SECTION-A

1. Option (3)

    A is cyclohexane, a saturated cyclic hydrocarbon and B and C are unsaturated cyclic hydrocarbons.

2. Option (3)

    $Na_2CO_3.10H_2O$

3. Option (4)

    Copper has low reactivity that makes it suitable for making utensils. Low reactivity is not a physical property, it is a chemical property.

4. Option (2) Milk of magnesia is basic. Its pH is around 10. It shows blue colour on pH paper.

5. Option (3)

    $MnO_2 + 4HCl \longrightarrow MnCl_2 + 2H_2O + 1Cl_2$

6. Option (1)

    Thermal decomposition of lead nitrate which produces brown fumes of nitrogen dioxide.

    $$2Pb(NO_3)_2(s) \xrightarrow{\text{Heat}} 2PbO(s) + 4NO_2(g) + O_2(g)$$
    Lead (II) Nitrate (White)   Lead (II) oxide (Yellow)   Nitrogen dioxide (Brown)

7. Option (2)

    It turns milky due to formation of calcium carbonate and on passing excess of carbon dioxide it becomes colourless due to formation of calcium hydrogen carbonate which is soluble in water.

8. Option (2) Decomposition of calcium carbonate to form quick lime and carbon dioxide, is an endothermic reaction.

    $CaCO_3 + Heat \longrightarrow CaO + CO_2$

9. Option (4)

    Explanation: Growth movements which occur in the direction of the stimulus are known as tropic movements. In this, the response acts on the protoplasm from one side. A tropic movement may be towards or away from the stimulus.

10. Option (1)

    Explanation: In an individual of a given species, gene has a fixed location on a particular chromosome. An alternate form of a gene exists and is called as allele. Alleles are located on the same position on homologous chromosomes.

11. Option (4)

    Explanation: Large intestine is the last part of the digestive system in vertebrates. Water is absorbed here from undigested food and the remaining waste material is stored as faeces before being removed by egestion or defecation.

12. Option (4)

    Explanation: Yeast, Mushroom, and Bread mould (rhizopus) are fungi and fungi are organisms that breaks down food into simple chemicals outside of the body before absorbing it.

13. Option (3)

    Explanation: The magnetic fields produced at the midpoint P, by the currents flowing in the same direction in the two parallel wires will be equal in magnitude but opposite in direction.

    $\therefore$ The resultant magnetic field at P will be zero.

14. Option (2)

Explanation:

The power of Iron = P_1 = 1500 W

Power of flash light = P_2 = 500 W

Total power = $P_1 + P_2$ = 1500 + 500 = 2000 W

Then the current drawn by the supply is

$$I = \frac{P}{V} = \frac{2000\,W}{200\,V} = 10 \text{ A}$$

Hence, the rating of the fuse is 10 A.

15. Option (1)

Explanation: 15 Amperes current rating circuits are used for higher power consumption sources that have a high power rating. It includes an air conditioner, geysers and iron box.

16. Option (4)

Explanation: When four identical resistors of 8 ohms each are connected in series, the effective resistance Rs is given by: R_S = 4 × 8 = 32 ohms

When the same resistors are connected in parallel, the effective resistance R_P is given by:

$1/R_P$ = (1/8) + (1/8) + (1/8) + (1/8)

R_P = 8/4 = 2 ohms

Therefore, the ratio R_S/R_P is:

R_S/R_P = 32/2 = 16

Hence, the ratio R_S/R_P is 16.

17. Option (1)

Explanation: When an electric current flows through a circular coil, it creates a magnetic field around it. The strength of this magnetic field depends on several factors, including the current in the wire, the radius of the coil, and the number of turns in the coil.

When the number of turns in the coil is increased, the total current passing through the coil also increases proportionally. As the current flows in the same direction through each turn of the coil, the magnetic fields produced by each turn add up, resulting in a stronger magnetic field at the center of the coil. This is known as the superposition principle.

18. Option (4) : (A) is false, but (R) is true.

Explanation: The microbes like yeast dissociate the food, that is, glucose into carbon dioxide, and ethanol, and discharge energy in the absence of oxygen.

**19.** Option (3) : (A) is true, but (R) is false.

In human being, the male has XY chromosome and female has XX chromosome. The male produces two types of gametes having either X or Y chromosome. The female produces only one type of gamete with X chromosome. A man always gets its Y chromosome from his father and X chromosome from his mother.

20. Option (1) : Both (A) and (R) are true and (R) is the correct explanation of (A).

SECTION-B

21. • Decomposers survive on the decaying and dead organic matter.

   • The decomposers are microorganisms like fungi and bacteria that can break down the dead or decaying organic material to release the nutrients.

   Reasons showing the existence of decomposers are important in the ecosystem:

   • Decomposers carry out the recycling of nutrients. This helps in releasing the nutrients back into their original pool. For instance, the carbon from the dead animal will be sent back to the pool (air) in simpler forms (carbon dioxide).

   • The decomposing microorganism degrades the garbage that otherwise might become a breeding ground for the germs. The dead organisms will also stay as they are in the absence of the decomposers.

22. (a)
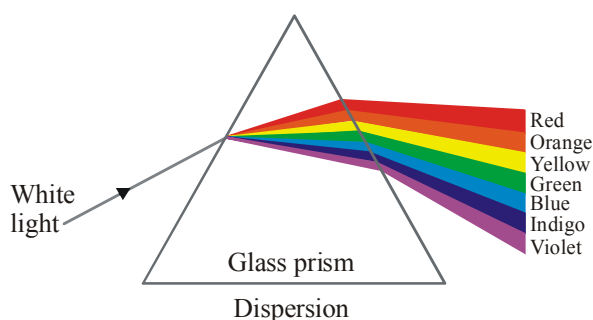
Dispersion

The phenomenon is called dispersion of light. It is because of the reason that different wavelengths of light travel with different speed in the glass prism.

OR

(b) (i) Due to gradual weakening of ciliary muscles and diminishing flexibility of the eye lens, the power of the eye to see clearly nearby as well as far off objects diminishes with age.

   (ii) Presbyopia always happens in old age because of loss of power of accommodation of the eye. A person affected by this defect can't see near as well as far objects.

   (iii) Bifocal Lenses are used for correcting presbyopia.
   • Bifocals have concave lens on top and convex lens at bottom.
   • Top allows you to see far objects, bottom allows you to see near objects.

Bifocal Lens
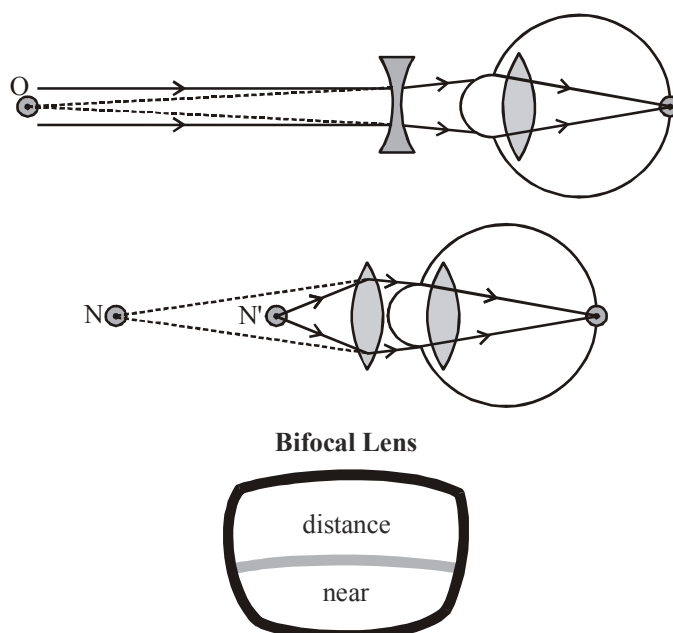
23. Each of your kidneys is made up of about a million filtering units called nephrons.

Nephrons:

1. The nephron is the functional unit of the kidney.

2. It is composed of a renal corpuscle and a renal tubule.

Structure of nephrons:

• Nephrons are basic filtering units of kidneys.

• Each kidney possesses a large number of nephrons (approx. 1-1.5 million).

• The components of the nephron:

• Glomerulus,

• Bowman's capsule

• Long renal tubule.

Functions of nephron:

• The blood enters the kidney through the renal artery (which branches into capillaries associated with the glomerulus).

• Water and solute are transferred to Bowman's capsule.

• In the proximal convoluted tubule, glucose and salts are selectively reabsorbed.

• Now filtrate moves down into the loop of Henle.

• And then move upward to the distal convoluted tubule and finally into the collecting duct.
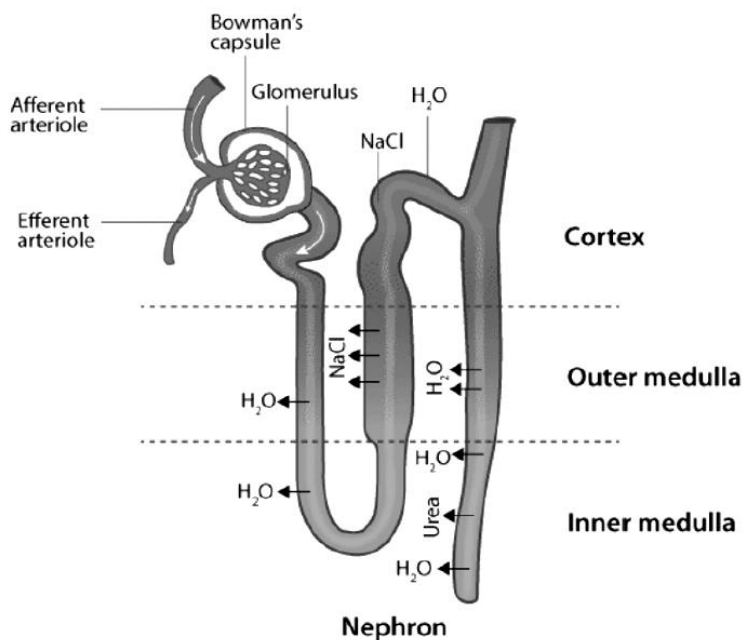
24. We can infer that the fruit is acidic in nature. Acids turn blue litmus red.

25. When a dust particle is inhaled through the nose, the following sequence of events occurs:

I.   The dust particle enters the nostrils and travels through the nasal passages.

II. The nasal passages are lined with mucous membranes that secrete mucus. The mucus traps the dust particle.

III. Tiny hair-like structures called cilia on the surface of the nasal passages move the mucus with the trapped dust particle towards the back of the throat.

IV. The person may cough or swallow to expel the mucus with the dust particle from the body.

V.   If the dust particle is not expelled, it may reach the lungs and cause irritation, triggering the immune response.

VI. The immune response involves the release of histamine and other chemicals that cause inflammation and swelling in the airways, making it difficult to breathe.

VII. The person may experience symptoms such as coughing, wheezing, and shortness of breath.

VIII. If the person has a pre-existing condition such as asthma or allergies, the response may be more severe and require medical attention.
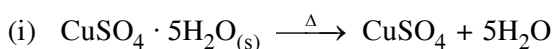
26. (i) 'X' is Plaster of Paris.

$$CaSO_4 \cdot \frac{1}{2} H_2O + \frac{3}{2} H_2O \rightarrow CaSO_4 \cdot 2H_2O$$
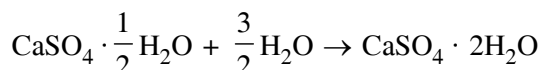
The chemical formula of plaster of paris is $CaSO_4 \cdot \frac{1}{2} H_2O$.

(ii) Baking soda is composed of Sodium bicarbonate. Whereas, Baking powder is composed of baking soda along with mild acid like tartaric acid.

OR

(i) $CuSO_4 \cdot 5H_2O_{(s)} \xrightarrow{\Delta} CuSO_4 + 5H_2O$

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

SECTION-C

27. (i) A kitchen garden is often considered an artificial ecosystem because it is created and managed by humans, using various techniques such as irrigation, fertilization, and pest control to support the growth of specific plants. The garden is typically designed to meet the specific needs and desires of the gardener, and the plants are often selected based on their ability to provide food, herbs, or aesthetic value.

On the other hand, a forest is considered a natural ecosystem because it exists without the direct influence or management of humans. The trees, plants, and animals in a forest have evolved over time to adapt to the climate, soil, and other environmental factors in that particular region. While humans may interact with a forest by harvesting timber, hunting, or hiking, the forest itself is largely self-sustaining and governed by natural processes such as photosynthesis, decomposition, and nutrient cycling.

Overall, the key difference between an artificial ecosystem like a kitchen garden and a natural ecosystem like a forest is the degree of human influence and management involved in their creation and maintenance.

(ii) When designing an artificial ecosystem at home, there are a few important things to keep in mind to make it self-sustaining. Here are two key considerations:

(a) Use a diverse range of plants: One of the key elements of a self-sustaining ecosystem is biodiversity. By planting a diverse range of plants, you can create a healthy ecosystem that is better able to support itself without the need for external inputs like fertilizers or pesticides. This is because each plant species has its own unique set of requirements, and together they can help to create a balanced ecosystem that supports a variety of pollinators, beneficial insects, and other organisms.

(b) Incorporate natural nutrient cycling: In a self-sustaining ecosystem, nutrient cycling is essential. Instead of relying on synthetic fertilizers or other external inputs, the ecosystem should be designed to naturally cycle nutrients from one organism to another. For example, you can use compost or other organic matter to add nutrients to the soil, which can then be taken up by the plants. In turn, when the plants die or are harvested, their nutrients are returned to the soil to be used by the next generation of plants. These two considerations are important because they help to create a more natural and balanced ecosystem that is better able to support itself over the long term.

OR

(i) Food chain refers to the order of events in an ecosystem, where one living organism eats another organism, and later that organism is consumed by another larger organism. The flow of nutrients and energy from one organism to another at different trophic levels forms a food chain.

Plants → Rats → Snakes → Hawks

(ii) The amount of energy transferred from one trophic level to the next is typically around 10% of the energy available at the previous level. This is known as the 10% rule.

Therefore, the amount of energy that will be transferred from organisms of the third trophic level to the organisms of the fourth trophic level can be calculated as follows:

Energy available at the third trophic level = 10% of the energy available at the second trophic level
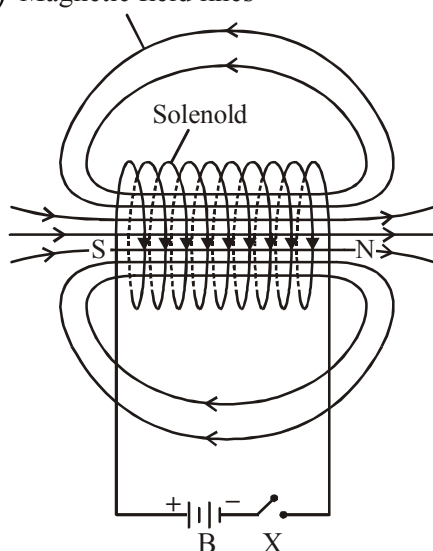
= 0.1 × 20,000 J

= 2,000 J

Therefore, 2,000 J of energy will be transferred from the organisms of the third trophic level to the organisms of the fourth trophic level.

28. (i) Fleming's left hand rule is used to find the direction of force acting on a current carrying conductor, placed in a magnetic field.

(ii) The force experienced by a current-carrying straight conductor is maximum when the conductor is placed perpendicular to the direction of the magnetic field. Hence the force will be maximum in the first case.
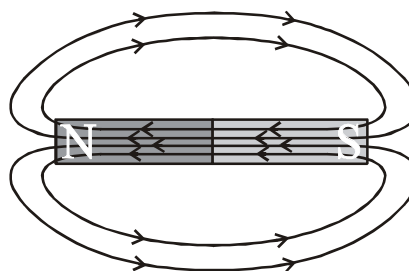
The force experienced by a current-carrying straight conductor is minimum when the conductor is placed along the direction of the magnetic field whether parallel or antiparallel. Hence the minimum force is experienced in the third case

OR

(i) (1) Magnetic field lines   (2)

(ii) • The poles of the bar magnet do not lie exactly at the end of the magnet but are somewhat inside. In a solenoid, poles can be considered to be lying at the edge.

• The magnetism retains in the bar magnet naturally but in the solenoid, the magnetism is there so long current flows through it.

29. • A person is suffering from an eye defect in which the far point of the eye is nearer than infinity. This eye defect is also called myopia or nearsightedness.

