CBSE
Class X Science
Board Paper – 2019 (Set 1)

Time allowed: 3 hours   **Maximum marks: 80**

General Instructions:

1. The question paper comprises of two **Sections, A** and **B**. You are to attempt both the sections.
2. All questions are compulsory.
3. All questions of **Section A** and **Section B** are to be attempted separately.
4. There is an internal choice in **three** questions of **three** marks each, **two** questions of **five** marks each in Section A and in **one** question of **two** marks in Section B.
5. Question numbers **1** and **2** in **Section A** are **one mark** questions. These are to be answered in one word or in **one** sentence.
6. Question numbers **3** to **5** in **Section B** are **two marks** questions. These are to be answered in about **30 words each**.
7. Question numbers **6** to **15** in **Section C** are **three marks** questions. These are to be answered in about **50 words each**.
8. Question numbers **16** to **21** in **Section D** are **five marks** questions. These are to be answered in about **70 words each**.
9. Question numbers **22** to **27** in **Section E** are based on practical skills. Each question is a **two** marks question. These are to be answered in brief.

Section A

1. State Ohm's law.   [1]

2. Name any two nutrients that the spent slurry has in the biogas plant.   [1]

Section B

3. Draw a labelled ray diagram to show the path of the reflected ray corresponding to an incident ray of light parallel to the principal axis of a convex mirror. Mark the angle of incidence and angle of reflection on it.   [2]

4. A compass needle is placed near a current carrying straight conductor. State your observation for the following cases and give reasons for the same in each case: [2]
   (a) Magnitude of electric current is increased.
   (b) The compass needle is displaced away from the conductor.

5. Out of HCl and CH_3COOH, which one is a weak acid and why? Explain with the help of an example. [2]

OR

"Sodium hydrogen carbonate is a basic salt." Justify this statement. How is it converted into washing soda?

Section C

6. Define genetics. Why is decrease in the number of surviving tigers a cause of concern from the point of view of genetics? Explain briefly. [3]

7. A concave mirror has a focal length of 20 cm. At what distance from the mirror should a 4 cm tall object be placed so that it forms an image formed. [3]

OR

A real image 2/3rd of the size of an object is formed by a convex lens when the object is at a distance of 12 cm from it. Find the focal length of the lens.

8. 2 g of ferrous sulphate crystals are heated in a dry boiling tube. [3]
   (a) List any two observations.
   (b) Name the type of chemical reaction taking place.
   (c) Write balanced chemical equation for the reaction and name the products formed.

OR

You might have noted that the when copper powder is heated in a china dish, the reddish brown surface of copper powder becomes coated with a black substance. [3]
   (a) Why has this black substance formed?
   (b) What is this black substance?
   (c) Write the chemical equation of the reaction that takes place.
   (d) How can the black coating on the surface be turned reddish brown?

9. What is a food chain? Why is the flow of energy in an ecosystem unidirectional? Explain briefly. [3]

OR

   (a) Why should National Parks be allowed to remain in their pristine form?
   (b) Why is reuse of materials better than recycling?

10. A white powder is added while baking cakes to make it soft and spongy. Name its main ingredients. Explain the function of each ingredient. Writ the chemical reaction taking place when the powder is heated during baking. [3]

11. Two circular coils P and Q are kept close to each other, of which coil P carries a current. What will you observe in the galvanometer connected across the coil Q [3]

(a) if current in the coil P is changed?

(b) if both the coils are moved in the same direction with the same speed?

Give reason to justify your answer in each case.

12. [3]

(a) Write two water conducting tissues present in plants. How does water enter continuously into the root xylem?

(b) Explain why plants have low energy needs as compared to animals.

13. Why does the flow of signals in a synapse from axonal end of one neuron to dendritic end of another neuron take place but not in the reverse direction? Explain. [3]

14. Mention the environmental consequences of the increasing demand for energy. List four steps you would suggest to reduce the consumption of energy. [3]

15. An ore on treatment with dilute hydrochloric acid produces brisk effervescence. Name the type of ore with one example. What steps will be required to obtain metal from the enriched ore? Also write the chemical equations for the reactions involved in the process? [3]

SECTION D

16. [5]

(a) State the reason why carbon can neither form C^{4+} cations nor C^{4-} anions, but forms covalent bonds. Also state reasons to explain why covalent compounds

(i) are bad conductors of electricity.

(ii) have low melting and boiling points.

(b) Write the structural formula of benzene, C_6H_6.

OR

(a) Define the term 'isomer'.

