CBSE Class 10

Science

Previous Year Question Paper 2020

Series: JBB/1 **Set– 1**

Code no. 31/1/1

- Please check that this paper contains **15** printed pages.
- Code number given on the right-hand side of the question paper should be written on the title page of the answer-book by the candidate.
- Please check that this question paper contains **30** questions.
- **Please write down the Serial Number of the question in the answer-book before attempting it.**
- 15 minutes of time has been allotted to read this question paper. The question paper will be distributed at 10.15 a.m. From 10.15 a.m. to 10.30 a.m., the students will read the question paper only and will not write any answer on the answer-book during this period.

SCIENCE

Time Allowed: **3** hours Maximum Marks: **80**

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 comprise multiple choice questions (MCQ), very short answer (VSA), and Assertion-Reason type questions. Answers 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, Answers 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 abovementioned 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.

SECTION - A

1. Name acyclic unsaturated carbon compound. 1 Mark

Ans: Acyclic unsaturated carbon compounds are those which contain double or triple bonds between carbon atoms and are acyclic in nature. For example: Butene.

2. The change in magnetic field lines in a coil is the cause of induced electric current in it. Name the underlying phenomenon. 1 Mark

Ans: According to the phenomenon of electromagnetic induction, the change in magnetic field lines in a coil is the cause of induced electric current in it.

Answer question numbers 3(a) to 3(d) and 4(a) to 4(d) on the basis of your understanding of the following paragraphs and the related studied concepts.

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 the population.

(a) List two common signs of sexual maturation in boys and girls. 1 Mark

Ans: Two common signs of sexual maturation in boys and girls are:

1. Pubic, underarm and facial hair development.

2. Common signs of acne development.

(b) What is the result of reckless female foeticide? 1 Mark

Ans: The reckless female foeticide will ultimately result in men: women ratio. Since due to foeticide the number of females decreases with respect to the number of males.

(c) Which contraceptive method changes the hormonal balance of the body? 1 Mark

Ans: The oral contraceptive method changes the hormonal balance of the body so this woman does not ovulate by taking such pills.

(d) Write two factors that determine the size of a population. 1 Mark

Ans: Two factors which determine the size of population are:

1. Birth rate

2. Death rate

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 biodegradable, 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? 1 Mark

Ans: Pesticides are extensively used for good production of crops and these crops will be consumed by us. Hence these pesticides transfer to the human body. Therefore 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. 1 Mark

Ans: Before eating food we must ensure to wash it properly so that if there is a layer of pesticides on the fruit then it gets washed.

(c) Various steps in a food chain represent: 1 Mark

(a) Food web **(b) Trophic level**

(c) Ecosystem **(d) Biomagnification**

Ans: The various steps which are represented in the food chain are known as trophic level Each trophic level represents a class of organism.

Hence the correct option is (b).

(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** **1 Mark**

Ans: According to various food chains operating in the ecosystem, a man is a consumer which does not produce anything of its own. It only consumes.

Hence the correct option is (a).

5. Calcium oxide reacts vigorously with water to produce slaked lime.

$$\mathbf{CaO_{(s)} + H_2O_{(l)} \rightarrow Ca(OH)_{2(aq.)}}$$

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)** **1 Mark**

Ans: The above reaction is an exothermic in nature which releases large amounts of heat and it is an example of a combination reaction.

Hence the correct option is (d).

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: **1 Mark**

(a) Combination reaction **(b) Displacement reaction**

(c) Decomposition reaction **(d) Double displacement reaction**

Ans: The reaction can be represented as:

$$H_2S_{(g)} + CuSO_{4(aq.)} \rightarrow CuS_{(s)} + H_2SO_{4(aq.)}$$

Thus it is a double displacement reaction.

Hence the correct option is (d).

6. In a double displacement reaction such as the reaction between sodium sulphate solution and barium chloride solution: **1 Mark**

(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)**

Ans: The reaction can be represented as:

$BaCl_2 + NaSO_4 \rightarrow NaCl + BaSO_4(\downarrow)$

Sodium chloride is not an insoluble salt therefore the correct options are A and C.

Hence the correct option is (b).

7. Baking soda is a mixture of: **1 Mark**

(a) Sodium carbonate and acetic acid

(b) Sodium carbonate and tartaric acid

(c) Sodium hydrogen carbonate and tartaric acid

(d) Sodium hydrogen carbonate and acetic acid

Ans: Baking soda is sodium bicarbonate which is $NaHCO_3$ which is a mixture of sodium hydrogen carbonate and tartaric acid.

Hence the correct option is (c).

8. The chemical formula for plaster of Paris is: **1 Mark**

(a) $\mathbf{CaSO_4.2H_2O}$ **(b)** $\mathbf{CaSO_4.H_2O}$

(c) $\mathbf{CaSO_4.\frac{1}{2}H_2O}$ **(d)** $\mathbf{2CaSO_4.H_2O}$

Ans: The correct formula for plaster of Paris is $CaSO_4.2H_2O$.

Hence the correct option is (a).

9. The laws of reflection hold true for: **1 Mark**

(a) plane mirrors only **(b) concave mirrors only**

(c) convex mirrors only **(d) all reflecting surfaces**

Ans: The laws of reflection hold true for all reflecting surfaces.

Hence the correct option is (d).

Or

When an object is kept within the focus of a concave mirror, an enlarged image is formed behind the mirror. This image is: 1 Mark

(a) real (b) inverted

(c) virtual and inverted (d) virtual and erect

Ans: The nature of the image will be virtual and erect.

Hence the correct option is (d).

10. At the time of short circuit, the electric current in the circuit: 1 Mark

(a) vary continuously (b) does not change

(c) reduces substantially (d) increases heavily

Ans: At time of short circuit the current increases heavily which will burn our devices too.

Hence the correct option is (d).

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: 1 Mark

(a) 0.4A (b) 0.6A

(c) 0.8A (d) 1A

Ans: The current will always be equal in series connection. Therefore current will be 1A.

Hence the correct option is (d).

12. Incomplete combustion of coal and petroleum: 1 Mark

(A) increases air pollution.

(B) increases the 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)**

Ans: Incomplete combustion of petrol will increase the air pollution and produce the poisonous gases consequently.

Hence the correct option is (b).

For question numbers 13 and 14, two statements are given – one labelled Assertion (A) and the other labelled Reason (R). 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 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.

13. 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. 1 Mark

Ans: Esterification is the process by which ester is formed and ester is a sweet smelling substance. When this ester reacts with sodium hydroxide an alcohol and sodium salt of carboxylic acid are obtained. Thus Assertion is true but reason is not correct explanation because ester smell because of volatile in nature.

Hence the correct option is (b).

14. Assertion (A): In the process of nuclear fission, the amount of nuclear energy generated by the fission of an atom of uranium is so tremendous that

it produces 10 million times the energy produced by the combustion of an atom of carbon from coal.

Reason (R): The nucleus of a heavy atom such as uranium, when bombarded with low energy neutrons, splits apart into lighter nuclei. The mass difference between the original nucleus and the product nuclei gets converted to tremendous energy. **1 Mark**

Ans: Nuclear fission produces a large amount of energy and this energy is produced as the result of bombardment of uranium with low energy neutrons. Thus both are true and reason is the correct explanation of assertion.

Hence the correct option is (a).

SECTION-B

15. 1g 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 reactions, the name and the color of the products formed in each case.
3 Marks

Ans: When 1*g* Copper powder is taken in a china dish and then it is heated, a black colored substance is formed which is known as copper oxide. The above reaction can be represented by using the equation as:

$$2Cu+O_2 \xrightarrow{\text{Heat}} 2CuO_{(black)}$$

This is because the copper is being oxidized to copper oxide which is black in color. Now when hydrogen gas is passed over this heated substance which is copper oxide then the copper metal is obtained. The reaction can be represented as:

$$CuO_{(black)}+H_2 \xrightarrow{\text{Heat}} Cu_{(s)} + H_2O_{(l)}$$

Thus we get copper back on heating the copper oxide with hydrogen gas and also water is formed as a by-product of reaction.

16. List the important products of the Chlor-alkali process. Write one important use of each. **3 Marks**

Ans: The chlor-alkali process is used in the electrolysis of sodium chloride $(NaCl)$. The important products which are formed during the electrolysis of sodium chloride are:

$$2NaCl+2H_2O \rightarrow 2NaOH + Cl_2 + H_2$$

The important products are sodium hydroxide, chlorine and hydrogen gas. When the electric current is passed through the aqueous solution of sodium chloride then hydrogen gas is formed at cathode and chlorine gas is formed at anode. Their uses are listed below:

(a) Sodium Hydroxide: It is used in manufacturing of soaps and detergents.

(b) Chlorine gas: It is used in pesticides and manufacturing of PVC pipes.

(c) Hydrogen gas: It is used in fuels and reduction reactions also.

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? 3 Marks

Ans: Washing soda can be prepared from sodium carbonate by adding ten molecules of water of crystallization. It is then known as sodium carbonate decahydrate or we can simply call it a washing soda in common name. The reaction of adding water of crystallization can be shown as:

$$Na_2CO_3+10H_2O \rightarrow Na_2CO_3.10H_2O$$

Washing soda is a sodium salt and we know that sodium salt is basic in nature. Therefore sodium carbonate is basic in nature and it is basic salt.

Basically there are two types of hardness in water which are temporary hardness and permanent hardness. Washing soda is used to remove both types of hardness. When we add washing soda in water it adds a large amount of carbonate ions in water which will react with calcium and magnesium ions to form insoluble precipitates and thus cleansing action is completed.

17. A 3 ml ethanol is taken in a test tube and warmed gently in a water bath. A 5% a solution of alkaline potassium permanganate is added first drop by drop to this solution, then in excess.