• It is caused by:

(1) Excessive curvature of the eye lens

(2) Elongation of the eyeball

Myopia

Correction : Concave lens
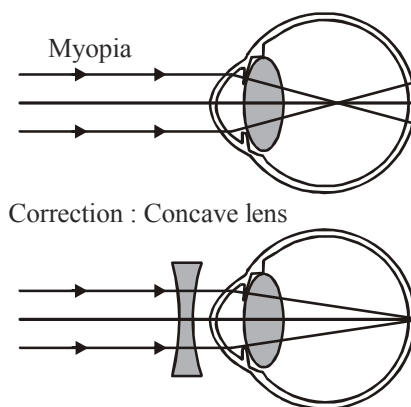
30. (a) (i) Magnification of lens $= \dfrac{\text{Image distance}}{\text{Object distance}} = \dfrac{\text{height of the image}}{\text{height of the object}}$

Since, image of an object formed by lens is of the same size but inverted

Magnification of lens $= -1$

$M = -1 = \dfrac{\text{Image distance}}{\text{Object distance}} = \dfrac{\text{Image distance}}{-30}$

Image distance $= -30$ cm

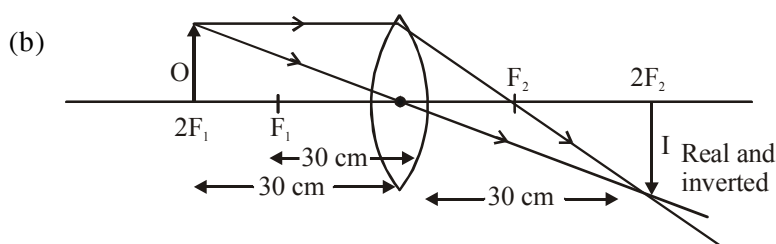The distance between the object and it's image

$= v - u = 30 - (-30) = 60$ cm

(ii) From lens formula,

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

$$\dfrac{1}{f} = \dfrac{1}{30} - \dfrac{1}{-30} = \dfrac{1}{30} + \dfrac{1}{30} = \dfrac{1}{15}$$

$f = 15$ cm

(b)

O

$2F_1$ F_1

← 30 cm →

← 30 cm →

F_2 $2F_2$

← 30 cm →

I Real and inverted

31. (i) The energy released during cellular respiration is immediately used to synthesise a molecule called ATP which is used to fuel all other activities in the cell. In these processes, ATP is broken down giving rise to a fixed amount of energy which can drive the endothermic reactions taking place in the cell.

(ii) Plants exchange gases through stomata, and the large intercellular spaces ensure that all cells are in contact with air. Carbon dioxide and oxygen are exchanged by diffusion here. They can go into cells, or away from them and out into the air.

(iii) The direction of diffusion depends upon the environmental conditions and the requirements of the plant.

- The concentration gradient of ions has to be maintained.
- The membrane potential of the plants also has to be varied in order to maintain the direction of diffusion.

OR

(i) The carbohydrates which are not used immediately are stored in the form of starch, which serves as the internal energy reserve to be used as and when required by the plant. In animals, some of the energy derived from the food we eat is stored in our body in the form of glycogen.

(ii) Desert plants take up carbon dioxide at night and prepare an intermediate which is acted upon by the energy absorbed by the chlorophyll during the day.

32. Tooth enamel is made up of mostly Calcium phosphate $Ca_3(PO_4)_2$.

Tooth enamel starts corroding in case the pH becomes less than 5.5. The germs in the mouth decompose the food stuck in between the teeth and produce acids. These acids react with the enamel causing tooth decay. To prevent tooth decay, it is advised to clean the mouth and use toothpastes which are generally basic, for cleaning the teeth. It neutralise the excess acid and prevent tooth decay.

33. (a) The substance that itself is oxidized is the reducing agent and the substance which gets reduced is the oxidizing agent.

(i) In the reaction $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$

There is the oxidation of ammonia (NH_3) and reduction of oxygen (O_2) taking place. So here NH_3 is the reducing agent and O_2 is oxidising agent.

(ii) In the reaction $H_2O + F_2 \rightarrow HF + HOF$

There is the oxidation of H_2O and reduction of F_2 taking place so here H_2O is the reducing agent and F_2 is oxidising agent.

(iii) In the reaction $Fe_2O_3 + 3\ CO \rightarrow 2Fe + 3CO_2$

There is the oxidation of CO and reduction of Fe_2O_3 taking place so here CO is the reducing agent and Fe_2O_3 is oxidising agent.

(iv) In the reaction $2H_2 + O_2 \rightarrow 2H_2O$

There is the oxidation of H_2 and reduction of O_2 taking place so here H_2 is the reducing agent and O_2 is oxidising agent.

(b) (i) Oxidation: A chemical reaction in which a substance gains oxygen is called oxidation.

Example: $2Cu + O_2 = 2CuO$ (Cu is oxidized to CuO)

(ii) Reduction: A chemical reaction in which a substance loses oxygen is called reduction.

Example: $ZnO + C \rightarrow Zn + CO$ (ZnO is reduced to Zn.)

SECTION-D

34. (a) Power at maximum rate = P = 880 W

voltage = V = 220 V

We know that $P = V^2/R$

$R = V^2/P$

$= 220 \times 220/880$

$= 48400/880$

$= 55$ ohm

Maximum current I is

$P = IV$

$I = P/V = 880/220 = 4A$

Power at minimum rate = P = 330 W

voltage = V = 220 Volts.

We know that $P = V^2/R$

$R = V^2/P$

$= 220 \times 220/330 = 48400/330$

≈ 146.66 ohms

Current at minimum rate is,

$P = IV$

$I = P/V = 330/220$

(b) When the conductor offers resistance to the flow of current, the work done by the electric current in overcoming this resistance is converted into heat energy. This is called the heating effect of electric current.

(c) Consider a resistor of Resistance R. Let the current flowing through the resistor be I and the potential difference across its ends be V. In time t. let Q amount of charge flow through the resistor.

Work done on Moving charge will be.

$W = V \times Q$ ...(1)

According to the definition of electric current.

$Q = I \times t$ ...(2)

Putting equation (2) in (1),

$W = V \times I \times t$

And the work done is dissipated as heat

Therefore. Heat produced.

$H = W = V \times I \times t = VIt$

$H = VIt$ ...(3)

According to Ohm's law

$V = I \times R$

Putting this in equation (3). we get,

$H = IR \times It$

Therefore, Heat $= I^2Rt$

35. (a) If the egg is not fertilized, the inner lining of the uterus (endometrium) which is chiefly maintained for the implantation of fertilized egg gets degenerated and discharged from the uterus as menstrual bleeding. This process is called menstruation.

- The male gametes which fertilize with the female gamete are known as sperm.

- Ovum is the female egg that is fertilized with the egg at the time of sexual intercourse.

- Sperm has XY+ 22 chromosomes whereas the female egg contains XX + 22 chromosomes.

- After the process of fertilization, a zygote is developed into an embryo and then a baby whose gender is based on the set of chromosomes by the mother and the father.

(c) Contraception is an artificial method or technique, mainly used to prevent pregnancy as a consequence of sexual intercourse.

Contraception:

1. A method or device used to prevent pregnancy is known as contraception.

2. It is also known as birth control, anticonception, or fertility control.

Methods of contraception:

1. Barriers: Barrier contraceptives are devices that are used to prevent pregnancy by blocking sperm from entering the uterus. Some of them include female condoms, male condoms, contraceptive sponges with spermicide, diaphragms and cervical caps. Among them the most common birth control methods are condoms.

2. Intra-uterine devices (lUDs):

- Intrauterine contraceptive devices are fitted in the uterus to act as a barrier and inhibit the chances of pregnancy.

- Copper-T inhibits pregnancy by releasing copper ions, which repel the movements of sperm by changing their pattern of movement.

3. Oral contraceptives:

- Females take small doses of progestogens or progesterone - estrogen combos in the form of tablets known as oral pills.

- Pills restrict or delay sperm access into the female genital canal by inhibiting ovulation and implantation, as well as altering the quality of cervical mucus.

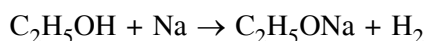**36.** (i) A is ethanol, B is ethene and C is ethane.

(ii) On the action of conc. Sulphuric acid $\underset{A}{C_2H_5OH} \rightarrow \underset{B}{C_2H_4} + H_2O$

Molecular mass of ethene is 28 amu.

(iii) On complete combustion of compound C, carbon dioxide and water are produced as products along with the release of heat and light.
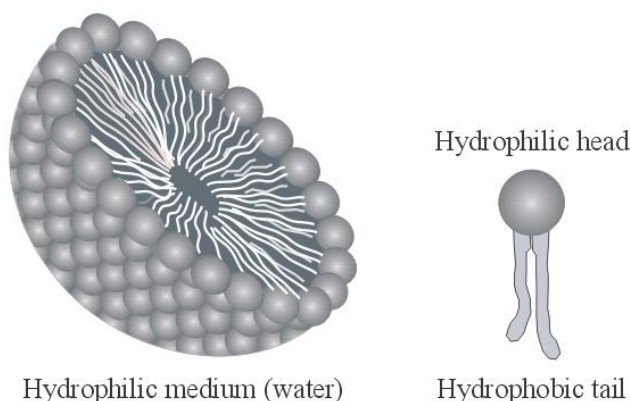
(iv) Hydrogenation is used in the production of saturated vegetable ghee from unsaturated vegetable oils.

(v) When sodium reacts with 'A' ethanol, sodium ethoxide and hydrogen is produced.

$C_2H_5OH + Na \rightarrow C_2H_5ONa + H_2$

OR

(i)

Hydrophilic head

Hydrophilic medium (water)   Hydrophobic tail

(ii) (1) More foam will be formed in test tube 'Y'. As soap will react with hardness to form scum. But detergent does not act on hardness of water. Action of detergent is better than soap in case of hard water.

(2) Curdy solid will be formed when soap is added to test tube 'X'. Soap acts on the hardness of water to form curdy solid known as scum.
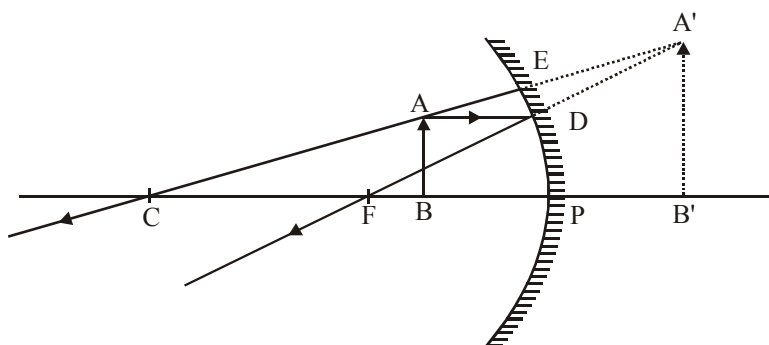
SECTION-E

37. (a) Two applications of concave mirror are:

1. It is used as a shaving mirror

2. It is used as reflector in torch, head light of automobiles etc

(b) For mirror, Radius of curvature = 2f = 2 × 15 cm = 30 cm.

(c) Image formation when the object is placed between the pole and focus of a concave mirror.

OR

(c) (i) Given u = − 100 cm

v = − 100 cm

When the object and image distance is same for a concave mirror, then the object has to be placed at the radius of curvature. Hence,

R = u = − 100 cm

Therefore; f = R/2 = − 100/2 = − 50 cm

(ii) Magnification m = − v/u = − 1
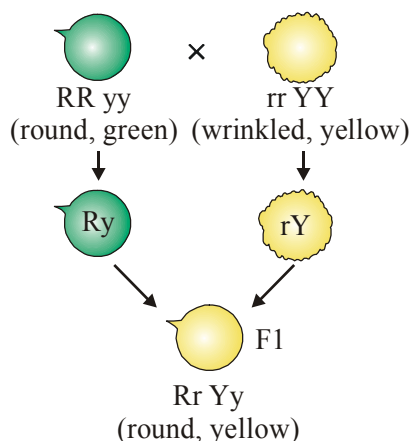
Since u = v = − 100 cm

38. (a) Seven pairs of contrasting characteristics of pea plants studied by Mendel in his experiments are as follows :-
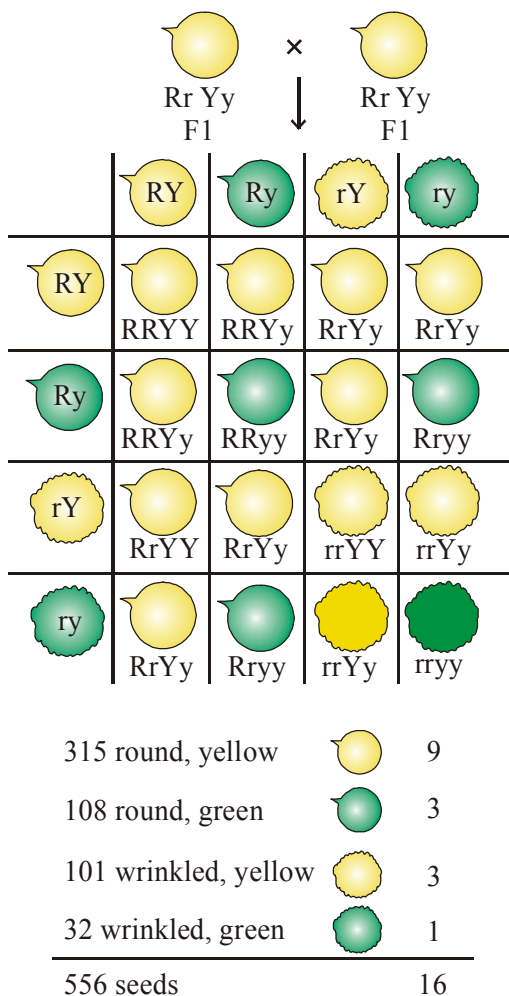
    I.   Pea shape: Round or Wrinkled.

    II. Pea color: Green or Yellow.

    III. Pod shape: Constricted or Inflated.

    IV. Pod color: Green or Yellow.

    V. Flower color: Purple or White.

    VI. Plant size: Tall or Dwarf.

    VII.Position of flowers: Axial or Terminal.

(b) Difference Between Recessive and Dominant Traits

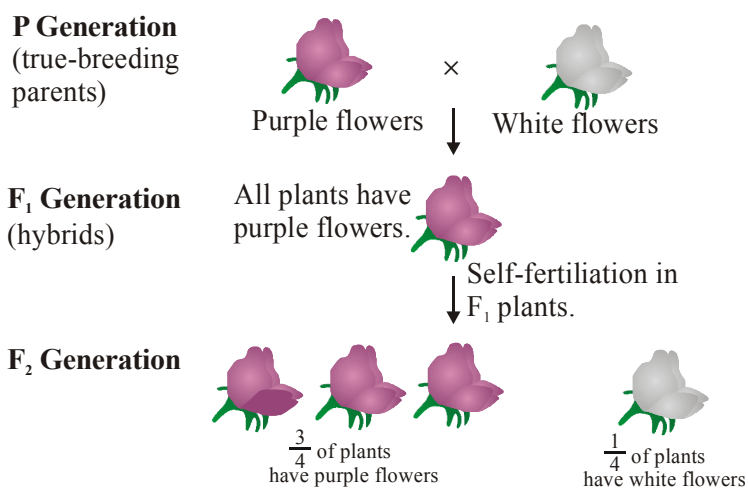| Dominant Trait	Recessive Trait
Dominant traits are always expressed when the connected allele is dominant, even if only one copy exists.	Recessive traits are expressed only if both the connected alleles are recessive. If one of the alleles is dominant, then the associated characteristic is less likely to manifest.
Dominant allele is denoted by a capital letter	Recessive allele is denoted by a small letter
(a) V-shaped hairline (b) Almond-shaped eyes (c) Right handedness (d) Detached earlobes (e) Dark hair (f) Brown eyes	(a) Straight hairline (b) Round eyes (c) Left handedness (d) Attached earlobes (e) Blond hair, red hair (f) Blue eyes (can also be a polygenetic trait)

(c) Ratio of the combinations observed in the seeds of F_2 generation is 9:3:3:1. In the above cross, some F_2 progeny are tall plants with round seeds, and some are short plants with wrinkled seeds. There are some F_2 progeny that showed new combinations. Some of them are tall, but have wrinkled seeds, while others are short, but have round seeds. New combinations of traits are formed in F_2 offspring when factors controlling for seed shape and seed colour recombine to form zygote leading to form F_2 offspring. Thus, the tall/short trait and the round seed/wrinkled seed trait are independently inherited.
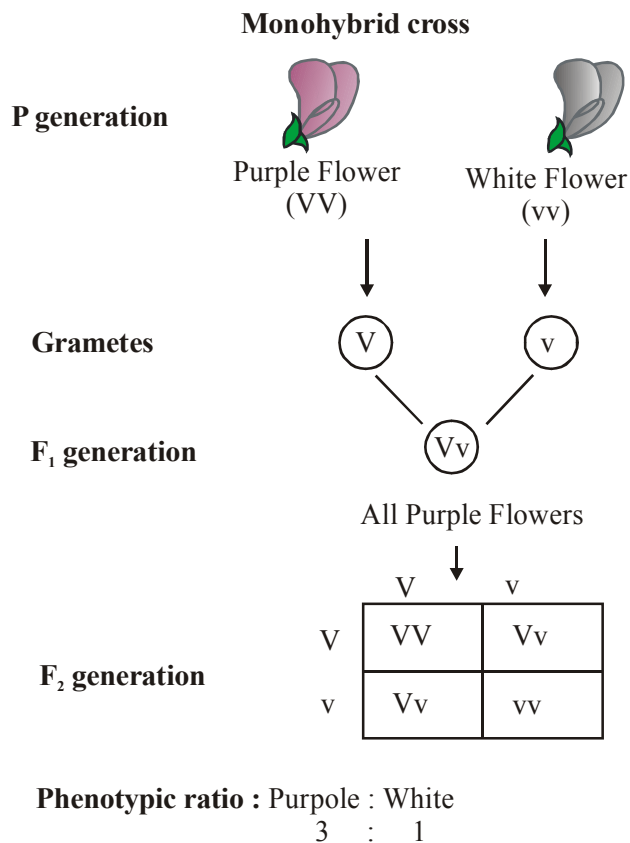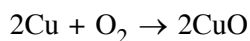

RR yy   ×   rr YY
(round, green)   (wrinkled, yellow)

Ry   rY

F1
Rr Yy
(round, yellow)

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

315 round, yellow	9
108 round, green	3
101 wrinkled, yellow	3
32 wrinkled, green	1
556 seeds	16

OR

The cross is studied by monohybrid cross since it involves only one trait which is the flower color.

