Science Delhi (Set 3)

General Instructions:

Read the following instructions very carefully and strictly follow them:

*(i) Question paper comprises **three** sections - **A, B** and **C.***
*There are **30** questions in the question paper. All questions are compulsory.*

*(ii) **Section A** - question no. 1 to 14 - all questions or part thereof are of one mark each. These questions comprises multiple choice questions (MCQ), very short answer (VSA), and Assertion-Reason type questions. Answer to these questions should be given in **one word or one sentence.***

*(iii) **Section B -** question no. 15 to 24 are short answer type questions, carrying 3 marks each. Answer to these questions should not exceed 50 to 60 words.*

*(iv) **Section C -** question no. 25 to 30 are long answer type questions, carrying 5 marks each. Answer to these questions should not exceed 80 to 90 words.*

(v) Answer should be brief and to the point. Also the above mentioned word limit be adhered to as far as possible.

(vi) There is no overall choice in the question paper. However, an internal choice has been provided in some questions in each Section. Only one of the choices in such questions have to be attempted.

(vii) In addition to this, separate instructions are given with each section and question, wherever necessary.

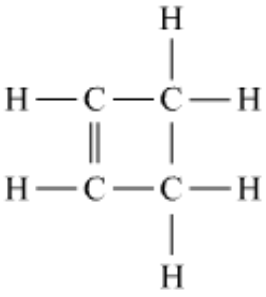
Science Delhi (Set 3)

Question 1

Name a cyclic unsaturated carbon compound.

Solution:

An example of a cyclic unsaturated compound is Cyclobutene.



Cyclobutene

Question 2

State an important advantage of using alternating current (a.c.) over direct current (d.c.).

Solution:

An important advantage of using alternating current (a.c.) over direct current (d.c.) is that alternating current can be easily transformed to higher or lower voltage levels while it is difficult to do that with direct current.

Question 3

The growing size of the human population is a cause of concern for all people. The rate of birth and death in a given population will determine its size. Reproduction is the process by which organisms increase their population. The process of sexual maturation for reproduction is gradual and takes place while general body growth is still going on. Some degree of sexual maturation does not necessarily mean that the mind or body is ready for sexual acts or for having and bringing up children. Various contraceptive devices are being used by human beings to control the size of population.

(a) List two common signs of sexual maturation in boys and girls.
(b) What is the result of reckless female foeticide?
(c) Which contraceptive method changes the hormonal balance of the body?
(d) Write two factors that determine the size of a population.

Solution:

a) Two common signs for sexual maturation in boys and girls are as follows:

1. Broadening of shoulder and chest in boys and development of mammary gland or breast in girls.
2. Appearance of hairs on various body parts like pubic area, armpits and face.

b) The number of females will become very low in comparison to the males. Hence, there will be a huge imbalance between male female ratio in the population.

c) Chemical method of contraception e.g. Oral pills interferes with the hormonal balance of the body.

d) Birth rate and death rate are factors that determine the size of a population.

Question 4

Human body is made up of five important components, of which water is the main component. Food as well as potable water are essential for every human being. The food is obtained from plants through agriculture. Pesticides are being used extensively for a high yield in the fields. These pesticides are absorbed by the plants from the soil along with water and minerals and from the water bodies these pesticides are taken up by the aquatic animals and plants. As these chemicals are not biodegradables, they get accumulated progressively at each trophic level. The maximum concentration of these chemicals gets accumulated in our bodies and greatly affects the health of our mind and body.
(a) Why is the maximum concentration of pesticides found in human beings?

(b) Give one method which could be applied to reduce our intake of pesticides through food to some extent.
(c) Various steps in a food chain represent :

(a) Food web
(b) Trophic level
(c) Ecosystem
(d) Biomagnification

(d) With regard to various food chains operating in an ecosystem, man is a:

(a) Consumer
(b) Producer
(c) Producer and consumer
(d) Producer and decomposer

Solution:

a) Maximum concentration of pesticides is found in human beings because humans are at the top of the food chain and due to biomagnification, the concentration of Dichlorodiphenyltrichloroethane (DDT) increases as one goes up the trophic levels.

b) Instead of synthetic pesticides, organic farming should be done and more biopesticides should be used.

c) The various steps in a food chain represent the trophic level.

Hence, the correct answer is option B.

d) Man is a consumer with respect to various food chains operating in an ecosystem.

Hence, the correct answer is option A.

Question 5

Which one of the following is responsible for the sustenance of underground water?
(a) Loss of vegetation cover
(b) Diversion for high water demanding crops
(c) Pollution from urban wastes
(d) Afforestation

Solution:

Afforestation prevents the water from immediately rushing into the rivers. Due to this, water can seep in the ground and replenish the groundwater.

Hence, the correct answer is option D.

Question 6

Incomplete combustion of coal and petroleum :
(A) increases air pollution.
(B) increases efficiency of machines.
(C) reduces global warming.
(D) produce poisonous gases.

The correct option is:
(a) (A) and (B)
(b) (A) and (D)
(c) (B) and (C)
(d) (C) and (D)

Solution:

Incomplete combustion of coal and petroleum increases air pollution and produce poisonous gases.

