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2X Learning Experience

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CLASS X

SAMPLE PAPER - 3

SCIENCE

Class X Session 2025-26
Subject - Science
Sample Question Paper - 03

Time Allowed: 3 hours **Maximum Marks: 80**

General Instructions:

1. This question paper consists of 39 questions in 3 sections. Section A is Biology, Section B is Chemistry and Section C is Physics.
2. All questions are compulsory. However, an internal choice is provided in some questions. A student is expected to attempt only one of these questions.

Section A

1. As compared to terrestrial organisms, the rate of breathing in aquatic organisms is: **[1]**

   a) slower because the capacity of water of dissolving atmospheric air is limited.

   b) slower because the amount of dissolved oxygen in water is fairly low.

   c) faster because they need more oxygen for their survival.

   d) faster because the amount of dissolved oxygen in water is fairly low.

2. In an experiment to study independent inheritance of two separate traits : shape and colour of seeds, the ratio of the different combinations in F_2 progeny would be **[1]**

   a) 1 : 3

   b) 1 : 2 : 1

   c) 9 : 1 : 1 : 3

   d) 9 : 3 : 3 : 1

3. Disposable plastic plates should not be used because**:** **[1]**

   a) They are made of materials with light weight.

   b) They are made of biodegradable materials.

   c) They are made of toxic materials.

   d) They are made of non-biodegradable material.

4. Match the following with correct response. **[1]**

Column A	Column B
(i) Central nervous system	(a) Brain
(ii) Peripheral nervous system	(b) Sympathetic nervous system
(iii) Autonomic nervous system	(c) Cranial and spinal nerves
(iv) Reflex action	(d) Reflex arc

   a) (i) - (c), (ii) - (b), (iii) - (d), (iv) - (a)

   b) (i) - (a), (ii) - (c), (iii) - (b), (iv) - (d)

   c) (i) - (b), (ii) - (d), (iii) - (a), (iv) - (c)

   d) (i) - (d), (ii) - (a), (iii) - (c), (iv) - (b)

5. What will happen if the deer are missing in the following food chain? **[1]**

Grass → Deer → Tiger

a) The population of tigers will increase
b) The tigers will die
c) The amount of grass will decrease
d) The tigers will start eating grass

6. Select from the following the correct statement about tropic movement in plants: **[1]**

a) It is due to stimulus of touch and temperature.
b) It does not depend upon the direction of stimulus received.
c) It is observed only in roots and not in stems.
d) It is a growth related movement.

7. Select from the following a plant hormone which promotes cell division. **[1]**

a) Abscissic Acid
b) Cytokinins
c) Auxins
d) Gibberellins

8. **Assertion (A):** Amoeba takes in food using finger like extensions of the cell surface. **[1]**
Reason (R): In all unicellular organisms, the food is taken in by the entire cell surface.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

9. **Assertion (A):** Producers are capable of using light energy from the sun to make food available in an ecosystem. **[1]**
Reason (R): All food chains in an ecosystem start with a producer.

a) Both A and R are true and R is the correct explanation of A.
b) Both A and R are true but R is not the correct explanation of A.
c) A is true but R is false.
d) A is false but R is true.

10. Define the term pollination. Differentiate between self-pollination and cross-pollination. What is the significance of pollination? **[2]**

11. a. Construct a food chain of four trophic levels operating in a grassland. If the energy available to the organisms of 4^{th} trophic level is 75 joules, how much energy was available with the organisms of the 2^{nd} trophic level for transfer to the next trophic level? Justify your answer. **[2]**
b. Why is the flow of energy unidirectional in a food chain?

OR

What is meant by trophic level in a food chain? Construct a terrestrial food chain with four trophic levels. The energy flow in a food chain is always unidirectional. Why?

12. Name a plant growth hormone synthesized at the shoot tip. Explain its effect on the growth of a plant in response to light. **[2]**

13. Name the plant Mendel used for his experiment. What type of progeny was obtained by Mendel in F_1 and F_2 generations when he crossed the tall and short plants? Write the ratio he obtained in F_2 generation plants. **[3]**

14. i. Write the correct sequence of steps followed during journey of oxygen rich blood from lungs to various organs of human body. **[3]**
ii. What happens when the system of blood vessels develop a leak?

15. **Read the following text carefully and answer the questions that follow:** **[4]**

A student crossed pea plants having round and yellow seeds with pea plants having wrinkled and green seeds. He found that only one type of seeds were produced in the F_1 generation. When these F_1 generation pea plants were self - pollinated with each other, then in addition to the seed type of F_1 generation, some new types of seed combinations were also obtained in the F_2 generation.

i. Write any two contrasting visible characters other than the ones shown above, taken by Mendel for his experiment. (1)

ii. Mention the dominant traits observed in F_1 generation. (1)

iii. Give reason why the traits which were not visible in the seeds of F_1 generation reappeared in the seeds of F_2 generation. Write the ratio of different types of seeds obtained in F_2 generation in this case. (2)

OR

What is meant by the terms (I) dominant, and (II) recessive traits? Explain. (2)

16. i. Name the mode of reproduction of the following organisms and state the important feature of each mode : **[5]**

a. Planaria

b. Hydra

c. Rhizopus

ii. We can develop new plants from the leaves of Bryophyllum. Comment.

iii. List two advantages of vegetative propagation over other modes of reproduction.