P Generation
(true-breeding parents)

Purple flowers × White flowers

F₁ Generation
(hybrids)

All plants have purple flowers.

Self-fertiliation in F₁ plants.

F₂ Generation

$\frac{3}{4}$ of plants have purple flowers

$\frac{1}{4}$ of plants have white flowers

Monohybrid cross

P generation

Purple Flower
(VV)

White Flower
(vv)

Grametes

V   v

F₁ generation

Vv

All Purple Flowers

	V	v
V	VV	Vv
v	Vv	vv

F₂ generation

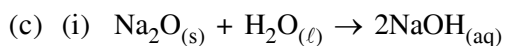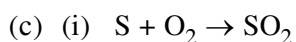**Phenotypic ratio :** Purpole : White
3   :   1

39. (a) Brown copper reacts with oxygen to form black copper(II) oxide.

$2Cu + O_2 \rightarrow 2CuO$

(b) Some metal oxides such as aluminium oxide and zinc oxide, reacts with both acids and bases. So they are called amphoteric oxides.

(c) (i) $Na_2O_{(s)} + H_2O_{(\ell)} \rightarrow 2NaOH_{(aq)}$

(ii) $Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O$

OR

(c) (i) $S + O_2 \rightarrow SO_2$
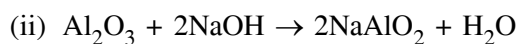
(ii) Sulphur dioxide

(iii) Sulphur dioxide is acidic in nature.
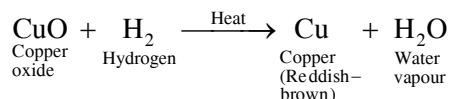
(iv) Sulphur dioxide turns moist blue litmus paper red. It does not have any action on dry litmus paper.

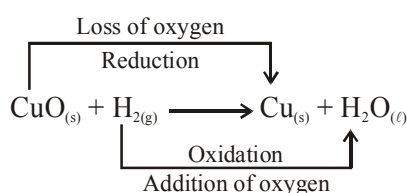**SAMPLE PAPER – 1**   **SOLUTIONS**

SECTION-A

1. Option (1)

$$CuO + H_2 \xrightarrow{\text{Heat}} Cu + H_2O$$

Copper oxide   Hydrogen   Copper (Reddish–brown)   Water vapour

2. Option (2)

Substance oxidised = H_2

Substance reduced = CuO

Loss of oxygen
Reduction

$$CuO_{(s)} + H_{2(g)} \longrightarrow Cu_{(s)} + H_2O_{(\ell)}$$

Oxidation
Addition of oxygen

3. Option (4)

It is a thermal decomposition reaction. When mercury(II) oxide is heated strongly, it decomposes to give the elements mercury and oxygen. $HgO \longrightarrow Hg + O_2\uparrow$

4. Option (4)

5. Option (4)

At anode oxidation occurs and at cathode reduction occurs.

6. Option (3)

An orange red colour of universal indicator shows that the solution tested is acidic in nature that is, salt is composed of a strong acid and a weak base.

7. Option (3)

Ethane has the formula C_2H_6.

8. Option (3)

9. Option (1)

10. Option (2)

11. Option (1)

12. Option (3)

13. Option (2)

Given : V = 4 V, I = 100 mA = 0.1 A

$\because$ V = IR,

$\therefore$ R = $\dfrac{V}{I} = \dfrac{4}{0.1} = 40 \ \Omega$

14. Option (1)

$\because$ Power = Voltage × Current

$\therefore$ 1 watt = 1 volt × 1 ampere

15. Option (4)

Using Fleming's left hand rule, it can be predicted that the direction of magnetic field is upwards.

16. Option (1)

When light ray goes from medium 'A' to medium B, it bends towards normal. It indicates that the speed of light reduces in medium B as compared to medium A.
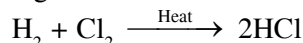
Refractive index of medium B w.r.t. medium A, $n_{BA} = \dfrac{v_A}{v_B}$

$\because \ v_A > v_B$

$\therefore \ n_{BA} > 1$

17. Option (3)

Hydrogen and chlorine combine to give hydrogen chloride. It is an example of combination reaction.
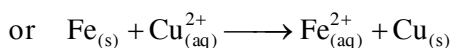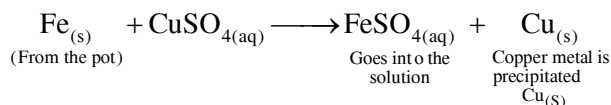
$H_2 + Cl_2 \xrightarrow{\text{Heat}} 2HCl$

18. Option (1)

19. Option (1)

20. Option (3)

Assertion is true but Reason is false.

SECTION-B

21. Iron is more reactive (or more electropositive) than copper. So, when a solution of copper sulphate [$CuSO_{4(aq)}$] is kept in an iron pot, iron gets oxidized and Fe^{2+} ions get dissolved in solution. This causes holes in the iron pot.

The reaction between iron and copper sulphate solution is

$$\underset{\substack{(\text{From the pot})}}{Fe_{(s)}} + CuSO_{4(aq)} \longrightarrow \underset{\substack{\text{Goes into the}\\\text{solution}}}{FeSO_{4(aq)}} + \underset{\substack{\text{Copper metal is}\\\text{precipitated}\\Cu_{(S)}}}{Cu_{(s)}}$$

or $\quad Fe_{(s)} + Cu_{(aq)}^{2+} \longrightarrow Fe_{(aq)}^{2+} + Cu_{(s)}$

OR

(a) Magnesium is able to react with zinc oxide to form zinc metal. Thus,

$$ZnO + Mg_{(s)} \xrightarrow{\text{heat}} Zn_{(s)} + MgO$$
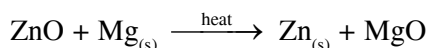
Copper will not give displacement reaction with zinc oxide because copper is less reactive than zinc.

(b) Magnesium oxide will not give displacement reaction with zinc, magnesium and copper.

(c) Both zinc and magnesium can give displacement reactions with copper oxide. This is because, both zinc and magnesium are more reactive than copper.
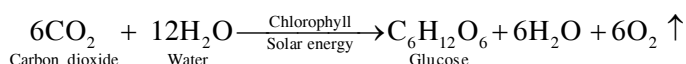
$$Mg_{(s)} + CuO \longrightarrow Cu_{(s)} + MgO, \ \ Zn_{(s)} + CuO \longrightarrow Cu_{(s)} + ZnO$$
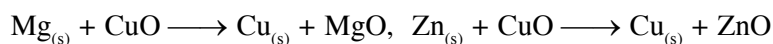
22. Small intestine is the site of complete digestion of food because it receives three types of juices i.e., bile juice from liver, pancreatic juice from pancreas and intestinal juice that together acts on the food and help in complete digestion.

23. Photosynthesis is important for a number of reasons :

(i) Food : By photosynthesis, green plants synthesise food from simple raw materials like CO_2 and H_2O. Thus, it sustains life on earth.

(ii) Oxygen : Oxygen released during the process of photosynthesis is needed by animals and humans for respiration. It is also required for respiration of microbes. Oxygen also supports combustion of fuels.

$$\underset{\text{Carbon dioxide}}{6CO_2} + \underset{\text{Water}}{12H_2O} \xrightarrow[\text{Solar energy}]{\text{Chlorophyll}} \underset{\text{Glucose}}{C_6H_{12}O_6} + 6H_2O + 6O_2 \uparrow$$

24. Hydra use regenerative cells for reproduction in the process of 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.

25. **Electric energy**

The total energy supplied by a source of emf in order to maintain the electric current in the circuit in a given time is called '**electric energy**'.

$E = P \times t = V \times I \times t$ [where, electric power (P) = electric potential (V) × electric current (I)]

S.I. Unit of electric energy = joule

Here, 1 joule = 1 volt-ampere-second = 1 VAs

Commercial unit of electric energy : Kilowatt hour (kWh)

OR

Given : Diameter = 0.25 mm = 0.25×10^{-3} m; so, radius, r = $\dfrac{0.25 \times 10^{-3}}{2}$ m,

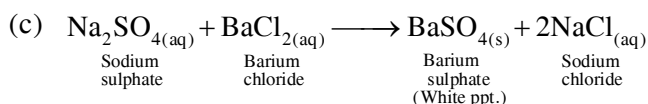Resistivity, $\rho = 0.8 \times 10^{-8}$ Ωm; Resistance, R = 5 Ω ; Length, ℓ = ?

We know that, R = $\rho \dfrac{\ell}{A}$

$\Rightarrow$ $\ell = \dfrac{RA}{\rho} = \dfrac{R \times \pi r^2}{\rho} = \dfrac{5 \times \pi \times \left[\dfrac{0.25 \times 10^{-3}}{2}\right]^2}{0.8 \times 10^{-8}}$ = 30.7 m

26. The sperm determines the sex of the child in human. This is because half of the sperms have X-chromosomes, i.e. (22 + X) and the other half have Y-chromosome, i.e. (22 + X) and (22 + Y), both in equal numbers. Thus, there is 50% chance of a (22 + Y) boy and 50% chance of a (22 + X) girl being born to the parents. Thus, making the statistical probability 50-50.

SECTION-C

27. (a) 'X' is sodium sulphate (Na_2SO_4) and 'Y' is barium sulphate ($BaSO_4$).

(b) It is a precipitation reaction as an insoluble substance is formed during the reaction.

It is also called a double displacement reaction as there is an exchange of ions between the reactants.

(c) $\underset{\substack{\text{Sodium}\\\text{sulphate}}}{Na_2SO_{4(aq)}} + \underset{\substack{\text{Barium}\\\text{chloride}}}{BaCl_{2(aq)}} \longrightarrow \underset{\substack{\text{Barium}\\\text{sulphate}\\\text{(White ppt.)}}}{BaSO_{4(s)}} + \underset{\substack{\text{Sodium}\\\text{chloride}}}{2NaCl_{(aq)}}$

28. (a) Covalent compounds : Those compounds in which elements shared electrons are called covalent compounds.

(b) Ionic compounds are formed by complete transfer of electrons from one atom to another. Ionic compounds are soluble in water whereas covalent compounds are insoluble in water.

(c) Properties of covalent compounds:

(i) They do not form ions in aqueous solution and do not conduct electricity.

(ii) They have low melting and boiling points.

(iii) They are mostly insoluble in water but soluble in organic solvents.

29.
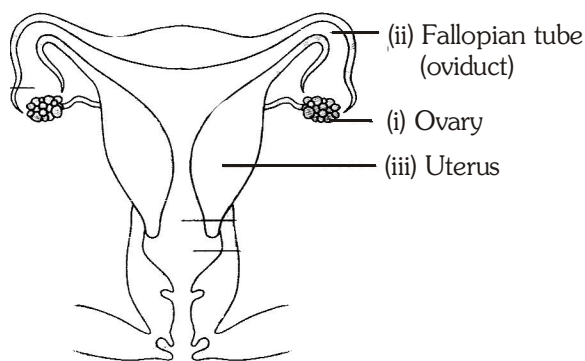
OR

(i) (a) **Nasal hairs :** These are fine hairs present in the inner lining of the nasal passage. These hairs help in filtering the air passing through nostrils so that, germ free air could reach the lungs.

(b) **Diaphragm :** It is a musclular partition between the thoracic and abdominal region in our body. Movement of diaphragm helps in the breathing process.

(c) **Alveoli :** These are balloon-like structures, which increases the surface area for the gaseous exchange in lungs.

(d) **Nasal cavity :** Nasal cavity conditions the air entering, i.e. warms and moisturises it.

(ii) The various organs that are involved in gaseous exchange in plants are stomata, root hairs and lenticles.

30. (i) The range of object's distance from mirror should be 0 cm to 12 cm. The image will be larger than the object.

    Ray diagram:
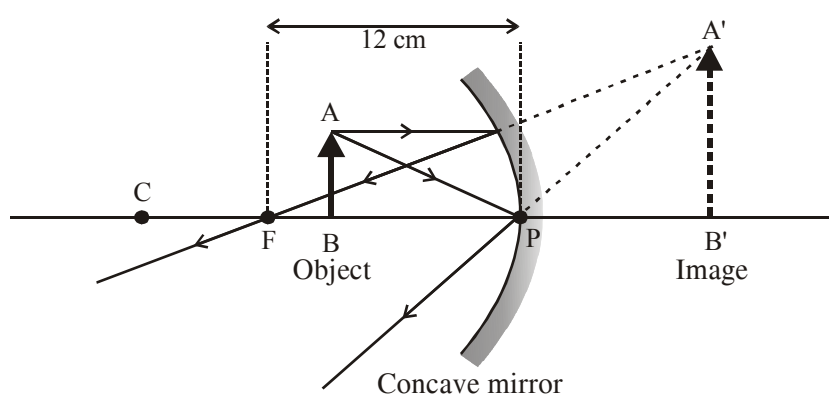
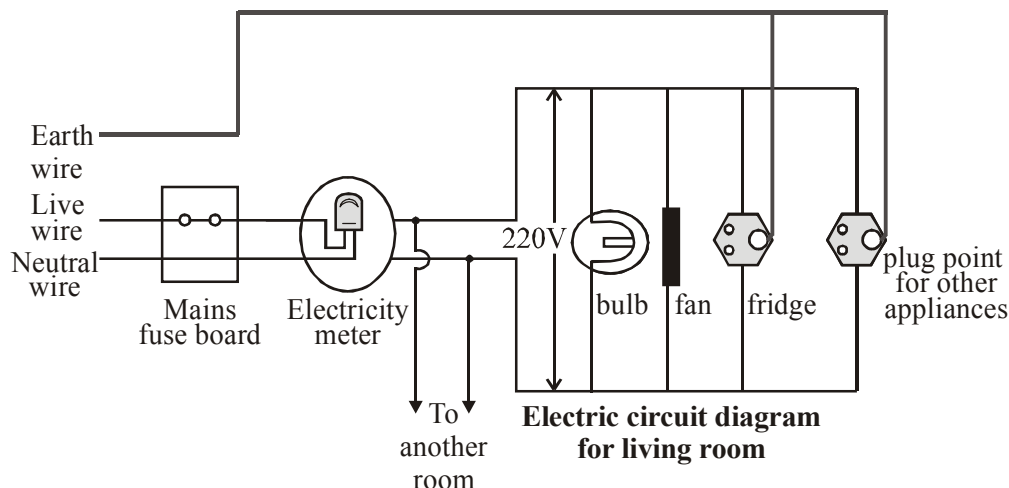**Formation of virtual and erect image by concave mirror**

(ii) Given : Concave mirror, u = – 24 cm, f = – 12 cm, v = ?

Using mirror formula,

$$\frac{1}{v} = \frac{1}{f} - \frac{1}{u} = \left[\frac{1}{-12}\right] - \left[\frac{1}{-24}\right] = \frac{-2+1}{24}$$

or v = – 24 cm   (Position of Image)

31.

Electric circuit diagram for living room

32 . (i) The phenomenon is called 'Dispersion'.