(i) How is 5% solution of $KMnO_4$ prepared?

(ii) State the role of alkaline potassium permanganate in this reaction. What happens when you add it in excess?

(iii) Write the chemical equation of this reaction. **3 Marks**

Ans:

(i) 5% solution of $KMnO_4$ is the solution in which there is 5 g of $KMnO_4$ is dissolved in 100 ml solution. Therefore it is ratio of weight of $KMnO_4$ and the volume of solution. It can be prepared in the following steps as:

(a)Take 100 ml of distilled water in a beaker.

(b) Now add 5 g of $KMnO_4$ into beaker gently and thus it from the 5% solution of $KMnO_4$.

(ii) When the alkaline potassium permanganate is added to ethanol then the ethanol gets oxidized. This is because alkaline potassium permanganate is an oxidizing agent which will oxidize the alcohol into carboxylic acid. The reaction between them can be shown as:

$$KMnO_4 \xrightarrow{C_2H_5OH} CH_3COOH$$

Here in the above reaction alkaline potassium permanganate acts as an oxidizing agent. When we add excess alkaline potassium permanganate then the purple color will persist.

(iii) The equation for the chemical reaction will be:

$$KMnO_4 + C_2H_5OH \rightarrow CH_3COOH$$

18. A squirrel is in a scary situation. Its body has to prepare for either fighting or running away. State the immediate changes that take place in its body so that the squirrel is able to either fight or run? **3 Marks**

Ans: There will be some immediate changes that take place in its body for the squirrel to be ready to fight or run away. These changes are listed below as:

(a) There will be release of adrenaline hormone which will cause an increase in the pumping rate of the heart and also the breathing rate of squirrels increases.

(b) There will be a change in blood pressure and the dilation of the pupil which helps while running.

(c) The hypothalamus of the squirrel activates the sympathetic nervous system and thus releases the adrenaline from adrenal gland.

(d) At that time the digestive activities and reproductive activities stop for a moment.

All these changes made squirrels to be active while running or fighting like situations.

Or

Why is chemical communication better than electrical impulses as a means of communication between cells in a multicellular organism? 3 Marks

Ans: Chemical communications is better than electrical impulses as means of communication between cells in a multicellular organism because of the following reasons:

(a) Chemical communication involves the communication which takes place through hormones. Thus it does not require any specialized tissue like nervous tissue which is used for electrical impulses.

(b) Since electric communication is limited to only certain regions. These regions are connected by nerves while the chemical connection is not specific to some regions, it is all over the body.

(c) In chemical communication signals are sent persistently and steadily while in nervous communication it can be done only at certain intervals of time.

19. Define the term pollination. Differentiate between self pollination and cross pollination. What is the significance of pollination? 3 Marks

Ans: Pollination can be defined as the act of transferring of pollen grains from the anther of male flower to stigma of female flower. After the pollination the seeds can be produced which will create offspring.

Self-Pollination	Cross Pollination
When the pollen grains transfer from anther of the same flower to the stigma of the same flower then this	When the pollen grains transfer from anther of flower to the stigma of different flowers then this kind of

kind of pollination is called self-pollination.	pollination is called cross pollination.
Here pollinating agents are not necessary.	Here pollinating agents are necessary for the transfer of pollen grains.

Significance of pollination:

The transfer of pollen grains is significant as it helps in fertilization by bringing male gamete to female egg and thus it helps in the production of seed and which will ultimately produce new offspring.

20. What are homologous structures? Give an example. Is it necessary that homologous structures always have a common ancestor? Justify your answer. 3 Marks

Ans: Homologous structures are those structures which have common basic structure but they perform different operations or functions. Thus we can say that homologous structures are similar to each other but they are modified to perform different functions.

For example: forelimbs of reptiles, amphibians and mammals have the same structure but they can perform different functions.

The Arms of human beings, wings of birds and the front legs of horses are homologous structures.

Yes, homologous structures have common ancestors but they are modified to carry out different operations or activities. The basic structure of the arms of the humans and wings of the bird are similar in structure but they are modified and hence perform different operations in different individuals. Arms of human beings cannot be used for flying while that of birds does. Thus we can say that they have common ancestors but perform different functions.

21. Why is the Tyndall effect shown by colloidal particles? State four instances of observing the Tyndall effect. 3 Marks

Ans: The scattering of light in a colloidal dispersion medium by colloidal particle is known as the Tyndall effect. When the same light is passed through pure medium then no such scattering of light takes place. Thus it is a property of colloidal particles to scatter the light when it passes through it. Hence we can say

that the Tyndall effect is used to determine whether a mixture is a true solution or a colloidal solution. The instances where we can see this Tyndall effect are listed below:

(a) The Tyndall effect can be shown when headlights of a car turns on on a foggy day. The light from the headlight gets scattered by the colloidal particles of the fog and thus we can see colloidal particles too.

(b) When sunlight passes through the canopy of the forest then we can see the scattering of light at the top of the tree which is the canopy region.

(c) The Tyndall effect can be visible when light enters a dark room through a hole and thus we can easily see the light scattered by the particles in the way of the light.

(d)When we direct the beam of light into the glass full of milk then we can also see this effect too.

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? 3 Marks

Ans: The difference between glass slab and glass prism is listed as:

Glass Slab	Glass Prism
It is a transparent substance in which reflecting surfaces are parallel to each other.	It is also a transparent substance in which reflecting surfaces are at an angle.
It is rectangular in shape.	It has two triangular sides inclined to each other and a rectangular base.
The direction of incident ray and emergent ray are parallel to each other.	The direction of incident ray and emergent ray are not parallel to each other.

(i) When the narrow beam of monochromatic light get passed through:

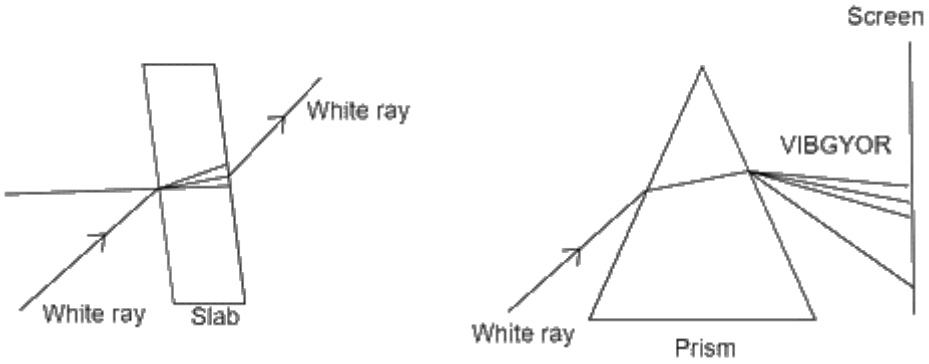
(a) Glass slab: It will deviate from the actual path but we know that the direction of the incident ray and the emergent ray are parallel to each other.

(b) Glass prism: There is splitting of white into seven colors and the direction of incident ray and emergent ray are not parallel to each other.

(ii) When the narrow beam of white light get passed through:

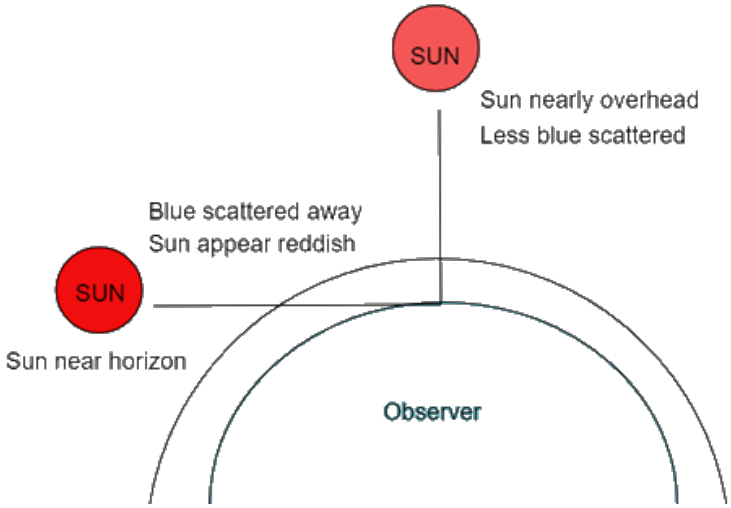
(a) Glass slab: When it strikes the first surface then splitting of white light takes place and when it strikes on the second surface then it comes out as single white light.

(b) When it falls on a prism, white light gets dispersed into seven different colors on the screen placed in front of the prism.



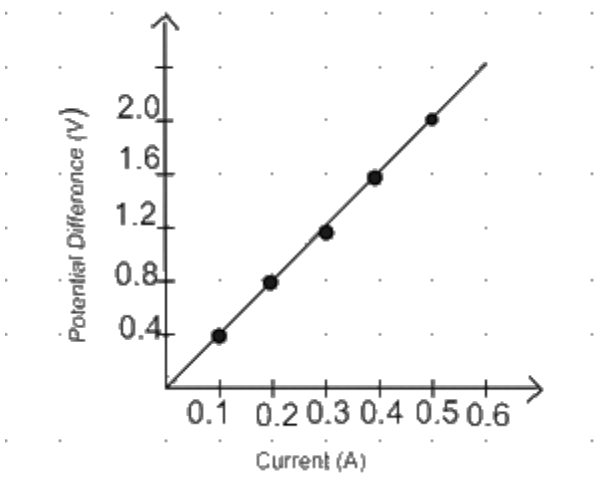
22. Draw a labelled diagram to show (i) reddish appearance of the sun at the sunrise or the sunset and (ii) white appearance of the sun at noon when it is overhead. **3 Marks**

Ans: When the sun is near the horizon then it appears to be reddish in color because as the light passes through the atmosphere enters at slant angle and due to which a large amount of scattering of light takes place. The blue light of the sky gets scarier than the red light of the sun thus we can see the reddish color of the sun more precisely. The same phenomena does not happen at noon.



