

Secondary School Examination-2019**SCIENCE****Board Question Paper****Time allowed: 3 hours****Maximum Marks: 80****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) Questions number 1 and 2 in Section A are one-mark questions. They are to be answered in one word or in one sentence..
- (v) Questions number 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.

Board Question Paper-2019

Section – A

Question 1: What is the function of a galvanometer in a circuit? [1]

Question 2: Why is biogas considered an excellent fuel? [1]

Section – B

Question 3: How can it be proved that the basic structure of the Modern Periodic Table is based on the electronic configuration of atoms of different elements? [2]

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.

Question 4: Write two different ways in which glucose is oxidized to provide energy in the human body. Write the products formed in each case. [2]

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. [2]

Section – C

Question 6: 2 g of silver chloride is taken in a china dish and the china dish is placed in sunlight for some time. What will be your observation in this case? Write the chemical involved in the form of a balanced chemical equation. Identify the type of chemical reaction. [3]

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.

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? [3]

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) Compounds formed when an element, A of group 2 combines with an element, B of group seventeen. [3]

Question 9: Write three types of blood vessels. Give one important feature of each. [3]

Question 10: Trace the sequence of events which occur when a bright light is focused on your eyes. [3]

Question 11: What are plant hormones? Name the plant hormones responsible for the following: [3]

- (i) Growth of stem
- (ii) Promotion of cell division
- (iii) Inhibition of growth
- (iv) Elongation of cells

Question 12: Name the plant Mendel used for his experiment. What type of progeny was obtained by Mendel in F_1 and F_2 generation when he crossed the tall and short plants? Write the ratio he obtained in F_2 generation plants. [3]

OR

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

Question 13: What is a rainbow? Draw a labelled diagram to show the information of a rainbow. [3]

Question 14: How can we help in reducing the problem of waste disposal? Suggest any three methods. [3]

OR

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

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 ground water. [3]

Section D

Question 16: (a) List in tabular form three chemical properties on the basis of which we can differentiate between a metal and a non-metal. [5]

(b) Give reasons for the following:

(i) Most metals conduct electricity well.

(ii) The reaction of Iron (III) oxide [Fe_2O_3] with heated Aluminium is used to join cracked machine parts.

Question 17: What is methane? Draw its electron dot structure. Name the type of bonds formed in this compound. Why are such compounds: [5]

(i) Poor conductors of electricity? And

(ii) Have low melting and boiling points? what happens when this compound burns in oxygen?

OR

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-

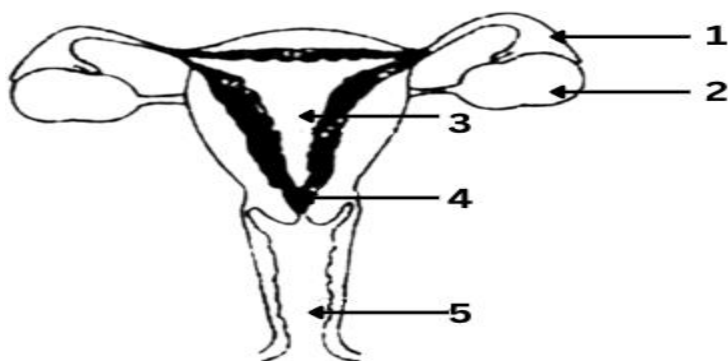
(i) sodium metal

(ii) hot concentrated sulphuric acid

Question 18: Define pollination. Explain the different types of pollination. List two agents of pollination? How does suitable pollination lead to fertilization? [5]

OR

- (a) Identify the given diagram. Name the parts 1 to 5.
 (b) What is contraception? List three advantages of adopting contraceptive measures.



Question 19: An object is placed at a distance of 60 cm from a concave lens of focal length 30 cm. [5]

- (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 a ray diagram to justify your answer of part (ii).

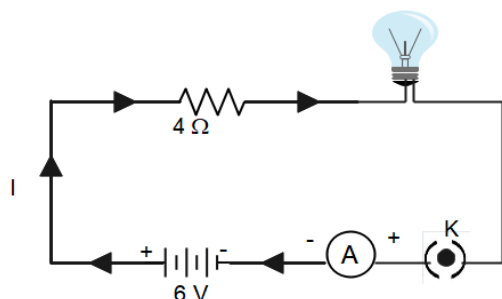
Question 20: (a) With the help of a suitable circuit diagram prove that the reciprocal of the equivalent resistance of a group of resistance joined in parallel is equal to the sum of the reciprocal of the individual resistances.

(b) In an electric circuit two resistors of $12\ \Omega$ each are joined in parallel to a 6 V battery. Find the current drawn from the battery. [5]

OR

An electric lamp of resistance $20\ \Omega$ and a conductor of resistance $4\ \Omega$ 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 (iii) conductor
- (d) Power of the lamp



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 field lines. [5]

Section E

Question 22: Blue litmus solution is added to two test tubes A and B containing dilute HCl and $NaOH$ solutions respectively. In which test tube a colour change will be observed, state the colour change and give its reasons. [2]

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 a chemical equation for the reaction involved.

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. [2]

Question 24: A student is observing the temporary mount of a leaf peel under a microscope. Draw a labelled diagram of the structure of stomata as seen under the microscope. [2]

OR

Draw labelled diagrams in proper sequence to show budding in hydra.

Question 25: In the experimental setup 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. [2]

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 resistor using this graph. [2]

OR

What would you suggest to a student if while performing an experiment he finds 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.

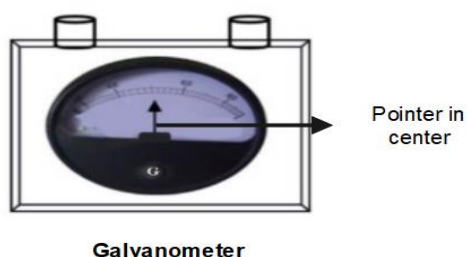
Question 27: List four precautions which a student should observe while determining the focal length of a given convex lens by obtaining an image of a distant object on a screen. [2]

Solution- Science Board Paper -2019

Section A

Question 1: What is the function of a galvanometer in a circuit? [1]

Solution: A galvanometer is used in the circuit to detect or measure the presence of a small amount of current flowing through it. The galvanometer pointer is placed in the centre when no current flows in the circuit. As soon as the current starts flowing, it will deflect either on the right side of the zero mark or may deflect on the left side of the zero mark. The deflection of the pointer depends on the direction of the current flowing in the circuit.



Question 2: Why is biogas considered an excellent fuel? [1]

Solution: Biogas is considered an excellent fuel due to the following reasons:

1. The major component of biogas is methane, nearly 75% of which burns without smoke and leaves no residue, similar to ash in wood and charcoal.
2. Due to high rise heating capacity.
3. The slurry left at the back of biogas is also used in agriculture as manure which is rich in nitrogen and phosphorus.

Section B

Question 3: How can it be proved that the basic structure of the Modern Periodic Table is based on the electronic configuration of atoms of different elements? [2]

OR

Question 3: The electronic configuration of an element is 2, 8, 4. State its:

- (c) group and period in the Modern Periodic Table.
- (d) name and write its one physical property.

Solution: In the modern periodic table, atomic number is made the basis of the classification of the element. According to this law, " The physical and chemical properties of the elements are periodic functions of the atomic numbers."

It means that when the elements are arranged in order of their increasing atomic numbers, it is observed that the elements of similar properties reoccur at regular intervals. For example, suppose we see elements of group I in the table and write their names along their electronic configuration. we will observe that all three elements have the same number of electrons in the outer shell, so they have a similar electronic configuration.

OR

Solution:

(a) The distribution of electrons into different orbits of an atom is known as electronic configuration, and the electrons in the different shells have different energies. $K, L, M,$ and N are the shells. The maximum number of electrons filled in $K - 2, L - 8, M - 18, N - 32$, etc. It is given that the electronic configuration of the atom is given 2, 8, 4, and we know the atom should accommodate 8 electrons in the outermost shell to attain stability.

