Class X
(CBSE 2019)
Science
Delhi (Set-1)

General Instructions:

(i) The question paper comprises **five** sections, **A**, **B**, **C**, **D** and **E.** You are to attempt all the sections.

(ii) All questions are **compulsory.**

(iii) Internal choice is given in sections **B**, **C**, **D** and **E.**

(iv) Question numbers **1** and **2** in Section **A** are one mark questions. They are to be answered in **one** word or in **one** sentence.

(v) Question numbers **3** to **5** in Section **B** are two-marks questions. These are to be answered in about **30** words each.

(vi) Question numbers **6** to **15** in Section **C** are three-marks questions. These are to be answered in about **50** words each.

(vii) Question numbers **16** to **21** in Section **D** are five-marks questions. These are to be answered in about **70** words each.

(viii) Question numbers **22** to **27** in Section **E** are based on practical skills. Each question is a two marks question. These are to be answered in brief.

Question 1

What is the function of a galvanometer in a circuit?

SOLUTION:

The function of the galvanometer in the circuit is to detect or measure the small amount of current flowing in the circuit.

Question 2

Why is biogas considered an excellent fuel?

SOLUTION:

Biogas is considered an excellent fuel because of the following reasons:

(i) Biogas does not cause air pollution.

(ii) Biogas produces a large amount of heat per unit mass.

Question 3

How it can be proved that the basic structure of the Modern Periodic Table is based on the electronic configuration of atoms of different elements?

OR

The electronic configuration of an element is 2, 8, 4. State its:

(a) group and period in the Modern Periodic Table.
(b) name and write its one physical property.

SOLUTION:

Modern periodic law states that the physical and chemical properties of an element in the periodic table are the periodic function of the atomic number of that element. Electronic configuration of the elements plays an important role in the placement of elements in the modern periodic table. The valence shell electron of an element decides its position in a particular group or period.
For example, if the electronic configuration of an element is 2, 1, it means that the element belongs to group I and 2nd period (valence electron is present in the 2nd shell). Similarly, if the electronic configuration of an element is 2, 8, 1, it means that the element belongs to group I and 3rd period (valence electron is present in the 3rd shell).

Thus, the modern periodic table is based on the electronic configuration of the different elements.

OR

(a) The electronic configuration of the given element is 2,8,4. Since, the number of valence electrons for the given element is 4. Hence, the element belongs to group 14 (10++4) and the 3rd period.

(b) The atomic number of the given element is 14. Hence, the given element is Silicon. Silicon is a metalloid.

Question 4

Write two different ways in which glucose is oxidized to provide energy in human body. Write the products formed in each case.

SOLUTION:

Glucose can be oxidised via the aerobic pathway or the anaerobic pathway. When oxidised via the aerobic pathway it leads to the formation of carbon dioxide, water and energy (ATP molecules).
In humans, anaerobic respiration occurs in muscle cells when they are fatigued. During this phase, lactic acid fermentation takes place and results in the production of lactic acid and two molecules of ATP.

Question 5

Define the term power of accommodation. Write the modification in the curvature of the eye lens which enables us to see the nearby objects clearly?

SOLUTION:

The ability of the eye lens to adjust its focal length is called the power of accommodation. There should be a contract in ciliary muscles, that will increase the curvature of the eye lens and becomes thicker consequently the focal length of the eye lens will decrease. It will enable us to see near objects clearly.

Question 6

2 g of silver chloride is taken in a china dish and the china dish is placed in sunlight for sometime. What will be your observation in this case? Write the chemical reaction involved in the form of a balanced chemical equation. Identify the type of chemical reaction.

OR

Identify the type of reactions taking place in each of the following cases and write the balanced chemical equation for the reactions.
(a) Zinc reacts with silver nitrate to produce zinc nitrate and silver.

(b) Potassium iodide reacts with lead nitrate to produce potassium nitrate and lead iodide.
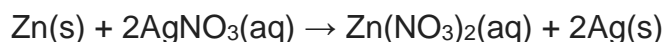
SOLUTION:
When 2 g of silver chloride, $AgCl$, is kept in sunlight then $AgCl$ breaks down into Ag and Cl_2. The color of the silver chloride turns to grey.
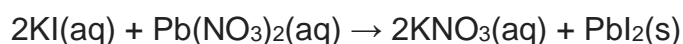The following change can be represented by the chemical reactions as:

$$2AgCl(s) \xrightarrow{\text{sunlight}} 2Ag(s) + Cl_2(g)$$. This type of reaction is an example of a photochemical decomposition reaction.

OR

(a) The given reaction is a displacement reaction in which more reactive zinc will displace less reactive silver from silver nitrate solution.

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

(b) The given reaction is a double displacement reaction.

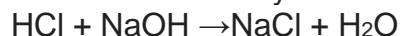$2KI(aq) + Pb(NO_3)_2(aq) \rightarrow 2KNO_3(aq) + PbI_2(s)$

Question 7

Identify the acid and the base from which sodium chloride is obtained. Which type of salt is it? When is it called rock salt? How is rock salt formed?