23. A V-I graph for a nichrome wire is given below. What do you infer from this graph? Draw a labelled circuit diagram to obtain such a graph.

3 Marks



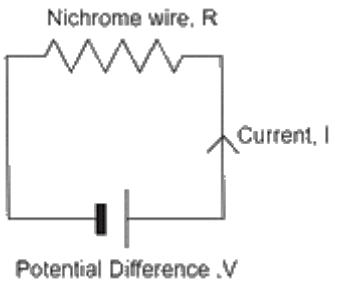
Ans: From the above we can see that there is a linear relation between the potential difference(V) and current (A), therefore it gives a straight line between them. We can depict that when we increase the potential difference across the nichrome wire then the current also increases in a constant ratio respectively. Thus we can say that the resistance of nichrome wire is constant. Since there is a linear relation between the current and potential difference we can say that the nichrome wire follows the ohm' law.

According to ohm's law there is a linear relation between the applied potential difference and the current passing through wire. It can be represented as:

$V \propto I$

$\Rightarrow V=IR$

Hence we can draw the circuit diagram of the above graph as:



Thus the resistance of nichrome wire is R and current passing through it is I. It is an ohmic device which follows ohm's law.

24. **3 Marks**

(a) Write the mathematical expression for Joule's law of heating:

Ans: (a) According to Joule's of heating when a current, I passes through conductor of resistance r, for time t, then the amount of heat produced in the conductor will be equal to product of square of current , the resistance and time. This can be represented as:

$H=i^2rt$

The S.I unit of energy is Joules.

(b) Compute the heat generated while transferring 96000 coulomb of charge in two hours through a potential difference 40 V.

Ans: Here the amount of charge, Q is $9600\ C$ and time for this flow of charge is $2\ hr$ which is equal to $7200\ s$. Hence we can find the electric current as:

$$i=\frac{Q}{t}$$

$$i=\frac{9600}{7200}=\frac{40}{3}\ A$$

Since we know that $V=ir$ the above equation can be reduced as:

$H=Vit$

It is given that $V=40\ V$, therefore the amount of heat can be calculated as:

$$H=40\times\frac{40}{3}\times7200$$

$H=3840000\ J$

$H=3.84\times10^6\ J$

SECTION-C

25. 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.

5 Marks

Ans: Carbon cannot reduce the oxides of sodium, magnesium and aluminium to their respective metals because sodium, magnesium and aluminium have higher affinity towards oxygen then that of carbon. This is because all these are highly reactive metals and thus it requires a lot of energy to reduce their oxides.

According to the reactivity series of metals which helps in finding the more reactive elements, it is found that sodium, magnesium and aluminium are more reactive than carbon and thus placed at higher levels than carbon in the reactivity series of elements. Therefore being less reactive, carbon is not used for extraction of sodium, magnesium and aluminium from their ores.

Such metals which are highly reactive than carbon elements are extracted by the help of electrolytic reduction process. It is also known as electrolysis of the molten solution of the ore. Thus we can say that sodium can be obtained with the help of electrolysis of its salt. In electrolysis a sufficient amount of current is passed through the aqueous solution and thus it breaks into its respective ions and thus metals get collected at cathode. The reaction can be represented as:

At cathode: $Na^+ + e^- \rightarrow Na$

At anode: $Cl^- \rightarrow \frac{1}{2}Cl_2 + e^-$

Therefore we get the pure metal at cathode. This method is basically used for elements which cannot be reduced by carbon.

26. 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:

(i) 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 the largest atomic size?

(v) To which family docs H, C and F belong? **5 Marks**

Ans: (i) The element which forms covalent compounds must have valence electrons greater than three and less than eight. Thus we can say that elements E and B will have a tendency to form covalent compounds.

(ii) Non-metals are present at the right hand side of the periodic table. They have a tendency to accept electrons. Thus we can say that element E will be non-metal and it can accept two electrons to form inert in nature.

(iii) Metals are present on the left hand side of the periodic table and they have a tendency to lose electrons. Thus we can say that G, A and D are metals. But D element will have a valency of 2.

(iv) As we go down the group the size of the element increases in the same group. Hence we can say that out of H, C and F , F has the largest atomic size. The size of atoms increases as the number of shells increases.

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? **5 Marks**

Ans: Atomic size: The distance between the centre of the nucleus of an atom and its outermost shell is known as the atomic size of an atom. The atomic size varies as the number of shells inside the atom increases. A atom having more number of shells will have more atomic size than an atom having less number of shells.

The atomic size is the distance between the nucleus of atom to outermost shell, hence it is measure in Angstrom $\left(\overset{\circ}{\text{A}}\right)$.

$1\overset{\circ}{\text{A}} = 10^{-10}\text{m}$

Trend observed in atomic radius in a group and period in modern periodic table:

Along the periods: When we move along the periods from left to right in a period the atomic radius of elements gradually decreases. The decrease in atomic radius is due to an increase in effective nuclear energy and more attraction between the electron and the nucleus of the atom. Since the shell does not increase and number of electrons increases which increases the attraction between the electrons and nucleus of the atom. This attraction will ultimately shrink the size of atoms. Therefore we can say that along the periods while moving from left to right the atomic radius decreases generally.

Down the groups: When we move down the group from top to bottom the atomic radius increases gradually. This is because the number of shells increases at each down element. Thus the number of shells increases at every element while moving down the group which ultimately increases the size of the element. Therefore we can say that the atomic radius increases while moving down the group.

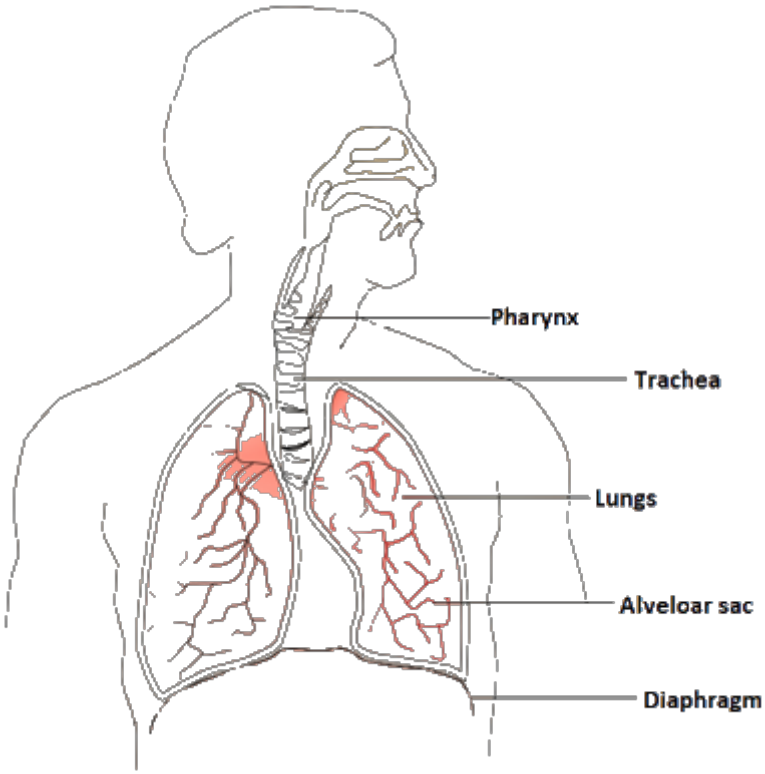
27. **5 Marks**

(a) Why is there a difference in the rate of breathing between aquatic organisms and terrestrial organisms? Explain.

Ans: One complete breath includes single inhalation and exhalation of air. Thus rate of breathing is the number of times a complete breath takes place in a minute. Rate of breathing is different in aquatic organisms and terrestrial organisms. This is because aquatic organisms like fishes obtain their oxygen from water which is present in dissolved state through their gills. Since we know that the amount of dissolved oxygen in water is less as compared to oxygen present in undissolved form in air. Thus they have high breathing rates to meet the breathing requirements. They breathe faster than humans to meet the oxygen demand of the body. Thus it is also seen that swimmers breathe at a faster rate when they swim across the river. Therefore there is a difference of breathing rates in both aquatic organisms and terrestrial organisms.

(b) Draw a diagram of the human respiratory system and label - pharynx, trachea, lungs, diaphragm and alveolar sac on it.

Ans: The human respiratory system can be shown as:



Or

5 Marks

(a) Name the organs that form the excretory system in human beings.

Ans: Human excretory system consists of following organs:

1.Two kidneys : Kidneys are located at one on each side of the spine at the level of the liver. Kidneys are the important organ of the human body and it is present in pairs. Kidney helps in purification of blood.

2.A urinary bladder: It is a sac-like structure and it stores urine until the process of expelling the urine. It receives urine from the ureters which are connected to each kidney separately.

3. Urethra: It is a tube -like structure which arises from the urinary bladder. It is shorter in females and longer in males. In males, it is a common path for sperms and urine both.

(b) Describe in brief how urine is produced in the human body.

Ans: The human body produces the waste chemical compounds like urea and uric acid with the help of urine. These waste are filtered with the help of the kidney.