OR

With the help of labelled diagram explain the general scheme to illustrate how nervous impulses travel in the body?

Section B

17. Select the incorrect statement. **[1]**

a. The formula of the compound is calcium sulphate dihydrate.

b. When mixed with water and left for half an hour, this compound sets into a hard mass.

c. If heated at higher temperature, the compound becomes dehydrated and is called dead burnt plaster.

d. Both (a) and (b)

a) Statement (d) is incorrect.

b) Statement (a) is incorrect.

c) Statement (b) is incorrect.

d) Statement (c) is incorrect.

18. Which of the given statement is correct or wrong: **[1]**

Statement A: Acetic acid freezes at 290K.

Statement B: Acetic is also called as glacial acetic acid.

a) Statement B is True; Statement A is false.

b) Statement A is true; Statement B is false.

c) Neither Statement A nor Statement B is true.

d) Both the statements A and B are true.

19. An element X reacts with O_2 to give a compound with a high melting point. This compound is also soluble in water. The element X is likely to be: **[1]**

a) silicon

b) carbon

c) iron

d) calcium

20. Match the following with the correct response: **[1]**

Column A	Column B
(i) Catenation	(a) Butene
(ii) Alkane	(b) Carbon compounds
(iii) Alkene	(c) Ethyne
(iv) Alkyne	(d) Ethane

a) (i) - (c), (ii) - (b), (iii) - (d), (iv) - (a)

b) (i) - (b), (ii) - (d), (iii) - (a), (iv) - (c)

c) (i) - (d), (ii) - (a), (iii) - (c), (iv) - (b)

d) (i) - (a), (ii) - (c), (iii) - (b), (iv) - (d)

21. During smelting, an additional substance is added which combines with impurities to form a fusible product known as: **[1]**

a) Mud

b) Gangue

c) Flux

d) Slag

22. Identify a group of the unsaturated hydrocarbons from the following: **[1]**

a) Butyne, Ethene, Propyne

b) Propane, Ethene, Butyne

c) Cyclohexane, Methane, Ethane

d) Ethene, Propane, Hexane

23. The name of the salt used to remove permanent hardness of water is: **[1]**

a) Calcium sulphate hemihydrate ($CaSO_4.\frac{1}{2}H_2O$)

b) Sodium carbonate decahydrate ($Na_2CO_3.10H_2O$)

c) Sodium hydrogen carbonate ($NaHCO_3$)

d) Sodium chloride (NaCl)

24. **Assertion (A):** When common salt is kept open, it absorbs moisture from the air. **[1]**
Reason (R): Common salt contains magnesium chloride.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

25. You have been provided with two test tubes. One of them contains distilled water and the other contain acid solution. How will you find out which of the test tube contains water without testing the contents of the test tube? **[2]**

26. Identify the type of reactions taking place in each of the following cases and write the balanced chemical equation for the reactions. **[3]**

a. Zinc reacts with silver nitrate to produce zinc nitrate and silver.

b. Potassium iodide reacts with lead nitrate to produce potassium nitrate and lead iodide.

OR

Define a chemical reaction. State four observations which help us to determine that a chemical reaction has taken place. Write one example of each of the observations with a balanced chemical equation.

27. The atomic number of an element is 20. Write its electronic configuration. State whether this element is a metal or a non-metal. What is its valency? Write the name and formula of the compound which this element forms with chlorine. **[3]**

28. **Read the following text carefully and answer the questions that follow:** **[4]**

Those reactions in which two compounds react by an exchange of ions to form two new compounds are called double displacement reactions. A double displacement reaction usually occurs in solution and one of the products, being insoluble, precipitate out (separates as a solid). Any reaction in which an insoluble solid (called precipitate) is formed that separates from the solution is called a precipitation reaction. The reaction in which acid or acidic oxide reacts with base or basic oxide to form salt and water is called neutralisation reaction.

For example, $2NaOH + H_2SO_4 \longrightarrow Na_2SO_4 + H_2O$

i. When hydrogen sulphide gas is passed through a blue solution of copper sulphate, a black precipitate of copper sulphide is obtained and the sulphuric acid so formed remains in the solution. Mention the type of reaction. (1)

ii. Balance the following chemical reaction. (1)

$Pb(NO_3)_{2(aq)} + KI_{(aq)} \longrightarrow PbI_{2(s)} + KNO_{3(aq)}$

iii. Barium chloride in reaction with ammonium sulphate forms barium sulphate and ammonium chloride. Which type of chemical reaction represents in this reaction? (2)

OR

Identify A in the following reaction. (2)

$AlCl_{3(aq)} + 3NH_4OH_{(aq)} \longrightarrow A + 3NH_4Cl_{(aq)}$

29. i. What are soaps? Explain the mechanism of cleansing action of soap with the help of a labelled diagram. **[5]**

ii. Detergents are better than soaps. Justify.

