Section A

1. Exothermic reaction: Reactions involving the release of heat energy.
   Endothermic reaction: Reactions involving the absorption of heat energy.

2. Egg shell contains calcium carbonate which reacts with acid forming calcium chloride salt, carbon dioxide and water. The bubbles evolved are of carbon dioxide.
   $CaCO_{3(aq)} + 2\ HCl_{(aq)} \rightarrow CaCl_{2(aq)} + CO_{2(g)} + H_2O$

3.
   (a) The magnetic field lines around the straight conductor carrying current are concentric circles whose centre lies on the wire.
   (b) The magnitude of the magnetic field is directly proportional to the current passing in the wire.
   (c) Maxwell's right-hand thumb rule is used to find the direction of magnetic field produced by the straight current-carrying conductor.
   (d) According to Maxwell's right-hand rule, the current will be flowing in the upward direction when the direction of the magnetic field is in the anti-clockwise direction.

4.
   (a) Cerebellum
   (b) Cerebrum
   (c) Medulla oblongata
   (d) Medulla oblongata

5. (B) halved
   If the resistance of the wire is doubled, then the current for the constant potential difference will be halved. The current will be inversely proportional to the resistance when the potential difference is constant.

OR

   (A) semi-conductor
   If the resistivity of the material is 0.6 Ωm, then it is most likely to be a semi-conductor.

6. (C) angle of reflection will be zero
   When the ray of light is incident normally or perpendicularly on the surface of the mirror, the ray of light will be reflected normally, and thus, the angle of reflection will be zero. The angle of reflection is the angle between the reflected ray and the normal.

7. (C) Costly
   The ideal source of energy must be cheap and easily available.

8. (B) In a 3-chambered heart, due to mixing of blood in a single ventricle, the parts of the body do not get blood saturated with oxygen. Therefore, a 3-chambered heart is less efficient as compared to a 4-chambered heart.

   OR

   (A) The opening and closing of stomata is regulated by kidney-shaped cells called guard cells.

9. (A) The first trophic level is composed of a large number of individuals, i.e. producers that are capable of producing their own food by trapping the energy of the sun.

10. (B) A combination reaction gives only a single product.

11. (B) Zinc sulphide is the chemical name of zinc blende.

12. (A) The balanced chemical reaction is
 $$Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$$
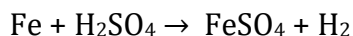
    OR

    (B) A white-coloured precipitate of barium sulphate is formed when sodium sulphate reacts with barium chloride.

13. Both A and R are true, and the reason is the correct explanation of the assertion. Lime water contains traces of calcium hydroxide dissolved in it. It reacts with carbon dioxide gas to form a white precipitate of calcium carbonate.
    $$Ca(OH)_{2(aq)} + CO_{2(g)} \longrightarrow CaCO_{3(s)} + H_2O_{(l)}$$
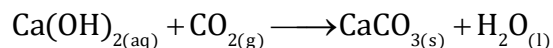
14. A is true, but R is false.
    The time of sunrise to sunset is lengthened by about 4 minutes. Atmospheric refraction causes advance sunrise and delayed sunset.
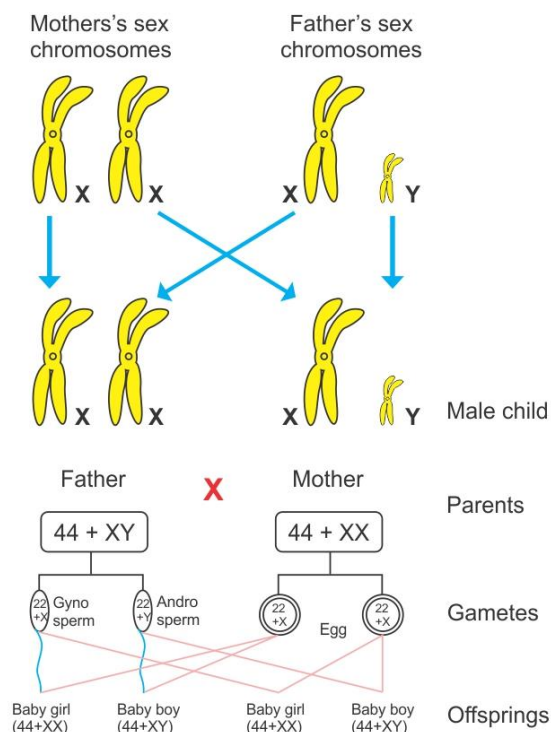
Section B