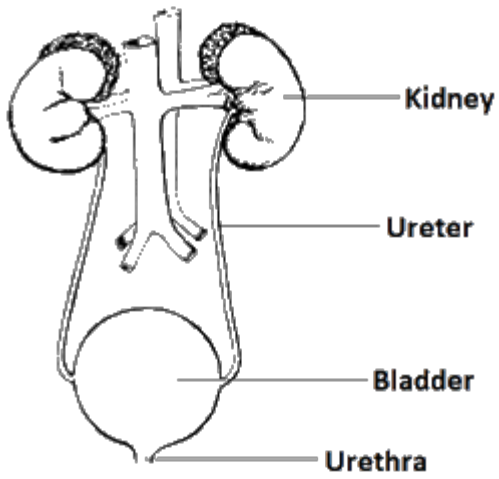
Thus we can say that the main role of the kidney is to filter our blood and produce the waste excreted out in the form of urine.

Basically the kidney contains a basic structure called nephrons which helps in the filtration process. It has two parts:

1. Bowman's Capsule: It is a cup shaped structure which consists of a coiled tube of blood capillary. This helps in the filtration process.

2. Renal Tubule: Now the filtrate obtained from Bowman's capsule goes into renal tubule. But some of the substances like amino acids and salts get absorbed in their initial state. The rest of water which contains only uric acid and urea gets passed through the tubule.

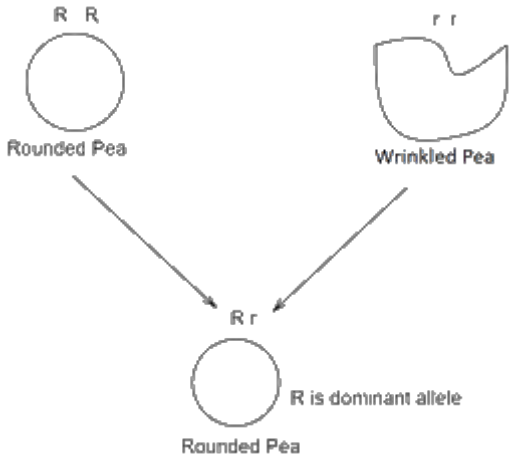
Now it moves through a duct and moves towards the urinary bladder where it gets stored and excreted out from the body in the form of urine.



28. **5 Marks**

(a) What is the law of dominance of traits? Explain with an example.

Ans: The law of dominance of traits states that in a heterozygous or we can say in a hybrid condition the allele having the characters expressed over the other allele is the dominant allele.



Here in the parent generation one of them is homozygous dominant and the other one is homozygous recessive allele. The first one gamete has the dominant pea shape structure while the other one gamete has the recessive structure. After he fertilization takes place, the first generation F_1 would have heterozygous conditions among the both alleles the 'R' character expresses over the 'r' allele. Thus we can say that here 'R' is the dominant allele.

(b) Why are the traits acquired during the lifetime of an individual not inherited? Explain.

Ans: The traits which are inherited during the lifetime cannot be inherited to successive generations as the changes do not reflect in the DNA of the germ cells. The traits acquired during the lifetime brings the change in non-reproductive tissues which cannot be passed to germ cells. Thus we can say these acquired traits cannot be passed to successive generations.

For example: a swimmer good at swimming cannot pass this acquired trait to successive generations as it brings changes only in non-reproductive cells which do not take part in reproduction.

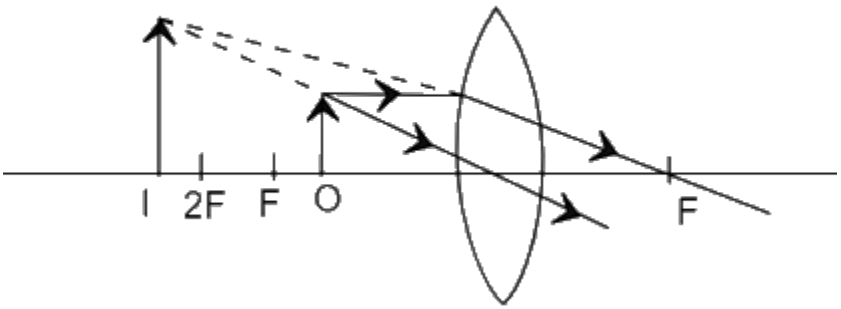
29. Draw a ray diagram in each of the following cases to show the formation of image, when the object is placed:

(i) between the optical centre and principal focus of a convex lens.

State the signs and values of magnifications in the above-mentioned cases (i) and (ii). 5 Marks

Ans: (i) Let us suppose O be the object and I be the image then the image can be formed as:

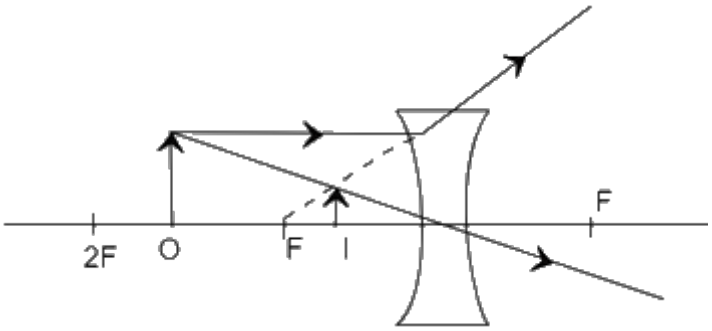
The image formed is enlarged and erect. Therefore its magnification will be positive and since it is enlarged therefore magnification will be greater than one.



(ii) anywhere in front of a concave lens.

Ans: Let us suppose O be the object and I be the image then the image can be formed as:

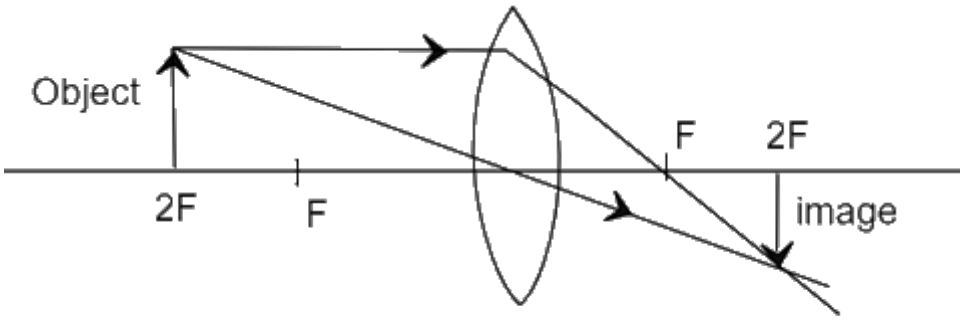
The image formed is diminished and erect. Therefore its magnification will be positive and since it is diminished therefore magnification will be less than one.



(iii) at 2F of a convex lens.

Ans: Let us suppose O be the object and I be the image then the image can be formed as:

The image will be formed at $2F$ on the other side of the lens and its magnification will be the same as that of the object.



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. **5 Marks**

(i) At what distance from the mirror should a screen be placed in order to obtain a sharp image?

Ans: Here, height of object, h_i=4 cm

Object distance u=25 cm

Focal length f=15 cm

We know that:

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

V is the image distance , object distance is taken as negative and focal length of concave mirror is always negative. Therefore,

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

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

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

$$\Rightarrow \frac{1}{v}=\frac{-2}{75}$$

v=-37.5 cm

(ii) Find the size of the image.

Ans: Magnification, $m=\frac{-v}{u}=\frac{h_i}{h_o}$

$\Rightarrow m=\frac{-(-37.5)}{-25}=\frac{h_i}{4}$

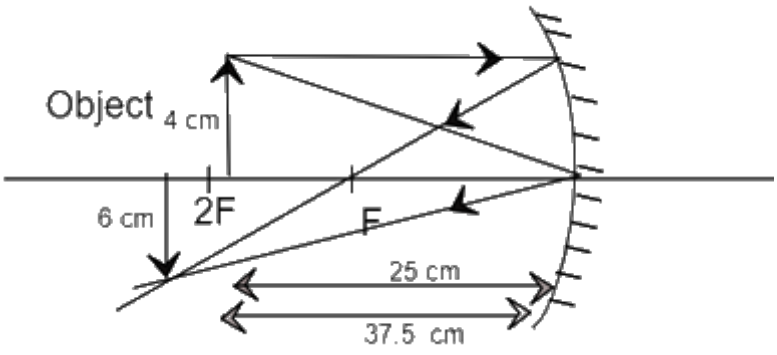
$\Rightarrow h_i=\frac{4\times 37.5}{-25}$

$\Rightarrow h_i=-6$ cm

Therefore height of image will be -6 cm. The image will be real and inverted.

(iii) Draw a ray diagram to show the formation of the image in this case.

Ans:



30. **5 Marks**

(a) What is an electromagnet? List any two uses.

Ans: An electromagnet is a type of magnet in which the magnetic field is produced by passing the electric current. Thus whenever the electric current passes through the electromagnet then it will behave like a magnet. It is also known as a temporary magnet. Its magnetism is not permanent in nature.

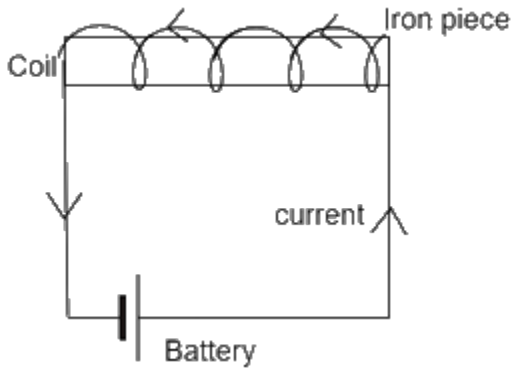
Uses of electromagnet:

1.It is used in lifting heavy weight objects.

2.It is used in transformers.

(b) Draw a labelled diagram to show how an electromagnet is made.

Ans:



(c) State the purpose of the soft iron core used in making an electromagnet.