OR

a. Distinguish between esterification and saponification reactions with the help of chemical equations for each.

b. With a labelled diagram describe in brief an activity to show the formation of an ester.

Section C

30. Find the incorrect statement: **[1]**

A. Convex mirrors are used by the dentist to see the large images of teeth of patients.

B. Convex mirrors are used as rear-view mirrors in cars, motorcycles, scooters, etc

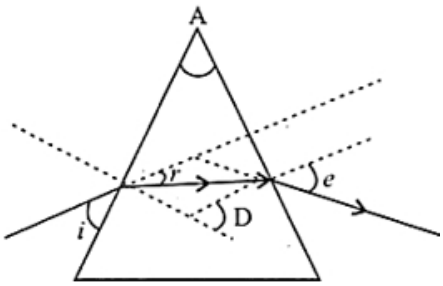
C. Concave mirrors are used for shaving purpose.

D. Concave mirrors are used by doctors to focus light inside the ear or inside the mouth for medical examination.

a) (B) b) (C)

c) (A) d) (D)

31. In the following diagram the correctly marked angles are: **[1]**



a) ∠A, ∠r and ∠D

b) ∠i, ∠A and ∠D

c) ∠A, ∠i and ∠e

d) ∠A and ∠e

32. **Assertion (A):** In electric circuits, wires carrying currents in opposite directions are often twisted together. **[1]**
Reason (R): If the wire are not twisted together, the combination of the wires forms a current loop. The magnetic field generated by the loop might affect adjacent circuits or components.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

33. Draw a ray diagram showing the path of rays of light when it enters with oblique incidence: **[2]**

a. from air to water

b. from water to air

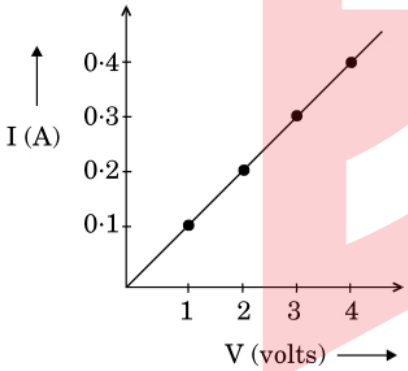
34. An electric heater rated 1100 W operates at 220 V. Calculate (i) its resistance, and (ii) the current drawn by it. **[2]**

OR

In the experiment to study the dependence of current (I) on the potential difference (V) across a resistor, a student obtained a graph as shown.

i. What does the graph depict about the dependence of current on the potential difference?

ii. Find the current that flows through the resistor when the potential difference across it is 2.5 V.



35. What is a Solenoid? Draw the pattern of the magnetic field lines around a current carrying solenoid. Mark on the pattern the region where the magnetic field is uniform. **[3]**

36. A student sitting at the back of the classroom cannot read clearly the letters written on the backboard. What advice will a doctor give to her? **[3]**

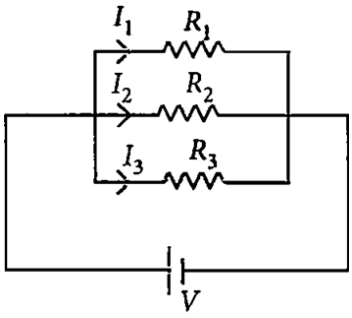
37. i. A straight cylindrical conductor is suspended with its axis perpendicular to the magnetic field of a horse-shoe magnet. The conductor gets displaced towards left when a current is passed through it. What will happen to the displacement of the conductor if the **[3]**

1. current through it is increased?
2. horse-shoe magnet is replaced by another stronger horse-shoe magnet?
3. direction of current through it is reversed?

ii. Name and state the rule for determining the direction of force on a current carrying conductor in a magnetic field.

38. **Read the following text carefully and answer the questions that follow:** **[4]**

If two or more resistances are connected in such a way that the same potential difference gets applied to each of them, then they are said to be connected in parallel.

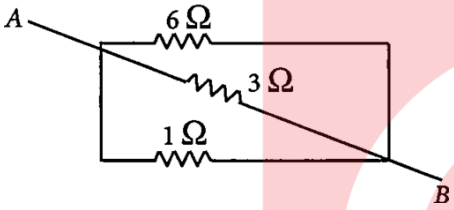


The current flowing through the two resistances in parallel is, however, not the same. When we have two or more resistances joined in parallel to one another, then the same current gets additional paths to flow and the overall resistance decreases.

i. Three resistances, 2 Ω, 6 Ω and 8 Ω are connected in parallel, then what will be the equivalent resistance? (1)

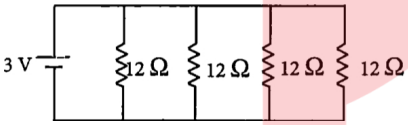
ii. A wire of resistance 12Ω is cut into three equal pieces and then twisted their ends together, then what will be the equivalent resistance? (1)

iii. Three resistances are connected as shown. Calculate the equivalent resistance between A and B (2)



OR

Find the current in each resistance. (2)



39. The variation of image distance (v) with object distance (u) for a convex lens is given in the following observation table. Analyse it and answer the questions that follow: **[5]**

S. No.	Object distance (u) cm	Image distance (v) cm
1	-150	+30
2	-75	+37.5
3	-50	+50
4	-37.5	+75
5	-30	+150
6	-15	+37.5

i. Without calculation, find the focal length of the convex lens. Justify your answer.

ii. Which observation is not correct? Why? Draw ray diagram to find the position of the image formed for this position of the object.

iii. Find the approximate value of magnification for u = -30 cm.