Hence, the correct answer is option (b).

Question 7

When sodium hydrogen carbonate is added to ethanoic acid a gas evolves. Consider the following statements about the gas evolved?
(A) It turns lime water milky.
(B) It is evolved with a brisk effervescence.
(C) It has a smell of burning sulphur.
(D) It is also a by-product of respiration.

The correct statements are:
(a) (A) and (B) only
(b) (B) and (D) only
(c) (A), (C) and (D)
(d) (A), (B) and (D)

Solution:

When sodium carbonate is reacted with ethanoic acid it forms sodium ethanoate, water and carbon dioxide gas. Carbon dioxide can be identified by the brisk effervescence. It turns lime water milky and is also a byproduct of respiration.

$$CH_3COOH + NaHCO_3 \rightarrow CH_3COONa + H_2O + CO_2$$

Hence, the correct answer is option (d).

Question 8

When a small amount of acid is added to water, the phenomena which occur are:
(A) Dilution
(B) Neutralisation
(C) Formation of H_3O^+ ions
(D) Salt formation

The correct statements are:
(a) (A) and (C)
(b) (B) and (D)
(c) (A) and (B)
(d) (C) and (D)

Solution:

The addition of acid to water is known as the process of dilution of acid, in this, the acid molecule loses H^+ ions in the solution to form hydronium ion.

$$HCl + H_2O \rightarrow H_3O^+ + Cl^-$$

Hence, the correct answer is option (a).

Question 9

A real image is formed by the light rays after reflection or refraction when they:
(A) actually meet or intersect with each other.
(B) actually converge at a point
(C) appear to meet when they are produced in the backward direction.
(D) appear to diverge from a point.

Which of the above statements are correct?
(a) (A) and (D)
(b) (B) and (D)
(c) (A) and (B)
(d) (B) and (C)

OR

Consider the following properties of virtual images:
(A) cannot be projected on the screen
(B) are formed by both concave and convex lens
(C) are always erect
(D) are always inverted

The correct properties are:
(a) (A) and (D)
(b) (A) and (B)
(c) (A), (B) and (C)
(d) (A), (B) and (D)

Solution:

A real image is formed when light rays actually meet or intersect at a point after reflection or refraction.
Hence, the correct answer is option (c).

OR

Virtual image has following properties -
i. It cannot be projected on the screen.
ii. It is formed by both concave and convex lens.
iii. It is always erect.

Hence, the correct answer is option (c).

Question 10

At the time of short circuit, the electric current in the circuit :
(a) vary continuously
(b) does not change.
(c) reduces substantially
(d) increases heavily

OR

Two bulbs of 100 W and 40 W are connected in series. The current through the 100 W bulb is 1A. The current through the 40W bulb will be:
(a) 0.4 A
(b) 0.6 A
(c) 0.8 A
(d) 1 A

Solution:

At the time of short circuit the electric current in the circuit increases heavily.

Hence, the correct answer is option (d).

OR

In series connection, the current through each device remain same. Therefore, the current through the 40 W bulb will also be 1 A.

Hence, the correct answer is option (d).

Question 11

Calcium oxide reacts vigorously with water to produce slaked lime.
$CaO(s) + H_2O(l) \rightarrow Ca(OH)_2(aq)$

This reaction can be classified as:
(A) Combination reaction
(B) Exothermic reaction
(C) Endothermic reaction
(D) Oxidation reaction

Which of the following is a correct option?

(a) (A) and (C)
(b) (C) and (D)
(c) (A), (C) and (D)
(d) (A) and (B)

OR

When hydrogen sulphide gas is passed through a blue solution of copper sulphate, a black precipitate of copper sulphide is obtained and the sulphuric acid so formed remains in the solution. The reaction is an example of a:

(a) Combination reaction
(b) Displacement reaction
(c) Decomposition reaction
(d) Double displacement reaction

Solution:

When calcium oxide reacts with water it produces slaked lime and a huge amount of heat is released, this reaction can be classified as a combination reaction.

Hence, the correct answer is option (d).

OR

In the case of a double displacement reaction, two reactants exchange their ions and form new products.

$$\underset{\text{Hydrogen sulphide}}{H_2S(g)} + \underset{\text{Copper sulphate}}{CuSO_4(aq)} \rightarrow \underset{\text{Copper sulphide, black ppt}}{CuS(s)} + \underset{\text{Sulphuric acid}}{H_2SO_4(aq)}$$

This reaction is an example of a double displacement reaction.

Hence, the correct answer is option (d).

Question 12

In a double displacement reaction such as the reaction between sodium sulphate solution and barium chloride solution:
(A) exchange of atoms takes place
(B) exchange of ions takes place
(C) a precipitate is produced
(D) an insoluble salt is produced

The correct option is:
(a) (B) and (D)
(b) (A) and (C)
(c) only (B)
(d) (B), (C) and (D)

Solution:

$$\underset{\text{Sodium sulphate}}{Na_2SO_4(aq)} + \underset{\text{Barium Chloride}}{BaCl_2(aq)} \rightarrow \underset{\text{Barium Sulphate}}{BaSO_4(s)} + \underset{\text{Sodium Chloride}}{2NaCl\ (aq)}$$

The white precipitate of $BaSO_4$ is formed by the reaction of SO_4^{2-} and Ba^{2+}.