(b) Two compounds have same molecular formula C_3H_6O. Write the name of these compounds and their structural formula.

(c) How would you bring the following conversions:

(i) Ethanol to ethane

(ii) Propanol to propionic acid

17. [5]

   (a) A 5 cm tall object is placed perpendicular to the principal axis of a convex lens of focal length 20 cm. The distance of the object from the lens is 30 cm. Find the position, nature and size of the image formed.

   (b) Draw a labelled ray diagram showing object distance, image distance and focal length in the above case.

18. [5]

   (a) How does metallic character of elements in Modern Periodic Table vary on moving from

      (i) left to right in a period?

      (ii) top to bottom in a group?

      Explain with the help of an example in each case.

   (b) If an element X is placed in group 14, what will be the nature of bond in its chloride? Write the chemical formula of the compound formed.

   (c) An element X has mass number = 35 and number of neutrons = 18. What is the atomic number of X? Write electronic configuration of X and determine its valency.

19. Compare the power used in 2 Ω resistor in each of the following circuits: [5]
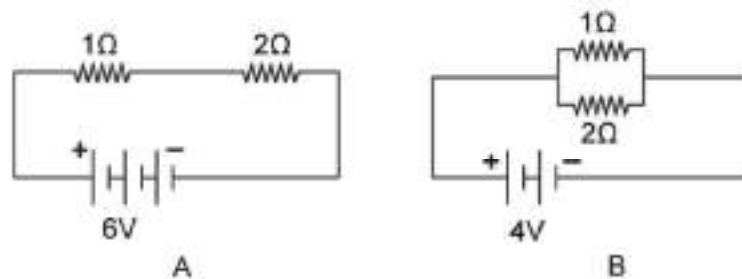
                        OR

A bulb is rated 40 W; 220 V. Find the current drawn by it, when it is connected to a 220 V supply. Also find its resistance. If the given bulb is replaced by a bulb of rating 25 W; 220 V, will there be any change in the value of current and resistance? Justify your answer and determine the change.

20. [5]

   (a) Distinguish between cross-pollination and self-pollination. Mention the site and product of fertilization in a flower.

   (b) Draw labelled diagram of a pistil showing the following parts:

      Stigma, Style, Ovary, Female germ cell

OR

(a) Draw a diagram of human female reproductive system and label the parts:
   (i) which produce an egg.
   (ii) where fertilization takes place.
(b) List two bacterial diseases which are transmitted sexually.
(c) What are contraceptive devices? Given two reasons for adopting contraceptive devices in humans.

21.   [5]
(a) How do the following provide evidences in favour of evolution in organisms? Explain with an example for each.
   (i) Homologues organs
   (ii) Analogous organs
   (iii) Fossils
(b) Explain two methods to determine the age of fossils.

SECTION E

22. What would you observe on adding zinc granules to freshly prepared ferrous sulphate solution? Given reason for your answer.   [2]

23. How is the presence of an acid tested with a strip of red litmus paper?   [2]

OR

A student is performing an experiment to study the properties of acetic acid. Answer the following question:
(i) Name the substance he must add to acetic acid to produce carbon dioxide.
(ii) Given the relevant chemical equation for the reaction.
(iii) How would he test CO_2 gas in the laboratory?

24. A teacher gives a convex lens and a concave mirror of focal length of 20 cm each to his student and asks him to find their focal lengths by obtaining the image of a distant object. The student uses a distant tree as the object and obtains its sharp image, one by one, on a screen. The distances d_1 and d_2 between the lens/mirror and the screen in the two cases and the nature of their respective sharp images are likely to be   [2]
(a) (20 cm, 40 cm) and (erect and erect)
(b) (20 cm, 40 cm) and (inverted and inverted)
(c) (20 cm, 20 cm) and (inverted and inverted)
(d) (20 cm, 40 cm) and (erect and inverted)

Given reasons for your answer.

25. The rest position of the needles in a milliammeter and voltmeter, not in use, are as shown in Figure A. When a student uses these instruments in his experiment, the reading of the needles are in the positions shown in Figure B. Determine the correct values of current and voltage the student should use in his calculations. [2]