OR

i. State laws of reflection of light.

ii. An object of height 5·0 cm is placed at 15 cm in front of a concave mirror of focal length 10 cm. At what distance from the mirror should a screen be placed, so that a focussed image is obtained on it? Find the height of the image.

Solution

Section A

1.

(c) faster because they need more oxygen for their survival.

Explanation:

Since the amount of dissolved oxygen is fairly low compared to the amount of oxygen in the air, the rate of breathing in aquatic organisms is much faster than in terrestrial organisms.

2.

(d) 9 : 3 : 3 : 1

Explanation:

9 : 3 : 3 : 1

3.

(d) They are made of non-biodegradable material.

Explanation:

Disposable plastic plates should not be used because they are made of non-biodegradable material. Non-biodegradable substances may be inert, are not broken down and persist in the environment for a long time. They may thus cause harm to the various members of the ecosystem.

4.

(b) (i) - (a), (ii) - (c), (iii) - (b), (iv) - (d)

Explanation:

- The central nervous system (CNS) is made up of the brain, the spinal cord, and the optic nerves.
- The nervous system outside the brain and spinal cord.
- The part of the nervous system responsible for the control of the bodily functions not consciously directed, such as breathing, the heartbeat, and digestive processes.
- Reflex action is an involuntary and nearly instantaneous movement in response to a stimulus. It is made possible by neural pathways called the reflex arc.

5.

(b) The tigers will die

Explanation:

The tigers will die

6.

(d) It is a growth related movement.

Explanation:

It is a growth related movement.

7.

(b) Cytokinins

Explanation:

Cytokinins promote cell division.

8.

(b) Both A and R are true but R is not the correct explanation of A.

Explanation:

An amoeba catches food via pseudopodia, which are finger-like extensions of its cytoplasm. The food particle is subsequently consumed by encasing it in the cell membrane and internalising it, a process known as phagocytosis. Food is consumed by the entire surface of unicellular organisms.

9.

(b) Both A and R are true but R is not the correct explanation of A.

Explanation:

Both A and R are true but R is not the correct explanation of A.

10. Pollination is the act of transferring pollen grains from the male anther of a flower to the female stigma. The goal of every living organism, including plants, is to create offspring for the next generation. One of the ways that plants can produce offspring is by making seeds. Seeds contain the genetic information to produce a new plant.

Self-pollination:

i. It is the transfer of pollen grains from the anther of the stamen to the stigma of the carpel of the same flower or different flower of the same plant.
ii. It does not require external agents.
iii. It does not introduce variation.
iv. It is a sure and economical method.
v. It avoids mixing or dilution of the original characters.
vi. The progeny becomes weaker after every generation

Cross-pollination:

i. It is the transfer of pollen grains from the anther to the stigma of different flowers of different plants.
ii. It requires external agents like wind, insects, etc. to carry out pollination.
iii. It introduces variation and adaptability.
iv. It is not economical and is highly wasteful.
v. Good characters of a race can be diluted.
vi. The progeny becomes healthier and better fitted for existence.

11. a. The energy at the 4th trophic level is given 75J. According to the 10% law, only 10% of the energy from one trophic level is transferred to the next trophic level. Energy at the 3rd level (Snake 75J/10% = 75J/0.1= 750 J.

b. The flow of energy is unidirectional in a food chain. The energy that is captured by the autotrophs does not revert back to the solar input and the energy which passes to the herbivores does not come back to autotrophs. As it moves progressively through the various trophic levels it is no longer available to the pervious tropic level.

OR

Each step in a food chain through which the transfer of food takes place constitutes a trophic level.