SOLUTION:

NaCl is obtained by the reaction between NaOH and HCl.
$HCl + NaOH \rightarrow NaCl + H_2O$

NaCl is a neutral salt. It is known as rock salt in crystalline form. Rock salt is simply crystallized salt, also known as halite. It is the result of the evaporation of ancient oceans millions of years ago. Sometimes, pressure from deep inside the Earth forces up large masses of rock salt to form salt domes.

Question 8

Based on the group valency of elements write the molecular formula of the following compounds giving justification for each:
**(i)** Oxide of first group elements.
(ii) Halide of the elements of group thirteen, and
(iii) Compound formed when an element, A of group 2 combines with an element, B of group seventeen.

SOLUTION:

(i) Oxides of the first group elements have the common formula of M_2O.
Example- Na_2O, K_2O. This is because, the first group elements have a common valency of 1, and the valency of Oxygen is 2 so, to satisfy the combining capacity of Oxygen two 1st group metals are required.
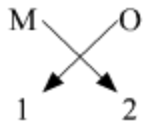
(ii) Halides of group 13 elements have a common formula of MX_3, where M-metal and X- halogen element.
Example- $AlCl_3$, BF_3. This is because the valency of group 13 elements is 3 and that of halogens is 1 so, to satisfy the combining capacity of aluminum or other group 13th elements three of halogens are required in the molecular formula.

(iii) The general formula for those kinds of compounds would be AB_2.
Example- $MgCl_2$, $CaCl_2$. This is because the valency of group 2 elements is 2 and that of group 17th elements if 1 so to satisfy the combining capacity of group 2 elements two of group 17 elements are required in the molecular formula.
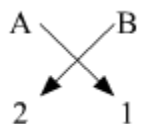
Question 9

Write three types of blood vessels. Give one important feature of each.

SOLUTION:

Three main types of blood vessels that are found in the human body are arteries, veins, and capillaries.
Arteries carry blood from the heart to different body parts. Veins bring blood from different body parts to the heart. Valves are present in veins to prevent backward flow of blood. Both arteries and veins divide in the organs to form arterioles and venules respectively. The arterioles sub-divide to form thin-walled capillaries which join to form venules. Venules join to form veins. The nutrients, hormones, gases can diffuse into the tissue cells through the walls of the capillaries and vice versa. Thus, arteries, arterioles, veins, venules, and capillaries are blood vessels.

Question 10

Trace the sequence of events which occur when a bright light is focused on your eyes.

SOLUTION:

When bright light is focussed on our eyes, then it goes to the brain, the brain reverts back the message by motor neuron which contracts the pupil. The sequence of events which occur is:

Receptor → Sensory neuron → Brain → Motor Neuron → Eye → Eye muscle contracts

Question 11

What are plant hormones? Name the plant hormones responsible for the following:
(i) Growth of stem
(ii) Promotion of cell division
(iii) Inhibition of growth
(iv) Elongation of cells

SOLUTION:

In plants, growth, development, and response to the environment are controlled and coordinated by a special class of chemical substances known as phytohormones. They are naturally occurring organic substances which are synthesized in minute quantities. These hormones are produced in one part of the plant body and are translocated to other parts. For example, a hormone produced in the roots is translocated to other parts where they are required.

(i) Gibberellins
(ii) Cytokinins
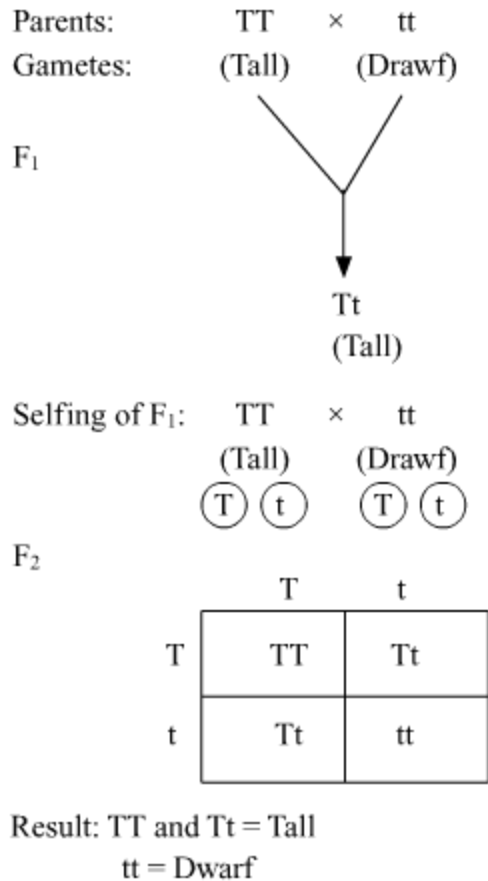**(iii)** Abscisic acid
(iv) Auxins

Question 12
Name the plant Mendel used for his experiment. What type of progeny was obtained by Mendel in F_1 and F_2 generations when he crossed the tall and short plants? Write the ratio he obtained in F_2 generation plants.

OR

List two differences between acquired traits and inherited traits by giving an example of each.