Here, the outermost shell has 4 electrons, so its valency becomes,

$valency = 8 - \text{the number of electrons in the outermost shell}$

$valency = 8 - 4$

$valency = 4$

Therefore the valency of the given element is 4. It belongs to group 14, and since it has 3 shells, its period is 3rd. Total electron present = Atomic number

Atomic number = 14; therefore the element is silicon.

(b) The name of the element is silicon.

The physical properties of silicon include the following:

- Exists as a solid at room temperature and pressure.
- It has a metallic lustre (a metal-like appearance)
- It is very brittle.
- It is a semiconductor (can be made to conduct electricity under certain conditions)
- Melting point: 1410 degrees Celsius.
- Boiling point: 3265 degrees Celsius.

Question 4: Write two different ways in which glucose is oxidized to provide energy in the human body. Write the products formed in each case. [2]

Solution: The two different ways in which glucose is oxidized to provide energy in the human body are:

1. **Aerobic respiration:** Respiration that happens in the presence of oxygen is known as aerobic respiration. For example, in the case of mitochondria, pyruvate breakdown occurs in the presence of oxygen, and Pyruvate is further broken down into carbon dioxide and water.

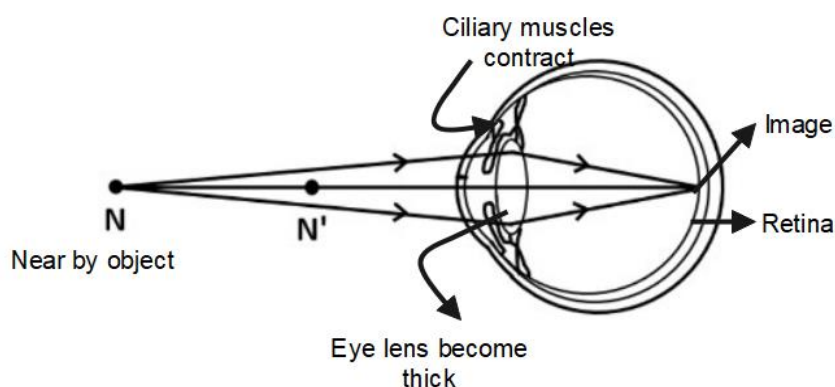
Product formed- *Water + carbon dioxide + energy*

2. **Anaerobic respiration:** The respiration that occurs without oxygen is called anaerobic respiration. For example, in yeast, pyruvate breakdown occurs in the absence of oxygen and pyruvate is further broken down into ethanol and carbon dioxide. In this process, much energy is released as compared to aerobic respiration.

Product formed- *Ethanol(2 carbon molecule) + carbon dioxide + energy*

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. [2]

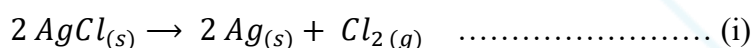
Solution: The capability of the eye lens to adjust its focal length is called the power of accommodation. When we look at nearby objects, the ciliary muscles contract, increasing the eye lens's thickness. The eye lens then becomes thicker. As a result, the eye lens's focal length decreases so that a clear, sharp image of a nearby object is formed on the retina. Thus, the object is visible clearly to us.



Section C

Question 6: 2 g of silver chloride is taken in a china dish and the china dish is placed in sunlight for some time. What will be your observation in this case? Write the chemical involved in the form of a balanced chemical equation. Identify the type of chemical reaction. [3]

Solution: When 2 g of silver nitrate is kept in the sunlight for some time, we will observe that its colour changes to grey due to the decomposition of the silver chloride into two chemicals, chloride and silver, by sunlight. The type of chemical reaction is photochemical decomposition, as shown in equation (i).



[where $AgCl_{(s)}$ = silver chloride; $Ag_{(s)}$ = silver and $Cl_{2(g)}$ = chlorine]

OR

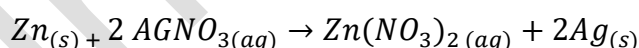
Question 6: Identify the type of reactions taking place in each of the following cases and write the balanced chemical equation for the reactions.

(c) Zinc reacts with silver nitrate to produce zinc nitrate and silver.

(d) Potassium iodide reacts with lead nitrate to produce potassium nitrate and lead iodide.

Solution:

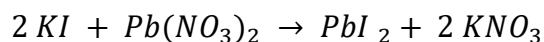
(a) As we know, zinc is present above silver in the reactivity series, which means that zinc is highly reactive, so when zinc reacts with silver nitrate, it replaces silver from the salt and combines with nitrate to form its salts known as zinc nitrate and silver. In this equation, only one metal is replaced and forms its salt, which is a displacement reaction.



Where, Zn = Zinc, $AgNO_3$ = Silver nitrate, $Zn(NO_3)_2$ = Zinc nitrate, Ag = Silver

(b) It is a double displacement reaction as both reactants exchange ions to form new products.

Also, it is a precipitation reaction as yellow colour lead iodide precipitates are formed.



Where, KI = potassium iodide, $Pb(NO_3)_2$ = lead nitrate, PbI_2 = lead iodide

KNO_3 = potassium nitrate

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? [3]

Solution: When sodium hydroxide (base) combines with hydrogen chloride (acid), then it forms sodium chloride (salt), which is a neutral salt. i.e. it is a salt of a strong acid and a strong base with a pH value of 7. As we know, seawater has various salts dissolved in it. We have to separate sodium chloride from this salt by the process of evaporation. Sometimes we will also find deposits of solid salt, which are large brown crystals known as rock salt. Beds of rock salt were formed when seas of bygone ages dried up. Rock salt is mined like coal.

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) Compounds formed when an element, A of group 2 combines with an element, B of group seventeen. [3]

Solution:

(i) All the elements will have similar physical and chemical properties in a group because of their similar outer shell electron structure. Now,

Oxides of group first means all the elements of the group, when combined with the oxygen, form their oxides. We know the 1st group elements have a valency one, and the valency of oxygen is 2. Therefore the oxides of the first group are X_2O . Where 'X' is the element. For example, when hydrogen reacts with oxygen it forms hydrogen oxides.

$X \quad O \quad [X = \text{element}, O = \text{oxygen}]$

$1 \quad 2 \quad [\text{now do cross multiply and we obtain}]$

X_2O

Hence the molecular formula of oxide of first group elements is X_2O

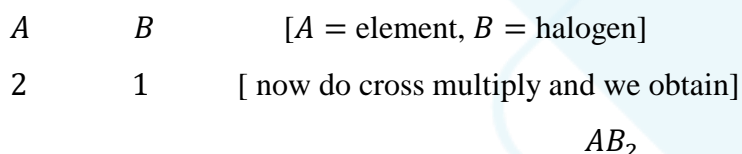
(ii) group 13 elements have 3 electrons in the outermost shell or valency 3. When they react with halogens (inert gas) they form halides. The halide of group 13 is MX_3

$M \quad X \quad [M = \text{element}, X = \text{halogen}]$

$3 \quad 1 \quad [\text{now do cross multiply and we obtain}]$

MX_3

(iii) Since the valency of elements in group 2 is +2 and -1 of elements in group 17, when these two elements react, A will accept 2 ions of B or each B atom will donate 1 ion to A resulting in formation of compound AB_2 .