Grass $\rightarrow$ Insect $\rightarrow$ Frog $\rightarrow$ Snake

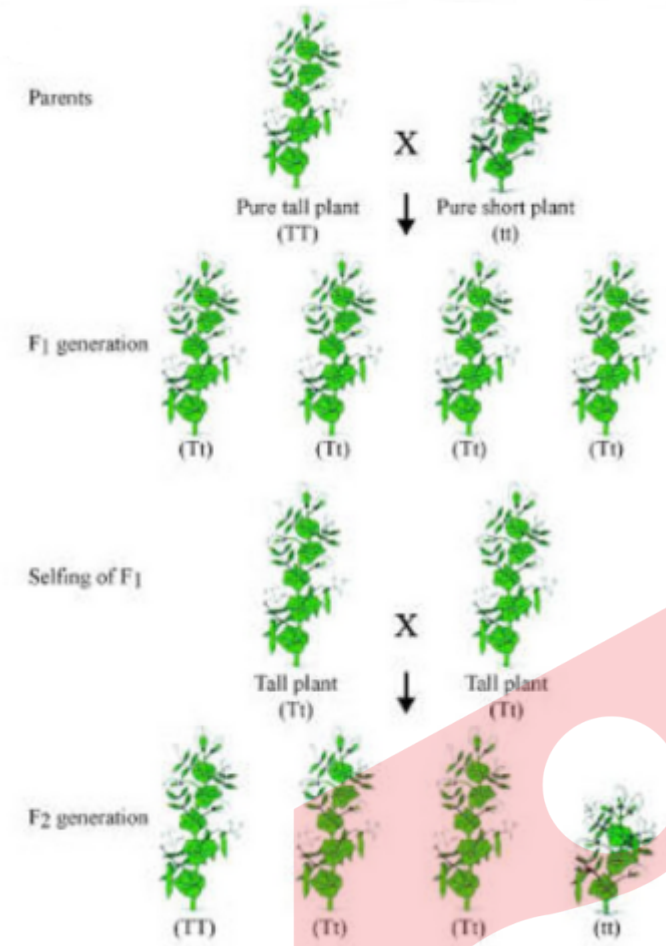
The flow of energy in food chains is unidirectional. The energy which passes to the herbivores does not come back to the autotrophs. The energy that is captured by the autotrophs does not revert back to the Sun. Therefore, in the food chain, the energy moves progressively through various trophic levels. This energy is no longer available to the previous trophic level. Thus, the flow of energy in a food chain is unidirectional.

12.
- Auxin
- When light is coming from one side of the plant, auxin located at shoot tip diffuses towards the shaded side of the shoot.
- Concentration of auxin in the shaded region stimulates the cells to grow longer as compared to the region exposed to light. So the plant tends to bend towards the light.

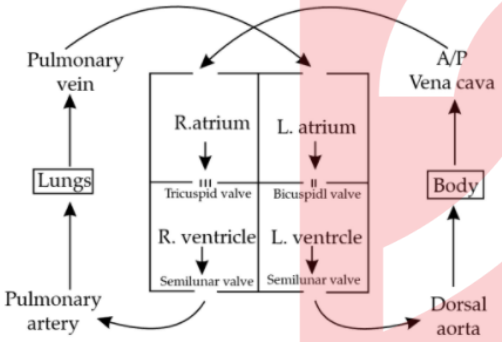
13. i. Plant used by Mendal is Garden Pea Plant (Pisum sativum).

ii. F_1 - All tall; F_2 - Tall and short

iii. The ratio in F_2 progeny is 3:1.



14. i. The correct sequence is blood flow from the Lungs $\xrightarrow[vein]{Pulmonary}$ Left sides of the heart $\rightarrow$ Ventricle $\rightarrow$ Aorta $\rightarrow$ Body organs



ii. The leaked blood flows into surrounding tissues leading to accumulation of blood. This condition is known as hematoma.

15. i. i. Flower color (purple or white)
ii. Plant size (tall or dwarf)

ii. In F_1 generation round and Yellow seeds were observed that mean round and Yellow are dominant traits.

iii. The traits which were not show in $_{F1}$ generation were recessive traits that do not show their presence in front of dominant genes.

Ratio of types if seeds in F_2 generation is 9 : 3 : 3 : 1

OR

I. The trait that first appears or is visibly expressed in the organism is called the dominant trait.

II. The trait that is present at the gene level but is masked and does not show itself in the organism is called the recessive trait.

16. i. a. **Planaria**: Fragmentation- occurs when an organism literally breaks off from itself. The broken fragments of the organism grow into individual separate organisms.

b. **Hydra-budding**: In hydra, a bud develops as an outgrowth due to repeated cell division at one specific site. These buds develop into tiny individuals and, when fully mature, detach from the parent body and become new independent individuals.

c. **Rhizopus**: spore formation occurs when a plant produces tiny spores and propagates through them. It burst open under favourable conditions giving rise to the new individual.

ii. Occurs asexually through vegetative propagation by leaves. These buds arise at the margins of leaves giving rise to adventitious roots, shoots and small leaves. The new plants then detach from the leaves and develop into a mature plant after coming in contact with the soil.

iii. a. offspring are clones of their parent plants.

b. The plants that cannot produce viable seeds such as banana, seedless grapes and oranges, etc, can be easily grown by vegetative propagation.

c. It is an easier, less expensive and a rapid method of propagation.

OR

Information	⟶	Received by dendrite tip of nerve cell	sets off a chemical reaction ⟶	Creates an electric impulse	⟶
Electric impulse travels from dendrites to	⟶	Neuron cell body	⟶	From cell body to ends of axon along axon	⟶
Electrical impulse cause release of some chemicals by the ends of axon	⟶	Chemicals cross the gap or synase and start similar electrical impulse in the dendrites of next neuron	⟶	Finally pass impulses from neurons to other cells *i.e.*, effector organ	

The information from the environment is detected by receptors and passed on to the dendrite of the sensory neuron, from where the electrical signals are passed on to the cyton then to axon and finally to the presynaptic knob which releases neurotransmitters which goes to the synaptic cleft and generates an electric response on to the dendrite of the next neuron and ultimately to brain (or spinal cord). The response from brain (or spinal cord) is similarly passed on to the effector, that undergoes the desired response.