SOLUTION:

Mendel used pea plant (*Pisum sativum*) for his experiments. When Mendel crossed tall and short plants, the progeny obtained in F1 generation were tall. When the F1 plants were selfed, the F2 generation showed three tall and one dwarf plant. The genotypic ratio of F2 generation is 1:2:1 (TT : Tt: Tt: tt) and the phenotypic ratio is 3:1 (Tall: Dwarf).

Parents: TT   ×   tt

Gametes: (Tall)   (Drawf)

F_1

Tt
(Tall)

Selfing of F_1:   TT   ×   tt
                  (Tall) (Drawf)
                  (T) (t) (T) (t)

F_2

	T	t
T	TT	Tt
t	Tt	tt

Result: TT and Tt = Tall
          tt = Dwarf

OR

Differences between Acquired Traits and Inherited Traits

Acquired Traits	Inherited Traits
i. These are somatic variations.	**i.** These are genetic variations.
ii. Acquired traits develop due to the effects of environmental factors, use and disguise of organs and special (conscious) efforts.	**ii.** Inherited traits develop due to a reshuffling of genetic material and mutations.
iii. These traits develop throughout the lifetime of an individual.	**iii.** These traits are transferred (inherited) by the parents to their offspring.
iv. Example-Learning of dance, music, etc. and muscular body of a wrestler.	**iv.** Example-Attached or free earlobe and curly hair.

Question 13

What is a rainbow? Draw a labelled diagram to show the formation of a rainbow.

The rainbow is a natural phenomenon in which white sunlight splits into beautiful colours by water droplets, which remain suspended in air after the rain.
Formation of a rainbow:
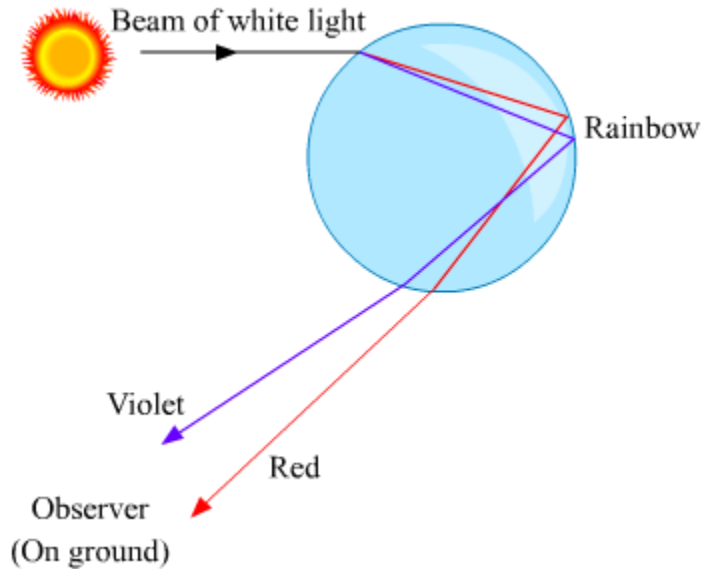
Question 14

How can we help in reducing the problem of waste disposal? Suggest any three methods.

OR

Define an ecosystem. Draw a block diagram to show the flow of energy in an ecosystem.

SOLUTION:

The three methods we can utilise for reducing the problem of waste disposal are:

- Segregation of waste into biodegradable and non-biodegradable

- Following the principle of 3R- reduce, reuse and recycle

- Converting biodegradable waste into useful commodities like energy from biogas, using the compost as fertilizer

OR

Ecosystem refers to the living and non-living components in an area and the interactions between them. Energy flows across the trophic levels as shown in the diagram below, following the ten percent law. Only ten percent of the energy available to a trophic level is passed on to the next trophic level. The remaining is dissipated away.
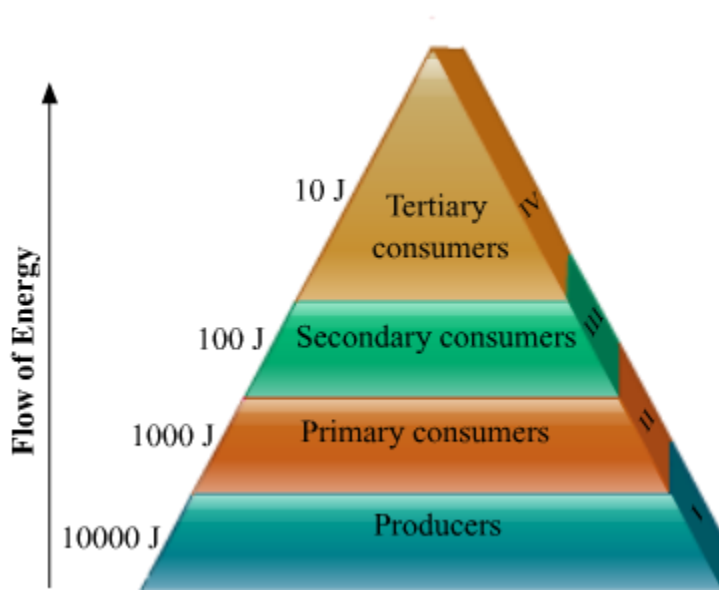
Assuming **10000 J** is the energy available to the producers, then
1000 J will be available to the primary consumers,
100 J will be available to secondary consumers and
10 J will be available to tertiary consumers.