Question 9: Write three types of blood vessels. Give one important feature of each. [3]

Solution: The three types of blood vessels are:

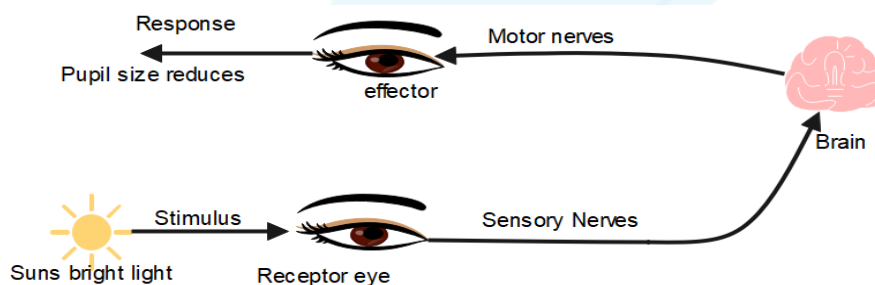
1. Arteries: They take oxygenated blood from the heart to the various body parts, except pulmonary arteries, which carry deoxygenated blood from the heart to the lungs. Arteries have very thick walls, a thick layer of muscle tissue inside and no valves (except for the pulmonary artery).
2. Veins: They carry deoxygenated blood from organs back to the heart. Except for pulmonary veins, which carry oxygenated blood from the lungs to the heart. Veins have thin walls, a thin layer of muscle tissue inside and contain valves to keep blood flowing.
3. Capillaries: Arteries and veins diverge to form arterioles and venules. As a result, the nutrients, hormones, and gases can diffuse into the cells of the tissue through the walls of the capillaries and vice versa.

Question 10: Trace the sequence of events which occur when a bright light is focused on your eyes. [3]

Solution: Reflex action is defined as an unconscious, automatic and involuntary response of the effector, i.e. muscle and gland, to a stimulus monitored through the spinal cord. For example, the sequence of events which occur when a bright light is focused on our eyes.

is as follows:

- a) Receptor organ eye receives the stimulus and activates a sensory nerve impulse
- b) Sensory neurons carry the message through the sensory impulse to the spinal cord.
- c) The spinal cord acts as a modulator. The neurons of the spinal cord transmit the sensory nerve impulses to motor neurons.
- d) The motor nerve conducts these impulses to the effector organ muscles in the eye, which respond by blinking an eye, as shown in the diagram below.



Question 11: What are plant hormones? Name the plant hormones responsible for the following: [3]

- (i) Growth of stem
- (ii) Promotion of cell division
- (iii) Inhibition of growth
- (iv) Elongation of cells

Solution: Plant hormones are naturally-occurring chemicals synthesized in one part of the plant body and diffused to other parts. They support the coordination of growth, development, and environmental responses. There are four naturally occurring plant hormones- Auxin, gibberellins, cytokinin, and abscisic acid.

(i) Growth of stem – Gibberellins

It is a plant hormone whose function is similar to auxin. It prompts elongation of the stem, flowering, and germination.

(ii) Promotion of cell division – Cytokinins

Cytokinins are a group of plant growth regulators primarily involved in performing cell division in plant roots and shoot systems. This hormone helps promote the cell's growth, development, and differentiation, affecting apical dominance and delay in leaf senescence.

(iii) Inhibition of growth: falling of senescent leaves – Abscisic acid

Abscisic is a growth inhibitor that was discovered in the 1960s. It was initially called dormant.

(iv) Elongation of cells – Auxins

The first phytohormone to be discovered is the auxin, which was discovered by the biologist Charles Darwin. Auxins are one of the most essential plant hormones. When light falls on a growing plant, a hormone called auxin is synthesized at the shoot tip of it, helping the cell to grow longer. If the plant receives light continuously from one side, auxin diffuses towards the shady side of the shoot. Therefore the concentration of this hormone auxin stimulates the cell

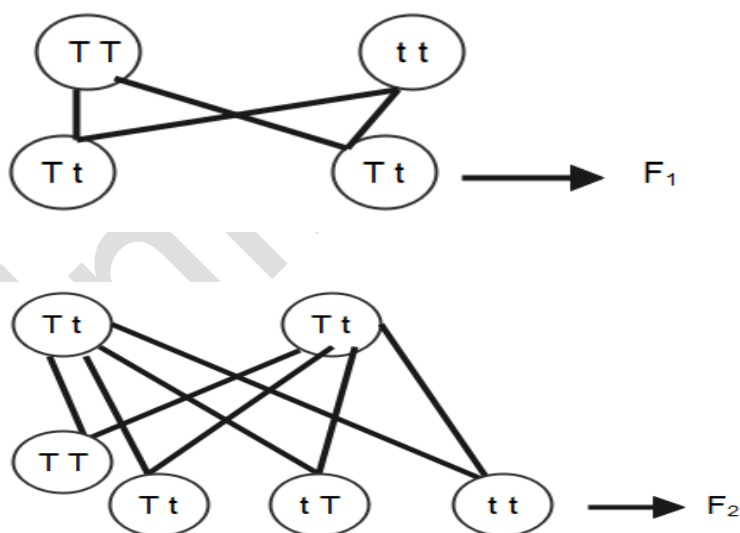
to grow longer on the side of the shoot, which is not exposed to light. As a result, the plant appears to bend towards the light.

Question 12: Name the plant Mendel used for his experiment. What type of progeny was obtained by Mendel in F_1 and F_2 generation when he crossed the tall and short plants? Write the ratio he obtained in F_2 generation plants. [3]

OR

Question 12: List two differences between acquired traits and inherited traits by giving an example of each.

Solution: George Mendel experimented on the pea plant. He took one tall (TT) and one short pea plant (tt) and made them cross each other. After crossing, obtained F_1 progeny, where all the plants are tall, and none of the plants is short. He again assumed F_1 progeny as parents and made them cross with each other for F_2 progeny. He obtained (TT, TT, Tt and Tt) from the cross, i.e. 1: 2: 1 ratio. Where T is the dominant trait and t is the recessive trait, only a single T is enough for the Tall characteristic. And only ' tt ' is the trait which gives the short plant.



OR

Solution: Trait means the inherited character, and it's the detectable variant. Traits are two types - acquired traits and inherited traits.

Inherited traits:

1. Inherited traits are the characteristics that are inherited by the offspring from the parents. These traits exist in the form of genetic material, DNA.
2. Each gamete of the opposite sex participating in sexual reproduction donates the traits as genetic material.
3. These traits are sent to the offspring and later carried on to the next generation. For example- Attached or free earlobe, Rolling of the tongue.

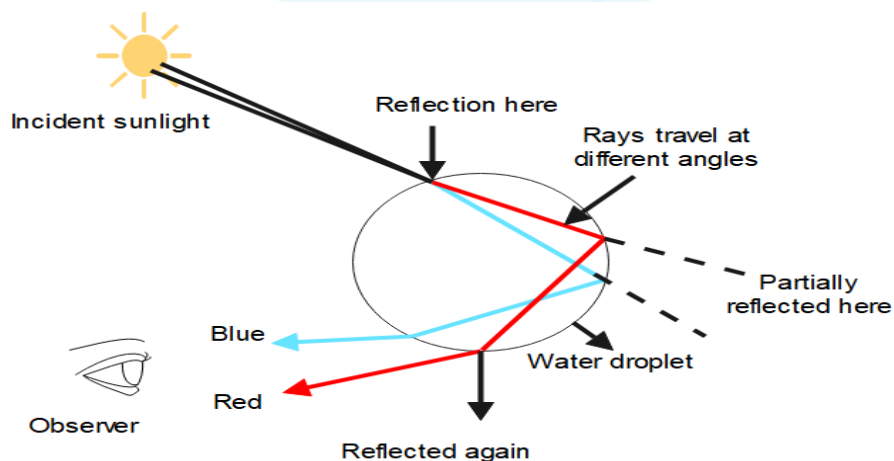
Acquired traits:

1. The individual acquired traits during their lifetime.
2. These are due to changes in lifestyle, injury, loss of body parts, and disuse of some parts.
3. These are the traits that occur in the somatic cells.
4. An acquired trait cannot pass a change to non-reproductive tissues onto the DNA of the germ cells. For example- Learning Dance or music and the Muscular body of a wrestler.