Ans: The soft iron core is used in electromagnets because the soft iron core has high magnetic properties. Because of its magnetic capability it is used in electromagnetism. It can provide a strong magnet when it is used as a core material in the electromagnets.

(d) List two ways of increasing the strength of an electromagnet if the material of the electromagnet is fixed.

Ans: Ways of increasing the strength of an electromagnet if the material of the electromagnet is fixed are listed below as:

1. By increasing the number of turns in the coil of electromagnet we can increase its magnetic strength.

2. By increasing the amount of current we can also increase its strength. But the amount of current should be increased in the limit of the coil as more current will burn out the coil. Thus the heating effect of the coil must be remembered while increasing current.

Class X Science
CBSE-2019

Time: 3Hr
Maximum Marks: 80

General Instructions:

I. *The question paper comprises five sections**. A. B. C. D and E.** You have 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.*

Section A

1. If you could use any source of energy for heating your food which one would you prefer? State one reason for your choice.

ANSWER: If I could use any source of energy for heating food then I would prefer solar energy because:
1)It is available in abundance
2)Energy from Sun is available to every individual
3)Solar energy also preserves the natural nutrients of food by cooking it slowly at low temperature.
4)It is economical.

2. Write the function of voltmeter in an electric circuit.

ANSWER: The function of the voltmeter in a circuit is to measure the voltage drop across any appliance. The voltmeter is always connected parallel in the circuit.

3. What happens to the image distance in the normal human eye when we decrease the distance of an object, say 10 m to 1 m ? Justify your answer.

ANSWER: If the object distance is greater than 25 cm the image is always formed on the retina as the focal length of the human eye lens gets adjusted depending on the object distance. This special property of human eye is called as power of accommodation. Hence, image distance will remain same if object distance changes from 10 m to 1 m.

4. List two different functions performed by pancreas in our body.

ANSWER: The pancreas contains both the endocrine and exocrine portions. The exocrine region secretes sodium bicarbonate and many digestive enzymes. The pancreatic amylase causes breakdown of starch, pancreatic lipase causes breakdown of lipids, and trypsin causes digestion of proteins The endocrine regions secrete hormones i.e. insulin and glucagon. These hormones regulate the level of glucose in the blood. Insulin decreases while glucagon increases the blood glucose level.

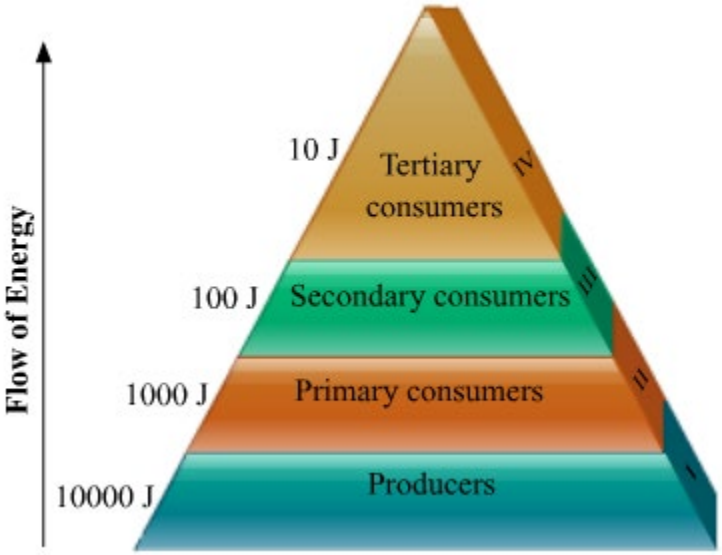
5. How it can be proved that the basic structure of the Modern Periodic Table is based on the electronic configuration of atoms of different elements?
OR
The electronic configuration of an element is 2, 8, 4. State its:
(a) group and period in the Modern Periodic Table.
(b) name and write its one physical property.

ANSWER: 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.

6. 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.

ANSWER: 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 fertiliser 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.

7. List three advantages each of:
(i) exploiting resources with short term aims, and
(ii) using a long term perspective in managing our natural resources.

ANSWER: (i) Advantages of exploiting resources with short term aims:

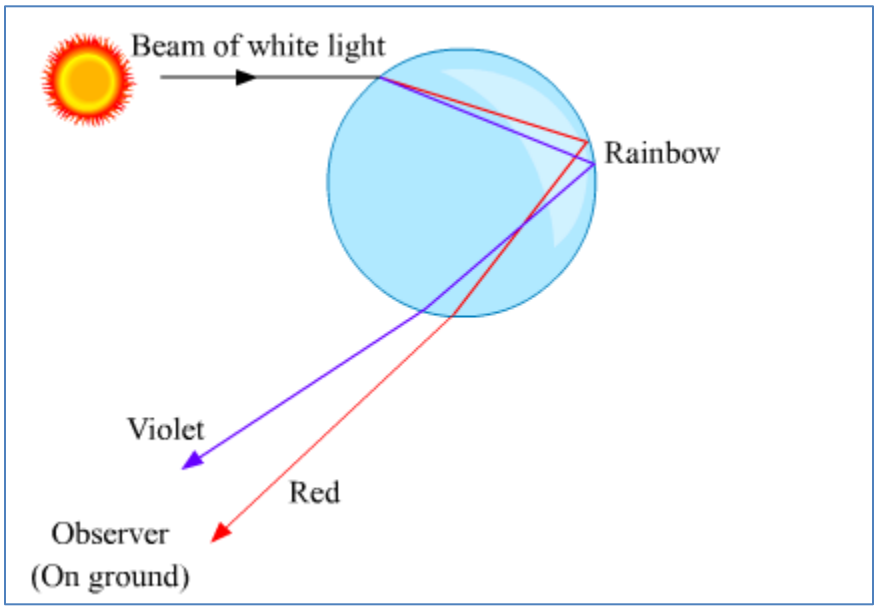
(i) The current basic needs of the population can easily be fulfilled.
(ii) Fast industrialisation.
(iii) Variety of useful products can be made to make life easy.

(ii) Advantages of long term perspective in managing our natural resources:

(i) Sustainable management of resources
(ii) The resources can be used efficiently by the present as well as future generations.
(iii) The pollution and the degradation of the environment can be reduced.

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

ANSWER: 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:



9. Nervous and hormonal systems together perform the function of control and coordination in human beings. Justify this statement with the help of an example.

ANSWER: In human beings, control and coordination is brought about by both nervous system and endocrine system. Nervous system works by generation and transmission of electrical impulse while the endocrine system works by secreting chemical messengers called hormones. These systems complement the action of each other to control and coordinate different functions in our body. For example, when an emergency stimulus is detected by the nervous system, the stimulus is received and analysed by CNS that send message to effectors to provide proper response. At the same time, the sympathetic nervous system activates adrenal gland to release adrenaline that prepares body by increasing heart rate, blood pressure, respiration and dilates pupil etc. Thus, both these systems interact and work together to produce an effective response.

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

ANSWER: 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:

$$Receptor \rightarrow Sensory\ neuron \rightarrow Brain \rightarrow Motor\ Neuron \rightarrow Eye \rightarrow Eye\ muscle\ contracts$$

11. What is photosynthesis? Explain its mechanism.

ANSWER: Photosynthesis is a process in which the energy of light is utilised to produce simple organic compounds in autotrophs. In the process of photosynthesis the energy of sunlight is captured by photosensitive pigment like chlorophyll in green plants. The energy harnessed by light is utilised for photolysis of water molecules within the chloroplasts of green plants. As a result nascent oxygen is released as molecular oxygen gas. Hydrogen released by the reduction of water is further utilised by the plants in light independent reaction where carbon dioxide is reduced to simple carbohydrates or sugars in a series of metabolic reactions within the plant chloroplasts.
The detailed equation of photosynthesis can be represented as:human

$$6CO_2 + 12H_20 \rightarrow C_6H_{12}0_6 + 60_2 + 6H_20$$

12. Name the plant Mendel used for his experiment. What type of progeny was obtained by Mendel in F1 and F2 generations when he crossed the tall and short plants? Write the ratio he obtained in F2 generation plants.

OR

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

ANSWER: Mendel used pea plant (Pisum sativum) for his experiments. When Mendel crossed tall and short plants, the progeny obtained in Fl generation were tall. When the Fl 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.

13. 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.

ANSWER: When 2 g of silver chloride, AgCI, is kept in sunlight then AgCI breaks down into Ag and C12. The color of the silver chloride turns to grey. The following change can be represented by the chemical reactions as:
sunlight 2AgCl(s) 2Ag(s) + Cl2(g) . This type of reaction is an example of a photochemical decomposition reaction.

(a) The given reaction is a displacement reaction in which more reactive zinc will displace less reactive silver from silver nitra Answer. Zn(s) + 2AgNO3(aq) -+Zn(NO3)2(aq) + 2Ag(s)
(b) The given reaction is a double displacement reaction. 2KI(aq) + Pb(NO3)2(aq) 2KNO3(aq) + Pb12(s)

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

ANSWER: Oxides of the first group elements have the common formula of M20.
Example- Na20, K20. 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.

Halides of group 13 elements have a common formula of MX3 , where M-metal and X- halogen element. Example- AICI3, BF3 . 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.

The general formula for those kinds of compounds would be AB2
Example- MgCl2, CaCl2. 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.

15. Explain the following:

(a) Sodium chloride is an ionic compound which does not conduct electricity in solid state where as it does conduct electricity in molten state as well as in aqueous solution.

(b) Reactivity of aluminium decrease if it is dipped in nitric acid.

(c) Metals like calcium and magnesium are never found in their free state in nature.

ANSWER: (a) NaCI conducts electricity in the molten state and in aqueous Answers because ions are free to move whereas in solid state ions are not free to move.