Question 15

What is water harvesting? List two main advantages associated with water harvesting at the community level. Write two causes for the failure of sustained availability of groundwater.

SOLUTION:

Collection of rainwater for direct use or for recharging the groundwater level for indirect use is called water harvesting.
Importance of water harvesting:

1. It can be used to recharge the groundwater.

2. It can be used for other domestic purposes.

3. It can increase the availability of water throughout the year.

4. It can help in reducing the storm water discharges, urban floods and overloading of sewage treatment plants

5. It can help to reduce seawater ingress in coastal areas.

6. It can be used for the purpose of irrigation.

Causes of failure of sustained availability of groundwater:

1. Pollution of water caused by human activities and industrial effluents.

2. Overuse of groundwater leading to the shortage of water.

Write the chemical formula and name of the compound which is the active ingredient of all alcoholic drinks. List its two uses. Write chemical equation and name of the product formed when this compound reacts with−

(i) Sodium metal
(ii) hot concentrated sulphuric acid

<center>**OR**</center>

What is methane? Draw its electron dot structure. Name the type of bonds formed in this compound. Why are such compounds:
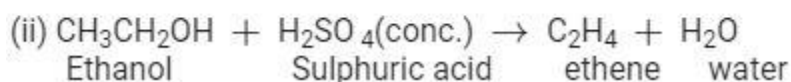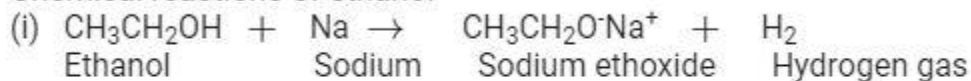
(i) poor conductors of electricity? And
(ii) have low melting and boiling points? What happens when this compound burns in oxygen?

SOLUTION:

Name of the compound which is the active ingredient of all alcoholic drinks is Ethanol, and its chemical formula is CH_3CH_2OH.

Uses- (i) Ethanol is used in medical wipes/swabs and antibacterial hand sanitizers.
(ii) Ethanol is also used in body lotions as preservatives and stabilizer of its ingredients.

Chemical reactions of ethanol-
(i) $\underset{\text{Ethanol}}{CH_3CH_2OH} + \underset{\text{Sodium}}{Na} \rightarrow \underset{\text{Sodium ethoxide}}{CH_3CH_2O^-Na^+} + \underset{\text{Hydrogen gas}}{H_2}$

(ii) $\underset{\text{Ethanol}}{CH_3CH_2OH} + \underset{\text{Sulphuric acid}}{H_2SO_4(conc.)} \rightarrow \underset{\text{ethene}}{C_2H_4} + \underset{\text{water}}{H_2O}$

<center>**OR**</center>

Methane is a colourless, odourless and highly flammable gas which is the main component of natural gas. It is also called as marsh gas as it is produced when vegetation decomposes naturally in any swampy or marshlands.
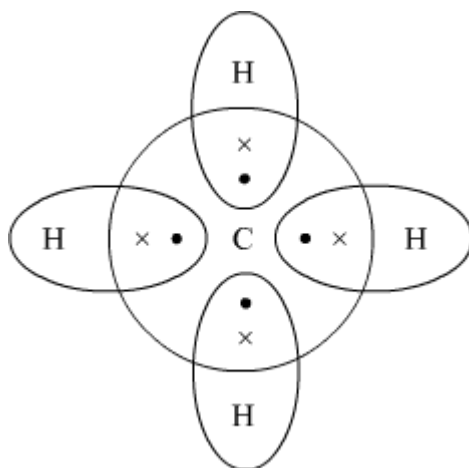

Electron Dot structure of methane is:

The type of bonds present in methane are all covalent bonds between four hydrogen atoms and the single carbon atom at the center of the molecule.

(i) Methane is a poor conductor of electricity because in methane all bonds are covalent bonds and therefore no free electrons are present in the molecule that can help in the conduction of electricity.

(ii) Covalent compounds have low intermolecular forces of attraction between the molecules and thus show low melting and boiling points. Since, methane is also a covalent compound thus methane has very low melting and low boiling point.

When methane is burned in the presence of Oxygen it forms Carbon dioxide gas and water as a product of the reaction.
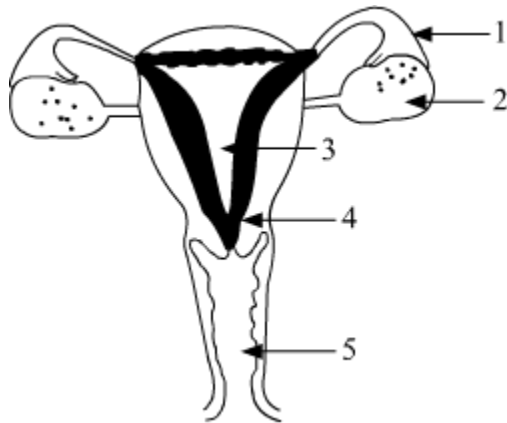
$$CH_4 + O_2 \rightarrow CO_2 + H_2O$$
Methane   Water   Carbon dioxide   Water
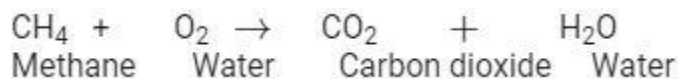
Question 18

Define pollination. Explain the different types of pollination. List two agents of pollination? How does suitable pollination lead to fertilization?