(ii) X $\rightarrow$ Violet, Y $\rightarrow$ Red

(iii) Different colours of white light bend through different angles with respect to the incident beam of light due to difference in speeds of light of different wavelengths, while passing through prism.

OR

(i) Visible spectrum (VIBGYOR) is the band of coloured components of a white light beam.

(ii) Red colour light can be seen from a greater distance since it has longer wavelength and it scatters the least by air molecules. Therefore, stopping light at traffic signals is chosen to be red.

(iii) The given setup will behave like a glass slab, resulting in recombination of the seven colours to produce white light. So, the emergent ray will be a white light ray.

33. (i) Translocation takes place with energy consumption in the form of ATP.

Sugar (sucrose) made in leaves are loaded into the sieve tubes of phloem by using energy from ATP. It increases the osmotic pressure of the sieve tubes.

Water now enters into sieve tubes containing sugar by the process of osmosis.

Soluble material is then transferred from phloem tissue to other tissues which have less pressure than in the phloem.

Thus, according to plants requirement, the material is translocated from higher osmotic pressure to lower osmotic pressure areas.

(ii) Root pressure plays an important role in transportation of water in plants at night

SECTION-D

**34.** **(a)** Ethanol having chemical formula C_2H_5OH is the active ingredient of all alcoholic drinks.

(b) Uses of ethanol :

1. Ethanol is widely used in industry as a solvent.

2. Ethanol is used as an antiseptic for wounds in the form of rectified spirit.
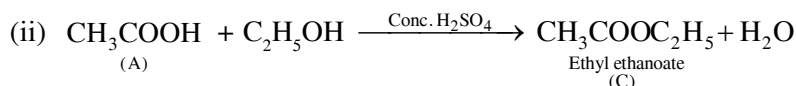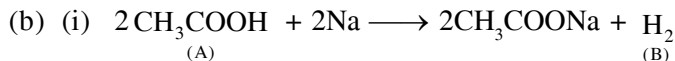
(c) Chemical equations :

(i) When a small piece of sodium is dropped into ethanol then hydrogen gas is liberated which burns with a pop sound.

$$2C_2H_5OH + 2Na \longrightarrow 2C_2H_5ONa + H_2\uparrow$$
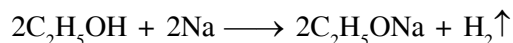
(ii) $\underset{\text{Ethanol}}{C_2H_2OH} \xrightarrow[\text{443 K}]{\text{Conc. H}_2\text{SO}_4} \underset{\text{Ethene}}{CH_2 = CH_2} + H_2O$

OR

(a) A : CH_3COOH, Ethanoic acid

   B : H_2, Hydrogen

   C : $CH_3COOC_2H_5$, Ethyl ethanoate

(b) (i) $2\underset{(A)}{CH_3COOH} + 2Na \longrightarrow 2CH_3COONa + \underset{(B)}{H_2}$

(ii) $\underset{(A)}{CH_3COOH} + C_2H_5OH \xrightarrow{Conc.\, H_2SO_4} \underset{\substack{Ethyl\ ethanoate \\ (C)}}{CH_3COOC_2H_5} + H_2O$

35. (i) Damage to the ozone layer is a cause for concern because the harmful ultraviolet (UV) radiation from the sun will reach the earth. These radiations are highly damaging to organisms as it can cause skin cancer, cataract, etc. Substances like chlorofluorocarbons, methane, nitrous oxide etc can cause damage to ozone layer.

(ii) any two

S.No.	Biodegradable waste	Non-biodegradable waste
1.	They can be broken down into simpler substances by the activity of biological catalysts called enzymes (present in surrounding bacteria or other saprophytes). Physical processes like heat and temperature help in the functioning of enzymes.	They can't be broken down into simpler and harmless products because the biological catalysts called enzymes can't act upon them. They can be acted upon only by some physical processes like heat and pressure.
2.	They can enter the biogeochemical cycles.	They cannot enter the biogeochemical cycles.
3.	They become pollutants only when they accumulate in large quantities and not degraded at the right time.	They always act as pollutants whether present in small or large quantity.
4.	All the biodegradable wastes should be treated properly before discharging them into water or soil.	They can't be treated properly before discharging them into water or soil. Instead, they can be either recycled or reused.
5.	They do not persist in the environment for a long time.	They persist in the environment for a long time.
6.	For example, Urine and faecal matter, Sewage, Paper, Vegetable and fruit peels, Agricultural residues, Wood and Cloth.	For example, Heavy metals like Mercury, Lead, Arsenic, Radioactive wastes like Uranium, Plutonium, Insecticides and Pesticides like DDT and BHC.

(iii) The non living components of environment are known as abiotic components for example air, water, soil, etc.

OR

(i) The movement of leaves of a sensitive plant is neither towards nor away from the stimulus like touch, light, temperature, etc. It is a non-directional movement (nastic movement) for example, folding and dropping of leaves of Mimosa plant while movement of shoot is towards the stimulus like light, forces of gravity, chemicals, water etc. and is a directional movement (tropic movement). Bending of stem towards light (phototropism) and downward growth of roots in response to gravity (geotropism) are some of its examples.

(ii) Human brain is lodged in a bony case, the cranium which protects it from mechanical injuries. It is wrapped in three sheets of connective tissue, known as meninges. The space between the meninges is filled with cerebrospinal fluid which acts as shock absorber.

36. (a) A magnet consisting of a soft iron core with a coil of insulated wire wound around it is called 'Electromagnet'.

(b) **Fleming's left hand rule :**

The direction of force on a current-carrying conductor kept in a magnetic field, is given by Fleming's left-hand rule. According to this rule, 'stretch the thumb, forefinger and central finger of your left hand such that they are mutually perpendicular. If the fore finger points in the direction of magnetic field and the central finger in the direction of current, then the thumb will point in the direction of motion of conductor or the force acting on the conductor.'

Thumb : Force (or motion)

Fore finger : Magnetic Field
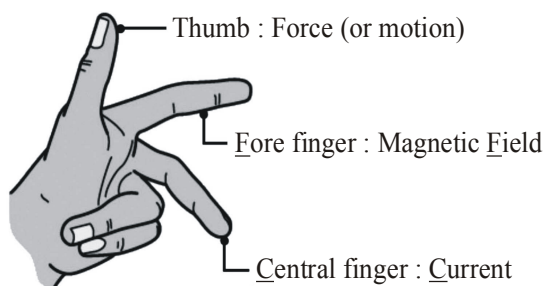
Central finger : Current

Fig. Fleming's left hand rule

Force on electron is maximum in case (a), because here the direction of motion of electron is perpendicular to the direction of magnetic field B. The force on electron is minimum i.e. zero in case (b), because in this case the direction of motion of electron is along the direction of magnetic field B. The direction of maximum force acting on electron [case (a)] is perpendicular to the plane of paper and directed into it.

SECTION-E

37. (a) The deterioration of surface of iron in presence of air and moisture is called rusting.
Rusting can be prevented by oiling, greasing, painting, etc.

(b) The corrosion of the iron is a type of Oxidation reaction. Oxidation reactions are the reactions in which the substances combine with oxygen gas to form metal oxides.

OR

(b) Silver articles became black after sometime when exposed to air because it react with sulphur compounds present in air to form a coating of silver sulphide.

$2Ag + H_2S \longrightarrow Ag_2S + H_2$
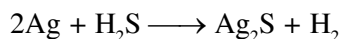
38. (a). Anti-diuretic hormone, Aldosterone.

(b). The various steps of urine formation are (i) ultrafiltration (ii) selective reabsorption (iii) tubular secretion.

(c). Artificial kidney is a machine that is used to filter the blood of a person whose both kidneys are damaged.
Drawbacks of artificial kidney :-

(i). It involves high risk of blood clot formation.

(ii). It may causes internal bleeding and cardiovascular problems.

OR

(c) The structural and functional unit of kidney is nephron. The three parts of nephric tubule are Bowman's capsule, Proximal convoluted tubule, Distal convoluted tubule.

39. (a) Emergent ray is parallel to incident ray but laterally displaced from incident ray.

(b) 'The law of refraction', expressed by equation (1), is also known as 'Snell's Law'

(c) It will return back and retrace its earlier path.

Absolute R.I. of glass, $n_g = \dfrac{C}{v_g}$

$\Rightarrow 1.5 = \dfrac{3 \times 10^8}{v_g}$ $[\because C = 3 \times 10^8 \text{ m/s}]$

$\Rightarrow v_g = \dfrac{3 \times 10^8}{1.5} = 2 \times 10^8 \text{ m/s}$

OR

(c) Yes, the lateral shift between emergent and incident rays depends on the thickness of glass slab and it increases with the increase in thickness of slab and vice-versa.

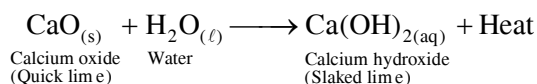$n_{ga} = \dfrac{v_a}{v_g} = \dfrac{\lambda_a}{\lambda_g}$

$\Rightarrow \dfrac{3}{2} = \dfrac{5700 \text{ Å}}{\lambda_g}$

$\Rightarrow \lambda_g = \dfrac{2 \times 5700 \text{ Å}}{3} = 3800 \text{ Å}$

SECTION-A

1. Option (3)

Calcium oxide (quick lime) reacts vigorously with water to produce calcium hydroxide (slaked lime) releasing a large amount of heat. It is a combination reaction.

$$\underset{\substack{\text{Calcium oxide}\\ \text{(Quick lime)}}}{CaO_{(s)}} + \underset{\text{Water}}{H_2O_{(\ell)}} \longrightarrow \underset{\substack{\text{Calcium hydroxide}\\ \text{(Slaked lime)}}}{Ca(OH)_{2(aq)}} + Heat$$

2. Option (2)

Reaction (i) : Here, HCl has lost hydrogen to give Cl_2. Hence, HCl has been oxidized to chlorine (Cl_2) and it is acting as the reducing agent.

Reaction(ii) :
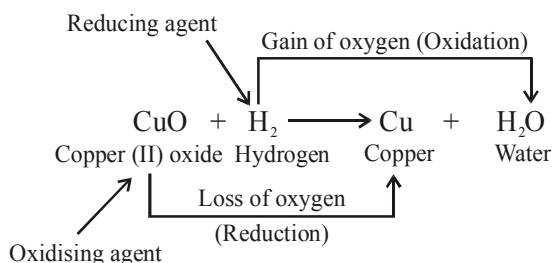
3. Option (4)

4. Option (3)

Since the number of valence electrons in X is 5, it is phosphorus and the number of valence electrons in Y is 7, it is fluorine.
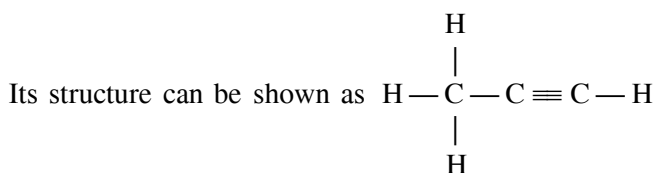
5. Option (3)

Gallium and caesium have very low melting points.

6. Option (1)

Vinegar (acetic acid) reacts with metal carbonates (Na_2CO_3) and metal hydrogencarbonates ($NaHCO_3$) to produce carbon dioxide gas which extinguishes burning matchstick.

7. Option (2)

C_3H_4 or propyne has a triple bond. It belongs to the bomologous series of alkynes with general formula C_nH_{2n-2}.

Its structure can be shown as

$$H - \overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}} - C \equiv C - H$$

8. Option (3)

Bread mould shows saprotrophic mode of nutrition by which it break down the nutrients of bread and then absorb them.

9. Option (2)

10. Option (4)

Endometrium is the innermost thick layer of uterus

11. Option (4)

12. Option (3)

Frog is the secondary consumer as it feeds on insect which is a primary consumer.

13. Option (1)

$$V = \frac{W}{q} \qquad \Rightarrow V = \frac{W}{I \times t} \qquad \Rightarrow \text{Voltage} = \frac{\text{Work done}}{\text{Current} \times \text{Time}}$$

14. Option (4)

Since, each circuit is closed and Ammeter (in each circuit) is connected in series with appropriate polarity, the current recorded in ammeters in all cases will be same.
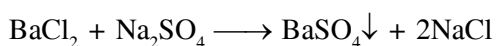
15. Option (1)

When a point source of light is placed at the focus of a concave mirror [or convex lens], the light rays emerges out as a parallel beam after reflection [or refraction] through mirror (or lens).

16. Option (3)

Sun's rays (a parallel beam of light coming from Sun) are focused on a screen at 24 cm away after reflection from mirror and the screen is placed in front of mirror. The device is a concave mirror of focal length 24 cm.

17. Option (1)

$BaCl_2 + Na_2SO_4 \longrightarrow BaSO_4\downarrow + 2NaCl$

18. Option (1)

Respiration is a biochemical process opposite to photosynthesis, because energy is released during respiration due to oxidation of food while in photosynthesis sunlight energy is used for the synthesis of food.

19. Option (4)

Glomerular filtration occurs because the pressure of the blood flowing in the glomerular capillaries is higher than the pressure of the filtrate in Bowman's capsule. The blood pressure drives glomerular filtration and because the process takes advantage of pressure gradient, glomerular filtration does not require expenditure of energy by kidney cells.
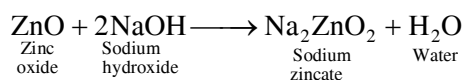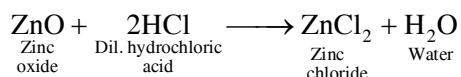
20. Option (4)

Assertion is false but reason is true.

SECTION-B

21. (a) Hydrogen gas is not evolved when most metals react with nitric acid with the exception of two metals (Mg and Mn). It is because HNO_3 is a strong oxidising agent. It oxidises the H_2 produced to water and itself gets reduced to any of the nitrogen oxides (N_2O, NO, NO_2).

    (b) ZnO reacts both with acids as well as bases to form salt and water. Thus, ZnO is an amphoteric oxide.

$$ZnO + \underset{\substack{\text{Dil. hydrochloric} \\ \text{acid}}}{2HCl} \longrightarrow \underset{\substack{\text{Zinc} \\ \text{chloride}}}{ZnCl_2} + \underset{\text{Water}}{H_2O}$$
(Zinc oxide)

$$\underset{\substack{\text{Zinc} \\ \text{oxide}}}{ZnO} + \underset{\substack{\text{Sodium} \\ \text{hydroxide}}}{2NaOH} \longrightarrow \underset{\substack{\text{Sodium} \\ \text{zincate}}}{Na_2ZnO_2} + \underset{\text{Water}}{H_2O}$$

OR

Based on the reactivity series, the relative position of the metals involved in solutions is :

Zn > Fe > Cu > Ag

Metal A is more reactive than copper and less reactive than iron.

Metal B is more reactive than iron and less reactive than zinc.

Metal C is more reactive than silver only and less reactive than other metals.

Metal D is the least reactive in nature.

In the light of above information, we can conclude that

(a) Metal B is the most reactive.

(b) The increasing order of reactivity of metals is :

D < C < A < B

22. When growing plants detect light, a hormone called auxin, synthesized at shoot tip, help the cells to grow longer. When light is coming from one side of the plant, auxin diffuses towards the shady side of the shoot. This concentration of auxin stimulates the cells to grow longer on the side of the shoot which is away from light. Thus, the plant appears to bend towards light.

23. The loss of water in the form of water vapour from the aerial parts of plant is known as transpiration. It is considered as necessary evil because it leads to loss of water from the plants but it also helps in absorption and upward movement of water.

It also helps in temperature regulation. The plants are protected from the burning due to transpiration. Evaporation of water from leaf produces cooling effect.

24. The required pH maintained in the stomach due to the presence of HCl in the gastric juice and in the small intestine the required pH is maintained due to the secretion of bile juice from liver which is alkaline in nature as well as intestinal juice is also alkaline.

25. (i) If alpha particle is at rest in a magnetic field, it will experience no magnetic force.

(ii) If alpha particle moves parallel to magnetic field lines, it will experience no magnetic force in this case also.

(iii) If the alpha particle moves perpendicular to the magnetic field lines, it experiences maximum force of magnetic field on it and direction of the force on alpha particle can be identified using fleming's left hand rule.
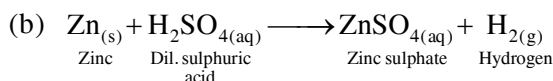
OR

Magnetic field can be produced or made available to a place wherever required by using

(i) a permanent magnet or artificial magnet (like bar magnet, Horse shoe magnet)

(ii) a straight current carrying conductor.

(iii) a flow of current in a solenoid.

26. Kidney produces 180 litre of filtrate per day but the amount of urine released is 1.5-2 litre per day, this is due to the phenomena of selective reabsorption that absorbs 99% of the filtrate and helps in concentration of urine.