Question 13: What is a rainbow? Draw a labelled diagram to show the information of a rainbow. [3]

Solution: When the sun comes out just after the rain, we sometimes see a band of seven colours in the sky. This band of seven colours is called a rainbow.

A rainbow is shown in the given figure. The rainbow is formed when the sunlight falls on the raindrops present in the atmosphere just after the rain, and these water droplets act as a small prism. Then the rays of sunlight enter the drop near its top surface. At this first refraction, the white light is dispersed into its spectrum of colours, violet being deviated the most and red the least. While reaching the opposite side of the drop, each colour is reflected in the drop because of total internal reflection. Upon arriving at the drop's surface, each colour is refracted into the air. At the second refraction, the angle between red and violet rays further increases when compared to the angle between those at the first refraction. Due to the dispersion of light and internal reflection, diverse colours reach the observer's eye. The rainbow is always formed in a direction opposite the sun.



Question 14: How can we help in reducing the problem of waste disposal? Suggest any three methods. [3]

OR

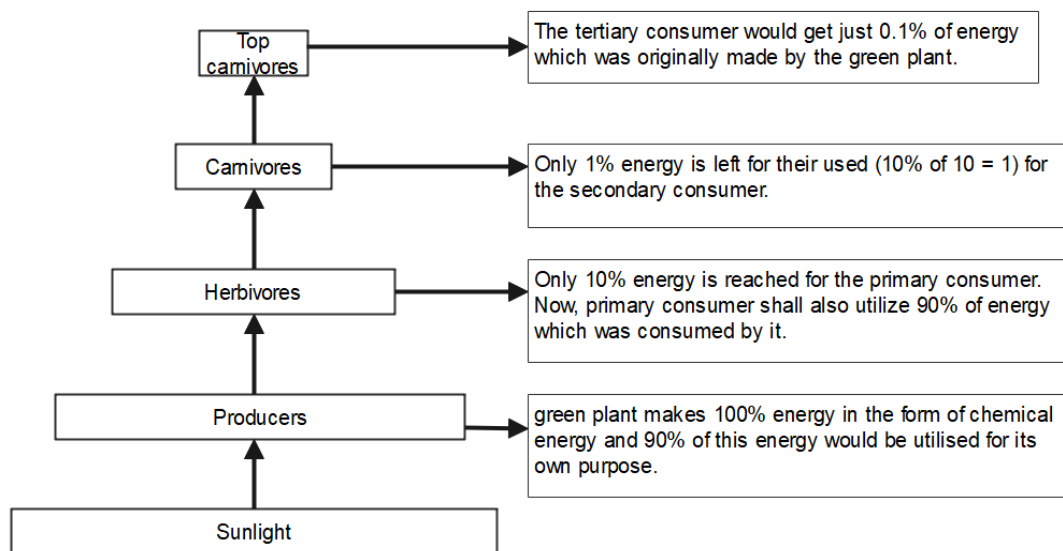
Question 14: Define an ecosystem. Draw a block diagram to show the flow of energy in an ecosystem.

Solution: In our daily activities, we generate a lot of material thrown away. Microorganisms break down some substances, and others remain in the environment. This remaining part is called waste. The problem of waste disposal can be solved by following methods:

1. Composting- Composting means putting the waste organic matter to decay. Once it decomposes, we can use the matter produced to fertilise agricultural land.
2. Recycling- Plastic waste is a serious concern because plastic is non-biodegradable, so we should avoid using plastic. Also, we should reuse the plastic which is present in our surroundings.
3. Landfills- Residues from waste incineration or waste unsuitable for material recycling or thermal treatment are deposited in landfills that comply with the legal requirements. If the waste does not fulfil the requirements for landfilling, it must be pre-treated.

OR

Solution: An ecosystem is formed of all organisms in an area interacting with the non-living constituents of the environment. These interact with each other and maintain a balance in nature. It is formed of biotic and non-biotic components. Biotic components include all living organisms, such as plants, animals, microorganisms, and human beings and Temperature, rainfall, wind, soil, and minerals are abiotic components. For example, a garden is an ecosystem where different plants, such as grasses and trees; flower-bearing plants like rose, jasmine, and sunflower; and animals like frogs, insects, and birds interact with each other and their activities; reproduction depends on abiotic factors of the ecosystem.



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 ground water. [3]

Solution: Water harvesting means capturing rainwater where it falls or the runoff in a local area for future use and the two advantages associated with water harvesting at the community level are:

- Water harvesting is an excellent solution to water problems in areas having inadequate water resources.
- It improves water quality and helps raise the groundwater level.

The two causes for the failure of sustained groundwater availability are:

- (a) Rising population: As the population increases, the demand for water increases, resulting in underground water level depletion.
- (b) Industrialization: Industries need more and more water to manufacture products. With the growing industrialization, the demand for water increases, resulting in a reduction in the availability of underground water.

Question 16: (a) List in tabular form three chemical properties on the basis of which we can differentiate between a metal and a non-metal. [5]

(b) Give reasons for the following:

(i) Most metals conduct electricity well.

(ii) The reaction of Iron (III) oxide [Fe₂O₃] with heated Aluminium is used to join cracked machine parts.

Solution: (a)

S. No	Compound	Metal	Non metal
1	Oxygen	$\text{Metal} + \text{Oxygen} \rightarrow \text{Metal oxide}$ When metal reacts with oxygen they form metal oxides. Which are basic in nature. For example: $4\text{Na} + \text{O}_2 \rightarrow 2\text{Na}_2\text{O}$ [where Na = sodium, O ₂ = oxygen; Na ₂ O = sodium oxide]	$\text{Non Metal} + \text{Oxygen} \rightarrow \text{Non Metal oxide}$ When non metal reacts with oxygen they form non metal oxides or neutral oxides. Which are acidic in nature.
2	Water	All metals do not react with water. Those which react can form metal oxide and hydrogen gas. Metal oxides that are soluble in water further form metal hydroxide. $\text{Metal} + \text{Water} \rightarrow \text{Metal oxide} + \text{Hydrogen}$ Note: The metals below hydrogen in the activity	Non metals do not react with water

		series do not react with water. The silver spoons, gold ornaments and platinum crucibles are washed with boiling water but do not get thinner.	
3	Acids	<p>Most metals react with acids producing salt and hydrogen.</p> $\text{Metal} + \text{Dilute acid} \rightarrow \text{Salt} + \text{Hydrogen}$ <p>For example: Hydrogen gas is not evolved when metals such as Zn, Fe and Al react with nitric acid: Nitric acid is a strong oxidising agent. It oxidises hydrogen to water and is itself reduced to oxides of nitrogen (N₂O, NO or NO₂)</p> $3\text{Fe}(s) + 8\text{HNO}_3(aq) \rightarrow 3\text{Fe}(\text{NO}_3)_2(aq) + 4\text{H}_2\text{O} + 2\text{NO}(g)$ <p>[where <i>Fe(s)</i>=Iron; <i>HNO₃</i>= Nitric acid (dil) ; <i>Fe(NO₃)₂</i>=Iron (II) nitrate; <i>H₂O</i>= water; NO= Nitrate oxide]</p>	Generally non metals do not react with acids because when they react with acid it provides electrons to the H ⁺ ions produced by the acids. We know that Non-metals are acceptors of electrons and hence, they cannot donate electrons.

(b) (i) Metals conduct electricity well because they have free electrons in their valence band. Whenever a small amount of energy is given to metal, that electron jumps from the valence band to the conduction band and thus starts conducting electricity.

(ii) When Iron (III) oxide [*Fe₂O₃*] is heated with Aluminium gives molten iron and aluminium oxides, and a large amount of heat is released. This reaction is called the thermit reaction. Because of this, it is used to join railway tracks or cracked machine parts.