Hence, the correct answer is option (d).

Question 13

Two statements are given - one labelled Assertion (A) and the other labelled Reason (R).
Assertion (A): Esterification is a process in which a sweet smelling substance is produced.
Reason (R) : When esters react with sodium hydroxide an alcohol and sodium salt of carboxylic acid are obtained.

Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.
(a) Both A and R are true and R is the correct explanation of the Assertion.
(b) Both A and R are true but R is not the correct explanation of the Assertion.
(c) A is true but R is false.
(d) A is false but R is true.

Solution:

Esterification is a process in which ethanoic acid reacts with absolute ethanol in the presence of an acid catalyst to give sweet-smelling substance called esters.

$$CH_3COOH + CH_3CH_2OH \xrightarrow{\text{acid}} CH_3COOCH_2CH_3 + H_2O$$

In this question, both the assertion and reason are correct but, the reason is not the correct explanation of the assertion.

Hence, the correct answer is option (b).

Question 14

Two statements are given - one labelled Assertion (A) and the other labelled Reason (R).

Assertion (A) : A solar cooker cooks the meal due to green house effect.
Reason (R) : The plane mirror is responsible for producing the green house effect.

Select the correct answer to these questions from the codes (a), (b), (c) and (d) as given below.
(a) Both A and R are true and R is the correct explanation of the Assertion.
(b) Both A and R true but R is not the correct explanation of the Assertion.
(c) A is true but R is false.
(d) A is false but R is true.

Solution:

A Solar cooker uses the green house effect to cook the food. this statement is correct.

This Assertion seems to be absolutely correct, but the reason listed in the question is not the correct one as concave mirror is used in case of a solar cooker to heat the food to an optimal temperature.

Thus we can conclude that the assertion is correct but the reason is not correct.

Hence, the correct answer is option (c).

Question 15

(a) Write the mathematical expression for Joule's law of heating,
(b) Compute the heat generated while transferring 96000 coulomb of charge in two hours through a potential difference of 40 V.

Solution:

(a)

The mathematical expression of Joules Law of heating is:

$$H = I^2Rt$$

Here, H is heating effect, I is current flowing through the device and t is time taken.

(b)

Given:

$$Charge\ (Q) = 96000\ \text{C},\ \text{Time}\ (t) = 2\text{h},\ \text{Potential difference}\ (V) = 40\text{V}$$

The heat generated,

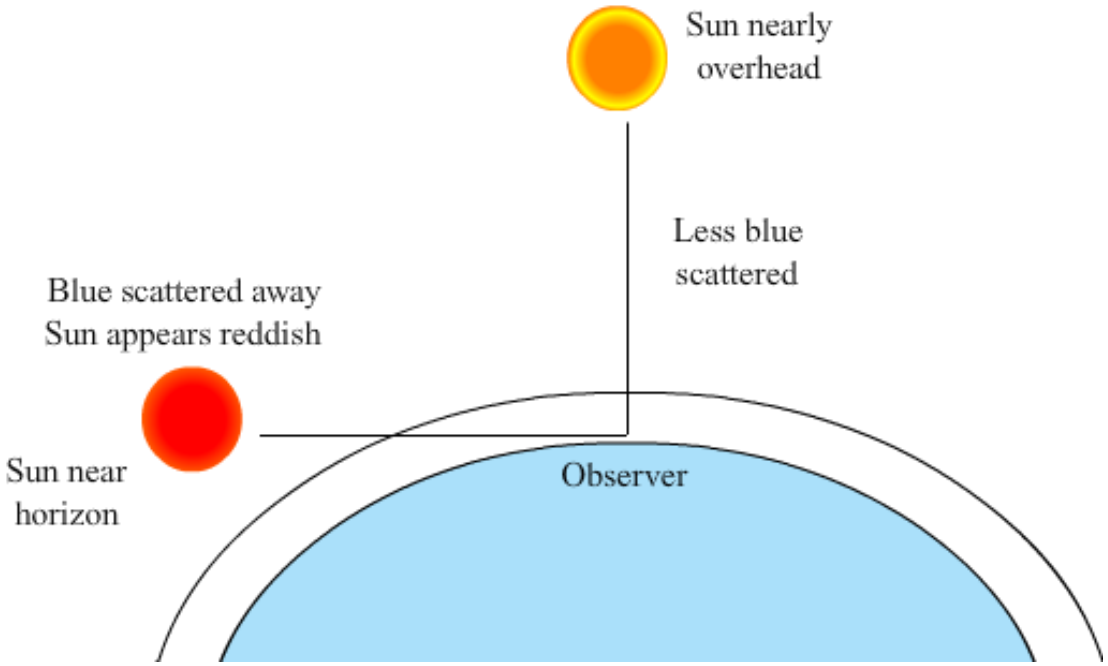
$$H = VIt$$
$$= V \times \frac{Q}{t} \times t$$
$$= V \times Q$$
$$= 40 \times 96000$$
$$= 3840000\ \text{J}$$

Question 16

Draw a labelled diagram to show (i) reddish appearance of the sun at the sunrise or the sunset and (ii) white appearance of the sun at noon when it is overhead.