15.
   Imagine that you are holding a current-carrying straight conductor in your right hand so that your thumb points in the direction of current. The direction in which your fingers encircle the wire will give the direction of magnetic field lines around the wire.
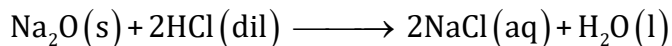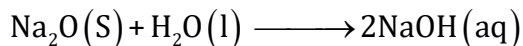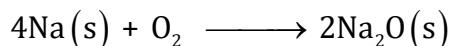
16. Before the rains, the tubers contained starch. When it rained, the plants started growing again producing new foliage. So, the plant converted the starch in the tuber to sugar, a water-soluble form, in order to be transported. This sugar made the tuber sweet.

17.
- Humans have 22 pairs of autosomes and 1 pair of sex chromosomes.
- The male parent produces X-bearing and Y-bearing gametes or sperms.
- The female parent produces only X-bearing gametes or eggs.
- During reproduction, the combination of an X-bearing gamete from the male with an X-bearing gamete from the female results in an offspring with the genetic constitution XX. The child produced is a female or a daughter.
- The combination of a Y chromosome from the male with an X chromosome from the female results in an offspring with the genetic constitution XY. The child produced is a male or a son.
- Thus, the birth of a boy or a girl is purely a matter of chance and entirely depends on the type of sperm which fertilises the egg.
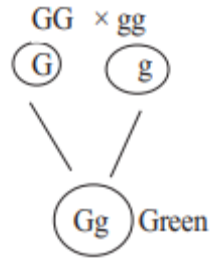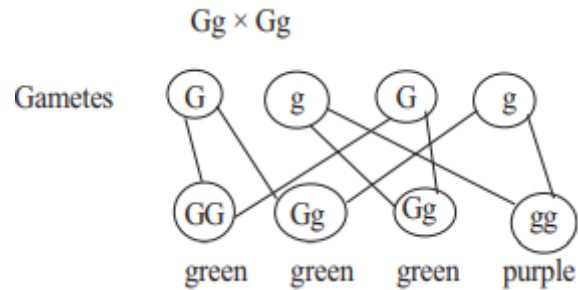

18. It is a metal.

$$4Na\,(s) + O_2 \longrightarrow 2Na_2O\,(s)$$

$$Na_2O\,(S) + H_2O\,(l) \longrightarrow 2NaOH\,(aq)$$

$$Na_2O\,(s) + 2HCl\,(dil) \longrightarrow 2NaCl\,(aq) + H_2O\,(l)$$

19. Green purple

GG × gg genotype

(i) Green gametes

GG × gg

Gg) Green

(ii) Gg × Gg

Gg × Gg

Gametes

GG) Gg) Gg) gg

green green green purple

Percentage of purple-stemmed plants = 25%

(iii) F_2 progeny

GG:Gg:gg = 1:2 : 1

GG : Gg = 1 : 2

20.

(a) As the resistors are connected in parallel, the voltage across each resistor is the same. Hence, the current through each resistor is

$$I_{10} = \frac{V}{10} = \frac{12}{10} = 1.2 \text{ A}$$

$$I_{30} = \frac{V}{30} = \frac{12}{30} = 0.4 \text{ A}$$

$$I_{50} = \frac{V}{50} = \frac{12}{50} = 0.24 \text{ A}$$

(b) Total current in the circuit is

$$I = I_{10} + I_{30} + I_{50}$$

$$\therefore I = 1.2 + 0.4 + 0.24$$

$$\therefore I = 1.84 \text{ A}$$

(c) Total resistance in the circuit is

$$V = IR_{eq}$$

$$\therefore R_{eq} = \frac{V}{I} = \frac{12}{1.84}$$

$$\therefore R_{eq} = 6.52 \text{ }\Omega$$

Rating of the electrical appliance is 220 V–100 W.