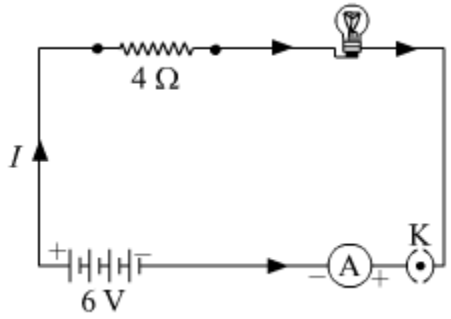
(b) When aluminium is dipped in nitric acid a layer of aluminium oxide is formed on the metal. This happens because nitric acid is a strong oxidizing agent. The layer of aluminium oxide prevents further reaction of aluminium. Due to this, the reactivity of aluminium decreases.

(c) Because Calcium and Magnesium are highly reactive.

16. (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 0 each are joined in parallel to a 6 V battery. Find the current drawn from the battery.

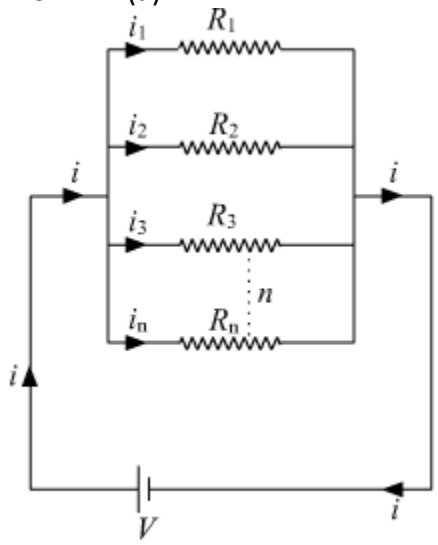
OR

An electric lamp of resistance 20 0 and a conductor of resistance 4 0 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.
ANSWER: (a)



Let there are n resistances, each of value RI, R2 Rn, respectively, are connected in parallel to a battery of voltage V. if the equivalent resistance of the circuit is Req, then current drawn from the battery is $i = \frac{V}{R_{eq}}$

The total current /then divides into Ii, iz, i3 in, respectively in the given resistors. As all the resistances are connected in parallel, hence the voltage across each resistor is Vvolt. Now we can write,

$$i = i_1 + i_2 + i_3 + ... + i_{eq}$$

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

From eq. 1,

$$\frac{1}{R_{eq}} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} .... + \frac{1}{R_n}$$

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 Root, Then

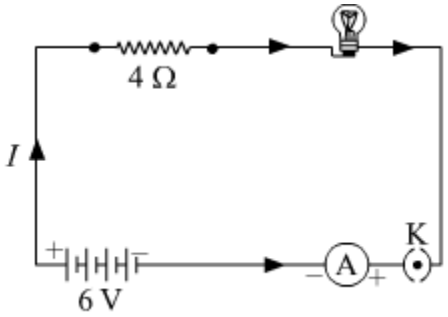
$$\frac{1}{R_{\text{net}}} = \frac{1}{12} + \frac{1}{12}$$

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

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

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

OR



Resistance of electric lamp = $20\,\Omega$

Resistance of conductor= $4\,\Omega$

Voltage battery= 6V

Apply Ohms law

$V = IR$

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

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

Hence, current in the circuit is 0.25A

(c)

Potential difference across the loop

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

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

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

Potential difference across the conductor

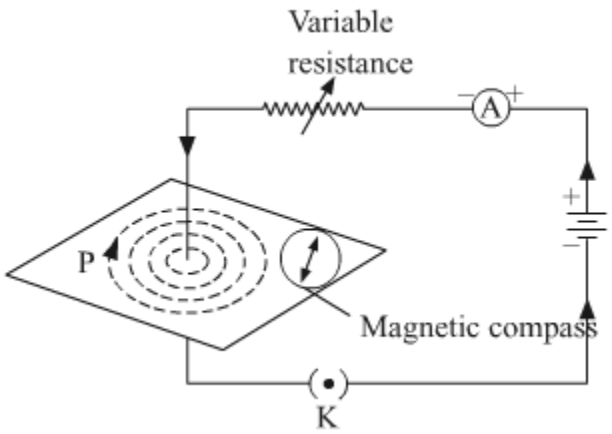
$V_{\text{Conductor}} = IR$

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

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

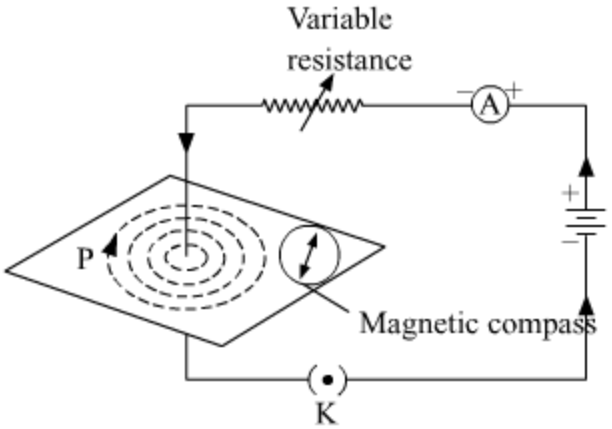
Power of lamp $I^2R = (0.25)^2 \times 20 = 1.25\,\text{W}$

17. (a) Draw magnetic field lines produced around a current carrying straight conductor passing through cardboard. Name, state and apply the rule to mark the direction of these field lines.
(b) How will the strength of the magnetic field change when the point where magnetic field is to be determined is moved away from the straight wire carrying constant current? Justify your answer.
ANSWER:



(a) To mark the direction of magnetic field lines, we will use The Right hand thumb rule. The right-hand thumb rule is used to find the direction of the magnetic field lines, according to this rule if we place our right-hand thumb along the direction of the current flowing in a current carrying wire, the direction in which the fingers wrap the wire represents the direction of the magnetic field. As we can see in the given figure, where the current is going downward, the direction of magnetic field lines is clockwise, according to the rule.

(b) Using a compass needle we can determine the magnetic field. When we move away from the compass needle from the straight wire, the deflection of the needle decreases which implies the strength of the magnetic field decreases, as the strength of magnetic field produced by a straight wire at any point is inversely proportional to the distance of the point from the wire.



18. 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).

ANSWER: We have, (i) Object distance, u= —60 cm Focal length of the concave lens, f= —30 cm
Using lens formula,

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

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

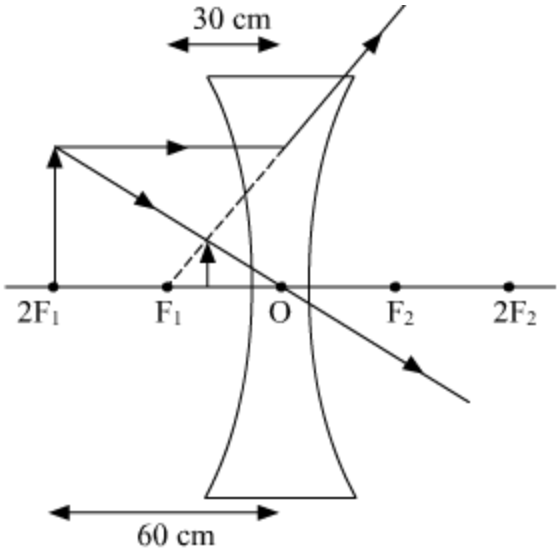
$$\frac{1}{v}=\frac{-1}{30}-\frac{1}{60}$$

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

$$v=-20\ cm$$

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 F1 and optical center 0. Size of the image is diminished. The image is Erect.

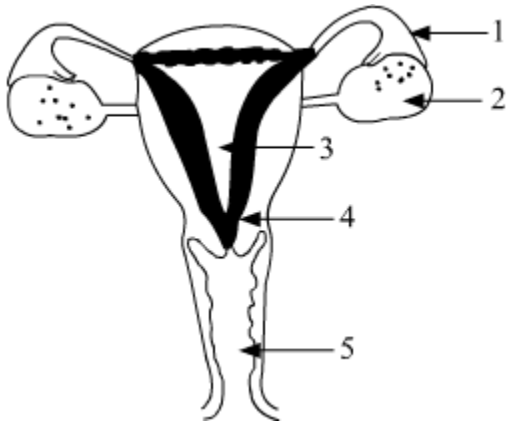
(iii)



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

OR

Identify the given diagram. Name the parts 1 to 5.



What is contraception? List three advantage of adopting contraceptive measures.

ANSWER: 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.

20. 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

OR

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?

ANSWER: Name of the compound which is the active ingredient of all alcoholic drinks is Ethanol, and its chemical formula is CH3CH2OH. 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-

$$CH_3CH_2OH + Na \rightarrow CH_3CH_2O^-Na^+ + H_2$$

$$CH_3CH_2OH + H_2SO_4 \rightarrow C_2H_4 + H_20$$

OR

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.