Figure A   Figure B
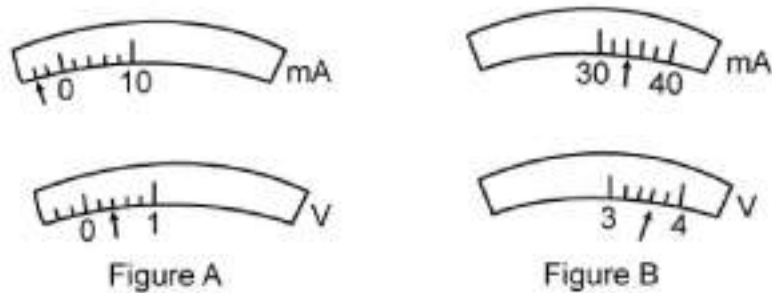
OR

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.
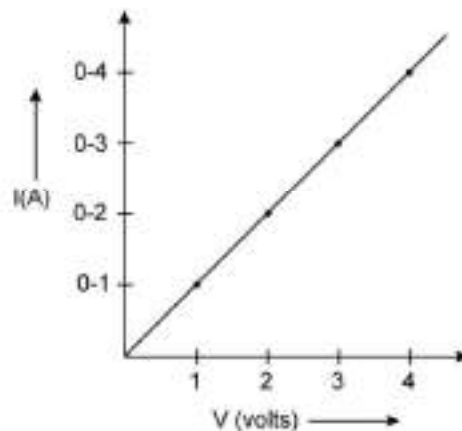
26. In the experiment "To prepare a temporary mount of a leaf peel to show stomata", glycerin and safranin are used. When and why are these two liquids used? Explain.   [2]

27. Draw labelled diagram to show the following parts in an embryo of a pea seed: [2]
        Cotyledon, Plumule, Radical

OR

A student observed a permanent slid showing asexual reproduction in Hydra. Draw labelled diagram in proper sequence of the observations that must have been made by the student. Name the process of reproduction also.
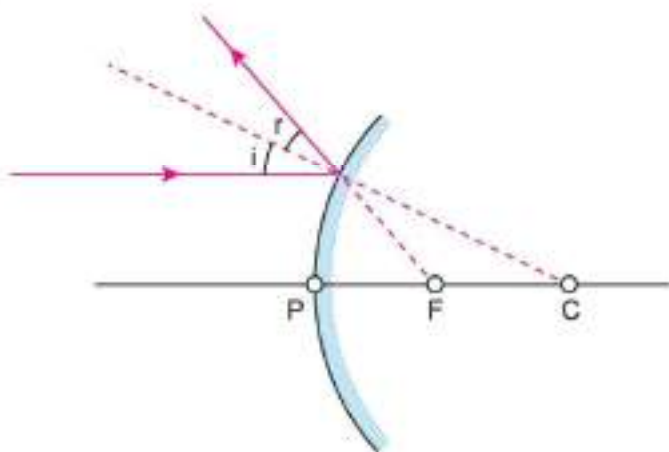
CBSE
Class X Science
Board Paper – 2019 (Set 1) Solution

Section A

1. Ohm's law – At constant temperature, the current flowing through a conductor is directly proportional to the potential difference across its ends.

2. Two nutrients in the spent slurry in the biogas plant are nitrogen and phosphorus.

Section B

3.

4.
   (a) The deflection in the compass needle will increase because the magnitude of the magnetic field produced by the current is directly proportional to the current passing through the conductor. Hence, greater the current, stronger will be the magnetic field and larger will be the deflection of the compass needle.

   (b) If the compass needle is displaced away from the current-carrying conductor, then the deflection of the compass needle will decrease because the magnitude of the magnetic field is inversely proportional to the distance of a particular point from the conductor. So, more the distance between the conductor and the needle, lesser will be the deflection in the compass needle.

5. HCl is a strong acid and CH_3COOH is a weak acid. HCl completely dissociates into ions in a solution, while CH_3COOH dissociates partially into ions in a solution.
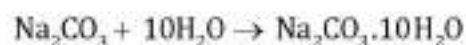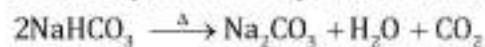
OR

A basic salt is formed from a strong base and a weak acid.

Sodium hydrogen carbonate is formed from a strong base NaOH and a weak acid H_2CO_3; hence, it is a basic salt.

$NaOH + H_2CO_3 \rightarrow NaHCO_3 + H_2O$

Sodium hydrogen carbonate is strongly heated to produce sodium carbonate, which then recrystallises to produce washing soda.

$2NaHCO_3 \xrightarrow{\Delta} Na_2CO_3 + H_2O + CO_2$

$Na_2CO_3 + 10H_2O \rightarrow Na_2CO_3.10H_2O$

Section C

6. Genetics is a branch of biology which explains the transmission of body characteristics, both similarities and differences, from parents to the offspring.