Therefore, the resistance of the appliance is

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

$$\therefore R = \frac{V^2}{P} = \frac{220^2}{100}$$

$$\therefore R = 484\ \Omega$$

Total power consumed by 3 bulbs will be 300 W.

Hence, for a five-hour operation, the energy consumed is

$$E = Pt$$

$$\therefore E = 300 \times 4 = 1200\ Wh = 1.2\ kWh$$

Cost of electricity per unit is Rs 2.80.

Hence, the total cost is

$$Cost = 1.2 \times 2.80 = Rs.\ 3.36$$

21. Dams are man-made structures constructed across rivers to control, collect and regulate the flow of water.

Importance and uses of building dams:
- Regulate the flow of water, which can then be supplied to the people in towns and cities for domestic purposes.
- Useful in flood control and collection of water for large irrigation projects.
- Used to harness hydroelectric power.

Main problems to be addressed to maintain peace among local people while building dams:
- Social problems because of displacement of a large number of tribals and peasants who are rendered homeless.
- No sufficient compensation, rehabilitation or benefits granted from these projects.
- Several environmental problems such as deforestation and loss of biodiversity leading to ecological imbalance.

OR

Biodegradable wastes	Non-biodegradable wastes
(a) Waste materials which can be broken down to non-poisonous substances in nature in due course of time by the action of microorganisms (such as certain bacteria) are called biodegradable wastes.	(a) Waste materials which cannot be broken down into non-poisonous or harmless substances in nature are called non-biodegradable wastes.
(b) Examples: Cattle dung, wool, paper, compost	(b) Examples: Plastics, polythene bags, metal articles, glass objects

<u>Changes which people must adopt to dispose non-biodegradable wastes for saving the environment:</u>

(a) Household waste, chemical waste and hospital waste should be disposed of by dumping them in the low-lying areas of the ground called a landfill.

(b) Broken plastic articles such as buckets, bowls, cups, plates etc. should be sent to plastic-processing factories.

22. Rusting of iron can be prevented by painting, oiling, greasing, galvanising, chrome plating or making alloys.

- Galvanisation is a method of preventing rusting of steel and iron by coating them with a thin layer of zinc.
- Alloying is also a very good method of improving the properties of metals. When iron is mixed with chromium and nickel, we get stainless steel which does not rust.
- When moisture comes in contact with the metal surface, it oxidises and forms a coating of rust on it. As oil and water do not mix with each other, oiling forms a protective layer on the metal surface and hence prevents rusting.
- Painting is yet another cost-effective method of preventing corrosion.

23. $m = -3$

$u = -20$ cm

$m = -v/u$

$-3 = -v/(-20)$

$v = -60$ cm

The image is located at a distance of 60 cm, and the nature of the image is enlarged, real and inverted.

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

$$\frac{1}{f} = \frac{1}{-60} + \frac{1}{-20}$$

$$\frac{1}{f} = \frac{-80}{1200}$$

$$f = -15 \text{ cm}$$

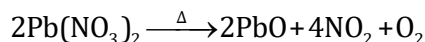Thus, the focal length of a concave mirror is 15 cm.
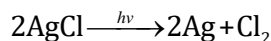
24.

(i) Yellow, lead iodide

(ii) $Pb(NO_3)_2 + KI \rightarrow PbI_2 + 2KNO_3$

(iii) The reaction is an example of a double displacement reaction.

OR

(a) Decomposition reaction where heat is supplied for energy:

$$2Pb(NO_3)_2 \xrightarrow{\Delta} 2PbO + 4NO_2 + O_2$$

(b) Decomposition reaction where light is supplied for energy:

$$2AgCl \xrightarrow{hv} 2Ag + Cl_2$$

(c) Decomposition reaction where electricity is supplied for energy:

$$2NaCl \xrightarrow{electricity} 2Na + Cl_2$$
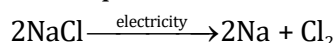
Section C

25.