Solution:

i) The reddish appearance of the sun at sunrise or sunset is due to the scattering of light by the molecules of air and other fine particles in the atmosphere that have the size smaller than the wavelength of visible light from the sun near the horizon. Light travels larger distances at the horizon in the earth's atmosphere before reaching our eyes and most of the blue light and shorter wavelengths are scattered away by the particles. So, only red light, being of higher wavelength reaches us which gives the reddish appearance of the sun at sunrise or sunset.



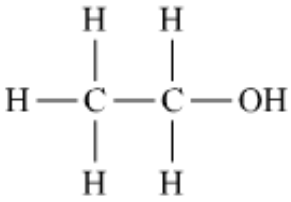
ii) At noon, the sun appears white, not red, as only a little of the blue and violet colors are scattered because light from the Sun overhead would travel a relatively shorter distance.

Question 17

(a) Draw the structures for (i) ethanol, (ii) ethanoic acid.
(b) Why is the conversion of ethanol to ethanoic acid considered an oxidation reaction? Write the oxidising agent used in the reaction involved.

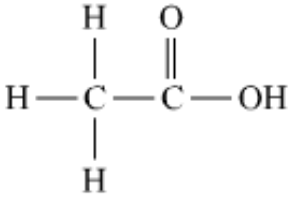
Solution:

(a) (i)



Ethanol

(a) (ii)



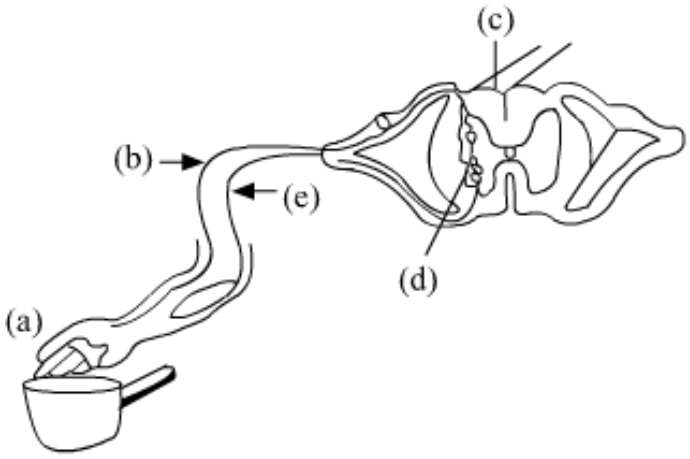
Ethanoic acid

(b) In the conversion of ethanol to ethanoic acid, a very strong oxidising agent alkaline potassium permanganate is used which donates oxygen to the ethanol to form ethanoic acid. Since the addition of oxygen to a compound is termed as oxidation, this reaction is considered as oxidation reaction.

In this process, the oxidising agent used is alkaline potassium permanganate.

Question 18

Name the parts (a) to (e) in the following diagram.

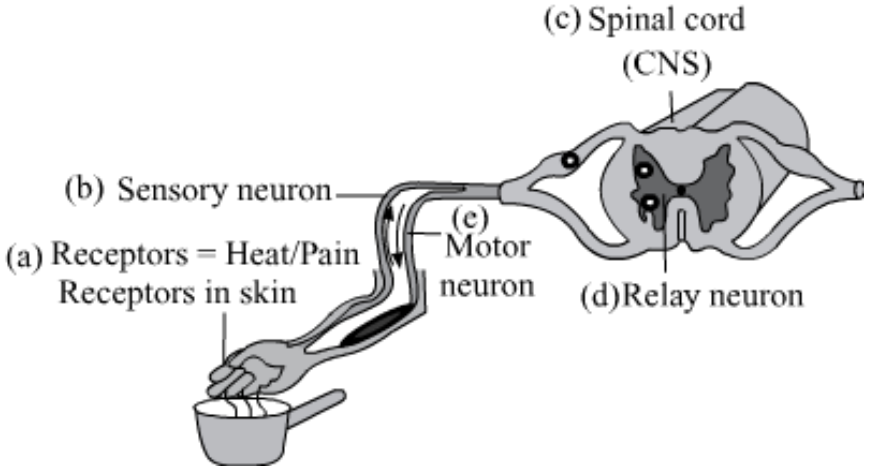


What is the term given to the sequence of events occurring in the diagram?

OR

(a) What is tropism?
(b) How do auxins promote the growth of a tendril around a support?

Solution:



The pathway of the nerve impulses involved during a reflex action constitutes the **reflex arc**. When there is a stimulus, it is first perceived by receptors present on the skin that send the stimulus in the form of an impulse to the spinal cord. The spinal cord interprets the stimulus and sends the impulse to the motor neurons. The motor neurons, in turn, stimulate the effectors or muscles to respond to the stimulus.

OR

(a) A growth movement of a plant in response to the external stimulus in which the direction of stimulus determines the direction of response is called tropism.

(b) Auxin is a plant hormone that is synthesized at the tip of the root and shoot. It helps in the process of cell elongation. When a tendril comes in contact with a support, auxin stimulates elongation of the cells on the opposite side of the stimulus, which results in the formation of a coil around the support.