SECTION-C

27. (a) 'X' is hydrogen gas.

The gas liberated is hydrogen and it can be tested by taking a burning matchstick near the mouth of the test tube in which the reaction is taking place. The gas will burn with a popping sound.

(b) $$\underset{\substack{\text{Zinc}}}{Zn_{(s)}} + \underset{\substack{\text{Dil. sulphuric}\\\text{acid}}}{H_2SO_{4(aq)}} \longrightarrow \underset{\substack{\text{Zinc sulphate}}}{ZnSO_{4(aq)}} + \underset{\substack{\text{Hydrogen}}}{H_{2(g)}}$$

Displacement reaction

(c) It is an exothermic reaction as heat is evolved.

28. (a) Copper

(b) It is concentrated by froth-floatation process.

(c) Impure metal is taken as anode whereas pure metal is taken as cathode. Soluble salt of metal is taken as electrolyte. When electric current is passed, impure metal changes to ions which gain electrons at cathode and change into pure metal. Impurities are left behind as anode mud.

At anode : $M(s) \longrightarrow M^{n+}(aq) + ne^-$
    Impure

At cathode : $M^{n+}(aq) + ne^- \longrightarrow M(s)$
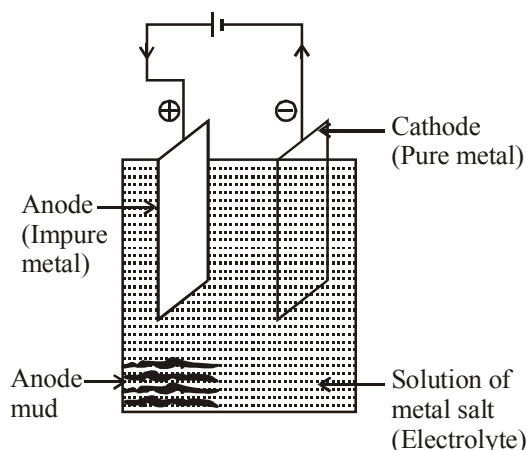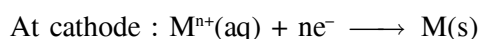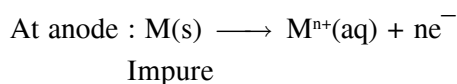
29. The three events that occur during the process of photosynthesis are :

(i) Absorption of light energy by chlorophyll.

(ii) Conversion of light energy into chemical energy and splitting of water molecule into hydrogen and O_2.

(iii) Hydrogen reduces CO_2 and synthesizes glucose (reduction of CO_2 into carbohydrates).

Two functions of stomata are :

(i) Massive amount of gaseous exchange takes place in the leaves through stomata.

(ii) Large amount of water is lost in the form of water vapour through stomata and it is known as transpiration.

OR

(i) The breathing cycle is rhythmic, as it consists of regular inhaling and exhaling of air. The exchange of gases is continuous because the lungs always contain a residual volume of air so that the absorption of oxygen and release of carbon dioxide keep on going.

(ii) Two molecules of ATP are produced by oxidation of glucose under anaerobic condition.

30. (i) (a) The position of object AB would have been beyond $2F_1$.

(b) Size of the object would have been bigger than the size of image.

(ii) Given : $n_w = \dfrac{4}{3}$, $n_g = \dfrac{3}{2}$, $\angle i = 45°$, $\angle r = ?$

The refractive index of glass with respect to water,

$$n_{gw} = \frac{n_g}{n_w} = \frac{\left(\dfrac{3}{2}\right)}{\left(\dfrac{4}{3}\right)} = \frac{9}{8} \qquad \qquad ....(1)$$

Since, $n_{gw} = \dfrac{\sin i}{\sin r} = \dfrac{\sin 45°}{\sin r} = \dfrac{\left(\dfrac{1}{\sqrt{2}}\right)}{\sin r} \qquad ....(2)$

Therefore, using relation (1) and (2), we have

$$\frac{9}{8} = \frac{\left(\dfrac{1}{\sqrt{2}}\right)}{\sin r}$$

$\Rightarrow \sin r = 0.6284 \quad \Rightarrow \quad r = 38.9°$

31. (i) Effective resistance of the network,

$$R_{AB} = 2\Omega + 6\Omega \parallel 3\Omega \ = 2 + \frac{6 \times 3}{6+3} = 2 + \frac{18}{9} = 2 + 2 = 4\ \Omega$$

(ii) The main current in the network, $I = \dfrac{V}{R_{AB}} = \dfrac{12}{4} = 3$ A

Potential difference across 2 Ω resistor, $V_1 = I \times R_1 = 3 \times 2 = 6$ V

So, potential difference across the parallel combination of 3 Ω and 6 Ω, $V_2 = 12 - 6 = 6$ V

Therefore, current flowing through 6 Ω resistor, $I' = \dfrac{6\,V}{6\,\Omega} = 1$ A

32. Given : Concave mirror, $h_0 = 6$ cm, $f = -30$ cm, $u = -45$ cm

Using mirror formula

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} \quad \Rightarrow \quad \frac{1}{-30} = \frac{1}{v} + \left[\frac{1}{-45}\right]$$

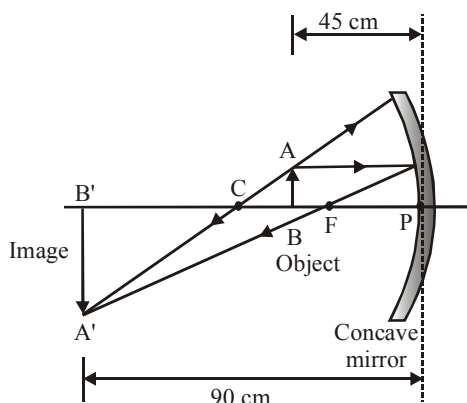$$\Rightarrow \quad \frac{1}{v} = \frac{1}{45} - \frac{1}{30} = \frac{2-3}{90} = -\frac{1}{90}$$

$\Rightarrow v = -90$ cm   (Position of Image)

Magnification, $m = \dfrac{h_i}{h_o} = \dfrac{-v}{u} = -\dfrac{(-90)}{(-45)} = -2$

$\Rightarrow h_i = h_o \times (-2) = 6 \times (-2) = -12$ cm

Therefore, the image formed is two times magnified (i.e. 12 cm tall), real and inverted and its position is at 90 cm from the mirror on the same side of object.

Ray diagram :

OR

Given : Convex lens, $h_0 = 6$ cm, $u = -50$ cm, $f = +30$ cm

Using lens formula,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \qquad \Rightarrow \quad \frac{1}{30} = \frac{1}{v} - \left[\frac{1}{-50}\right]$$

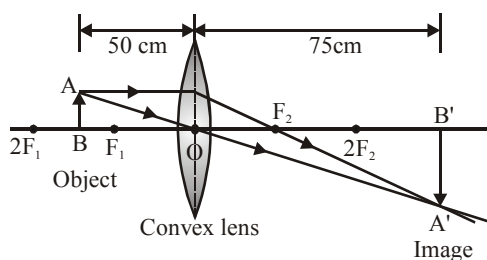$$\Rightarrow \quad \frac{1}{v} = \frac{1}{30} - \frac{1}{50} = \frac{5-3}{150} = \frac{2}{150}$$

$$\Rightarrow \quad v = \frac{150}{2} = +75 \text{ cm} \quad \text{(Position of Image)}$$

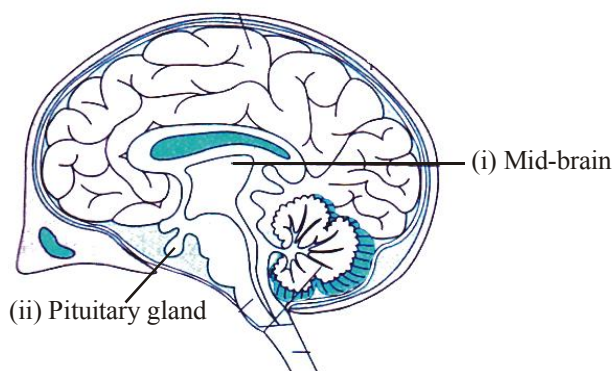Magnification, $m = \dfrac{h_i}{h_o} = \dfrac{v}{u} = \dfrac{+75}{-50} = -\dfrac{3}{2} = -1.5$

$$\Rightarrow \quad h_i = h_o \times (-1.5) = 6 \times (-1.5) = -9 \text{ cm}$$

Therefore, the image formed will be real, 1.5 times magnified (i.e 9 cm in size) and inverted. The screen should be placed at 75 cm distance from convex lens (on other side of object) to obtain the sharp image on it.
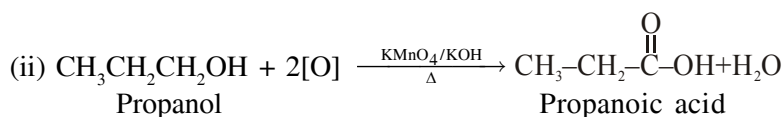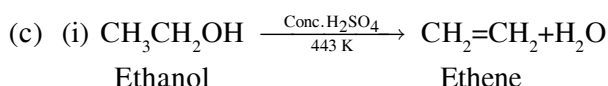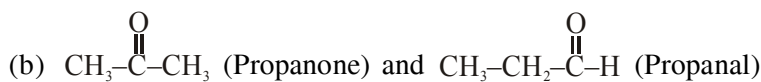
Ray diagram :

33.

SECTION-D

34. (a) 'X' is ethanol, C_2H_5OH. 'Y' is H_2 gas

(b) $2C_2H_5OH + 2Na \longrightarrow C_2H_5ONa + H_2\uparrow$

    Ethanol   Sodium   Sodium   Hydrogen

     'X'   Ethoxide   'Y'

    'Y' is hydrogen gas, which burns with 'pop' sound.

(c) Ethene, C_2H_4 is formed when 'X' is heated with conc. H_2SO_4.

$CH_3CH_2OH \xrightarrow[\text{Heat}]{\text{Conc.}H_2SO_4} CH_2 = CH_2 + H_2O$

Ethanol   Ethene   Water

   ('X')

OR

(a) Those compounds which has same molecular formula but different structural formula are called isomers.

(b) $CH_3-\overset{\overset{\displaystyle O}{\|}}{C}-CH_3$ (Propanone) and $CH_3-CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-H$ (Propanal)

(c) (i) $CH_3CH_2OH \xrightarrow[\text{443 K}]{\text{Conc.}H_2SO_4} CH_2=CH_2+H_2O$

     Ethanol   Ethene

(ii) $CH_3CH_2CH_2OH + 2[O] \xrightarrow[\Delta]{KMnO_4/KOH} CH_3-CH_2-\overset{\overset{\displaystyle O}{\|}}{C}-OH+H_2O$

      Propanol   Propanoic acid

35. (i) Placenta is a fully formed reddish brown disc embedded in the uterine wall, that serves to bring the foetal and maternal blood close enough.

Function of placenta (i) It provides a large surface area for glucose and oxygen to pass from the mother to the embryo. (ii) The developing embryo will also generate waste substances which can be removed by transferring them into the mother's blood through the placenta.

(ii) The various methods of contraception are :

(1) Mechanical methods (any one)

(i) It includes use of condoms which are the rubber or plastic sheets put on the penis before coital activity.

(ii) Use of diaphragms or cervical caps fitted in vagina of female to check the entry of sperms into the uterus and also helps in avoiding conception.

(iii) Use of IUCD i.e. Intra Uterine Contraceptive Devices like copper T and loops fitted in the uterus, help to prevent fertilization and implantation of embryo. They can cause side effects due to irritation or infection of uterus.

(2) Chemical methods (any one)

(i) It consists of using some chemicals which are spermicidal. They may be in form of tablets, jellies, paste and creams introduced in the vagina before coital activity.

(ii) Another chemical method is the use of oral contraceptive (OC) pills which inhibit the secretion of FSH (Follicle Stimulating Hormone) and LH (Leutinising Hormone) from the anterior lobe of pituitary gland and thus inhibiting ovulation from the ovary. These contraceptives therefore change the hormonal balance so that egg cell is not released (inhibit ovulation) and hence prevent fertilization.

(3) Surgical methods (any one)

(i) Tubectomy involves cutting of fallopian tubes in females and Vasectomy involves cutting of vas deferens of each side in males.

(ii) Surgical removal of ovaries is known as ovariectomy and removal of testes is known as castration.

(iii) Another surgical method is MTP i.e. Medical Termination of Pregnancy or abortion.

(iv) Other method is tubal ligation in which fallopian tubes are blocked by an instrument called laproscope.

OR

(a) The reason for the selection of pea plants for the genetic experiments are:

(i) It is easy to grow in the garden.

(ii) The flowers of pea plants are bisexual so choice of self fertilization and cross fertilization.

(iii) Easy to obtain pure breed plant through self-fertilization

(iv) Plant has short life cycle . (Any two)

(b) **(i) Law of dominance :** In crossing between organisms pure for contrasting characters of a pair, only one character of the pair appears in the F1 generation. This character is termed as dominant while the one which does not express itself in F1 generation is termed as recessive.

(ii) Law of segregation : Different alleles or genes of a character remain together in an individual and segregate randomly at the time of gamete formation. This is also known as the Law of purity of gametes.

(iii) Law of independent assortment : This law states that when individuals differing in two or more than two pairs of contrasting characters are crossed, the inheritance of any one pair is not affected by the presence of the other.

e.g., The inheritance of seed shape character is not related to the seed colour character. Rather, the two characters inherit independently of each other.

36. (a) Magnetic field lines can never intersect each other because if they intersect at a point, magnetic field at that point will have two directions which is not possible. (If we put a magnetic needle at such a point, it will point in two directions, that is impossible)

(b) **Right hand thumb rule :** 'Imagine that you are holding a current-carrying straight conductor in your right hand and the thumb is stretched along the direction of current, then, your fingers will wrap around the conductor in the direction of the magnetic field lines of the magnetic field'.
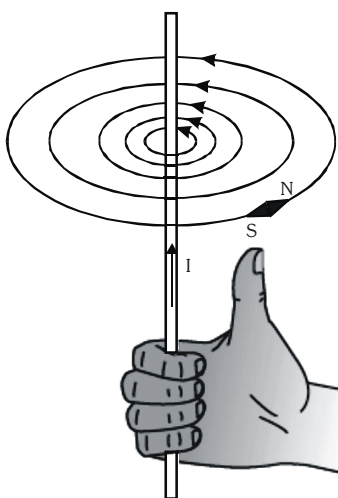
(c) Magnetic field produced by a straight current carrying conductor depends upon:

(i) Current. The strength of magnetic field is directly proportional to the current flowing through it.

(ii) Distance from conductor. The strength of magnetic field is inversely proportional to the distance from the conductor.

SECTION-E

37. (a) Corrosion and Rancidity

   (b) $CuSO_4$ in (III) and CuO in (VI)

OR

   (b) Oxidation takes place at anode and reduction at cathode

38. (a). Two examples of artificial ecosystem are- Crop field, aquarium.

(b). Biotic factors of an ecosystem- Producers, Consumers, and Decomposers

(c). DECOMPOSERS-The micro-organisms which break down the complex organic compounds in dead organisms into simpler substances.

Role of decomposers in an ecosystem are as follows-

i. Clean the environment.

ii. Helps in nutrients recycling.

iii. Maintains soil fertility.

OR

(c). It is because only 10% of energy is passed on to next higher trophic level in a food chain. As a result of this, there is a progressive decline in the energy level and the amount of energy available is not enough to sustain more than few trophic levels in a food chain.

39. (a) The distance between the focus and the optical centre of concave lens is called its 'focal length'.

   (b) **Ray diagram :**
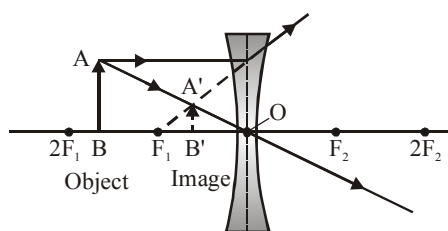
   (c) Divergent lens (Concave lens), f = –30 cm

   h_0 = +5 cm, v = –15 cm, u = ?

   [A concave lens forms virtual images on the same side of object.]