Question 17: 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?

[5]

OR

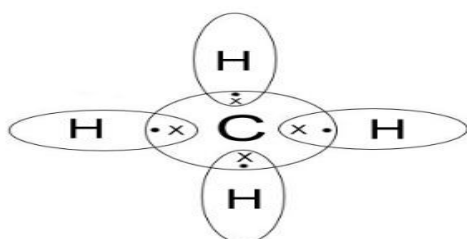
Question 17: Write the chemical formula and name of the compound which is the active ingredient of all alcoholic drinks. List its two uses. Write the chemical equation and name of the product formed when this compound reacts with-

(i) sodium metal

(ii) hot concentrated sulphuric acid

Solution: Methane is a colourless, fragrance-free and highly flammable gas, which is the main component of natural gas. Methane is widely used as a fuel and is a major component of bio-gas and Compressed Natural Gas (CNG). It is also the simplest compound formed by carbon. CH_4 is the chemical formula of methane. Since carbon has 4 electrons in its valence shell, to achieve the noble gas configuration, carbon shares each of the 4 electrons with four atoms of hydrogen, thus forming a covalent compound.

The electron dot structure of methane is shown below:



Atomic number of carbon = 6, Electronic configuration of carbon = 2, 4

Valence electron in carbon = 4 ; Thus we can write $C(6) \rightarrow 2, 4$

Similarly, Atomic number of hydrogen = 1;

Electronic configuration of hydrogen = 1

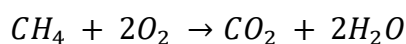
Valence electron in hydrogen = 1; $H(1) \rightarrow 1$

The carbon shares its 4 valence electrons with atoms of other elements and with itself to attain stability resulting in the formation of covalent bonds.

(i) As we know that CH_4 is the molecular formula of methane. All four carbons form a single covalent bond with hydrogen; therefore, no free electron is present for the conduction of electricity.

(ii) Covalent compounds show low melting and boiling points because of the weak covalent bond. If a small amount of energy is given to the covalent compounds, the covalent bond between them easily breaks down due to low intermolecular forces and forms new products.

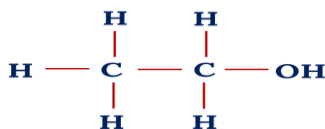
When methane burns in the presence of oxygen, it will form carbon dioxide and water as by-products. The reaction is,



[where, CH_4 = methane; O_2 = oxygen; CO_2 = carbon dioxide and H_2O = water

OR

Solution:



Ethanol is the compound which is the active ingredient of all alcoholic drinks. Its chemical formula is C_2H_5OH as shown above. It is also known as ethyl alcohol. The two uses of ethanol are:

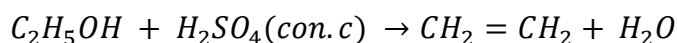
- (a) Ethanol is used in nail paint removers, polishes, and many cosmetic items.
- (b) It is used in the manufacturing of many drugs as well as hand sanitisers.

(i) When ethanol reacts with sodium, it gives ethoxide or sodium ethoxide and hydrogen gas. This reaction can detect the presence of Alcohol, and the gas liberated can be tested using a burning splinter to observe the "pop" sound. The reaction is shown below,

$$2CH_3CH_2OH + 2Na \rightarrow 2CH_3CH_2ONa + H_2$$

[where CH_3CH_2OH = ethanol; Na = sodium; CH_3CH_2ONa = sodium ethoxide and H_2 = hydrogen]

(ii) When ethanol reacts with hot, concentrated sulphuric acid, it forms ethene and water. The reaction is,

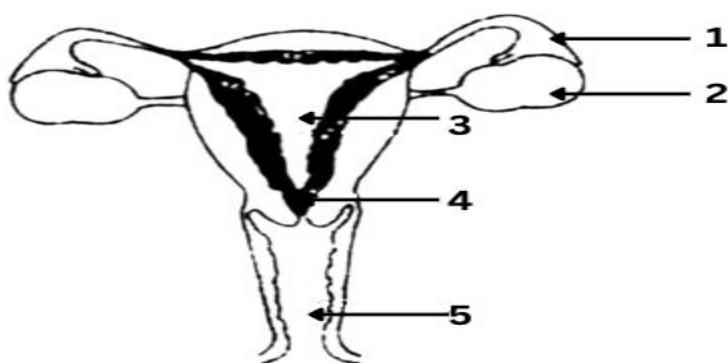


[where C_2H_5OH = ethanol; H_2SO_4 = concentrated hydro sulphuric acid; H_2O = water and $CH_2 = CH_2$ = ethene]

Question 18: Define pollination. Explain the different types of pollination. List two agents of pollination? How does suitable pollination lead to fertilization? [5]

OR

**Question 18: (a) Identify the given diagram. Name the parts 1 to 5.
 (b) What is contraception? List three advantages of adopting contraceptive measures.**



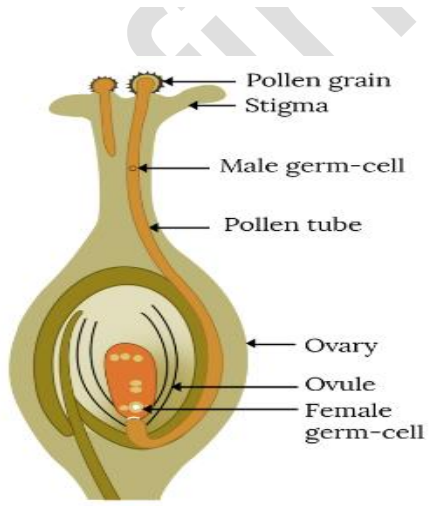
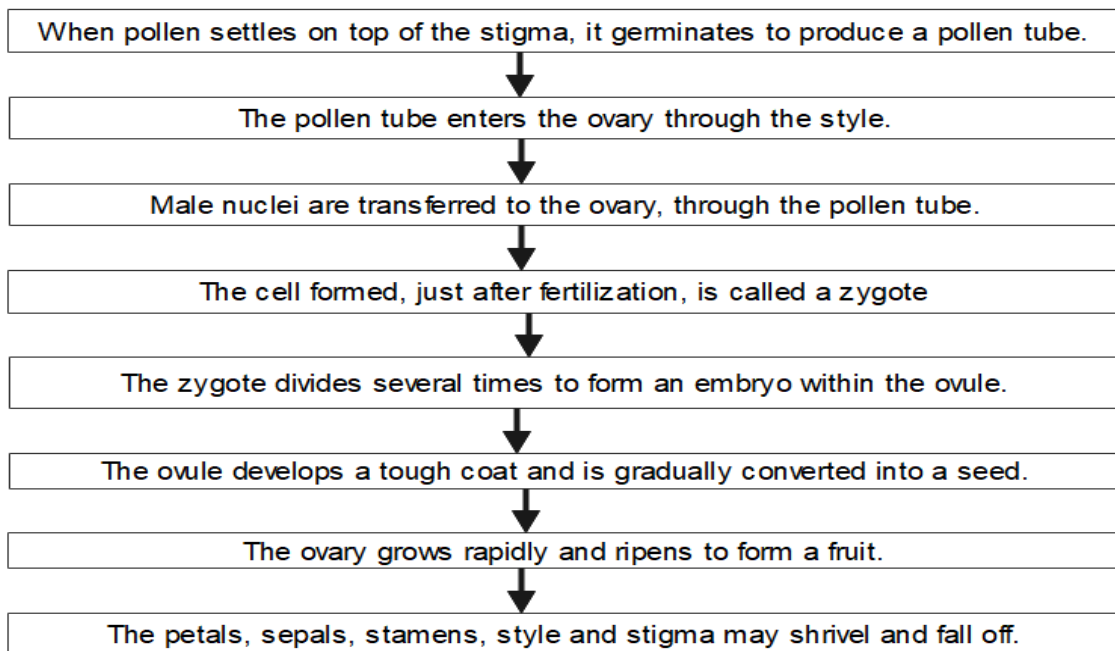
Solution: Pollination means the transfer of pollen grains from anthers to the stigma. It is of two types- Self and cross-pollination.