OR

(a) Identify the given diagram. Name the parts 1 to 5.

(b) What is contraception? List three advantages of adopting contraceptive measures.

SOLUTION:

Transfer of pollen grain from the anther of a flower to stigma is termed as pollination.

Based on the transfer of pollen grains between plants, pollination can be of two types:

1) Self Pollination: When pollen of a plant is transferred to the stigma of a flower on the same parent plant then it is termed as self-pollination.

2) Cross Pollination: When pollen of a plant is transferred to the stigma of a flower of a plant different from the one from which pollen is obtained then it is termed as cross-pollination.

Some of the most common agents of pollination that helps in carrying the pollen from the anther to the stigma of a flower are insects and wind.

As the pollen of the right type is deposited on to the stigma of the flower of the same species, quite often it leads to germination of pollen grain as a result of a chemical cross-talk between the pollen and the carpel. Germination leads to the growth and extension of the pollen tube through the style of the flower to its ovary. The pollen tube carries the male gametes all the way to the ovule inside the ovary, leading to fertilisation of male gamete with the female gamete inside the ovule.

OR

(a) The labelled parts of the female reproductive system are as follows:

1 - Oviduct or Fallopian Tube
2 - Ovary
3 - Uterus
4 - Cervix
5 - Vagina

(b) Contraception includes methods or ways to prevent fertilisation and pregnancy in a

fertile female as a result of successful copulation between a fertile male and female.

Some of the major advantages of adopting various contraceptive methods include:

(i) Prevention of unwanted pregnancies
(ii) Help in family planning and population control
(iii) Some contraceptive devices like condoms and female diaphragm prevent spread of STDs like AIDS and Hepatitis B.

Question 19

An object is placed at a distance of 60 cm from a concave lens of focal length 30 cm.

(i) Use lens formula to find the distance of the image from the lens.

(ii) List four characteristics of the image (nature, position, size, erect/inverted) formed by the lens in this case.

(iii) Draw ray diagram to justify your answer of part (ii).

SOLUTION:

We have,

(i) Object distance, $u = -60$ cm

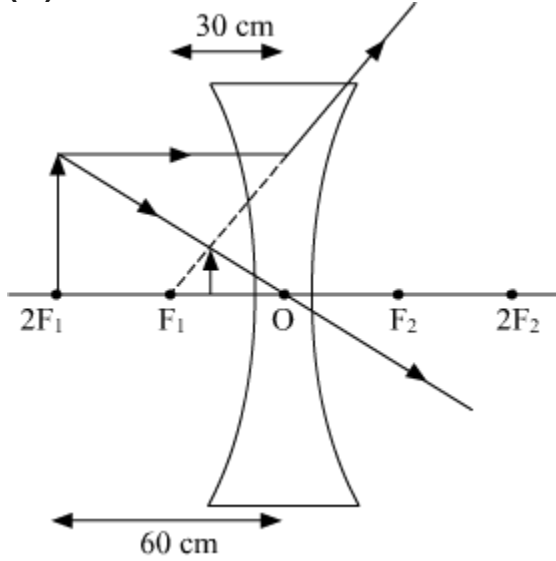Focal length of the concave lens, $f = -30$ cm

Using lens formula,
$$\frac{1}{v} - \frac{1}{u} = \frac{1}{f}$$
$$\frac{1}{v} - \frac{1}{(-60)} = \frac{1}{(-30)}$$
$$\frac{1}{v} = \frac{-1}{30} - \frac{1}{60}$$
$$\frac{1}{v} = \frac{-3}{60}$$
$$v = -20 \text{ cm}$$

The image will be formed at a distance of 20 cm in front of the lens.

(ii) Nature of the image is virtual.
The position of the image is between F_1 and optical center O.
Size of the image is diminished.
The image is Erect.

(iii)

Question 20

(a) With the help of a suitable circuit diagram prove that the reciprocal of the equivalent resistance of a group of resistances joined in parallel is equal to the sum of the reciprocals of the individual resistances.

(b) In an electric circuit, two resistors of 12 Ω each are joined in parallel to a 6 V battery. Find the current drawn from the battery.