   When a population is small, the scope and number of variations are limited, and hence, diversity and traits are reduced. The decrease in the number of surviving tigers is a cause of concern from the point of view of genetics because it would cause a loss of genetic variability. Tigers carry genes which have made them adapt to the particular environment during the long process of evolution. If these tigers become extinct, then the genes responsible for survival would also become extinct and would not be able to contribute to the survival of future generations.

7. $f = -20$ cm

   $h_0 = 4$ cm

   $v = -30$ cm

   $u = ?$

   $h_i = ?$

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

   $\dfrac{1}{-20} = \dfrac{1}{-30} + \dfrac{1}{u}$

   $\dfrac{1}{u} = \dfrac{1}{-20} - \dfrac{1}{-30}$

   $\dfrac{1}{u} = \dfrac{1}{-20} + \dfrac{1}{30}$

   $\therefore u = -60$ cm

   Thus, the object must be placed at 60 cm to get an image at 30 cm.

   $\dfrac{-v}{u} = \dfrac{h_i}{h_o}$

   $-\dfrac{-30}{-60} = \dfrac{h_i}{4}$

   $h_i = -2$ cm

   Thus, the height of the image is 2 cm.

OR

The real image is 2/3rd the size of the object in front of the convex lens.

This means $m = -2/3$

We know

$$m = \frac{h_i}{h_o} = \frac{v}{u}$$

$$\frac{h_i}{h_o} = -\frac{2}{3}$$

$$\therefore \frac{v}{u} = -\frac{2}{3} \quad \text{(negative sign indicates that image is real and inverted)}$$

Also, the object is at 12 cm from the lens.

Thus, $u = -12$ cm ... (object is placed to the left side of the lens)

So, $v = -\frac{2}{3} \times -12 = 8$ cm

Thus, $v = 8$ cm

By the lens formula,

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

$$\frac{1}{f} = \frac{1}{8} - \frac{1}{-12} = \frac{1}{8} + \frac{1}{12}$$
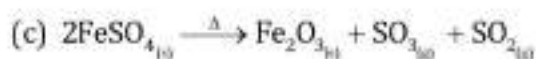
$$\therefore f = 4.8 \text{ cm}$$

Thus, the focal length of the convex lens is 4.8 cm.

8.

(a) The green colour of ferrous sulphate crystals on heating loses water of crystallisation and becomes anhydrous ferrous sulphate.

The colour first changes from light green to white and then brown solid ferric oxide is formed.
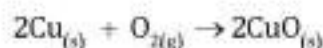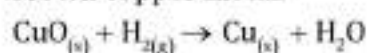
(b) It is a decomposition reaction.

(c) $2FeSO_{4(s)} \xrightarrow{\Delta} Fe_2O_{3(s)} + SO_{3(g)} + SO_{2(g)}$

OR

(a) The black colour is due to the oxidation of copper.

(b) When copper is heated, it forms a black-coloured compound copper oxide.

(c)

$$2Cu_{(s)} + O_{2(g)} \rightarrow 2CuO_{(s)}$$

(d) When hydrogen gas is passed over copper oxide, it gets reduced to reddish brown copper metal.

$$CuO_{(s)} + H_{2(g)} \rightarrow Cu_{(s)} + H_2O$$

9. The sequence of living organisms in a community in which one organism consumes another organism to transfer food energy is called a food chain.

Energy enters plants from the Sun during the process of photosynthesis. This energy is then passed on from one organism to another in a food chain. The solar energy converted by the autotrophs into food energy cannot be reconverted to solar energy, and the energy which passes from the herbivores to the carnivores can never go back to the herbivores. The energy lost as heat cannot be returned to the plants and reused during photosynthesis. Therefore, the flow of energy in an ecosystem is said to be unidirectional.

OR

(a) National parks should be allowed to remain in their pristine form so that the natural habitat of wild animals and birds is preserved.
(b) Recycling is the process which involves conversion of used materials to new materials which are ready for use again. It helps in the conservation of raw materials. However, the process involves a lot of expenditure and energy consumption. Recycling units release a lot of toxic chemicals as waste materials and pollute the environment.
Reuse involves using the same materials again and again for different purposes. This does not utilise any money or energy and does not release toxic wastes.
Hence, the reuse of materials is better than recycling.