Question 19

Why is Tyndall effect shown by colloidal particles? State four instances of observing the Tyndall effect.

OR

Differentiate between a glass slab and a glass prism. What happens when a narrow beam of (i) a monochromatic light, and (ii) white light passes through (a) glass slab and (b) glass prism?

Solution:

Tyndall Effect : It is the effect under which a ray of light scatters in all direction as soon as it encounters a colloidal or suspension particle. It is shown by colloidal particles because the colloidal particles size are roughly equal to the wavelength of the light.

Four instances of observing tyndall effect:

1. It can be observed in fog.
2. It can be observed when light passes through the canopy in forest.
3. It is the reason of blue colour of sky.
4. It can be observed when light passes through the milk.

OR

Glass slab: It is rectangular in shape and made up of glass. In glass slab, the direction of incident ray and emergent ray of light are parallel to each other.

Glass Prism: It has two triangular sides, two inclined rectangular sides and one rectangular base. In glass prism, the direction of incident ray and emergent ray of light are not parallel to each other.

When a narrow beam of monochromatic light passes through:

- Glass slab: It is deviated from the actual path but the direction of incident ray and emergent ray of light are parallel to each other.
- Glass prism: It is deviated from the actual path but the direction of incident ray and emergent ray of light are not parallel to each other.

When a narrow beam of white light passes through:

- Glass slab: The splitting of white light into its constituent colour does not occur. And the direction of incident ray and emergent ray of light are parallel to each other.
- Glass prism: The splitting of white light into its constituent seven colours occurs. And the direction of incident ray and emergent ray of light are not parallel to each other.

Question 20

Define the term pollination. Differentiate between self pollination and cross pollination. What is the significance of pollination?

Solution:

The process of transfer of pollen from an anther to the stigma is called pollination.

Self-pollination: It is the transfer of pollen from the anther to the stigma in the same flower or pollen is transferred from the anther of one flower to the stigma of another flower on the

same plant.

Cross-pollination: It is the transfer of pollen from an anther of a flower to the stigma of a flower on another plant.

Significance of pollination:

Pollination is essential for the process of fertilization. Fertilization thereby results in the formation of fruits and seeds. Without pollination, there wouldn't be any fruit and seed formation.

Question 21

List the important products of the Chlor-alkali process. Write one important use of each.

OR

How is washing soda prepared from sodium carbonate? Give its chemical equation. State the type of this salt. Name the type of hardness of water which can be removed by it?

Solution:

There are three products that are produced in the Chlor-alkali process, which are Sodium Hydroxide(NaOH), chlorine gas (Cl_2) and hydrogen gas(H_2).
Uses of sodium hydroxide:
1. It is used in the manufacturing of paper.
2. It is used for making soaps and detergents.

Uses of chlorine gas:
1. It is used in the production of bleaching powder.
2. It is used to make plastics(PVC), pesticides chlorofluorocarbon(CFCs), chloroform, carbon tetrachloride, Paints.

Uses of hydrogen gas:
1. It is used as a fuel for rockets.
2. It is used in the hydrogenation of oils to obtain vegetable ghee.

OR

Washing soda is prepared from sodium carbonate by recrystallisation .

$$\underset{\text{Sodium carbonate}}{Na_2CO_3} + 10H_2O \rightarrow \underset{\text{Washing soda}}{Na_2CO_3.10H_2O}$$

Washing soda is a basic salt. It is used for removing permanent hardness of water.

Question 22

1 g of copper powder was taken in a China dish and heated. What change takes place on heating? When hydrogen gas is passed over this heated substance, a visible change is seen in it. Give the chemical equations of reactions, the name and the color of the products formed in each case.

Solution:

When copper powder in a china dish is heated in air, copper undergoes surface oxidation by reacting with the oxygen present in the air to form copper oxide and forms a black layer on top.

$$2\,Cu\left(s\right) + O_2\left(g\right) \xrightarrow{\text{Heat}} \underset{\text{Black colour}}{2\,CuO(s)}$$

When hydrogen gas is passed over the hot copper oxide, it reacts with hydrogen gas to form elemental copper and water will be produced in the liquid state.

$$CuO(s) + H_2(g) \rightarrow Cu(s) + H_2O(l)$$

Question 23

The near point of the eye of a person is 50 cm. Find the nature and power of the corrective lens required by the person to enable him to see clearly the objects placed at 25 cm from the eye ?

Solution:

Since the near point of eye is 50 cm which is greater than 25 cm, person is suffering from hypermetropia.

Object distance (u) = -25 cm
Image distance (v) = -50 cm

Using lens formula

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$$
$$\frac{1}{f} = \frac{1}{(-50)} - \frac{1}{(-25)}$$
$$\frac{1}{f} = -\frac{1}{50} + \frac{1}{25}$$
$$\frac{1}{f} = \frac{-1+2}{50}$$
$$\frac{1}{f} = \frac{1}{50}$$
$$f = +50\ cm$$

Since the focal length of the lens is positive, corrective lens required is convex lens.

$$f = +50\ cm$$
$$f = +0.5\ m$$

Power (P) of corrective lens will be

$$P = \frac{1}{f(m)}$$
$$P = \frac{1}{0.5}$$
$$P = +2\ D$$

Question 24

What are homologous structures? Give an example. Is it necessary that homologous structures always have a common ancestor. Justify your answer.