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OR

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An electric lamp of resistance 20 Ω and a conductor of resistance 4 Ω are connected to a 6 V battery as shown in the circuit. Calculate:
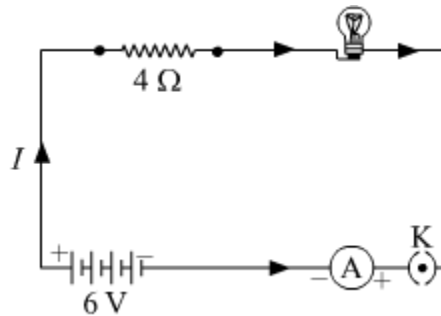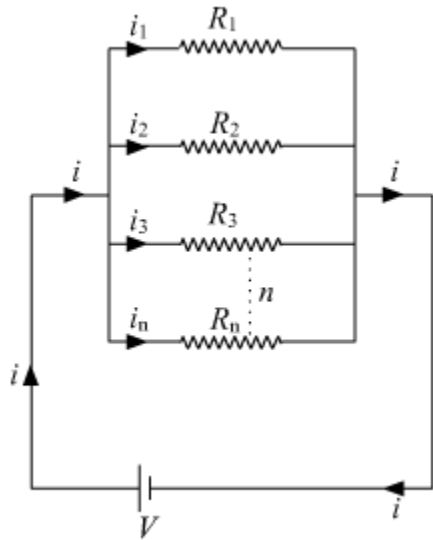

(a) the total resistance of the circuit,

(b) the current through the circuit,

(c) the potential difference across the (i) electric lamp and (ii) conductor, and

(d) power of the lamp.

SOLUTION:

(a)

Let there are n resistances, each of value R_1, R_2......R_n, respectively, are connected in parallel to a battery of voltage V. if the equivalent resistance of the circuit is R_{eq}, then current drawn from the battery is $i = \dfrac{V}{R_{eq}}$

The total current i then divides into i_1, i_2, i_3.....i_n, respectively in the given resistors.

As all the resistances are connected in parallel, hence the voltage across each resistor is V volt.

Now we can write,

$i = i_1 + i_2 + i_3 + \ldots \ldots + i_{eq}$

$\dfrac{V}{R_{eq}} = \dfrac{V}{R_1} + \dfrac{V}{R_2} + \dfrac{V}{R_3} \ldots \ldots + \dfrac{V}{R_n} \quad \ldots \ldots (1)$

From eq. 1,

$\dfrac{1}{R_{eq}} = \dfrac{1}{R_1} + \dfrac{1}{R_2} + \dfrac{1}{R_3} \ldots \ldots + \dfrac{1}{R_n}$

Hence, reciprocal of the equivalent resistance is equal to the sum of reciprocal of each resistor joined in parallel

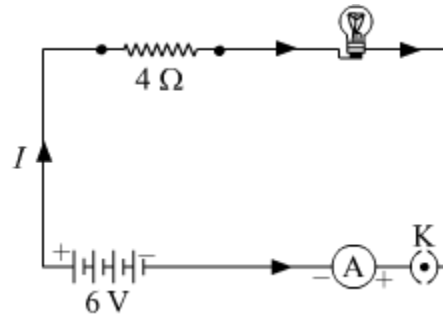**(b)** Let net resistance of the given parallel combination be R_{net}, Then,

$$\frac{1}{R_{net}} = \frac{1}{12} + \frac{1}{12}$$

$$\frac{1}{R_{net}} = \frac{2}{12} = \frac{1}{6}$$

$$\Rightarrow R_{net} = 6\ \Omega$$

Hence, current, $i = \dfrac{V}{R_{net}} = \dfrac{6\ V}{6\ \Omega} = 1\ A$

OR

Resistance of electric lamp = $20\ \Omega$

Resistance of Conductor = $4\ \Omega$

Voltage of Battery = $6\ V$

(a) The total resistance of the circuit = $20\ \Omega + 4\ \Omega = 24$

(b) Current in the circuit = I

Applying Ohm's law in the circuit,

$V = IR$

$6\,\text{V} = I \times 24\,\Omega$

$I = \frac{6\,V}{24\,\Omega} = 0.25\,\text{A}$

Hence current in the circuit is 0.25 Ampere.

(c) Potential difference across lamp,

$V_{\text{lamp}} = IR$

$V_{\text{lamp}} = 0.25\,\text{A} \times 20\,\Omega = 5\,\text{V}$

$\therefore V_{\text{lamp}} = 5\,\text{V}$

Potential difference across conductor,

$V_{\text{Conductor}} = IR$

$V_{\text{Conductor}} = 0.25\,\text{A} \times 4\,\Omega = 1\,\text{V}$

$\therefore V_{\text{Conductor}} = 1\,\text{V}$

(d) Power of Lamp = $I^2 R = (0.25)^2 \times 20 = 1.25\,\text{W}$

Question 21

What is a solenoid? Draw the pattern of magnetic field lines of (i) a current carrying solenoid and (ii) a bar magnet. List two distinguishing features between the two fields.
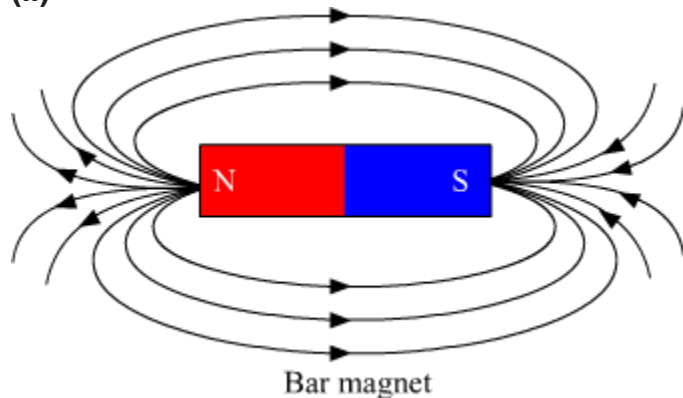
SOLUTION:

A solenoid is a long cylindrical coil of wire consisting of a large no. of turns bound together very tightly.