10. The white powder added while baking cakes to make it soft and spongy is baking soda.
It consists of sodium bicarbonate ($NaHCO_3$) and edible acids such as tartaric acid.
When baking powder comes in contact with water, tartaric acid gets activated and sodium bicarbonate gives CO_2 which makes the cake soft and spongy.
Also, tartaric acid neutralises the bitterness of sodium bicarbonate.

$$2NaHCO_3 \xrightarrow{\Delta} Na_2CO_3 + CO_2 + H_2O$$
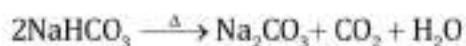
11. The galvanometer connected across the coil Q will show a momentary deflection and will return to the zero position. This is because when the current is passed through coil P, the current gets induced in the coil Q momentarily, but as the current is steady in coil P, its magnetic field also becomes steady and the current in coil Q stops.
(a) If the current in coil P is changed, then the galvanometer will show deflection. If the current is increased, then the deflection will increase. If the current flow is stopped, then the galvanometer will deflect in the opposite direction. This behaviour of the pointer indicates that the current is being induced in coil Q continuously.

(b) When both coils are moved with the same speed in the same direction, then the relative motion between the two coils will be zero. Thus, the galvanometer will show no deflection.

12.

(a) Tracheids and xylem vessels are the two water-conducting tissues in plants.
<u>Entry of water into the root xylem:</u>
- Continuous flow of water in the root xylem occurs due to transpirational pull.
- Water lost through the stomata during transpiration is replaced by the xylem vessels.
- Evaporation of water molecules from leaf cells creates a suction which pulls water from the xylem of roots to the leaves.
- In this way, transpiration helps in the absorption and upward movement of water and minerals dissolved in soil from roots to leaves.
- Cells of roots are in close contact with soil and so actively take up ions by diffusion.
- The ion concentration increases inside the root, and hence, osmotic pressure increases the movement of water from the soil into the roots which occurs continuously.

(b)
- Plants are stationary. They are autotrophic and do not have to move from one place to another in search of food. Hence, their energy requirement is less. Therefore, most plant tissues are dead with no living protoplasm.
- On the other hand, animals are heterotrophic and have to move in search of food, mates and shelter. Hence, they require more energy. Therefore, most animal tissues are living.

13. When an electrical signal reaches the axonal end of a neuron, it releases a chemical substance. This chemical diffuses towards the dendrite end of the next neuron where it generates an electrical impulse or signal. Hence, the electrical signal is converted to a chemical signal at the axonal end. Since the chemicals are absent at the dendritic end of the neuron, the nerve impulse can go across only from one side, i.e. from the axon towards the dendrites. The synapse actually acts like a one-way valve and ensures that the nerve impulses travel in only one direction.

14. <u>Environmental consequences of the increasing demand for energy:</u>
- Fossil fuels are non-renewable sources of energy and can get exhausted faster if increasingly used.
- Burning of fossil fuels produces smoke which causes severe environmental pollution.
- Gases produced upon combustion of fossil fuels lead to the greenhouse effect, which is responsible for global warming.

<u>Steps to reduce energy consumption:</u>
- Use of electricity and electrical appliances must be reduced
- Prefer to use public transport or bicycles for commuting
- Prevent unnecessary wastage of water
- Use solar heaters in place of electrical heaters wherever possible

15. An ore on treatment with dilute hydrochloric acid produces brisk effervescence, so the ore must be carbonate ore.

Example: Zinc carbonate ($ZnCO_3$)

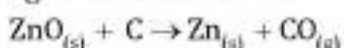Steps required to obtain metal from the enriched ore:

<u>Calcination:</u>

Carbonate ores are converted to metal oxides by the process of calcination.

$$ZnCO_{3(s)} \xrightarrow{\Delta} ZnO_{(s)} + CO_{2(g)}$$
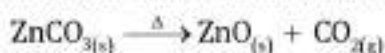
<u>Reduction:</u>

Metal oxides are reduced to their respective metals by using a suitable reducing agent such as carbon.

$$ZnO_{(s)} + C \rightarrow Zn_{(s)} + CO_{(g)}$$

Section D

16.

(a) The carbon atom has 4 electrons in its valence shell. It requires four electrons to complete its octet. The removal of four valence electrons will require a large amount of energy, so it does not form C^{4+} cations. Also, the cation so formed will have two electrons and six protons which makes it highly unstable. The nucleus of the carbon atom consists of 6 protons which are unable to hold ten electrons to form an anion. Therefore, the carbon is unable to form C^4 anions.

But it can achieve a stable electronic configuration by sharing its four electrons with other atoms. Therefore, it forms a covalent bond by sharing electrons.

(i) In a covalent compound, there are no free electrons present to conduct electricity; therefore, covalent compounds are bad conductors of electricity.

(ii) The intermolecular force of attraction in covalent compounds is weak, so less energy is required to break the bond. Therefore, they have low melting and boiling points.