- (a) Self-pollination: The process is called self-pollination when pollen grains from the anther of one flower fall on the stigma of the same flower or another flower present on the same plant. Self-pollination is commonly seen in pea plants.
- (b) Cross-pollination: Transfer of pollen from the anther of one flower to the stigma of another flower on a different plant of the same kind. Cross-pollination is common in most plants. Plants use various agents of pollination to carry out cross-pollination. Example: Pumpkin, Papaya, etc.

The pollination process requires agents (pollinators) that carry or move the pollen grains from the anther to the receptive part of the female reproductive organ, i.e. the stigma. Wind, water, insects, birds, animals and humans are some agents of pollination. Pollen grains have a hard

protective coat that prevents them from drying up. Since pollen grains are carried by wind or water because they are light. Insects visit flowers and move away pollen on their bodies. Some of the pollen grains land on the stigma of the same flower or a different flower on a different plant of the same kind.

The fusion of the male gamete and the female gamete is called fertilization. It results in the formation of a single-celled zygote.



OR

Solution:

1. Fallopian Tube:

- (i) One fallopian tube comes from each side at the top of the uterus.
- (ii) The fallopian tubes end in finger-like structures; called fimbriae.
- (iii) Fertilization happens in the fallopian tube.

2. Ovary:

- (i) There are two ovaries near each fallopian tube.
- (ii) Ovary produces the eggs (female gametes).
- (iii) Ovary releases a hormone named Oestrogen.
- (iv) Ovaries of girls contain many immature eggs.
- (v) On reaching puberty, one matured egg matures in each ovulation cycle and is released from the ovary.
- (vi) The egg is caught by the fimbriae and transferred to the fallopian tube.

3. Uterus:

- (i) It is an inverted pear-shaped hollow muscular organ.
- (ii) The uterus is where the embryo gets implanted and develops into a newborn baby.
- (iii) The wall of the uterus provides safety and nutrition to the growing foetus.

4. Cervix :

The cervix (mouth of the uterus) opens into the vagina.

5. Vagina :

- (i) The vagina is a muscular tube-like organ
- (ii) It serves as the passage for the sperm and also forms the canal during childbirth.

Contraception is an artificial Method of Birth Control. They are physically preventing the coming together of the ovum and sperm with the help of a barrier. Barriers include condoms, diaphragms, cervical caps and vaults.

The three advantages of adopting contraceptive measures are:

- (i) It will reduce the chances of Surgery for the removal of unwanted pregnancies
- (ii) They create a mechanical barrier between the sperm and ovum and thus prevent fertilization
- (iii) They can help to prevent the population's uncontrolled growth.

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 a ray diagram to justify your answer of part (ii). [5]**

Solution: (i) Given,

Object distance (u) = -60 cm [As object is placed on the left side of the lens so we put minus sign against 'u'

Lens- concave (diverging)

Focal length (F) = -30 cm [Concave lens has negative focal length as it is a diverging lens]

Image distance (v) = ?

To find image distance we use lens formula,

$$\frac{1}{f} = \frac{1}{v} - \frac{1}{u} \dots\dots\dots (i)$$

Put the above values in equation (i) we get,

$$\frac{1}{-30} = \frac{1}{v} - \frac{1}{(-60)}$$

$$\Rightarrow \frac{1}{-30} = \frac{1}{v} + \frac{1}{60}$$

$$\Rightarrow -\frac{1}{v} = \frac{1}{60} + \frac{1}{30}$$

$$\Rightarrow -\frac{1}{v} = \frac{1+2}{60}$$

$$\Rightarrow -\frac{1}{v} = \frac{3}{60}$$

$$\Rightarrow -\frac{1}{v} = \frac{1}{20}$$

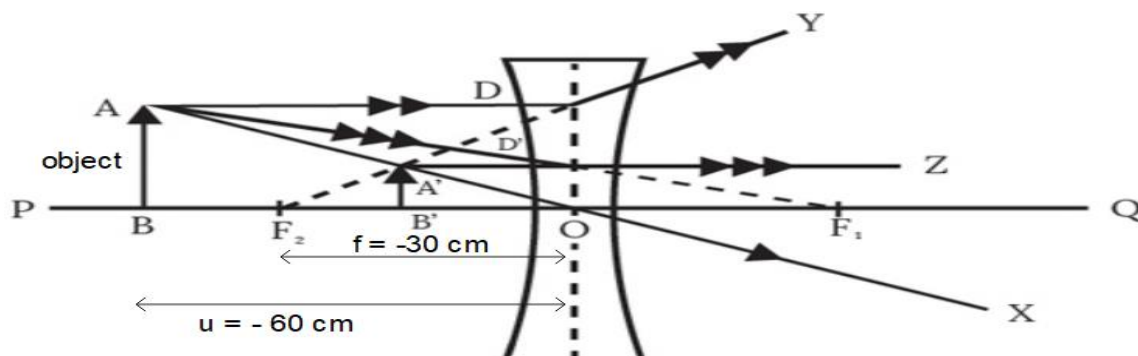
$$\Rightarrow -v = 20\text{ cm}$$

So, the distance of the image from the lens is -20 cm .

(ii) The four characteristics of the image is:

1. Nature- Virtual
2. Position- Somewhere between pole and focus of lens
3. Size- Diminished
4. Erect/ inverted- Erect as the image formed is virtual

(iii)



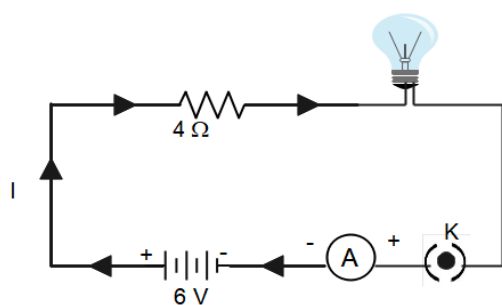
Question 20: (a) With the help of a suitable circuit diagram prove that the reciprocal of the equivalent resistance of a group of resistance joined in parallel is equal to the sum of the reciprocal of the individual resistances.

(b) In an electric circuit two resistors of $12\ \Omega$ each are joined in parallel to a $6\ V$ battery. Find the current drawn from the battery. [5]

OR

Question 20: An electric lamp of resistance $20\ \Omega$ and a conductor of resistance $4\ \Omega$ are connected to a $6\ V$ battery as shown in the circuit. calculate:

- The total resistance of the circuit,
- The current through the circuit
- The potential difference across the (i) electric lamp and (iii) conductor
- Power of the lamp



Solution: (a) Consider a circuit having three resistances R_1 , R_2 , R_3 connected in parallel with a voltage source V as shown in figure below, then total current flowing in the circuit is-

$$I = I_1 + I_2 + I_3 \dots\dots\dots (i) \text{ [Where, } I_1 = \text{current flowing across } R_1; I_2 = \text{current flowing across } R_2; I_3 = \text{current flowing across } R_3 \text{ and } I = \text{total current in the circuit}]$$

By using Ohm's law, the current in the circuit will be,

$$I = \frac{V}{R} \dots\dots\dots (ii) \text{ [Where } V = \text{voltage; } R = \text{total resistance of the circuit}]$$

Now I_1 is the current across R_1 , which is given by,

$$I_1 = \frac{V}{R_1} \dots\dots\dots (iii)$$

Similarly I_2 is the current across R_2 , which is given by,

$$I_2 = \frac{V}{R_2} \dots\dots\dots (iv)$$

and I_3 is the current across R_3 , which is given by,

$$I_3 = \frac{V}{R_3} \dots\dots\dots (v)$$

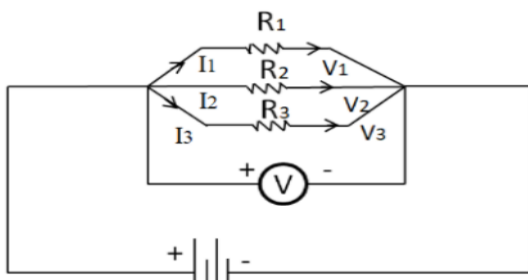
Put the values of equations (ii),(iii), (iv) and (v) in equation (i) we get,

$$\frac{V}{R} = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$$

$$\frac{V}{R} = V \left[\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \right]$$

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \dots\dots\dots (vi)$$

Hence, from equation (vi), it is proved that the reciprocal of the equivalent resistance of a group of resistance joined in parallel is equal to the sum of the reciprocal of the individual resistances.