(i)

Magnetic field lines

Solenold

S N

+ − B X

(ii)

N S
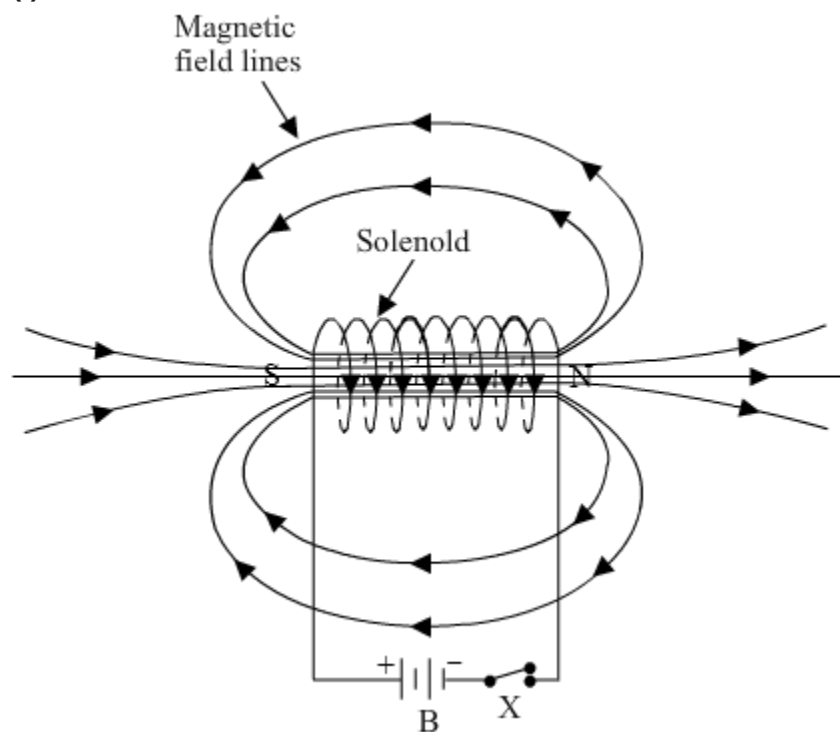
Bar magnet

Two distinguishing features between the two fields:

1. Magnetic field of the solenoid can be varied as per our requirements just by changing the current or core of the solenoid whereas the magnetic field of the bar magnet is fixed.

2. Magnetic field outside the solenoid is negligible as compared to the bar magnet.

Question 22
Blue litmus solution is added to two test tubes A and B containing dilute HCl and NaOH solution respectively. In which test tube a colour change will be observed? State the colour change and give its reason.

OR

What is observed when 2 mL of dilute hydrochloric acid is added to 1 g of sodium carbonate taken in a clean and dry test tube? Write chemical equation for the reaction involved.

SOLUTION:

Test tube A contains dil. HCl and test tube B contains dil. NaOH. On adding blue litmus solution to both the test tubes, the colour of the test tube A will change from blue to red. This is because HCl is an acid and acids turn blue litmus to red.

OR

On adding dilute hydrochloric acid to sodium carbonate taken in a clean and dry test tube, a brisk effervescence will be observed due to the evolution of carbon dioxide gas.

$$2\,HCl \ + \ Na_2\,CO_3 \ \rightarrow \ 2\,NaCl \ + \ H_2O \ + \ CO_2$$
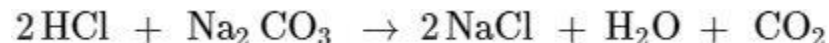
Question 23

In three test tubes A, B, and C, three different liquids namely, distilled water, underground water and distilled water in which a pinch of calcium sulphate is dissolved, respectively are taken. Equal amount of soap solution is added to each test tube and the contents are shaken. In which test tube will the length of the foam (lather) be longest? Justify your answer.

SOLUTION:

A
Distilled
water

B
Underground
water

C
Distilled water
with CaSO₄
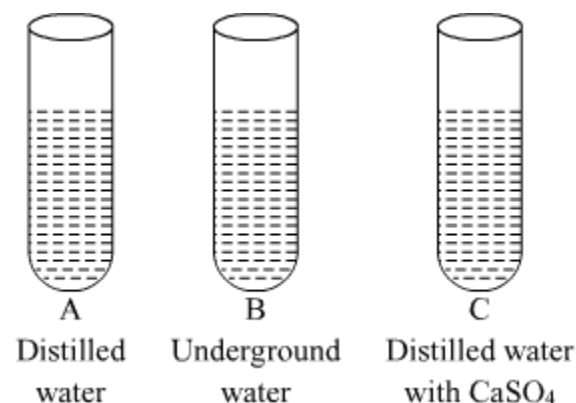
Test tube A contains distilled water which is considered as soft water, free from ions like Mg^{2+}, Ca^{2+}, etc. So, in this case, the length of foam will be the longest(maximum).
Test tube B contains underground water which contains ions like Mg^{2+}, Ca^{2+}, etc. which react with soaps to form salts of fatty acids called scum, which are insoluble in water. So, in this case, the length of foam will be the less in comparison to test tube A.
Test tube C contains distilled water with $CaSO_4$, which contains Ca^{2+} ions which react