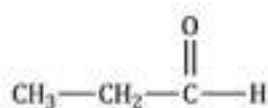(b) The structural formula of benzene (C_6H_6) is

Benzene

(a) Compounds with the same molecular formula but different structural formula are called isomers.

(b) Isomers of C_3H_6O are propanal and propanone.

$$CH_3-CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-H$$

Propanal

$$CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-CH_3$$
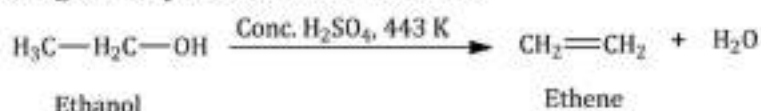
Propanone

(c)

    (i) Conversion of ethanol to ethane

    When ethanol is heated with excess of concentrated sulphuric acid at 443 K, it gets dehydrated to form ethane.

$$H_3C-H_2C-OH \xrightarrow{\text{Conc. } H_2SO_4,\ 443\ K} CH_2{=}CH_2 + H_2O$$

Ethanol   Ethene

    (ii) Propanol to propaonic acid

    Propanoic acid is formed by the oxidation of propanol by using an oxidising agent such as alkaline $KMnO_4$ or acidified $K_2Cr_2O_7$.

$$H_3C-H_2C-CH_2-OH + 2[O] \xrightarrow{\text{Alkaline } KMnO_4;\text{Heat}} CH_3-CH_2-COOH + H_2O$$

Propanol   Propanoic acid

17.

  (a) $h_o = 5$ cm

      $f = +20$ cm

      $u = -30$ cm

      $v = ?$

      By the lens formula,

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

$$\frac{1}{+20} = \frac{1}{v} - \frac{1}{-30}$$

$$\frac{1}{v} = \frac{1}{20} + \frac{1}{-30}$$

$$\therefore v = 60 \text{ cm}$$

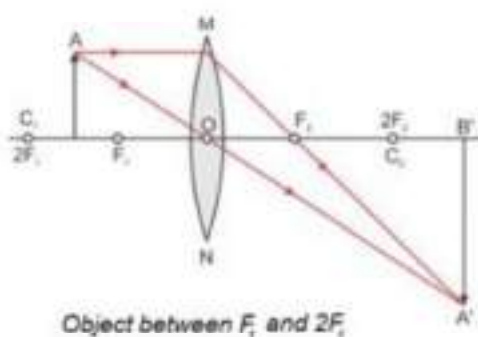Thus, the image will be formed at 60 cm to the right side of the lens.

We know

$$m = \frac{h_i}{h_o} = \frac{v}{u}$$

$$\frac{h_i}{5} = \frac{60}{-30}$$

$$\therefore h_i = -10 \text{ cm}$$

Height of the image is 10 cm. The negative sign indicates that the image is real and inverted, while the value indicates that it is magnified.

(b)

Object between F_1 and $2F_1$

18.

(a)

(i) On moving from left to right in a period in the periodic table, the metallic character of the element decreases.
On moving across a period, the nuclear charge increases and the atomic size decreases, and hence, elements cannot lose electrons easily. Therefore, the metallic nature decreases across a period on moving from left to right.
Example: In the 2nd period, lithium is the most metallic element.

(ii) In the periodic table, on moving down a group, the metallic character of the element increases.
On moving down a group, the atomic size increases and electrons are away from the nucleus and can lose electrons easily.
Example: In group 1, lithium is the least metallic element, while francium is the most metallic element.

(b) An element X is placed in group 14.
So, the valency of element X is 4.
Therefore, to achieve the stable electronic configuration, it will share its four electrons with chlorine to form a covalent bond.
The formula of chloride formed is XCl_4.

(c) Given:

Mass number of X = 35

No. of neutrons = 18

Mass number = No. of protons + No. of neutrons

No. of protons = 35 – 18

So, the atomic number = 17

Electronic configuration: 2, 8, 7

There are 7 valence electrons; therefore, the valency of element X is 1.

19.

(a) In the first circuit,

V = 6 V

Total resistance, R = 1 + 2 = 3 Ω

By Ohm's law,

V = I R

Thus, 6 = I x 3

Therefore, I = 2 A

Now, as the current flowing through the resistors in the series is the same,

$P = I^2 R$

$P = (2)^2 \times 2$

P = 8 W

The power consumed by a 2 Ω resistor in the first circuit is 8 W.

In the second circuit,

V = 4 V

When the resistors are in parallel, the potential difference across the resistors is the same.