   Using lens formula,

   $\dfrac{1}{f} = \dfrac{1}{v} - \dfrac{1}{u}$ $\Rightarrow -\dfrac{1}{30} = \dfrac{1}{(-15)} - \dfrac{1}{u}$

   $\Rightarrow \dfrac{1}{u} = \dfrac{1}{30} - \dfrac{1}{15} = \dfrac{1-2}{30}$

   $\Rightarrow u = -30$ cm   [Object's position from lens]

OR

(c) Given : Concave lens, $m = +\dfrac{1}{2}$, $|u| + |v| = 60$ cm

$\because$ $m = \dfrac{v}{u} = +\dfrac{1}{2}$ $\qquad\qquad$ $\therefore$ $v = \dfrac{u}{2}$

If, $u = -x$ cm (say); then, $v = -\dfrac{x}{2}$ cm $\qquad\qquad$ ..... (1)

Given, $|u| + |v| = 60$ cm

Therefore, $|-x| + \left|\dfrac{-x}{2}\right| = 60$

$\Rightarrow \dfrac{3x}{2} = 60$

$\Rightarrow x = 40$

So, $u = -40$ cm and $v = -20$ cm $\qquad$ [By using relation (1)]
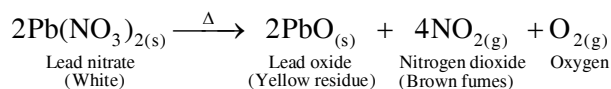
Using lens formula,

$$\dfrac{1}{f} = \dfrac{1}{v} - \dfrac{1}{u} = \left(\dfrac{1}{-20}\right) - \left(\dfrac{1}{-40}\right) = \dfrac{-2+1}{40} = -\dfrac{1}{40}$$

$\Rightarrow f = -40$ cm [Focal length of concave lens]

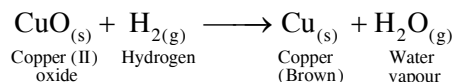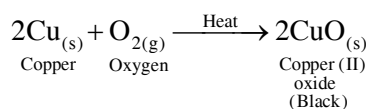# SAMPLE PAPER – 3   SOLUTIONS

SECTION-A

1. Option (4)

Brown fumes of nitrogen dioxide are evolved and a yellow residue of lead oxide is left behind in the test tube.

$$2Pb(NO_3)_{2(s)} \xrightarrow{\Delta} 2PbO_{(s)} + 4NO_{2(g)} + O_{2(g)}$$

Lead nitrate (White)   Lead oxide (Yellow residue)   Nitrogen dioxide (Brown fumes)   Oxygen

2. Option (4)

It is a neutralisation reaction which does not involve any change in oxidation states.

3. Option (4)

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

Copper   Oxygen   Copper (II) oxide (Black)

$$CuO_{(s)} + H_{2(g)} \longrightarrow Cu_{(s)} + H_2O_{(g)}$$

Copper (II) oxide   Hydrogen   Copper (Brown)   Water vapour

4. Option (2)

Copper is more reactive than silver and displaces silver from its salt solution.

5. Option (2)

Sodium and potassium are very reactive that they have to be kept in kerosene.

6. Option (4)

The colour of pH paper is orange in acidic medium while it is blue in basic medium.

7. Option (2)
(i)   Butanol $\Rightarrow CH_3CH_2CH_2CH_2OH$
(ii) Propene $\Rightarrow CH_3CH = CH_2$
(iii) Ethanoic acid $\Rightarrow CH_3COOH$

8. Option (2)

9. Option (1)

10. Option (4)

11. Option (1)

12. Option (3)

13. Option (4)

Magnetic field lines arrange themselves in form of concentric circles around a straight current carrying wire.

14. Option (1)

When a charged particle moves perpendicular to a magnetic field, it executes circular motion in the field.

15. Option (3)

For given conductor, $R = \rho \dfrac{\ell}{A}$ ......(1)

For another conductor, $R = \rho \dfrac{\ell'}{A'} = \rho \cdot \dfrac{2\ell}{A'}$ ......(2)

Using equation (1) and (2), we have

$\rho \cdot \dfrac{\ell}{A} = \rho \cdot \dfrac{2\ell}{A'}$ $\Rightarrow A' = 2A$

16. Option (2)

The human eye lens can adjust its focal length (with the help of ciliary muscles) to form clear images on retina for objects at different locations. This is called 'Power of accommodation' of eye.

17. Option (1)

Cu is oxidised to Cu^{2+}.

18. Option (3)

19. Option (1)

20. Option (1)

Both assertion and reason are true and reason is the correct explanation of assertion.

SECTION-B

21. (a) Acid A is concentrated HCl.

Acid B is concentrated HNO_3.

(b) 3 parts of concentrated HCl is mixed with 1 part of concentrated HNO_3 to make royal water called aqua-regia.

OR

(a) Order of reactivity : C > A > B > D

(b) Electrolysis of their molten or fused salts.

22 **A-Cerebrum :** It is responsible for memory, thinking, will power and conciousness.

B- Cranium : It is a bony covering that provides protection to the brain.

C-Midbrain : It controls the reflex movements of the ears and eyes muscles. It also provides a passage for the different neurons going in and coming out of the cerebrum.

D-Cerebellum : It is responsible for maintaining the balance while walking, swimming, riding, etc. It is also responsible for precision and the fine control of the voluntary movements.

23. (i) The lining of the alimentary canal has muscles that contract rhythmically so that the food can be pushed down through it easily. This action is known as peristalsis. These movements of muscles help the passage of food through the gut.

(ii) The rate of breathing in aquatic organisms is much faster than terrestrial organisms, because water has low content of oxygen than air.

24. (i) Nephron is the structural and functional unit of kidney. It has following functions:

(a) Filtration (b) Selective reabsorption

(c) Tubular secretion

(ii) Ultrafiltration : The first step in clearing the blood is filtration under pressure, the passage of a liquid through a filter to remove impurities. Filtration occurs in the glomeruli. Blood pressure helps plasma (the liquid portion of the blood) to pass through the capillary walls in the glomerulus. Glomerular capillaries are more permeable than other capillaries. The filtrate contains water, glucose, amino acids, ions and urea.

25. Given : Concave mirror, h_o = 5 cm, f = – 10 cm, |m| = 1.5, u = – 15 cm, h_i = ?, v = ?

If the image formed is real, m = –1.5

$$\because \quad m = \frac{h_i}{h_o} = -\frac{v}{u}$$

$\therefore$ Height of the image, $h_i = h_o \times m = 5 \times (-1.5) = -7.5$ cm

Also, the position of image from the mirror, $v = m \times (-u) = (-1.5) \times [-(-15)] = -22.5$ cm

OR

Given : Concave mirror, h_o = 10 cm, f = – 10 cm, m = +1.5 (virtual image), u = ?, h_i = ?

$$\because \quad m = \frac{h_i}{h_o} = \frac{f}{f-u}$$

Therefore,

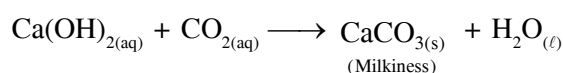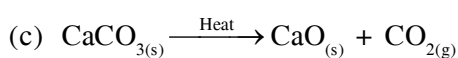$$+1.5 = \frac{f}{f-u} = \frac{-10}{-10-u}$$

$$\Rightarrow 15 + 1.5\,u = 10$$

$$\Rightarrow u = -\frac{10}{3} = -3.33 \text{ cm} \qquad \text{(Position of object from the mirror)}$$

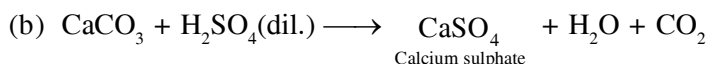Height of image, $h_i = h_o \times m = 10 \times 1.5 = +15$ cm

26. (i) Deer and rabbit belong to second trophic level. Frog, Lion, Eagle belong to third trophic level.

(ii) This phenomenon is called Biomagnification. It involves progressive increase in concentration of harmful non-biodegradable chemical at different trophic levels in a food chain.

SECTION-C

27. (a) Limewater turns milky due to formation of a white precipitate.

(b) Calcium carbonate is a compound. It decomposes into simpler substances on heating.

(c) $CaCO_{3(s)} \xrightarrow{\text{Heat}} CaO_{(s)} + CO_{2(g)}$

$Ca(OH)_{2(aq)} + CO_{2(aq)} \longrightarrow \underset{\text{(Milkiness)}}{CaCO_{3(s)}} + H_2O_{(\ell)}$

28. (a) 'X' is $CaCO_3$ (calcium carbonate). The gas evolved is CO_2.

(b) $CaCO_3 + H_2SO_4(dil.) \longrightarrow \underset{\text{Calcium sulphate}}{CaSO_4} + H_2O + CO_2$

(c) Sodium hydrogen carbonate, $NaHCO_3$ is an antacid. Antacids produces bicarbonate ions which neutralises excess of acid formed in the stomach.

29. (i) Haemoglobin is a protein molecule, which contains iron as a mineral element. It is present in RBCs of the blood in humans. It has a high affinity for oxygen and transport the same to all body parts along with blood. Thus, it plays an essential role of being a respiratory pigment as the diffusion pressure alone cannot take care of oxygen delivery to all body parts in large sized animal such as humans.

(ii) **Differences between Aerobic and Anaerobic respiration (any three)**

| S.NO	Features	Aerobic Respiration	Anaerobic Respiration
1	O_2 requirement	O_2 required	Not required
2	Occurs in	Cytoplasm and mitochondria	Cytoplasm only
3	Breakdown	Complete breakdown of glucose takes place	Incomplete breakdown of glucose takes place
4	End products	CO_2 and H_2O	CO_2 and ethyl alcohol or lactic acid
5	Energy produced from one glucose molecule	38 ATP	2 ATP

OR

(i) **Blood vessels** They are of three types , i.e. arteries, veins and capillaries. They carry the oxygenated blood from heart to different parts of the body and return back to heart with deoxygenated blood.

(ii) **Lymph** It is colourless and flows from tissues to heart. It carries digested and absorbed fat from intestine. It drains excess fluid from extracellular space back into the blood.

(iii) **Heart** It is pumping machine that pushes out the blood into the blood vessels. It has four chambers separated by septum, which prevents the mixing of pure and impure blood.

30. Direction of current through the conductor will be from East to West direction, if the position of observer is at West [See figure (a)].

Direction of current through the conductor will be from West to East direction, if the position of observer is at East [See figure (b)].
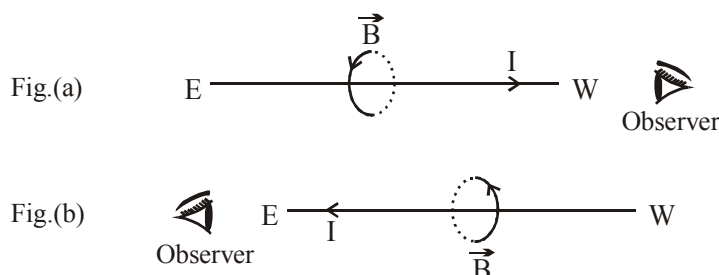
Maxwell's right hand thumb rule.

31. Since all the cylindrical conductors are made from same material i.e. copper, their resistivity is same.

Resistance of conductor (a), $R_1 = \rho \cdot \dfrac{L}{A}$

Resistance of conductor (b), $R_2 = \rho \cdot \dfrac{3L}{(A/3)} = 9 \cdot \dfrac{\rho L}{A} = 9R_1$

Resistance of conductor (c), $R_3 = \rho \cdot \dfrac{(L/3)}{3A} = \dfrac{1}{9} \cdot \rho \dfrac{L}{A} = \dfrac{R_1}{9}$

Therefore, $R_2 = 9R_1$ and $R_3 = \dfrac{R_1}{9}$

OR

The resistors B, C and D are connected in series, so their series equivalent,

$R_s = 2 + 2 + 2 = 6\ \Omega$

Resistor A is in parallel with the series combination of resistors B, C and D. So, the equivalent resistance of the network can be calculated as follows:

$\dfrac{1}{R_{eq}} = \dfrac{1}{6} + \dfrac{1}{2} = \dfrac{4}{6}$

or $\boxed{R_{eq} = \dfrac{3}{2}\ \Omega = 1.5\ \Omega}$

Current flowing through resistor A,

$I_A = \dfrac{V}{R_A} = \dfrac{6}{2} = 3\ A.$
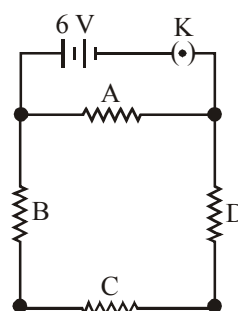
32. (a) The defect that arises due to ageing in which a person cannot read comfortably and distinctly without corrective eye glasses is called 'presbyopia'.

Cause of presbyopia :

The power of accommodation of the eye decreases with ageing. For most of the people, the near point recedes, this means, the least distance of distinct vision increases. This phenomenon arises due to the gradual weakening of ciliary muscles and decreasing flexibility of the crystalline eye lens.

Correction :

Here, the cornea and lens together are not able to bring nearby objects into focus on the retina. The symptoms are the same as with hypermetropia or (farsightedness), and the condition can be corrected using a converging lens i.e., convex lens.

(b) Given : Near point = 0.5 m, Far point = 3 m

For correction of Near sightedness,

u = – ∞, v = – 3 m (Far point)

Using lens formula,

$\dfrac{1}{f} = \dfrac{1}{v} - \dfrac{1}{u} = \dfrac{1}{(-3)} - \dfrac{1}{(-\infty)} = -\dfrac{1}{3}$ $\Rightarrow$ f = – 3 m = – 300 cm

For correction of Far sightedness,

u = – 25 cm = – 0.25 m, v = – 0.5 m (Near point)

Using lens formula,

$\dfrac{1}{f} = \dfrac{1}{v} - \dfrac{1}{u} = \dfrac{1}{(-0.5)} - \dfrac{1}{(-0.25)} = \dfrac{-100+200}{50} = \dfrac{100}{50}$

$\Rightarrow$ f = $+\dfrac{1}{2}$ m = + 50 cm

33. **(i) The various methods of waste disposal are :**

1. Land fills : In urban areas, majority of the solid wastes are buried in low lying areas to level the uneven surface of land. This method of waste disposal is commonly called land fills.

2. Recycling of wastes : Number of solid wastes (paper, plastics, metal etc.) can be recycled by sending them to respective recycling units. For instance, paper is sent for recycling into special paper mills ; broken plastic (e.g., plastic bags, buckets, bowls, dishes, mugs, discs, etc.) are sent to plastic processing factories.

3. Preparation of compost : Household waste such as peels of fruits and vegetables, left-over food, fallen dead leaves of kitchen garden plants and potted plants etc. can be converted into compost and used as manure.

(ii) Abiotic components include the non-living physico-chemical factors of the environment.
Ex. air, water.

SECTION-D

34. (a) Covalent bonds between carbon atoms in each layer and vander Waals' forces between the layers of carbon atoms.

(b) Graphite is soft. The layers of carbon atoms can slide and glide over each other because the weak van der Waals' forces between the layers are easy to overcome.

(c) Chemically graphite is carbon which combines with oxygen to form carbon dioxide.

OR

(a) Single covalent bond is present between two chlorine atoms in a chlorine molecule.

(b) The two chlorine atoms share one pair of electrons, so that both atoms achieve a noble gas configuration.

(c)
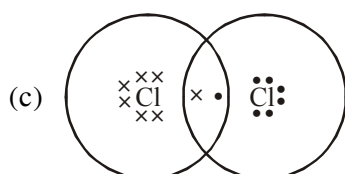
35. (i) Differences between pollen tube and style are:

Pollen Tube	Style
A tube growing out of pollen grain when it reaches stigma.	The middle elongated part of the carpel, i.e. female part of a flower.
It transports male gametes from pollen grains to ovules.	The attachment of stigma to the ovary.

(ii) Fission in *Amoeba* is binary and in Plasmodium is multiple. The difference is :

Binary Fission	Multiple Fission
The division of parental body into two identical daughter cells at a time.	The parental body divides into numerous daughter cells simultaneously.

(iii) Difference between fragmentation and regeneration is :

Fragmentation	Regeneration
The method in which multicellular organism breaks up into two or more smaller fragments.	The growth of a whole new organism from any of its body part, i.e. single segment forming new individual.

(iv) Difference between bud of *Hydra* and *Bryophyllum* is :

Bud of Hydra	Bud of Bryophllum
It is seen during budding as an outgrowth on the body of Hydra which gets fully grown and then detaches from the body and becomes a new individual.	This is present on the leaves of Bryophyllum develop into a new plant when it comes in contact with soil and other favourable conditions.

(v) Difference between cross pollination and self pollination :

Cross pollination	Self pollination
It is the transfer of pollen grains from anther to the stigma of different plants of the same species, it is also called xenogamy. (e.g. Mango).	It is the transfer of pollen grains from an anther to the stigma of the same plant.

OR

(i) Scrotum (scrotal sacs)   (ii) Penis
(iii) Ovary   (iv) Semen
(v) Puberty

36. (a) Description of two rays to obtain image from concave mirror :

(i) A ray parallel to the principal axis passes through the principal focus F of a concave mirror, after reflection [see fig.(a)].