Section B

17.

(c) Statement (b) is incorrect.

Explanation:

Atmosphere of Venus is made up of thick white and yellowish clouds of sulphuric acid.

18.

(d) Both the statements A and B are true.

Explanation:

The freezing point of ethanoic acid is 17^{o} C (290 K). When ethanoic acid (acetic acid) is cooled, it freezes to form a colourless, ice-like solid. The solid looks like a glacier and hence pure ethanoic acid are also called glacial ethanoic acid (or glacial acetic acid).

19.

(d) calcium

Explanation:

calcium

20.

(b) (i) - (b), (ii) - (d), (iii) - (a), (iv) - (c)

Explanation:

- Carbon forms a large number of compounds due to the property of catenation. Catenation is the linkage of atoms of the same element into longer chains. Catenation occurs most readily in carbon.
- Ethane is an alkane (saturated hydrocarbon with single bonds between the two carbon atoms).
- Butene is an alkene (unsaturated hydrocarbon with double bonds between two carbon atoms).
- Ethyne is an alkyne (unsaturated hydrocarbon with triple bonds between the two carbon atoms).

21.

(d) Slag

Explanation:

During the smelting of iron, limestone is added as a flux. The temperature inside the blast furnace decomposes limestone to calcium oxide which removes silicate impurity. Impurities like silicon are passed into the slag. The metal is separated from the molten slag.

$CaCO_3 \rightarrow CaO + CO_2$

$CaO + SiO_2 \rightarrow CaSiO_3$ (Slag)

22. **(a)** Butyne, Ethene, Propyne

Explanation:

Butyne, Ethene, Propyne

23.

(b) Sodium carbonate decahydrate ($Na_2CO_3.10H_2O$)

Explanation:

Insoluble carbonates are created when washing soda reacts with the salts in water and are easily removed through physical means.

24. **(a)** Both A and R are true and R is the correct explanation of A.

Explanation:

Magnesium chloride present in common salt is deliquescent i.e., it absorbs moisture from the air when kept in open.

25. Take two blue litmus paper strips and one by one dip in both test tubes A and B. The one which changes the colour of the litmus paper to red it is acid and the one which shows no change in color is water.

26. a. It is a displacement reaction.

$Zn + 2AgNO_3 \rightarrow Zn(NO_3)_2 + 2Ag$

b. It is a double displacement reaction.

$2Kl + Pb(NO_3)_2 \rightarrow 2KNO_3 + Pbl_2$

OR

Chemical reaction is the transformation of chemical substance into another chemical substance. Only a rearrangement of atoms takes place in a chemical reaction. Old bonds are broken and new bonds are formed. Some of the characteristics of chemical reactions are:

i. **Change in colour:** In some reactions, there is a change in colour after the reaction. For example, a chemical reaction between citric acid and purple-coloured potassium permanganate solution is characterised by a change in colour of potassium permanganate from purple to colourless.

$Pb(NO_3)_2(aq) + 2KI \longrightarrow 2KNO_3(aq) + PbI_2(s)$

$Pb(NO_3)_2(aq)+2KI$ - Colourless

$PbI_2(s)$ - Yellow

ii. **Formation of precipitate:** The chemical reaction between sulphuric acid barium chloride solution. $BaCl_2(aq) + H_2SO_4(aq) \longrightarrow 2HCl(aq) + BaSO_4(s)$

iii. **Change in temperature:** Temperature change is the characteristic of many reactions. For example, the chemical reaction between quicklime and water to form slaked lime. In this reaction temperature of the reaction is increased.

$CaO(s)+H_2O(l) \longrightarrow Ca(OH)_2(aq)+Heat$

iv. **Evolution of gas:** Some reactions are characterised by evolution of gas as a result of chemical reaction. For example, the chemical reaction between sodium carbonate and hydrochloric acid is characterised by the evolution of carbon dioxide gas.

$Zn + H_2SO_4 \longrightarrow ZnSO_4 + H_2$

27. The element with an atomic number of 20 is calcium (Ca).

The electronic configuration of calcium is: $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6\ 4s^2$.

Calcium is a metal because it is located in Group 2 (or Group IIA) of the periodic table, which consists of metals known as alkaline earth metals.

The valency of calcium is +2.

The compound that calcium forms with chlorine is calcium chloride. The chemical formula for calcium chloride is $CaCl_2$.

28. i. Double displacement reaction

$CuSO_4 + H_2S \longrightarrow 4CuS + H_2SO_4$

Both $CuSO_4$ and H_2S exchange their ions to give new compounds-CuS and H_2SO_4. Hence, this is a double displacement reaction.

ii. $Zn_{(s)} + H_2SO_{4(aq)} \longrightarrow ZnSO_{4(aq)} + H_{2(g)}$

It is an example of single displacement reaction.