(a) <u>Properties of magnetic field lines</u>:

i) Magnetic field lines originate from the North pole and end at the South pole.

ii) Magnetic field lines come closer to one another near the poles of the magnet but are widely separated at other places.

iii) Magnetic field lines do not intersect each other.

(b) An electromagnet is a magnet consisting of a long coil of insulated copper wire wrapped around a soft iron core that is magnetised when electric current is passed through the coil.

An electromagnet works on the principle of the magnetic field of an electric current.

(c) <u>Factors affecting the strength of an electromagnet</u>:

i) Number of turns in the coil: If the number of turns increases, the strength of the electromagnet increases.

ii) Current flowing in the coil: If the current in the coil increases, the strength of the magnet increases.

iii) Length of the air gap between its poles: If the length between the poles of an electromagnet is reduced, the strength of an electromagnet increases.

26. From the electronic configuration, it is clear that the compound is chlorine (Cl).

(a) Atomic number: 17

(b) Chlorine is a non-metal.

(c) F, as it belongs to the same group as the element chlorine.

(d) Compound is sodium chloride (NaCl) also known as common salt.

(e) Compound is calcium bicarbonate $Ca(HCO_3)_2$ which causes temporary hardness of water.

27. Evolution is the formation of more complex organisms from pre-existing simpler organisms over a certain period. Accumulation of variation in genetic material forms the basis of evolutionary processes.

Fossils provide a unique view into the history of life by showing the forms and features of life in the past. Fossils tell us how species have changed across long periods of the Earth's history.

Importance of fossils in the evolutionary process:

• Some invertebrates living on the sea bed died and were buried in the sand.

• More sand was accumulated and formed sandstone under pressure.

• After millions of years, dinosaurs living in the area died and their bodies were buried in the mud.
• The mud got compressed into the rock, just above the rock containing earlier invertebrate fossils.
• Again millions of years later, the bodies of horse-like creatures dying in the area were fossilised in the rocks above the earlier rocks.
• Much later, because of erosion and water flow, some rocks wore out and exposed the horse-like fossils.

OR

Pollination: Transfer of pollen grains from the anther to the stigma is called pollination.
Fertilisation: The process of fusion of male and female gametes to form a zygote which eventually develops into an embryo is called fertilisation.
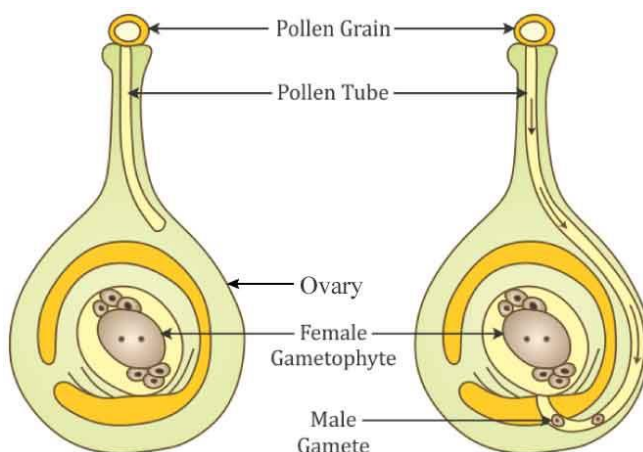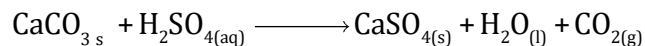

28.
(a) A is propanol, CH3-CH$_2$-CH$_2$OH
(b) B is propene, CH$_3$CH=CH$_2$
(c) Dehydration reaction
(d) C is propane, CH$_3$CH$_2$-CH$_3$
(e) Addition reaction

OR

The water-insoluble substance 'X' is metal carbonate CaCO$_3$.On reacting with dilute H$_2$SO$_4$, it releases a colourless and odourless gas accompanied by brisk effervescence of carbon dioxide.
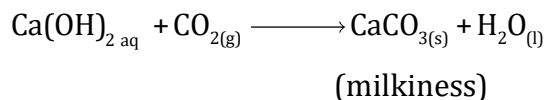
$$CaCO_{3\ s} + H_2SO_{4(aq)} \longrightarrow CaSO_{4(s)} + H_2O_{(l)} + CO_{2(g)}$$