(ii) A ray passing through the centre of curvature of a concave mirror, is reflected back along its own path, after reflection [see fig.(b)].
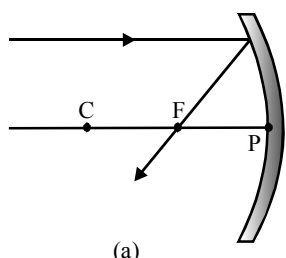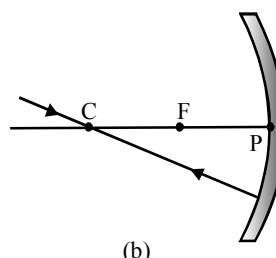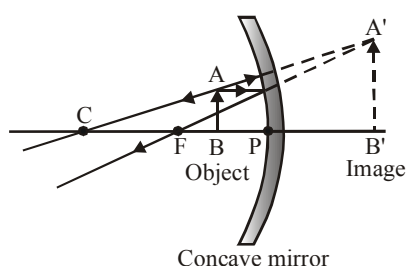

(a)   (b)

Ray diagram (using above two rules) for position of the object between pole and focus of a concave mirror :

(b) Given : Concave mirror, m = –3 (real image), u = –20 cm, v = ?

Magnification, $m = -\dfrac{v}{u}$

$\Rightarrow -3 = -\dfrac{v}{[-20]}$ $\Rightarrow v = -60$ cm

So, the screen should be placed at 60 cm in front of the concave mirror.

SECTION-E

37. (a) The spoiling of food due to oxidation of fats and oils present in the food material.

(b) The type of substances which can prevent the oxidation process of certain food materials are called as antioxidants. Some natural antioxidants are vitamin-C and vitamin-E.

OR

There are a few methods used by our ancestors to prevent rancidity:

(a) Salting   (b) Sugaring   (c) Pickling

38. (a)

♀\♂	B	B
b	Bb Black	Bb Black
b	Bb Black	Bb Black

F_1 Generation

In F_1 Generation, all rabbit will be black in colour.

(b)

♀\♂	B	b
B	BB Homozygous black	Bb Heterozygous black
b	Bb Heterozygous black	bb white

Phenotypes of offspring - 1 : 2 : 1

BB-Black : Bb-Black : bb-White

(c) 25% of white rabbit in F_2 generation as black colour is dominant on white colour.

OR

(c)   Tt   ×   tt
(heterozygous tall)   homozygous dwarf

♀\♂	T	t
t	Tt Tall	tt dwarf
t	Tt Tall	tt dwarf

Out of four, two are heterozygous tall and two are dwarf.

39. (a) $R_{eq} = 5 + 10 + 15 = 30\ \Omega$

$$I = \frac{V}{R_{eq}} = \frac{30}{30} = 1\ A$$

Potential difference across 15 Ω resistor
= $I \times R_{15} = 1 \times 15 = 15$ V

(b) When resistors are connected in parallel,

Current through 5 Ω resistor, $I_1 = \frac{V}{R_1} = \frac{30}{5} = 6$ A

Current through 10 Ω resistor, $I_2 = \frac{V}{R_2} = \frac{30}{10} = 3$ A

(c) $R_{AB} = 10\ \Omega + (20\ \Omega \parallel 20\ \Omega) = 10\ \Omega + \frac{20}{2}\Omega$

$= 10\ \Omega + 10\ \Omega = 20\ \Omega$

OR

(c) $R_{AB} = (20\ \Omega + 10\ \Omega) \parallel 20\ \Omega = 30\ \Omega \parallel 20\ \Omega$

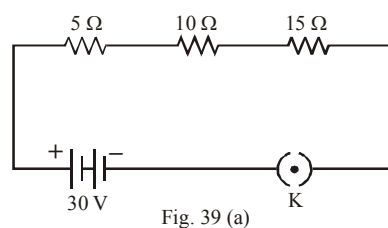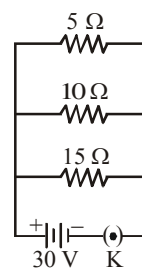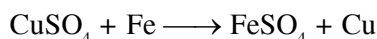$= \frac{30 \times 20}{(30 + 20)} = \frac{600}{50} = 12\ \Omega$

Fig. 39 (a)

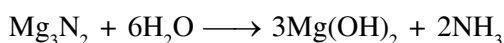Fig. 39 (b)

SAMPLE PAPER – 4   SOLUTIONS

SECTION-A

1. Option (2)

Since iron is more reactive than copper but less reactive than zinc and aluminium, hence it displaces copper from copper sulphate solution.

$$CuSO_4 + Fe \longrightarrow FeSO_4 + Cu$$

2. Option (2)

$$Mg_3N_2 + 6H_2O \longrightarrow 3Mg(OH)_2 + 2NH_3$$

3. Option (1)

Methyl orange turns red in acidic solution. In test tube P, water is added to orange juice which is acidic. It dilutes the solution but it still remains acidic.

Test tubes Q and R contains basic solutions. Solution in tube Q remains basic even after dilution. In test tube R, the basic solution (sodium hydroxide) is added. So it remains basic. Test tube S contains hydrochloric acid which is neutralized on adding equal volume of sodium hydroxide (a base) of equal strength, resulting into a neutral solution which does not change the colour of methyl orange. Hence, solution of test tube P only turns methyl orange to red.

4. Option (4)

CuO is basic in nature, ZnO is amphoteric in nature. Oxide of K dissolves in water to form alkali.

$$K_2O_{(s)} + H_2O_{(\ell)} \longrightarrow 2KOH_{(aq)}$$
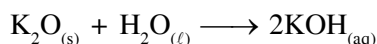
Pb does not react with water at all.

Thus, K, L, M and N are Cu, Zn, K and Pb respectively.

5. Option (4)

As copper is more reactive than silver, it displaces silver from silver nitrate solution.

6. Option (1)

Water turns the colour of pH paper to green.

7. Option (3)

Alkenes are the compounds which contain —C=C— bonds.

8. Option (4)

9. Option (4)

The exchange of gases in terrestrial animals occur through alveoli in lungs which increases the surface area for better exchange of gases. There is also a good supply of blood to transport the gases like CO_2 and O_2.

10. Option (4)

11. Option (3)

12. Option (1)

13. Option (3)

The least distance of distinct vision for a young adult with normal vision is about 25 cm.

14. Option (3)

In parallel combination of bulbs A(40 W), B(60 W) and C(100 W), the order of brightness will be,
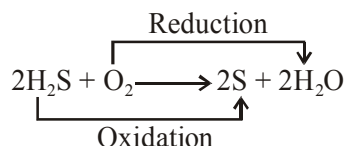A < B < C

15. Option (1)

Rear view mirror in vehicles is a convex mirror and it forms a diminished image of an object. So, magnification is less than one.

16. Option (1)

Refractive index of medium B relative to medium A,

$$n_{BA} = \frac{\sin 60°}{\sin 45°} = \frac{\left(\frac{\sqrt{3}}{2}\right)}{\left(\frac{1}{\sqrt{2}}\right)} = \frac{\sqrt{3}}{\sqrt{2}}$$

17. Option (1)

$$\overset{\text{Reduction}}{2H_2S + O_2 \longrightarrow 2S + 2H_2O}$$
$$\underset{\text{Oxidation}}{}$$

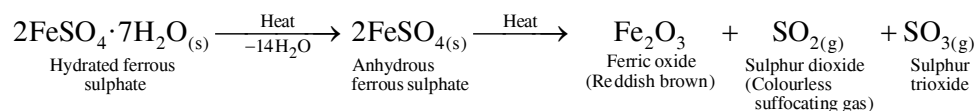**18.** Option (1)

19. Option (3)

Assertion is true and reason is false.

20. Option (2)

Both Assertion and Reason are true and Reason is not the correct explanation of Assertion.
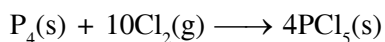
SECTION-B

21. The salt is ferrous sulphate ($FeSO_4.7H_2O$).

$$\underset{\substack{\text{Hydrated ferrous}\\\text{sulphate}}}{2FeSO_4 \cdot 7H_2O_{(s)}} \xrightarrow[-14H_2O]{\text{Heat}} \underset{\substack{\text{Anhydrous}\\\text{ferrous sulphate}}}{2FeSO_{4(s)}} \xrightarrow{\text{Heat}} \underset{\substack{\text{Ferric oxide}\\\text{(Reddish brown)}}}{Fe_2O_3} + \underset{\substack{\text{Sulphur dioxide}\\\text{(Colourless}\\\text{suffocating gas)}}}{SO_{2(g)}} + \underset{\substack{\text{Sulphur}\\\text{trioxide}}}{SO_{3(g)}}$$

OR

(a) It is a combination reaction.

$P_4(s) + 10Cl_2(g) \longrightarrow 4PCl_5(s)$
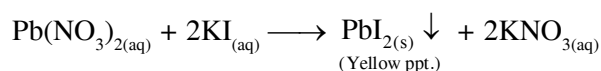
(b) (i) When lead nitrate is added to potassium iodide then yellow precipitate of lead iodide is formed along with potassium nitrate.

(ii) This type of reaction is called precipitation reaction in which one of the products formed is an insoluble substance or this is also called double displacement reaction.

(iii) Balanced chemical reaction is as follows :

$$Pb(NO_3)_{2(aq)} + 2KI_{(aq)} \longrightarrow \underset{\text{(Yellow ppt.)}}{PbI_{2(s)}} \downarrow + 2KNO_{3(aq)}$$

22. (Any three)

| S.No.	Features	Arteries	Veins	Capillaries
	Comparative Study of Blood Vessels			
1	Direction of blood flow	Take the blood away from heart to different parts of body.	Bring the blood towards the heart from various body parts.	Blood flows from arterioles to capillaries and then to venules.
2	Kind of blood	Oxygenated blood except in pulmonary artery.	Deoxygenated blood except in pulmonary vein.	Blood changes from oxygenated to deoxygenated.
3	Blood pressure	Pressure is high.	Pressure is low.	Pressure is extremely low.
4	Blood flow	Blood flows rapidly with jerks.	Blood flows smoothly without jerks.	Blood flows smoothly without jerks.
5	Lumen	Narrow	Wide	Very small
6	Valves	Absent	Present	Absent
7	Location	Mostly deep seated.	Mostly superficial.	Form a network all over the body and in the organs.

23. (i) A-Pituitary, B-Thyroid, C-Adrenal and D-Pancreas.

(ii) D-**Pancreas** secretes insulin, which controls the amount of sugar in blood. E- **Testes** secrete testosterone, which controls sperm production and secondary sexual characters in males.

24.

Reabsorption: During reabsorption, substances considered necessary in the filtrate are reabsorbed by renal tubules which then travel back into the bloodstream. Maximum reabsorption occurs in PCT because of the presence of microvilli.	**Tubular secretion :** Passage of unwanted substances out of the capillaries directly into the renal tubules is called as tubular secretion. This is an additional way of getting waste materials into the urine.

25. The nature of lens is 'Diverging' i.e., it is a concave lens.

Ray diagrams for image formations using concave lens :
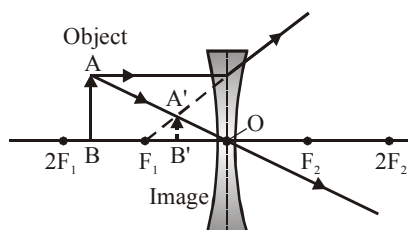
(a) Object placed at some finite distance
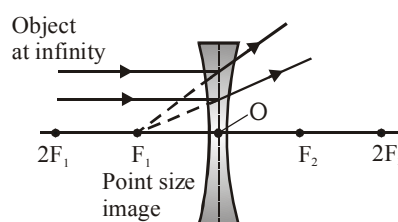
(b) Object at infinity

OR

The power of a lens is a measure of the degree of convergence or divergence of light rays falling on it. or

The power of a lens is defined as the 'reciprocal of its focal length'.

Given : Power of concave lens, P = –10 D

∴ Focal length of lens, f = $\dfrac{1}{P}$ = $-\dfrac{1}{10}$ m = – 0.1 m = – 10 cm

26. In the given figure, the C feeds directly on D which is the producer as it is absorbing light energy from the Sun. Hence, C is the primary consumer, B is the secondary consumer as it feeds on the primary consumer C.

A are decomposers, i.e. bacteria and fungi which decompose B, C and D in the food chain.

SECTION-C

27. **(a) Precipitation reaction :** The reaction in which two compounds exchange their ions and produces a precipitate which is insoluble in water is called precipitation reaction.

$AgNO_3(aq) + KI(aq) \longrightarrow AgI(s) + KNO_3(aq)$
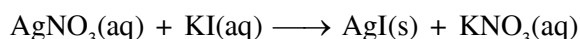
(b) Exothermic reaction : The reaction in which heat is evolved is known as exothermic reaction.
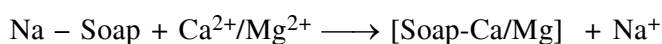
$C + O_2 \longrightarrow CO_2 + heat$
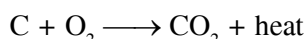
(c) Oxidation reaction : The reaction in which oxygen is added or hydrogen is removed or loss of electrons takes place is called oxidation reaction.

$2Cu + O_2 \longrightarrow 2CuO$
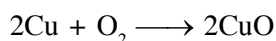
28. (a) Soap is sodium or potassium salt of fatty acids.

(b) Hard water prevents lathering of soap by forming curdy precipitate called scum.

$Na - Soap + Ca^{2+}/Mg^{2+} \longrightarrow [Soap\text{-}Ca/Mg] + Na^+$

<div align="center">white ppt.</div>

When soaps is used for washing clothes with hard water, a large amount of soap is wasted in reacting with the calcium and magnesium ions of hard water to form an insoluble precipitate called **scum**, before it can be used for the real purpose of washing soap. A large amount of soap is needed for washing clothes when the water is hard.
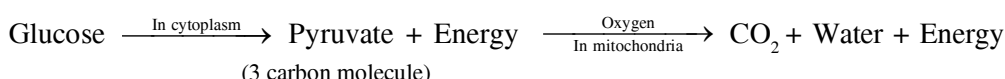
(c) Cleansing action of soaps and detergents : The molecules of soap are sodium or potassium salts of long chain carboxylic acids. The ionic end of soap dissolves in water while the carbon chain dissolves in oil. The soap molecules, thus form structures called micelles where one end of the molecules is towards the oil droplet while the ionic end faces outside. This forms an emulsion in water. The soap micelle thus helps in dissolving the dirt in water and we can wash out clothes clean.

29. (i)

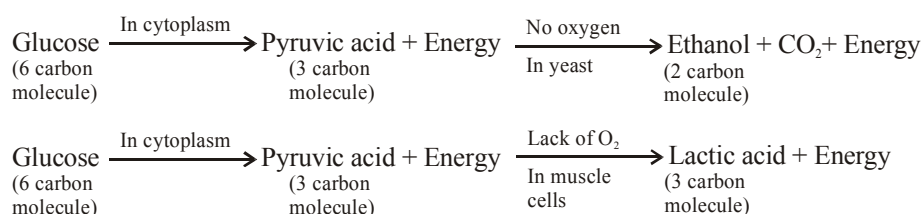| Saprotrophic nutrition	Parasitic nutrition
In this type of nutrition the organisms obtain their food from decaying organic substances. They are also called saprotrophs. They breakdown the food material outside the body and then absorb it.	Mode of nutrition in which organisms (parasite) derive nutrition from other plants and animals (host) without killing them.
E.g., Bacteria, Fungi (bread moulds, yeasts and mushrooms).	E.g., Cuscuta (Amarbel), ticks, lice, leeches and tapeworms.

(ii) Desert plants take up CO_2 at night and prepare an intermediate which is acted upon by the energy absorbed by the chlorophyll during the day and form glucose.

OR

(i) **In the presence of oxygen** When breakdown of glucose is carried out in the presence of oxygen in a cell, it is called as aerobic respiration. Glucose is converted into a 3 carbon molecule called pyruvate, which further breaks down in the presence of oxygen to form carbon dioxide and water. Energy is released in the process.

Glucose $\xrightarrow{\text{In cytoplasm}}$ Pyruvate + Energy $\xrightarrow[\text{In mitochondria}]{\text{Oxygen}}$ CO_2 + Water + Energy
(3 carbon molecule)

(ii) **In the absence of oxygen** When breakdown of glucose is carried out in the absence of oxygen in a cell, it is called as anaerobic respiration. This process is called as fermentation in microbes. Ethyl alcohol or lactic acid is produced by the breakdown of pyruvate.