with soaps to form salts of fatty acids called scum, which are insoluble in water. So, in this case also, the length of foam will be the less in comparison to test tube A.
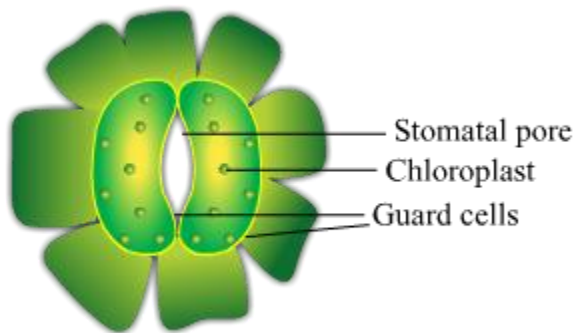
Question 24

A student is observing the temporary mount of a leaf peel under a microscope. Draw labelled diagram of the structure of stomata as seen under the microscope

<div align="center">OR</div>

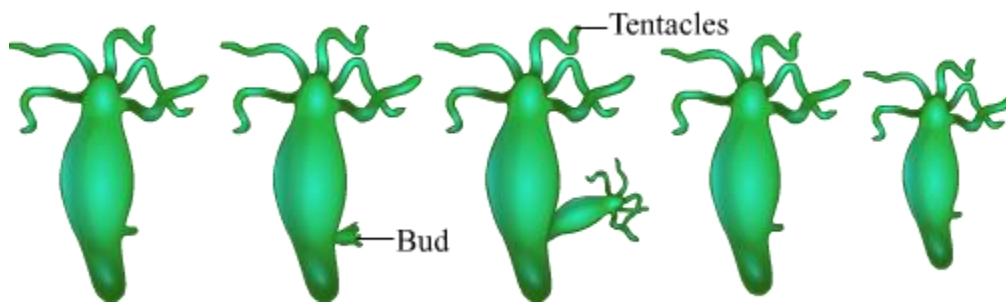Draw a labelled diagram in proper sequence to show budding in hydra.

SOLUTION:

Structure of stomata

<div align="center">OR</div>

Budding in *Hydra*

Question 25

In the experimental set up to show that "CO_2 is given out during respiration", name the substance taken in the small test tube kept in the conical flask. State its function and the consequence of its use.

In the above mentioned experimental setup, lime water is taken in a small test tube which is kept in the conical flask.
Lime water is used to detect the presence of carbon dioxide.
When carbon dioxide passes through lime water, it turns milky due to the formation of calcium carbonate.
Hence, it is used in the above experiment to check whether CO_2 is released during respiration.

Question 26

While studying the dependence of potential difference (V) across a resistor on the current (I) passing through it, in order to determine the resistance of the resistor, a student took 5 readings for different values of current and plotted a graph between V and I. He got a straight line graph passing through the origin. What does the straight line signify? Write the method of determining the resistance of the resister using this graph.

OR

What would you suggest to a student if while performing an experiment he finds that the pointer/needle of the ammeter and voltmeter do not coincide with the zero marks on the scales when the circuit is open? No extra ammeter/voltmeter is available in the laboratory.
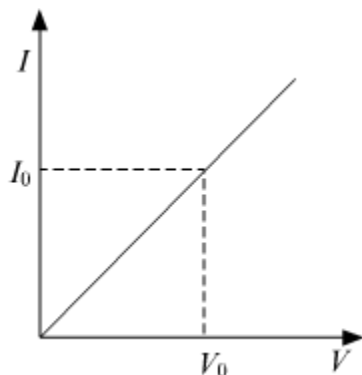
Straight line graph between potential difference(V) and current(I) shows that resistor is a linear element and follows Ohm's Law.

Calculation of Resistance:

At any point on the graph, resistance is given as, $R = \dfrac{V_o(\text{value of potential difference at that point})}{I_o(\text{value of current at that point})}$

In other words, the Slope of the graph at any point gives the value $\dfrac{1}{R}$,

Hence,

$$\text{slope} = \dfrac{I_o}{V_o} = \dfrac{1}{R}$$

$$\Rightarrow R = \dfrac{1}{slope} = \dfrac{V_o(\text{Value of Potential difference at that point})}{I_o(\text{Value of Current at that point})}$$

OR

This is called the zero error of the scale of ammeter or voltmeter. If there is a zero error, then this error is subtracted from the value that depicts when the circuit is closed, otherwise, the accurate current or potential difference will not be recorded.

Question 27

List four precautions which a student should observe while determining the focal length of a given convex lens by obtaining image of a distant object on a screen.

SOLUTION:
Following are the precautions while making the image by hte help of convex lens:

1.) Fix the convex lens vertically in the lens holder.

2.) The base of the lens and white screen should be in a line with the measuring scale.

3.) Record the position of the lens and screen only when a well defined sharp image is formed.

4.) There should not be any obstacle in the path of the convex lens.