Solution:

Homologous organs: These are organs that are similar in origin, but perform different functions. For example, the forelimbs of humans and the wings of birds perform different functions, but their skeletal structures are similar.

Yes, homology indicates common ancestry. Homologous organs follow the same basic plan of organisation during their development but in the adult condition, these organs are modified to perform different functions as an adaptation to different environments.

Question 25

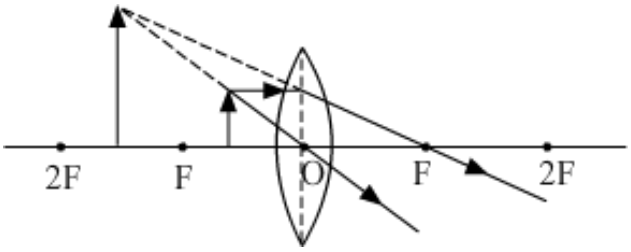
Draw a ray diagram in each of the following cases to show the formation of image, when the object is placed :
(i) between optical centre and principal focus of a convex lens.
(ii) anywhere in front of a concave lens.
(iii) at 2F of a convex lens.
State the signs and values of magnifications in the above mentioned cases (i) and (ii).

OR

An object 4.0 cm in size, is placed 25.0 cm in front of a concave mirror of focal length 15.0 cm.
(i) At what distance from the mirror should a screen be placed in order to obtain a sharp image?
(ii) Find the size of the image.
(iii) Draw a ray diagram to show the formation of image in this case.

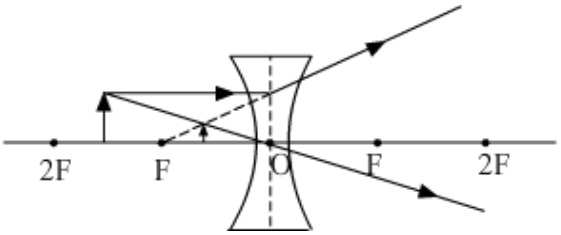
Solution:

(i) When an object is placed between optical centre and principal focus of a convex lens



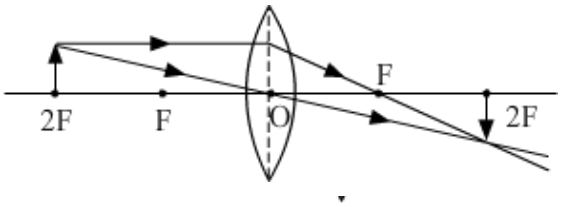
Since the image formed is virtual and erect so sign of magnification will be positive. Moreover, image formed is magnified therefore absolute value of magnification will be greater than one.

(ii) When an object is placed anywhere in front of a concave lens.



Since the image formed is virtual and erect so sign of magnification will be positive. Moreover, image formed is diminished therefore absolute value of magnification will be less than one.

(iii) When an object is placed at 2F of a convex lens.



OR

Given:

$\text{Height of object } (h_O) = 4 \text{ cm}$

$\text{Object distance } (u) = -25 \text{ cm}$

$\text{Focal length } (f) = -15 \text{ cm}$

(i)

Applying mirror formula and substituting the values,

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

$\frac{1}{v} = \frac{1}{-15} - \frac{1}{-25}$

$\frac{1}{v} = \frac{-5+3}{75}$

$v = \frac{-75}{2} = -37.5 \text{ cm}$

Negative sign indicates that the image is in front of the mirror.
Therefore, the screen must be placed in front of the mirror at a distance of 37.5 cm.

(ii)

Applying magnification formula and substituting the values,

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

$\frac{-\left(\frac{-75}{2}\right)}{-25} = \frac{h_i}{4}$

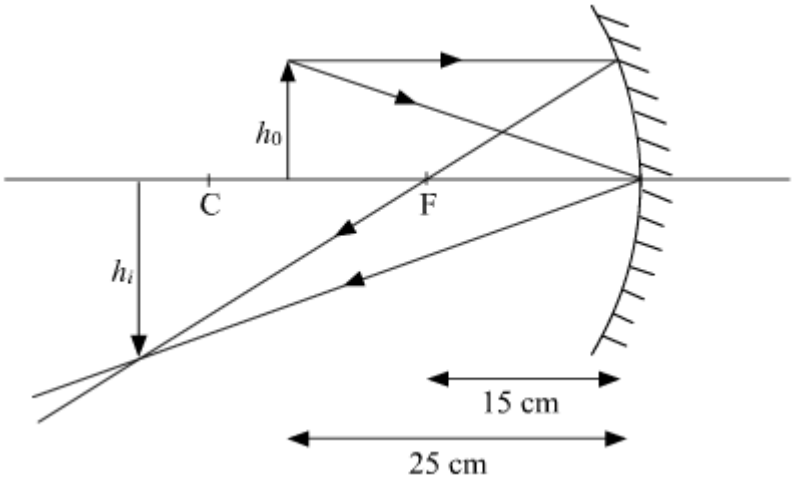
$h_i = \frac{-75}{2 \times 25} \times 4$

$h_i = -6 \text{ cm}$

Negative sign indicates that the image is below the principal axis.
Therefore, the size of the image is 6 cm.