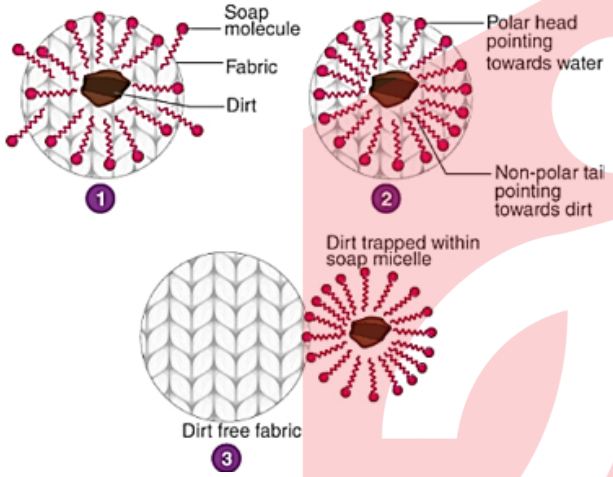
iii. $BaCl_2 + (NH_4)_2SO_4 \rightarrow \underset{(ppt.)}{BaSO_4} \downarrow + 2NH_4Cl$

It is a precipitation reaction as well as double displacement reaction.

OR

$AlCl_3 + 3NH_4OH \longrightarrow Al(OH)_3 + 3NH_4Cl$

29. i. Soaps are molecules has two ends have differing properties, one is hydrophilic (interacts with water), while the other end is hydrophobic (interacts with hydrocarbons). When soap is at the surface of water, the hydrophobic 'tail' of soap will not be soluble in water and the soap will align along the surface of water with the ionic end in water and the hydrocarbon 'tail' protruding out of water. Inside water, these molecules keeps the hydrocarbon portion out of the water. Thus, clusters of molecules in which the hydrophobic tails are in the interior of the cluster and the ionic ends are on the surface of the cluster. This formation is called a micelle. Soap in the form of a micelle is able to clean, since the oily dirt will be collected in the centre of the micelle. The micelles stay in solution as a colloid and will not come together because of ion-ion repulsion. Thus, the dirt suspended in the micelles is also easily rinsed away. The soap micelles are large enough to scatter light.



ii. Detergents are sodium salts of sulphonic acids or ammonium salts with chlorides or bromide ions etc. Detergents have long hydrocarbon chains. The charged ends of these compounds do not form insoluble precipitates with the calcium and magnesium ions in hard water but soap reacts with calcium and magnesium ions present in the hard water to form insoluble substance called scum. Thus, detergents are better cleansing agents than soaps, they remain effective even in hard water.

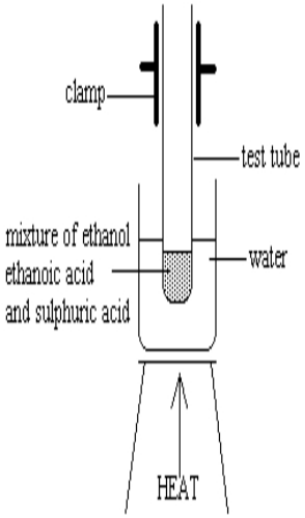
OR

- Here the difference between esterification and saponification reactions

$$\underset{Alcohol}{C_2H_5OH} + \underset{Acid}{CH_3COOH} \rightarrow \underset{Ester}{CH_3COO\,C_2H_5} + \underset{Water}{H_2O}(esterification)$$

$$\underset{Ester}{CH_3COOC_2H_5} + \underset{Base}{NaOH} \rightarrow \underset{Alcohol}{C_2H_5OH} + \underset{Salt}{CH_3COONa}\ (saponification)$$

- Diagram for esterification



Description

1mL ethanol, 1mL glacial acetic acid and a few drops of conc. H_2SO_4

↓

Warmed in a water bath

↓

Water is poured into the beaker

↓

Fruity smell is produced

Section C

30.

(c) (A)

Explanation:

Concave mirrors are used by the dentist to see the large images of teeth of patients since concave mirrors form enlarged images. Concave mirrors are also used for shaving purpose. Convex mirrors form diminished images. They are used as rear-view mirrors in cars, motorcycles, scooters, etc since they give a wide field of view.

31.

(d) ∠A and ∠e

Explanation:

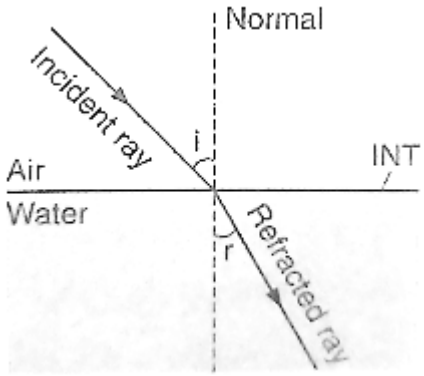
∠A and ∠e

32. **(a)** Both A and R are true and R is the correct explanation of A.

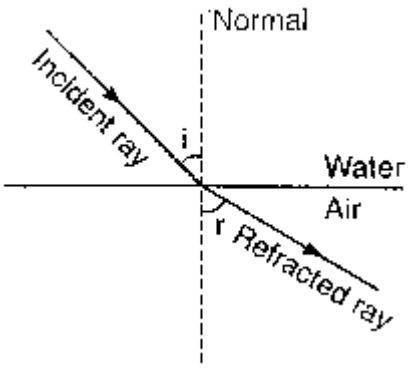
Explanation:

If the wires are twisted together, they can be modelled as a single wire carrying current in the opposite directions. In this model, no magnetic field is induced in the wires which does not affect adjacent circuits.