Thus,

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

$$P = \frac{(4)^2}{2}$$

∴ P = 8 W

The power consumed by a 2 Ω resistor in the second circuit is 8 W.

Thus, the power consumed by the 2 Ω resistors in both circuits are equal.

OR

When a bulb of 40 W, 220 V is connected to the battery of 220 V,

P = V x I

So, I = 40/220 = 0.18 A

Thus, current drawn by a bulb of 40 W is 0.18 A.

The resistance of the bulb is given by

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

$$R = \frac{(220)^2}{40}$$

$$\therefore R = 1210 \ \Omega$$

Thus, the resistance of a 40 W bulb is 1210 Ω.

Now,

When the bulb of rating 25 W, 220 V is connected in the circuit,

The current will be

I = P/V = 25/220 = 0.11 A

Thus, there is a small change in the current.

Similarly, the resistance of the 25 W bulb is

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

$$R = \frac{(220)^2}{25}$$

R=1936 Ω

There is a change in the resistance.

The resistance of low-power devices is more than high-power devices.

20.

(a) Differences between self-pollination and cross pollination: (Any four points)

Self-pollination	Cross-pollination
1. It is the transfer of pollen grains from the anther to the stigma of the same flower.	1. It is the transfer of pollen grains from the anther of one flower to the stigma of another flower of a different plant of the same species.
2. It does not require any external agent, such as wind, water and insects, to carry out pollination.	2. It requires an external agent for pollination to occur.
3. It can take place even when the flower is closed.	3. It can occur only when the flower is open.
4. In self-pollinated flowers, the anther and stigma mature at the same time.	4. In cross-pollinated flowers, the anther and stigma mature at different times.
5. It preserves parental characters.	5. It does not preserve parental characters.
6. New varieties are not possible.	6. New varieties can be produced.

The site of fertilisation in flowers is the ovule which is present in the ovary. The product of fertilisation is a zygote which later develops into a fruit.

(b) Diagram of pistil:
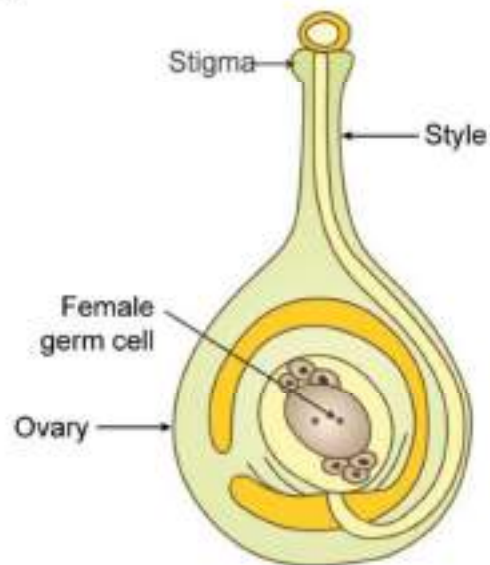
OR

(a) Human female reproductive system:
  (i) Part which produces an egg: Ovary
  (ii) Part where fertilisation takes place: Fallopian tubes

(b) Bacterial diseases which are transmitted sexually:
  1. Gonorrhoea
  2. Syphilis

(c) Contraceptive devices involve the use of various devices, drugs, agents, sexual practices or surgical procedures to prevent conception or pregnancy.
Reasons for adopting contraceptive devices in humans:
  - To prevent unwanted pregnancies to control population growth
  - To offer protection from sexually transmitted diseases
  - To ensure proper health of the mother and child by preventing frequent pregnancies
  - To offer sufficient gap between offspring to ensure their proper care

21.

(a)

(i) Homologous organs:

- Homologous organs are organs which have the same structure and origin but different function.
- Example: Forelimbs of man and bird have the same structure, but they have different functions of handling and flying, respectively.
- The presence of homologous organs provides evidence that they have been derived from the same ancestor and hence have the same structure but different functions.

(ii) Analogous organs:

- Analogous organs are organs which have different structure and origin but the same function.
- Example: Wings of an insect and wings of a bird have different structures but perform the same function of flying.
- Analogous organs prove that organisms belonging to different ancestors perform similar functions and then keep evolving with favourable environment conditions.

(iii) Fossils:

- Fossils are the dead remains of plants and animals which lived in the remote past.
- The presence of fossils provides evidence for evolution.
- Example: Archaeopteryx is a bird which has many characteristics similar to those of reptiles which implies that birds seem to have evolved from reptiles.

