Three Evidences for Evolution:

Fossil Evidence

- Fossils are the preserved remains or traces of organisms from the past. They provide a historical record of life on Earth, showing how species have changed over time.
- By studying fossils, scientists can observe how simple organisms evolved into more complex forms. For example, the fossil record shows the gradual transition from fish to amphibians and from reptiles to birds.

Comparative Anatomy:

- Comparative anatomy is the study of similarities and differences in the structures of different species.
- Homologous structures (similar structures in different species due to common ancestry) and vestigial structures (body parts that have lost their original function) provide evidence for evolution.

For example, the forelimbs of humans, bats, and whales have a similar bone structure, indicating a common ancestor despite different functions.

Molecular Evidence:

- The study of DNA, proteins, and other molecular structures provides evidence for evolution. All living organisms share a common molecular foundation, such as the genetic code, suggesting a common origin.
- Similarities in DNA sequences between different species show how closely related they are. For instance, humans and chimpanzees share about 98% of their DNA, indicating a recent common ancestor.

These evidences collectively support the theory that species evolve over time due to genetic changes passed through generations.

Q6.   Answer the following question.   **1 x 5 = 5**

38. Explain the experiment conducted by Newton to show that white light contains seven colours. Sun appears red in colour during sunrise but appears white at noon. Explain with the reasons.

Solution:

Isaac Newton conducted an experiment using a prism to demonstrate that white light is a combination of multiple colors. Here's how he did it:

- **Setup**: Newton used a glass prism and directed a beam of sunlight (white light) through the prism.
- **Observation**: As the white light passed through the prism, it was refracted (bent) and split into a spectrum of seven distinct colors: red, orange, yellow, green, blue, indigo, and violet.
- **Conclusion**: Newton concluded that white light is not a single color but a mixture of different colors, each with different wavelengths. These colors form the visible spectrum. The different colors in the spectrum were the result of the different degrees of bending (refraction) as the light passed through the prism.

Newton's experiment showed that white light contains a spectrum of seven colors. These colors can be observed in a rainbow or when light is refracted through a prism.

The color of the sun appears to change depending on the time of day, due to the scattering of light in Earth's atmosphere.

Sunrise (Red Appearance):

- During sunrise (and sunset), the sunlight has to pass through a thicker layer of the Earth's atmosphere.
- The shorter wavelengths of light (blue and violet) are scattered more by the atmosphere due to the Rayleigh scattering effect.
- As a result, the longer wavelengths (red, orange, and yellow) dominate and give the sun a red or orange appearance.

Noon (White Appearance):

- At noon, the sun is higher in the sky, and its light has to pass through a thinner layer of the atmosphere.
- The scattering effect is less pronounced for shorter wavelengths, so the entire spectrum of colors (including blue, green, yellow, etc.) reaches our eyes.

This combination of all colors together results in the sun appearing white when viewed from the Earth.