33. a. **From air to water :** Since the light is going from rarer (air) to denser (water) medium, therefore it will bend away from normal after refraction.



b. **From water to air :** Since the light is going from denser (water) to rarer (air) medium, therefore it will bend towards normal after refraction.



34. i. P = $\frac{V \times V}{R}$

R = $\frac{V \times V}{P}$

R = $\frac{220 \times 220}{1100}$

R = $\frac{48400}{1100}$

R = 44 ohm

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

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

I = $\frac{220}{44}$

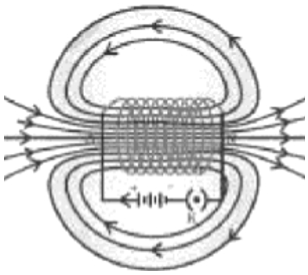
I = 5 A

OR

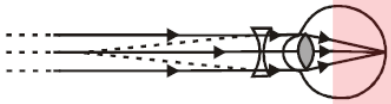
i. V $\propto$ I i.e current is directly proportional to applied voltage.

ii. at 2.5 V current will be 0.25 A

35. A coil of insulated copper wire wound in the form of a cylinder is a solenoid. When current is passed through a solenoid, it produces magnetic field lines like a bar magnet. The pattern of magnetic field lines of a solenoid is shown in the figure. Inside the solenoid, field lines are parallel to each other This indicates that the magnetic field is uniform .



36. This student is unable to see far off objects. This means that the student is suffering form myopia. Doctor will prescribe a concave lens a suitable focal length.



Correction for myopia

37. i. 1. The force acting on a current-carrying conductor placed perpendicular to a magnetic field increases with the increase in the current flowing through a conductor.

2. When a horseshoe magnet is replaced by a stronger magnet, then the magnetic field increases. Thus, the force acting on the conductor increases.

3. If the length of the conductor increases then the force acting on the conductor also increases.

ii. Fleming's left hand rule: Stretch the forefinger, middle finger and the thumb of your left hand mutually perpendicular to each other. If the forefinger indicates the direction of magnetic field and the middle finger indicates the direction of current, then the thumb will indicate the direction of motion of conductor.

38. i. The equivalent resistance in the parallel combination is lesser than the least value of the individual resistance.

The equivalent resistance of parallel combinations

$\frac{1}{Rp} = \frac{1}{2} + \frac{1}{4} + \frac{1}{8}$

$\Rightarrow$ Rp = $\frac{8}{7}\Omega$

Thus equivalent resistance is less than 2Ω.

ii. Resistance of each piece $= \frac{12}{3} = 4\Omega$

$\frac{1}{R_p} = \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{3}{4} \Rightarrow R_p = \frac{4}{3}\Omega$

iii. All the three resistors are in paralle.

$\therefore \frac{1}{R_p} = \frac{1}{6} + \frac{1}{3} + \frac{1}{1} = \frac{1+2+6}{6} = \frac{9}{6}$ $R_P = \frac{6}{9} = \frac{2}{3}\Omega$

OR

All are in parallel.

$\frac{1}{R_p} = \frac{1}{12} \times 4 = \frac{1}{3} \Rightarrow R_p = 3\Omega$

$I = \frac{3}{3} = 1$ A

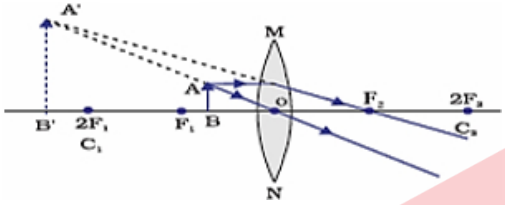
So, current in each resistor $I' = \frac{3}{12} = \frac{1}{4}$ A

39. i. S. No. 3, 2f is 50 cm. $\therefore$ 2f = 50 cm, or f = 25 cm.

Justification: Object distance(u) and image distance (v) are same so it implies that object is placed at 2F.

ii. S. No. 6, is not correct.

Reason: For u = −15 cm, sign of v must be - ve (as the image is formed on the same side of the lens as the object)



iii. Magnification: $m = \frac{v}{u}$

$= \frac{+150 \text{ cm}}{-30 \text{ cm}} = -5$ cm

OR

i. The angle of incidence is equal to the angle of reflection.

The incident ray, the normal to the mirror at the point of incidence and the reflected ray, all lie in the same plane.

ii. u = -15 cm, f = -10 cm (concave mirror)

h = 5.0 cm

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

$\frac{1}{v} = \frac{-1}{10 \text{ cm}} + \frac{1}{15 \text{ cm}} = \frac{-1}{30 \text{ cm}}$

or v = -30 cm. The screen must be placed at a distance of 30 cm from the mirror in front of it

$(m) = \frac{h'}{h} = -\frac{v}{u}$

$h = \frac{-v}{u} \times h = -\frac{-30 \text{ cm}}{-15 \text{ cm}} \times 5 \text{ cm} = -10$ cm

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