(b) Let the two resistances are R_1 and R_2 both connected in parallel. Therefore,

$$R_1 = R_2$$

Given,

$$R_1 = R_2 = 6 \Omega$$

$$V = 6 V \quad [\text{Where } V = \text{voltage in the circuit}]$$

First calculate the total resistance in the circuit by using,

$$\frac{1}{R_{\text{parallel}}} = \frac{1}{R_1} + \frac{1}{R_2} \quad \dots\dots\dots (i)$$

Put the above values in equations (i) we get,

$$\Rightarrow \frac{1}{R_{\text{parallel}}} = \frac{1}{12} + \frac{1}{12}$$

$$\Rightarrow \frac{1}{R_{\text{parallel}}} = \frac{1+1}{12}$$

$$\Rightarrow \frac{1}{R_{\text{parallel}}} = \frac{2}{12}$$

$$\Rightarrow \frac{1}{R_{\text{parallel}}} = \frac{1}{6}$$

$$\Rightarrow R_{\text{parallel}} = 6 \Omega$$

For calculating the total current in the circuit we use ohm's law,

$$I = \frac{V}{R} \quad \dots\dots\dots (ii) \quad [I = \text{Total current flowing in the circuit}; R = \text{Total resistance in the circuit}]$$

Put the above values in equation (ii) we get,

$$I = \frac{6}{6}$$

$$I = 1 A$$

Hence the total current drawn from the battery is 1 A.

OR

Solution: Given,

$$\text{Resistance of lamp } (R_1) = 20 \Omega$$

$$\text{Resistance of conductor } (R_2) = 4 \Omega$$

$$\text{Voltage } (V) = 6 V$$

The total current in the circuit (I) = ?

Total resistance (R) = ?

The potential difference across electric lamps (V_1) = ?

The potential difference across the conductor (V_2) = ?

Power of lamp (P) = ?

(a) First we calculate total resistance in the circuit by using formula,

$$R = R_1 + R_2 \quad \dots\dots\dots (i)$$

Put the values in the above equation,

$$R = 20 + 4$$

$$= 24 \Omega \quad \dots\dots\dots (ii)$$

(b) Calculate the total current in the circuit by using ohm's law,

$$I = \frac{V}{R} \quad \dots\dots\dots (iii)$$

On putting values we get,

$$I = \frac{6}{24}$$

$$= \frac{1}{4}$$

$$= 0.25 \text{ A} \dots\dots\dots \text{(iv)}$$

(c) As bulb and conductor are connected in series so potential difference across electric lamps

$$\begin{aligned} (V_1) &= IR_1 \\ &= 0.25 \times 20 \\ &= 5 \text{ V} \end{aligned}$$

The potential difference across the conductor $(V_2) = IR_2$

$$\begin{aligned} (V_2) &= 0.25 \times 4 \\ &= 1 \text{ V} \end{aligned}$$

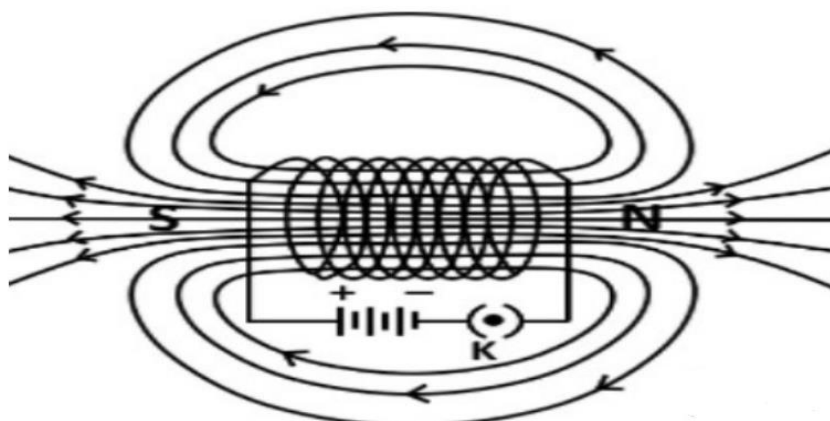
(d) The power of the lamp

$$\begin{aligned} \text{Power, } P &= VI \\ &= 5 \times 0.25 \\ &= 1.25 \text{ watt} \end{aligned}$$

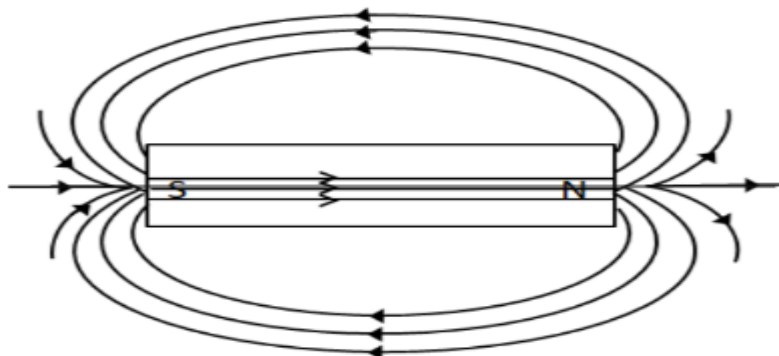
Question 21: What is a solenoid? Draw the pattern of magnetic field lines of (i) a current carrying solenoid and (ii) a bar magnet. List two distinguishing features between the two field lines.

Solution: A coil of numerous circular turns of insulated copper wire enclosed closely in the shape of a cylinder is called a solenoid.

(i) The pattern of magnetic field lines of a current carrying solenoid.



(ii) The pattern of magnetic field lines of a bar magnet.



The magnetic lines in (i) and (ii) are similar because a current-carrying solenoid behaves like a bar magnet. In both diagrams, magnetic field lines emerge from the north pole and enter the south pole. Inside the magnet magnetic field, lines are straight parallel lines moving from south to north.

The two distinguishing features between the two field lines are:

1. As we know bar magnet is a permanent magnet with fixed poles, i.e. north and south poles. Where a solenoid behaves as a magnet when an electric current is passed through it, so by changing the current direction in the coil, we can change the poles of a solenoid.
2. The strength of the magnetic field of a bar magnet is permanent. But in the case of the solenoid, the strength of the magnetic field can be increased by increasing the number of turns in the solenoid.

SECTION-E

Question 22: Blue litmus solution is added to two test tubes A and B containing dilute HCl and $NaOH$ solutions respectively. In which test tube a colour change will be observed, state the colour change and give its reasons. [2]

OR

Question 22: 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 a chemical equation for the reaction involved.

Solution: Suppose test tube A contains dilute hydrochloric acid and test tube B contains dilute sodium hydroxide. Now add a blue litmus solution to both the test tubes. As soon as you put the litmus solution, the colour in tube A changes from blue to red, whereas the colour of test tube B remains the same. The colour changes from blue to red signify that in test tube A, acid is present, and in test tube B, the base is present, which does not change the colour of the litmus solution.