(iii)

The ray diagram showing the formation of image in this case is,



Question 26

(a) What is the law of dominance of traits? Explain with an example.
(b) Why are the traits acquired during the life-time-of-an individual not inherited? Explain.

Solution:

(a) **Law of Dominance:** According to this law, characters are controlled by discrete units called factors, which occur in pairs with one member of the pair dominating over the other in a dissimilar pair. This law explains the expression of only one of the parental characters in the F1 generation and expression of both in the F2 generation.

For example, a tall pea plant can be crossed with a dwarf pea plant in the following manner:

Parent	TT	×	tt		
	tall		dwarf		
	↓				
F_1 generation	Tt	×	Tt		
	tall	Selfing	tall		
	↓				
F_2 generation	TT	Tt	Tt	tt	
	tall	tall	tall	dwarf	

(b) Traits acquired during the lifetime of an individual are not inherited. This is because an acquired trait involves the change in somatic cells which are non-reproductive cells. These cells do not produce gametes and thus, these traits cannot be inherited.

Question 27

(a) A gas is released during photosynthesis. Name the gas and also state the way by which the gas is evolved.
(b) What are stomata? What governs the opening and closing of stomata?

OR

(a) Draw a diagram of human alimentary canal and label - gall bladder, pancreas, liver and small intestine on it.
(b) Give two reasons to explain why absorption of digested food occurs mainly in the small intestine.

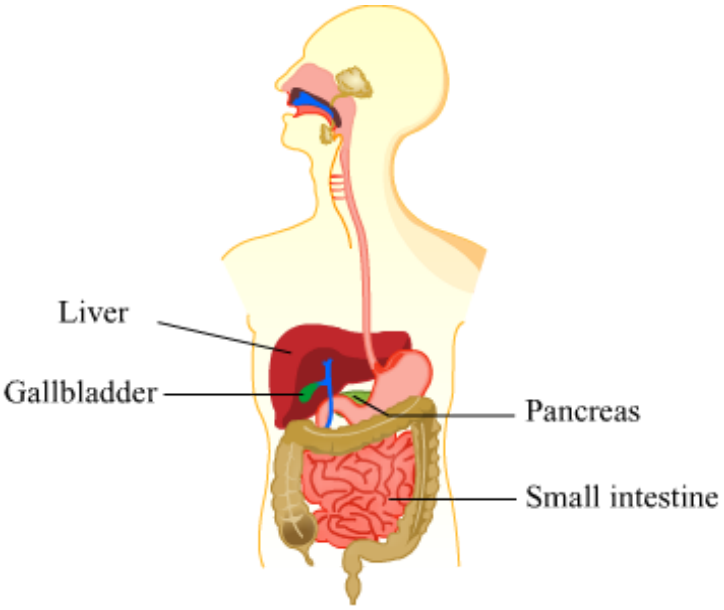
Solution:

(a) Oxygen(O_2) is released during photosynthesis.
During photosynthesis, plants absorb carbon dioxide and sunlight to produce carbohydrates. The solar energy trapped by chlorophyll breaks down water molecules by the process of photolysis. It is a type of photo-oxidation reaction that releases oxygen. This released oxygen gets emitted in the atmosphere.

(b) Stomata are the tiny pores present on the surface of leaves which helps in gaseous exchange and transpiration.
When water moves inside the guard cells, they swell and become turgid which facilitates the opening of the stomata. Similarly, when water moves out of the cell, the cell become flaccid which promotes the closing of the stomata. This occurs due to the difference in solute concentration.

OR

(a)



(b) The absorption of digested food primarily occurs in the small intestine because of the following reasons:

(i) The finger-like projection of mucosa into the lumen of the small intestine is called villi which in turn serves to increase the surface area to facilitate maximum absorption of digested food.

(ii) Wall of the small intestine is richly supplied with blood vessels which take the absorbed food to the different body parts.

Question 28

Carbon cannot reduce the oxides of sodium, magnesium and aluminium to their respective metals. Why? Where are these metals placed in the reactivity series ? How are these metals obtained from their ores? Take an example to explain the process of extraction along with chemical equations.

Solution:

Oxides of sodium, magnesium and aluminium are very strong oxides as these metal are very reactive metals, but carbon is not a strong reducing agent and hence cannot reduce the reactive metal oxides to metals.