(b) Methods to determine the age of fossils:

- If we dig into the Earth in search of fossils, the fossils closer to the surface are more recent as compared to the fossils found in deeper layers. This is the relative method of determining the age of fossils.
- Radiocarbon dating: Detecting the ratios of different isotopes of the same element in the fossil material.
- When living organisms change into fossils, their rate of radioactive C_{14} decay decreases slowly.
- In this way, the age of fossils can be determined with the help of radioactive C_{14}.

Section E

22. When zinc granules are added to freshly prepare ferrous sulphate solution, a black coating is formed due to the formation of iron. This displacement reaction occurs as:

$$Zn + FeSO_4 \longrightarrow ZnSO_4 + \underset{Black}{Fe}$$

23. The red litmus paper does not show colour change with acid. So, first dip it in an alkaline solution, and the colour will change to blue. Then it can be used to test the acid which will show the colour change from blue to red again.
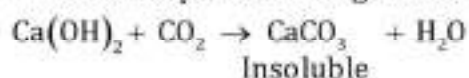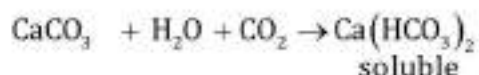
OR

(i) Sodium carbonate

(ii) $Na_2CO_3 + CH_3COOH \rightarrow CH_3COONa + CO_2 + H_2O$
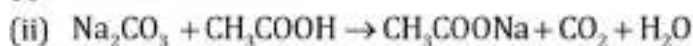
(iii) Lime water is used to test the presence of CO_2.

When CO_2 is passed through lime water, lime water turns milky.

$$Ca(OH)_2 + CO_2 \rightarrow \underset{Insoluble}{CaCO_3} + H_2O$$

If excess of CO_2 is passed through the solution, then the solution becomes clear due to the formation of sodium bicarbonate.

$$CaCO_3 + H_2O + CO_2 \rightarrow \underset{soluble}{Ca(HCO_3)_2}$$

24. For a convex lens,

When the object is at infinity, the image must be formed at the focus.

The focal length of the convex lens is 20 cm.

Thus, the distance between the screen and the lens must be 20 cm, and as the image is obtained on the screen, it is real and inverted. The screen must be placed on the other side of the lens.

Similarly, for a concave mirror,

When the object is at infinity, the sharp image will be formed at the focus of the concave mirror.

The focal length of the mirror is 20 cm.

Thus, the screen must be placed at the same side as that of the object and the distance between the screen and the mirror must be 20 cm.

As the image can be obtained on the screen, it will be real and inverted.

Thus, the answer is (20 cm, 20 cm) and (inverted, inverted).

So, option (C) is correct.

25.

(i) As the current-voltage graph is a straight line, it shows that current is directly proportional to the potential difference. So, as V increases, the current also increases and the ratio of V/I remains constant.

(ii) The ratio of V/I gives the resistance of the resistor.
Thus,
From the graph,
When V = 2 V, I = 0.2 A
Thus, R = 10 Ω
So, if V = 2.5 V
Then I = V/R
Thus, I = 2.5/10 = 0.25 A
So, when the voltage is 2.5 V, the current in the resistor will be 0.25 A.

OR

From the given diagram, it is clear that
The least count of the milliammeter is

$\frac{10}{5} = 2$ mA

Thus, the correct value of the current measured will be 38 mA.

While the least count of the voltmeter is

$\frac{1}{5} = 0.2$ V Thus, the correct value of the voltage measured will be 3.2 V.

26. Experiment to prepare a temporary mount of a leaf peel to show stomata:
Safranin:
After treatment with distilled water, the leaf epidermis is transferred into a watch glass containing safranin solution.
Role:

- It stains the lignin and suberin and other plant materials easily.
- It imparts a red colour to the cells and tissues, thereby highlighting them when seen under the microscope.
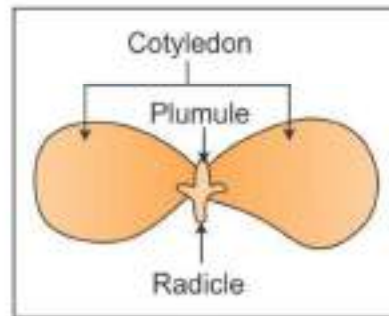
Glycerine:
Once the leaf epidermis is placed onto a clean glass slide, few drops of glycerine are added on the peel.
Role:

- It is a good dehydrating agent and prevents the specimen from drying out.
- Due to its refractive nature, it tends to reflect the light better, and as a consequence, the specimen can be clearly observed under the microscope.

27. Embryo of a pea seed:

OR

Asexual reproduction in *Hydra* occurs through budding.