Glucose $\xrightarrow{\text{In cytoplasm}}$ Pyruvic acid + Energy $\xrightarrow[\text{In yeast}]{\text{No oxygen}}$ Ethanol + CO_2 + Energy
(6 carbon molecule) (3 carbon molecule) (2 carbon molecule)

Glucose $\xrightarrow{\text{In cytoplasm}}$ Pyruvic acid + Energy $\xrightarrow[\text{In muscle cells}]{\text{Lack of } O_2}$ Lactic acid + Energy
(6 carbon molecule) (3 carbon molecule) (3 carbon molecule)

30. (a) Magnification, m = − 5 expresses a real, inverted and magnified image and such image is produced by a converging (convex) lens.

Focal length of convex lens, f = +6 cm

Ray diagram:

(Not drawn to scale)
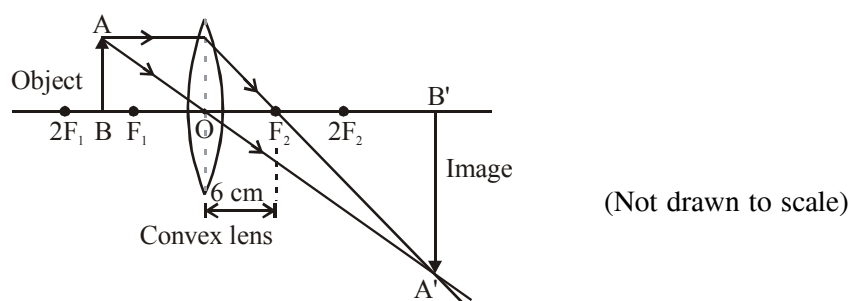
(b) The girl must have directed the ray of light along the direction of the optical centre of the lens because a ray of light passes straight through the optical centre of the lens, without any deviation.

Convex lens
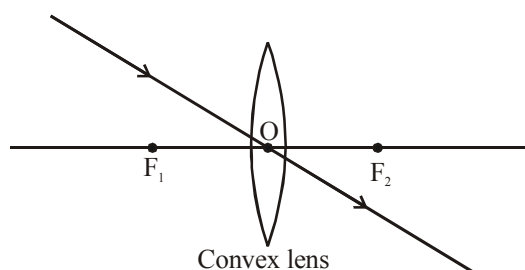
31. Resistivity of each part of the conductor will not change as it depends on the nature of the material of the conductor and material is same in this case.

The length of each part of conductor becomes $\dfrac{L}{4}$, but the resistivity and cross section area will remain same for each part.

Resistance of given conductor, $R = \rho\dfrac{L}{A}$

Resistance of each part of conductor, $R_{part} = \rho\dfrac{\left(\dfrac{L}{4}\right)}{A} = \dfrac{1}{4}\times\rho\dfrac{L}{A} = \dfrac{R}{4}$

When these four parts of conductors are joined in parallel, the equivalent resistance of this parallel combination will be,

$R_{eq} = \dfrac{R_{part}}{4} = \dfrac{\left(\dfrac{R}{4}\right)}{4} = \dfrac{R}{16}$

32. (a) Let us consider three resistors having resistances R_1, R_2, R_3 respectively. Let the voltage across the parallel combination of resistors is 'V' and currents through R_1, R_2, R_3 are I_1, I_2, I_3 respectively. Voltage across all the resistors is same as all of them have same terminal points (A and B). [See figure below]

Parallel combination of resistors
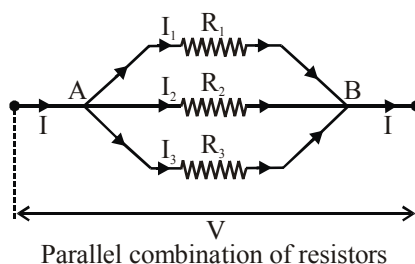
$V_1 = V_2 = V_3 = V$ (let) ... (1)

The total current 'I' entering through 'A' is divided among the three resistors (I_1, I_2 & I_3). Thus, total current 'I' is sum of individual currents through R_1, R_2 & R_3.

$I = I_1 + I_2 + I_3$ ... (2)

Let the equivalent resistance of whole combination be R_p.

$$I = \frac{V}{R_p} \qquad\qquad ... (3)$$

From (2) & (3), we get, $\dfrac{V}{R_p} = I_1 + I_2 + I_3$

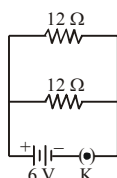or $\dfrac{V}{R_p} = \dfrac{V}{R_1} + \dfrac{V}{R_2} + \dfrac{V}{R_3} \qquad \left[\because I = \dfrac{V}{R}\right]$

or $\dfrac{V}{R_p} = V\left(\dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3}\right)$ or $\dfrac{1}{R_p} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3}$

General formula for n resistors in parallel :

$$\boxed{\dfrac{1}{R_p} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3} + - - - + \dfrac{1}{R_n}}$$

(b) $R_{eq} = \dfrac{12}{2} = 6\ \Omega$

$I = \dfrac{V}{R_{eq}} = \dfrac{6}{6} = 1\ A$

OR

(a) The total resistance of the circuit, $R_{eq} = 20 + 4 = 24\ \Omega$

(b) The current through the circuit, $I = \dfrac{V}{R_{eq}} = \dfrac{6}{24} = \dfrac{1}{4} = 0.25\ A$

(c) The energy consumed by electric bulb in 8 hrs,

$E = P \times t = I^2R \times t = (0.25)^2 \times 20 \times 8 = 10\ Wh = 0.01\ kWh = 0.01\ unit \qquad [\because 1\ kWh = 1\ unit]$
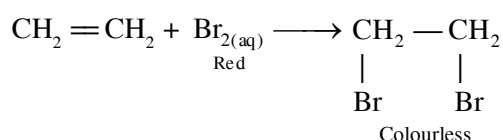
33. (i)

S.No.	Food Chain	Food Web
1	The sequence of eating and being eaten among the living organisms to transfer food energy is called food chain.	It is a system of interconnected food chains. The network of food chains develop a relationship between various
2	It is having 4-5 populations (trophic levels) of different species.	It is having numerous populations of different species.
3	It is a part of food web.	It contains many food chains.
4	Food chains do not help in increasing population of endangered species.	Food web helps in increasing the population of endangered species.

(ii) Hydrofluorocarbon (HFC) and the hydrochlorofluorocarbon (HCIFC). These two gases have replaced CFCs.

Incineration : It is the process of burning of substance at high temperature (usually more than 1000°C) and ultimately converting them into ashes. This ash can be disposed off by land fills. In cities, municipal committees / corporations generally do large scale disposal of waste by incineration.

SECTION-D

34. (a) Alkenes with general formula C_nH_{2n}.

(b) Next homologue of compound (I) is C_3H_6 i.e., propene and next homologue of compound (II) is C_5H_{10} i.e., pentene.

(c) These compounds are alkenes and they decolourise bromine water.

$$CH_2 = CH_2 + \underset{Red}{Br_{2(aq)}} \longrightarrow \underset{\underset{Colourless}{Br \qquad Br}}{\overset{CH_2 - CH_2}{\underset{|\qquad |}{}}}$$

OR

(a) (i) As C_3H_8 has general formula C_nH_{2n+2} thus it belongs to alkane.

(ii) P, Q, R and S are classified as hydrocarbons because these compounds are made up of carbon and hydrogen only.

(b) C_3H_8, C_4H_{10} and C_5H_{12} all have general formula C_nH_{2n+2} thus, all of these belong to alkanes.

(c) They have general formula C_nH_{2n+2} and they contain single covalent bond between C–C atoms.

35. (i) RRyy   ×   rrYY   Parent generation

Round green   Wrinkled yellow

Ry   Ry   rY   rY

RrYy   RrYy   RrYy   RrYy   F$_1$ generation
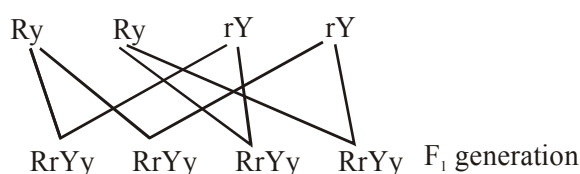
All will have round & yellow seeds.

(ii) Monohybrid cross : It is a cross in which only one character is studied at a time.

In his first monohybrid cross, Mendel crossed a pure breed tall plant (TT) and a pure breed dwarf plant (tt).

And he found that in F$_1$ generation only tall plant were born out of these seeds, no intermediate character or mixing or blending was observed by him. Mendel termed tallness as dominant and dwarfness as a recessive character.

To explain the experiment he said that each character is controlled by a pair of factor.

During gamete formation, the paired factors got segregated and moved to different gametes.

When these gametes fused together they used to restore paired state again.

In heterozygous conditions out of the two alleles only one allele is able to express its effect it is called dominant allele and other which does not show its effect in heterozygous condition is called recessive allele.

When F1 plants are grown and allowed to self pollinate he got many seeds and when they were grown he found that the ratio of tall plants and dwarf plants was 3:1 respectively.

The dwarfness which was not visible in F_1 generation reappeared in F_2 generation.

Monohybrid cross
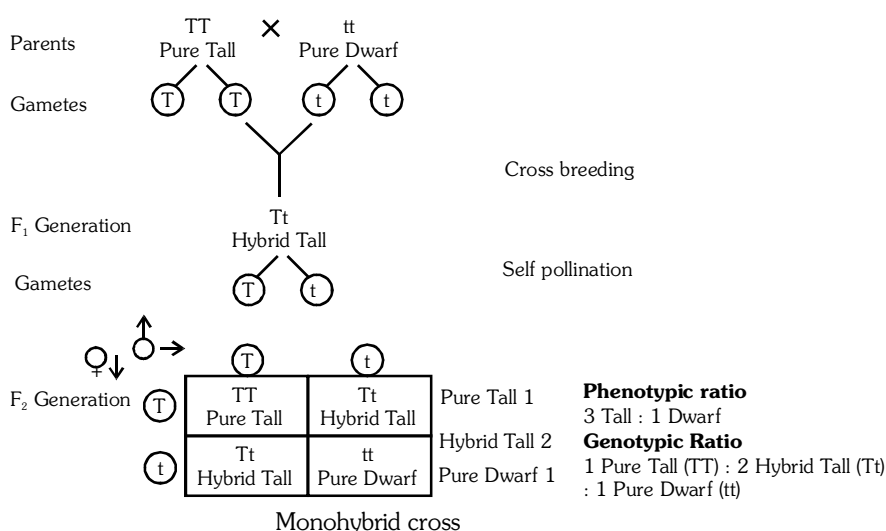
OR

(i)

	Y	y
y	Yy(yellow)	yy(white)
y	Yy(yellow)	yy(white)

Phenotype - 2 : 2

Genotype - 2 : 2

(ii) (a) Children have both Blue and black eye colour.

(ii) (b) Percentage of blue eyed coloured children is 50% and black eyed coloured children is 50% .

Bb × bb

(black eyed) (blue eyed female)

male

↓

|	B	b
b	Bb	bb
b	Bb	bb

50% → Black eyed

50% → Blue eyed

36. (a) Given that the magnetic field lines associated with current carrying vertical straight conductor is in anticlockwise direction, as seen by observer. It indicates two possible situation of current flow through the wire regarding two different observation's points.

Either, the observer is facing up and the anticlockwise magnetic field lines are seen by him. In this situation, the direction of current flow through vertical straight conductor is downwards (fig.1).

Or, the observer is facing down when he observes the anticlockwise magnetic field lines. In this situation, the current is flowing through the vertically straight conductor in upward direction (fig.2).

Fig (1)   Eye observation upwards

Eye observation downwards

Fig (2)
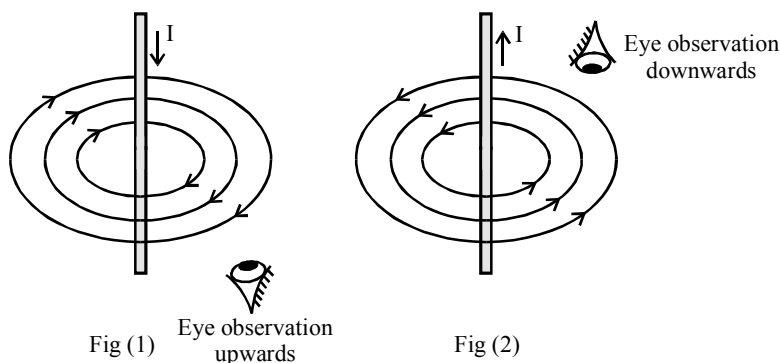
(b) When live wire touches the neutral wire, circuit offers very low resistance to the flow of current due to which current increases heavily in the circuit and electric short circuit occurs.

(c) Magnetic field (B) at the centre of the circular coil

(i) increases if the current is increased, since $B \propto I$.

(ii) reverses on reversing the current.

SECTION-E

37. (a) The methods by which concentrated ore is converted into metallic oxide are calcination (for carbonate ores) and roasting (for sulphide ores).

(b) One of the ore of zinc is zinc blende (ZnS). This sulphide ore can be concentrated by froth flotation method. The concentrated ore can be changed into its oxide by roasting method i.e., by heating the concentrated ore strongly in the presence of excess of air. The reaction is as follows-

$$2ZnS + 3O_2 \longrightarrow 2ZnO + 2SO_2$$
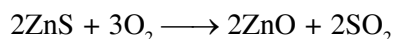
OR

(b) The oxides of metals low in the activity series can be reduced to metals by heating alone. For example, mercury is obtained from its ore, cinnabar (HgS), by the process of heating only.

$$2HgS + 3O_2 \longrightarrow 2HgO + 2SO_2$$
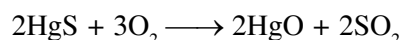
38. (a) In regular menstrual cycle of 28 days, at an interval of 28 days a single egg is released from either of two ovaries. If this egg get fertilised no further egg will be released and menstruation stop.

(b) After fertilisation uterine walls become more thick & vascularised & a disc shaped structure formed called placenta.

(c) The chemical methods of avoiding pregnancy are :

(i) In one of the method some chemicals are used which are spermicidal. They may be in form of tablets, jellies, paste and creams introduced in the vagina before coital activity.

(ii) Another chemical method is the use of oral contraceptive (OC) pills which inhibit the secretion of FSH (Follicle Stimulating Hormone) and LH (Leutinising Hormone) from the anterior lobe of pituitary gland and thus inhibiting ovulation from the ovary. These contraceptives therefore change the hormonal balance so that egg cell is not released (inhibit ovulation) and hence prevent fertilization.

OR

(c) Zygote is formed by fusion of sperm and egg, it repeatedly divides and develops in a ball like structure called embryo, embryo get embeded in endometrium and obtain nutrition through placenta develop into the foetus.

39. (a) Refrective index of diamond with respect to water,

$$n_{dw} = \frac{n_d}{n_w} = \frac{2.42}{1.33} \approx 1.82$$

(b) Glass is optically denser than water. So, when light ray enters the glass from water, the speed of ray decreases but its frequency remains unchanged; therefore the wavelength of light ray decreases because wavelength of light is directly proportional to its speed i.e., $\lambda \propto v$.

(c) Let the velocity of light in air be v_1 and velocity of light in the medium be v_2.

Refractive Index of a medium, $n_{21} = \dfrac{\text{Velocity of light in air } (v_1)}{\text{Velocity of light in the medium } (v_2)}$

Given : $v_2 = \dfrac{v_1}{\sqrt{3}}$

Hence, $n_{21} = \dfrac{v_1}{v_2} = \dfrac{v_1}{\left(\dfrac{v_1}{\sqrt{3}}\right)} = \sqrt{3}$
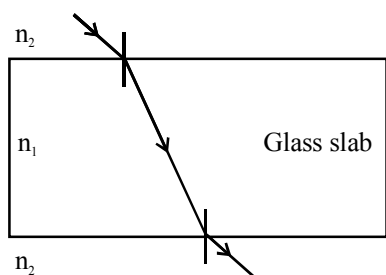
Now, $n_{21} = \dfrac{\sin i}{\sin r}$

$\Rightarrow \sqrt{3} = \dfrac{\sin 60°}{\sin r} = \dfrac{\left(\dfrac{\sqrt{3}}{2}\right)}{\sin r}$
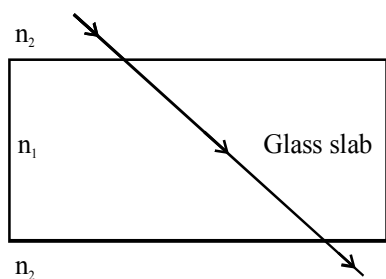
$\Rightarrow \sin r = \dfrac{1}{2} = \sin 30°$

$\Rightarrow \angle r = 30°$

OR

(c) (i) The emergent ray moves away from normal ($n_1 > n_2$).

(ii) The emergent ray moves undeviated ($n_1 = n_2$).

(iii) The emergent ray moves towards the normal ($n_1 < n_2$).