OR

Solution: $Na_2CO_{3(s)} + 2 HCl_{(aq)} \rightarrow 2 NaCl_{(aq)} + CO_{2(g)} + H_2O_{(l)}$ (i)

[where $Na_2CO_{3(s)}$ = sodium carbonate; $HCl_{(aq)}$ = Hydrochloric acid; $NaCl_{(aq)}$ = sodium chloride; $CO_{2(g)}$ = carbon dioxide and $H_2O_{(l)}$ = water]

In equation (i), we see that when you react 2 g of sodium carbonate with an acid, i.e. HCl (2 ml), sodium chloride, water and carbon dioxide are formed with brisk effervescence.

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 taken. In which test will the length of the form (lather) be longest? justify your answer. [2]

Solution:

1. In test tube A, distilled water is poured. Now, if we add an equal amount of soap solution, then we observe the length of form is the longest because distilled water is pure water. It has no free ions present in it.
2. In test tube B, underground water is poured, containing ions of Mg^{+2} , Ca^{+2} , etc. Pouring soap solution into it will form salts of fatty acids called scum insoluble in water. We observe the length of the form is less in comparison with test tube A
3. In test tube C, distilled water is poured. Now add small $CaSO_4$, which contains ions of Ca^{+2} . It will react with soap to form salts of fatty acids, so again, the length of form will be less in this case.

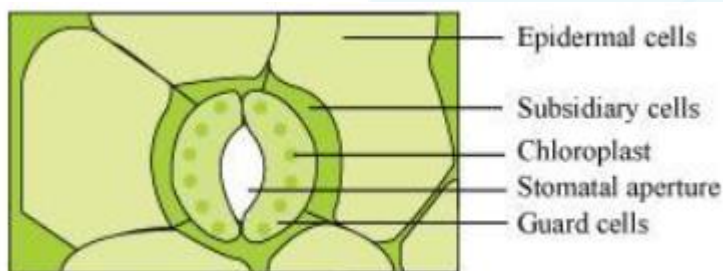
Conclusion: From test tubes A, B and C, Test tube A will have the longest soap form length.

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. [2]

OR

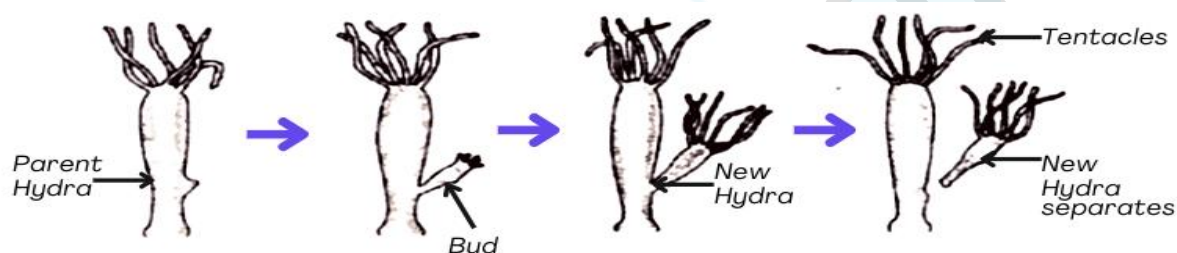
Question 24: Draw labelled diagrams in proper sequence to show budding in hydra.

Solution: The small pores present in the epidermis are known as stomata. The stomatal pore is encased between two bean-shaped guard cells. The guard cell's inner walls are thick, while the outer walls are thin. The guard cells are enclosed by subsidiary cells. These are the special epidermal cells present around the guard cells. The pores, the guard cells, and the subsidiary cells constitute the stomatal apparatus.



OR

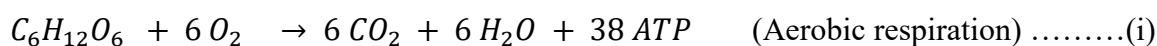
Reproduction in hydra is done by using regenerative cells in the process of budding. In hydra, a bud grows as an outgrowth due to repeated cell division at one specific site. When fully mature, these buds develop into tiny individuals, detach from the parent body and become new independent individuals, as shown in the figure below.



Question 25: In the experimental setup 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. [2]

Solution: In a conical flask, germinating seeds are present along with KOH , which is kept in a small test tube hung with the thread inside the conical flask. The conical flask is closed with a lid. In the lid, there is a small hole from which the pipe is put and reaches the beaker, in which water is filled with water. Now germinated seeds produce CO_2 , which is absorbed by KOH , which causes the flask to become vacuum sealed. Now the flask receives the air in the bent glass tube. Therefore the water level in the curved tube rises up. The consequences of using KOH are:

1. KOH acts as an absorber, so the whole CO_2 , liberated by germinating seeds, gets absorbed by KOH to prevent it from being used by the plant for photosynthesis.
2. The gas produced in the conical flask will not come out, nor the air or any other gas enter it.
3. Germinating seed produces CO_2 via the following reactions:-



[Where $C_6H_{12}O_6$ = glucose; O_2 = oxygen; H_2O = water, ATP = adenotripshate]

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 resistor using this graph. [2]

OR

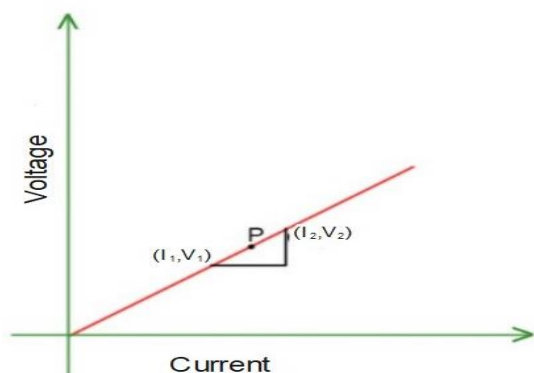
Question 26: What would you suggest to a student if while performing an experiment he finds the pointer/needle of the ammeter and voltmeter do not coincide with the zero marks on the scales when the circuit is open? No extra ammeter/voltmeter is available in the laboratory.

Solution: A student took 5 readings for different current values and plotted a graph between V and I . The student got a straight-line graph passing through the origin when he plotted all 5 readings on graph paper. The straight line here signifies Ohm's law. It states, "The potential difference V , across the ends of a given metallic wire in an electric circuit is directly proportional to the current I flowing through it, provided its temperature remains the same." Mathematically, $V \propto I$ or $VI \text{ constant} = R$

$$\Rightarrow V = IR \quad [\text{where } V = \text{voltage, } R = \text{resistance and } I = \text{current}]$$

R = constant called resistance which opposes the flow of electric current through the conductor. Thus Resistance, $R = \frac{V}{I}$. By using this relation, a student can easily find out the resistance. Its SI unit Ω . High resistances are measured in the units *kilo – Ohm and mega Ohm* etc.

The given graph verifies Ohm's law



OR

The pointer/needle of the ammeter and voltmeter do not coincide with the zero marks on the scales when the circuit is open, which means both instruments have zero errors. So firstly, the student should calculate the zero error and add as many least counts as needed to add up to the

point where the needle coincides. Now subtract the values of the ammeter and voltmeter values when both circuits are open to the reading when the student is doing experiments.

$$\text{Actual reading} = \text{Final reading} - \text{Initial reading}$$

Question 27: List four precautions which a student should observe while determining the focal length of a given convex lens by obtaining an image of a distant object on a screen. [2]

Solution: Four precautions that a student should observe while determining the focal length of a given convex lens by obtaining an image of a distant object on a screen are:

1. Convex lens should be fixed vertically in a holder.
2. The image formed on the screen should be accurate and sharp.
3. The distant object should be visible.
4. The position of the meter scale should be at the correct place between the wall and the centre of the convex lens.