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

21. Write the main difference between an acid and a base. With the help of suitable examples explain the term neutralization and the formation of –
(i) acidic,
(ii) basic and
(iii) neutral salts

ANSWER:

Acid	Base
1. Turns blue litmus red	1. Turns red litmus blue
2. Sour in taste	2. Bitter in taste
3. Release H+ ion in water3.	Release OH- ion in water
4. pH is less than 7	4. pH is more than 7
5. Example: HCl	5. Example: NaOH

Neutralization is a type of chemical reaction in which an acid and base react to form salt and water with evolution of heat. i) When neutralisation of a strong acid with a weak base takes place, it leads to the formation of acidic salt. Example

$HCl + NH_4OH \rightarrow NH_4Cl + \mathrm{H_2O}$

$NaOH + CH_3COOH \rightarrow CH_3COO^- Na^+ + \mathrm{H_2O}$

$NaOH + HCl \rightarrow NaCl + \mathrm{H_2O}$

22. In the experimental set up to show that "CO2 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.

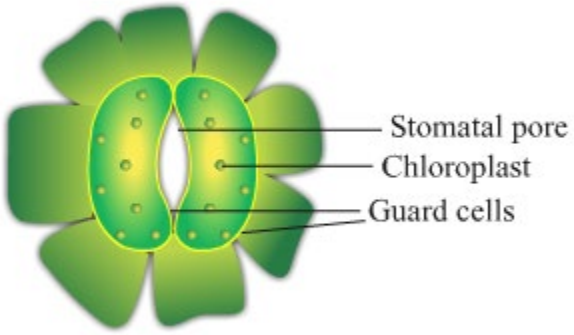
ANSWER: In the above mentioned experimental setup, lime water is taken in a small test tube which is kept in the conical flask. Lime water is used to detect the presence of carbon dioxide. When carbon dioxide passes through lime water, it turns milky due to the formation of calcium carbonate. Hence, it is used in the above experiment to check whether CO2 is released during respiration.

23. 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

OR

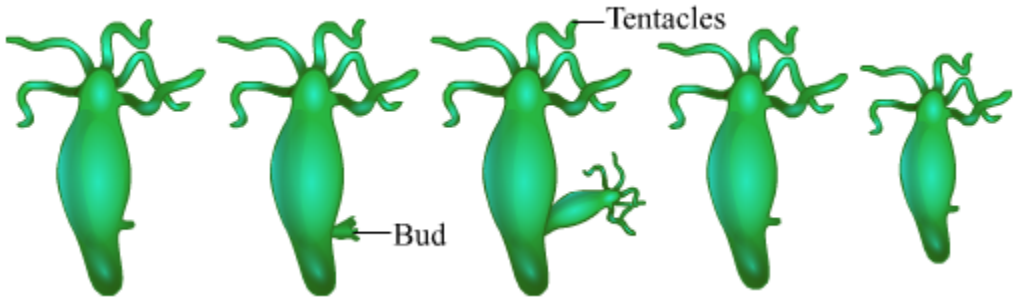
Draw a labelled diagram in proper sequence to show budding in hydra.

ANSWER: Structure of stomata



OR

Budding of hydra



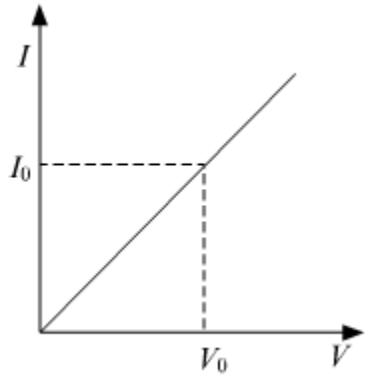
24. List four precautions which a student should observe while determining the focal length of a given convex lens by obtaining image of a distant object on a screen.

ANSWER: Following are the precautions while making the image by the 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.

25. 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 t. 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.
ANSWER:



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,

$$R = \frac{V_o(\text{value of potential difference at that point})}{I_o(\text{value of current at that point})}$$

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

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

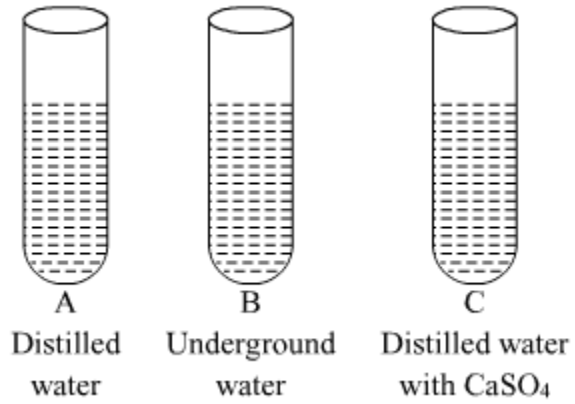
$$\Rightarrow R = \frac{1}{slope} = \frac{V_o(\text{Value of Potential difference at that point})}{I_o(\text{Value of Current at that point})}$$

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.

26. 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 Answer 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.

ANSWER:



Test tube A contains distilled water which is considered as soft water, free from ions like Mg2÷, Ca2+, etc. So, in this case, the length of foam will be the longest(maximum). Test tube B contains underground water which contains ions like Mg2+, Ca2÷, 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 CaSO4, which contains Ca2÷ 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.

27. Blue litmus is added to two test tubes A and B containing dilute HCl and NaOH. Answer 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.

ANSWER: Test tube A contains dil. HCl and test tube B contains dil. NaOH. On adding blue litmus Answer 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.

$$2HCl + Na_2CO_3 \rightarrow 2NaCl + H_2O + CO_2$$

X - CBSE BOARD - 2018

Date: 16.03.2018 Science - Question Paper Solutions

SECTION - A

1. Write the energy conversion that takes place in a hydropower plant.

Ans. Potential energy of water stored in a dam is converted into kinetic energy of the falling water. The water falls on the turbine, so kinetic energy of the flowing water is converted into the kinetic energy of the armature of the generator connected to the turbine. Then kinetic energy is converted into the electrical energy known as hydro-electricity.

2. A Mendelian experiment consisted of breeding pea plants bearing violet .flowers with pea plants bearing white flowers. What will be the result in F_1 pregeny ?

Ans. In mendelian experiment, breeding of pea plants bearing violet flowers with pea plant bearing white flower leds to production of all violet coloured flowers (F_1 progeny plants). The plants bearing violet coloured of the flower is dominant over write coloured flower in pea plant.

3. (a) Name one gustatory receptor and one alfactory receptor present in human beings.

(b) Write *a* and *b* in the given flow chart of neuron through which information travels as an electrical impulse.

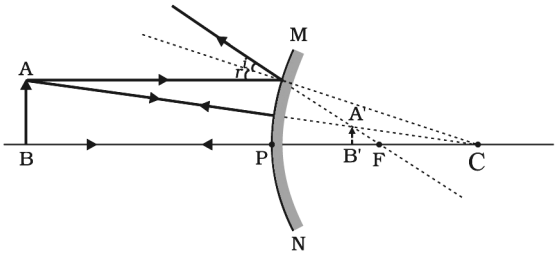
Dendrite ⟶ a ⟶ b ⟶ End point of Newron

Ans. (a) Gustatory receptors – Tongue
Olfactory receptors – Nose

(b) Dendrite → Cyton → Axon → End point of Newron

4. If the image formed by a spherical mirror for all positions of the object placed in front of it is always erect and diminished, what type of mirror is it ? Draw a labelled ray diagram to support your answer.

Ans. To get erect and diminished image mirror used is convex mirror.



5. A compound 'X' on heating with excess conc. sulphuric acid at 443 K gives an unsaturated compound 'Y'. 'X' also reacts with sodium metal to evolve a colourless gas 'Z'. Identify 'X', 'Y' and 'Z'. Write the equation of the chemical reaction of formation of 'Y' and also Write the role of sulphuric acid in the reaction.

Ans. Compound 'X' on heating with excess conc. sulphuric acid at 443 gives unsaturated compound.

$$\underset{(\text{Alcohol})}{CH_3 - CH_2 - OH} + H_2SO_4\,(\text{conc.}) \xrightarrow{443K} CH_2 = CH_2 + H_2O$$

$$CH_3 - CH_2 - OH + Na \longrightarrow CH_3 - CH_2 - ONa + H_2$$

Concentrated H_2SO_4 act as a dehydrating agent

$X \rightarrow C_2H_5OH$

$Y \rightarrow C_2H_4$

$Z \rightarrow H_2 \uparrow$

6. State the laws of refraction of light. Explain the term 'absolute refractive index of a medium' and write an expression to relate it with the speed of light in vacuum.

Ans. **Laws of Refraction of light :**

Refraction of light follows the following two laws :

First Law : The incident ray, the normal to the transparent surface at the point of incidence and the refracted ray, all lie in one and the same plane.

Second Law : The ratio of sine of the incidence angle $(\angle i)$ to the sine of the refracted angle of the medium is called refractive index. It is denoted by n.

i.e., $\dfrac{\sin i}{\sin r} = n$

Refractive index of second medium with respect to the first medium is denoted by ${}_2n_1$.

Thus, eq.(i) can be written as $_2n_1 = \frac{\sin i}{\sin r}$

This law is called Snell's law as it was stated by Prof. Willenbrord Snell (Dutch mathematicial and astronomer).

Absolute Refractive index :

Absolute refractive index of a medium is defined as the ratio of the speed of light in vacuum or air to the speed of light in the medium. It is denoted by n.

Then, $n = \frac{\text{speed of light in air}}{\text{speed of light in medium}} = \frac{c}{v}$

It has no unit.

OR

What is meant by power of a lens ? Write its SI unit. A student uses a lens of focal length 40 cm and another of –20 cm. Write the nature and power of each lens.

Ans. $P \propto \frac{1}{f}$

Unit of Power is Dioptre (D)

Focal length = 40 cm

Focal length = –20 cm

Convex lens $P = \frac{1}{f} = \frac{100}{40} = 2.5\,D$

Concave lens $P = \frac{1}{f} = \frac{-100}{20} = -5\,D$

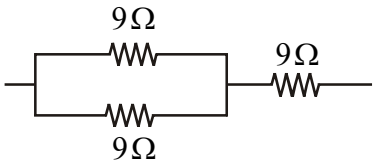
7. Write one main difference between asexual and sexual mode of reproduction. Which species is likely to have comparatively better chances of survival - the one reproducing asexually or the one reproducing sexually ? Give reason to justify your answer.