When the carbon dioxide gas was passed through water, the solution obtained turned blue litmus red.

$$CO_{2(g)} + H_2O_{(l)} \longrightarrow H_2CO_{3(aq)}$$
carbonic acid
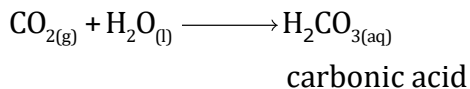
On bubbling the carbon dioxide gas through lime water, it initially became milky.

$$Ca(OH)_{2\ aq} + CO_{2(g)} \longrightarrow CaCO_{3(s)} + H_2O_{(l)}$$
$$\text{(milkiness)}$$

The milkiness disappeared when carbon dioxide gas was passed in excess.

$$CaCO_{3\ aq} + CO_{2(g)} \longrightarrow H_2O_{(l)} + Ca(OH)_2$$
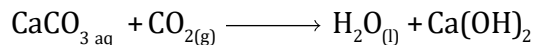
Excess milkiness disappeared

29.

(a) HIV stands for human immunodeficiency virus.

Yes, HIV is an infectious agent which spreads through sexual contact.

Modes by which HIV can spread:

  i. Through sexual contact

  ii. From pregnant woman to the growing foetus

  iii. Through transfusion of infected blood

  iv. By sharing of needles or syringes

(b) The lungs contain millions of alveoli which provide a surface for the exchange of gases. An extensive network of blood vessels is present in the wall of the alveoli. By lifting our ribs and flattening the diaphragm, the chest cavity becomes spacious. Air is sucked into the lungs and alveoli. Oxygen from the breath diffuses into the blood and carbon dioxide from the blood (brought from all over the body) diffuses out to the air.

The trachea has rings of cartilage around it. These rings of cartilage prevent the trachea from collapsing when we breathe out.

30.

(a) When an object is placed at 2F in front of the convex lens:

Object at 2F₁
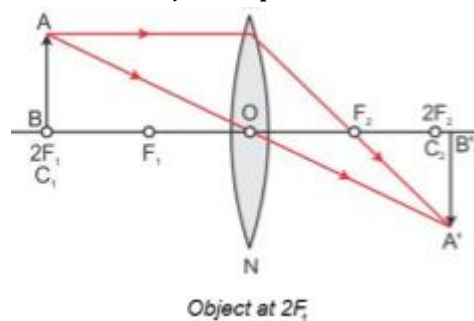
Nature of the image is real, inverted and is of the same size as that of the object. Position of the image formed is at a distance of 2f on the other side of the image.

(b) When an object is placed anywhere between the optical centre and infinity of the concave lens:

*Object between
infinity and optical centre*
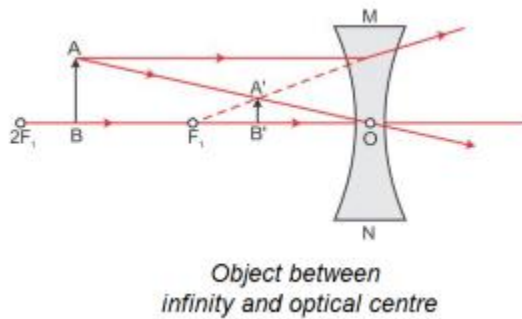
Nature of the image is virtual, erect and diminished.
Position of the image is between the optical centre and the focus.

OR

(a) The relation between the object distance (u), image distance (v) and focal length (f) of a spherical mirror is given by the mirror formula.
The object distance (u), image distance (v) and focal length (f) of a spherical mirror are related as

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

(b)

i) The pole (P) of a spherical mirror is the centre of the mirror.
ii) The centre of curvature (C) of a spherical mirror is the centre of the hollow sphere of glass, of which the spherical mirror is a part.
iii) The principal axis of a spherical mirror is a straight line passing through the centre of curvature C and pole P of the spherical mirror.