In the reactivity series, sodium, magnesium and aluminium are placed in the upper portion which means these metals are very reactive in nature and carbon is less reactive.
K > Na > Ca > Mg > Al > C > Zn > Fe
<na<ca<mg<al<zn<fe<sn<pb<h<cu<ag<au

Oxides of reactive metals are directly put for electrolytic reduction process to obtain the pure metal.</na<ca<mg<al<zn<fe<sn<pb<h<cu<ag<au

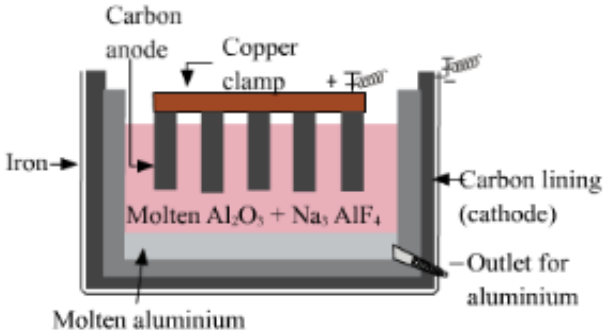
For the oxide of a reactive metal like aluminium oxide, as the metal is already in its oxide state so, it is directly put for the electrolytic reduction process. In this process, graphite electrodes are used as anode and cathode in the electrolytic chamber. The pure aluminium is attracted to the cathode, which is a lining of graphite. The oxygen is attracted to the anode, and bubbles through the solution.

Cathode reaction: at cathode reduction of aluminium takes place and thus aluminium is discharged at the cathode.

$$Al^{3+} + 3e^- \rightarrow Al$$

Anode reaction: at anode oxidation takes place and oxygen gas is evolved.

$$2O^{2-} \rightarrow O_2 + 4e^-$$



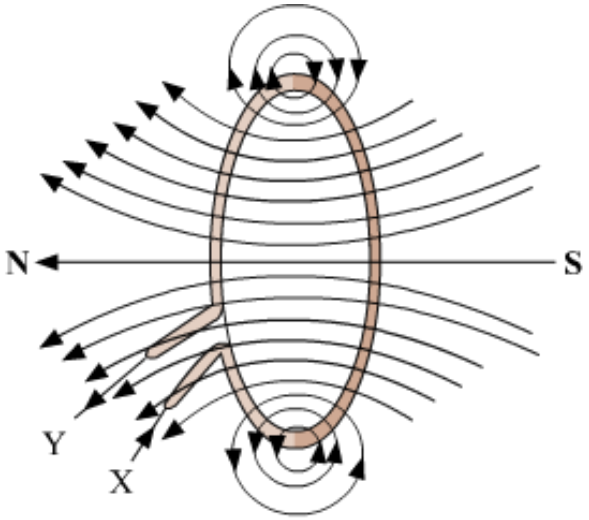
Electrolytic cell for the extraction of aluminium

Question 29

(a) Explain with the help of the pattern of magnetic field lines the distribution of magnetic field due to a current carrying a circular loop.
(b) Why is it that the magnetic field of a current carrying coil having *n* turns, is '*n*' times as large as that produced by a single turn (loop)?

Solution:

(a) The distribution of the magnetic due to a circular current carrying loop can be seen in the following diagram with help of magnetic field lines:



(b) The magnetic field produced by a single wire loop will have a definite direction and strength. If we increase the number of loops the magnetic field due to each loop will add. The magnetic field is directly proportional to the current in the wire loop, with each loop the current increases and so the magnetic field increases. Moreover, it will increase the density of magnetic field lines and so the magnetic field strength. Therefore, the magnetic field of a current carrying coil having *n* turns is '*n*' times as large as produced by single loop.

Question 30

The position of certain elements in the Modern Periodic Table are shown below.

Group → / Period ↓	1	2	3 to 12	13	14	15	16	17	18
1	G								H
2	A			I			B		C
3		D			E				F

Using the above table answer the following questions giving reasons in each case :
(1) Which element will form only covalent compounds?
(ii) Which element is a non-metal with valency 2?
(iii) Which element is a metal with valency 2?
(iv) Out of H, C and F which has largest atomic size?
(v) To which family does H, C and F belong?

OR

Define atomic size. Give its unit of measurement. In the modern periodic table what trend is observed in the atomic radius in a group and a period and why is it so?

Solution:

(i) Element E is Silicon. It will form covalent bond only. The outermost orbit of silicon has four electrons and it needs four more electrons to become stable.
(ii) Non-metal with valency 2 is B, which is Oxygen. As Oxygen has a high electronegativity, due to which it has a higher tendency to attract electrons rather than donating them.
(iii) Element D is a metal with valency 2. Element D is magnesium, due to its low electronegativity it has a very high tendency to donate electrons.
(iv) Element F has the largest atomic size. According to the electronic configuration of element F which is argon, it occupies 3 energy shells compared to elements H and C which occupies one and two energy shells and due to this its atomic radius is the largest.
(v) Elements H, C and F belong to Group number eighteen, which means according to their outer electronic configuration their octet is complete and thus these elements are stable. They have a very low tendency to react with other elements. Group eighteen elements belong to the noble gas family.

OR

Atomic size is the distance between the center of an atom i.e. from the nucleus to the outermost shell (valence shell) of that atom.

Atomic size is measured in Angstroms ($\mathring{A}$), where $1\ \text{Angstrom} = 10^{-10}\ \text{meters}$.

In the modern periodic table, the atomic size of elements increases down the group and the atomic size decrease along the period from left to right.

Down the group, as the number of energy shells of the atoms keeps on increasing from top

to bottom so, the atomic radius also increases.

Along the period, the atomic number of elements increases which leads to an increase in the number of protons inside the nucleus and thus, the effective nuclear charge increases. So, the atomic radius decreases along the period.