Ans. Asexual reproduction involves single individual which produces new generation whereas sexual reproduction involves two individuals one is male parent & other is female parent to produce new individuals. Sexually reproducing species is likely to have comparitively better chance of survival as it involves two different individuals.

Sexual mode of reproduction incorporates such a process of combining DNA from two different gametes of two different parents i.e., male and female gametes of male and female parents respectively. Thus sexual reproduction involves variation in the new individuals which helps in survival of the species.

8. Show how would you join three resistors, each of resistance 9Ω so that the equivalent resistance of the combination is (i) 13Ω (ii) 6Ω ?

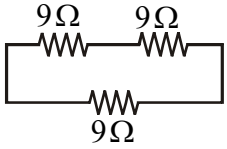
Ans. (i) $\frac{9\times9}{9+9}=\frac{9\times9}{2(9)}=4.5\Omega+9\Omega=13.5\Omega$



two 9Ω resistors are connected in parallel and one in series.

(ii) 2 resistors connected in series $=(9+9)\Omega=18\Omega$

18Ω and 9Ω are connected in series.



$\frac{18\times9}{18+9}=6\Omega$

OR

(a) Write Joule's law of heating.

(b) Two lamps, one rated 100 W; 220 V, and the other 60 W; 220 V, are connected in parallel to electric mains supply. Find the current drawn by two bulbs from the line, if the supply voltage is 220 V.

Ans. (a) Joule's law of heating $H=I^2Rt$

When electric current flows through resistance element, the flowing charges suffer resistance, the work done to overcome resistance is converted to heat energy.

(b) $P_1=100W, V_1=220V$

$P_2=60W, V_2=220V$

$P=VI$

$I_1=\frac{P_1}{V_1}=\frac{100}{220}=\frac{10}{22}=0.45\ Amp$

$I_2=\frac{P_2}{V_2}=\frac{60}{220}=\frac{3}{11}=0.27\ Amp$

9. Name the hormones secreted by the following endocrine glands and specify one function of each :

(a) Thyroid (b) Pituitary (c) Pancreas

Ans. Following are the hormones & functions secreted by given glands.

(a) **Thyroid** : Thyroid gland secretes thyroxin hormone.

Function : Thyroxin regulates carbohydrate, protein & fat metabolism in the body to provide best balance for the growth.

(b) **Pituitary gland** : Pitutary gland secretes growth hormone.

Function : Growth hormone regulates growth & development of the body.

(c) **Pancreas** : Pancreas secretes insulin hormone.

Function : Insulin helps in regulating blood sugar level.

10. 2 mL of sodium hydroxide solution is added to a few pieces of granulated zinc metal taken in a test tube. When the contents are warmed, a gas evolves which is bubbled through a soap solution before testing. Write the equation of the chemical reaction involved and the test to detect the gas. Name the gas which will be evolved when the same metal reacts with dilute solution of a strong acid.

Ans. (i) $Zn + 2NaOH \longrightarrow Na_2ZnO_2 + H_2 \uparrow$

(ii) The liberated H_2 gas can be detected by putting a burning matchstick at the opening of test tube, it will burn with a pop sound with blue flume.

(iii) $Zn + 2HCl \longrightarrow ZnCl_2 + H_2 \uparrow$

OR

The pH of a salt used to make tasty and crispy pakoras is 14. Identify the salt and write a chemical equation for its formation. List its two uses.

Ans. (i) The salt is $NaHCO_3$.

(ii) $Na_2CO_3 + H_2O + CO_2 \longrightarrow 2NaHCO_3$

(iii) (a) In medicine as antacid.

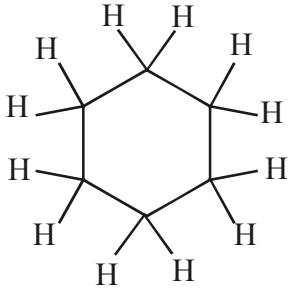
(b) Used in cakes to make it more fluffy.

11. (a) Why are most carbon compounds poor conductors of electricity ?

(b) Write the name and structure of a saturated compound in which the carbon atoms are arranged in a ring. Give the number of single bonds present in this compound.

Ans. (a) An carbon is a non-metal so most of its compound are poor conductors of electricity.

(b)



Name - Cyclohexane
Single bond - 18

12. Decomposition reactions require energy either in the form of heat or light or electricity for breaking down the reactants. Write one equation each for decomposition reactions where energy is supplied in the form of heat, light and electricity.

Ans. (a) $2Pb\left(NO_3\right)_{2(s)} \xrightarrow{\Delta} 2PbO + 4NO_2 + O_2$

(b) $2AgCl_{(s)} + \text{Sunlight} \longrightarrow 2Ag_{(s)} + Cl_{2(g)}$

(c) $2NaCl_{(l)} \xrightarrow{\text{electricity}} 2Na_{(l)} + Cl_{2(g)}$

13. What is a dam ? Why do we seek to build large dams ? While building large dams, which three main problems should particularly be addressed to maintain peace among local people ? Mention them.

Ans. A dam is a barrier constructed to hold back water and raise its level forming a reservoir used to generator electricity or as a water supply.

Large dams are built in order to generate electricity from water supply.

The dams can be constructed only in a limited number of place preferably in hilly terrains. large areas of agricultural land and human habitation are to be sacrificed as they get submerged. large eco-systems are destroyed when submerged under the water in dams. The vegetation large amounts of methane which is also a green-house gas. It created the problem of satisfactory rehabilitation of displaced people.

14. Students in a school listened to the news read in the morning assembly that the mountain of garbage in Delhi, suddenly exploded and various vehicles got buried under it. Several people were also injured and there was traffic jam all around. In the brain storming session the teacher also discussed this issue and asked the students to find out a solution to the problem of garbage. Finally they arrived at two main points - one is self management of the garbage we produce and the second is to generate lee garbage at individual level.

(a) Suggest two measures to manage the garbage we produce.

(b) As an individual, what can we do to generate the least garbage ? Give two points.

(c) List two values the teacher instilled in his students in this episode.

Ans. (a) (i) Garbage should be kept in proper place indicated by municipality.

(ii) We can put wet garbage and dry garbage in separate container so that they can be used for recycling.

(b) (i) We should be careful in kitchen not to cook more food than necessary.

(ii) We can also give green vegetable and food waste to nearby pet animals like cow etc.

(c) (i) Teacher is environment corrsious.

(ii) Teacher wants to make his students responsible citizens.

15. (a) List the factors on which the resistance of a conductor in the shape of a wire depends.

(b) Why are metals good conductors of electricity whereas glass is a bad conductor of electricity? Give reason.

(c) Why are alloys commonly used in electrical heating devices ? Give reason.

Ans. (a) Resistance of conductor depends on following factor:

(i) Resistance of conductor is directly proportional to length (l) of the conductor.

$R \propto \ell$

(ii) Resistance of conductor is inversely proportional to area of cross section of conductor.

$$R \propto \frac{1}{A}$$

(iii) Resistance also depends on a material of conductor (ρ)

$$\therefore R = \rho \frac{\ell}{A}$$

(iv) Resistance and resistivity also depends on temperature.

(b) Metals have more free electrons than glass to carry currents. That's why glass is bad conductor and metals are good conductors.

(c) Alloys are used rather than pure metals in electrical heating devices, since they have low electrical conductivity and also low melting point.

16. (a) State Fleming's left hand rule.

(b) Write the principle of working of an electric motor.

(c) Explain the function of the following parts of an electric motor.

(i) Armature (ii) Brushes (iii) Split ring

Ans. (a) Hold the forefinger the centre finger and the thumb of your left hand at right angles to one another If the forefinger points in the direction of magnetic field, and centrefinger points in the direction of current, the thumb gives direction of motion conductor.

(b) Electric motor is based on the principal that a current carrying conductor placed perpendicular to the magnetic field experience a force.

(c) (i) **Armature :** It contains of a single loop of inculated copper wire in the form o a rectangle. rectangle.

(ii) **Brushes :** Two carbon brushes B_1 and B_2 press against the commutator. These brushes act as the contacts between the commutator and the terminals of the battery.

(iii) **Split-ring :** It consists of two halves (R_1 and R_2) of a metallic ring. The two ends of the armature coil are connected to these two halved of the ring. Commutator reverses the direction of current in the armature coil.

17. (a) Write the function of following parts in human female reproductive system :

(i) Ovary (ii) Oviduct (iii) Uterus

(b) Describe in brief the structure and function of placenta.

Ans. (a) Functions of following parts of human reproductive system.

(i) Ovary – production of egg every month.

(ii) Oviduct or fallopian tube.

Function – carries egg from the ovary to the womb.

(iii) Uterus function :

* Implantation of zygote in the lining of the uterus.

* Nourishes the growing embryo as its lining is thickened due to rich supply of blood.

(b) Structure & function of placenta :

The placenta is a disc – like structure which is embedded in the uterine wall.

Placenta contain villi on the embryo side of the tissue.

Function of placenta :

1. It helps in nourishment of the embryo.
2. It also helps in exchange of gases by providing O_2 & removal of CO_2 from the foetus.
3. A placenta is also involved in removal of metabolic wastes generated by embryo through the placenta.

18. (a) Write the steps involved in the extraction of pure metals in the middle of the activity series from their carbonate ores.

(b) How is copper extracted from its sulphide ore ? Explain the various steps supported by chemical equations. Draw labelled diagram for the electrolytic refining of copper.

Ans. (a) Let us consider the case of Zn metal extraction from its carbonate ore.

Steps involved are

(i) The ore $ZnCO_3$ is first concentrated by gravity separation method.

(ii) The ore is calcinated absence of it gets converted to oxide

$$ZnCO_3 \xrightarrow{\Delta} ZnO + CO_2 \uparrow$$

(iii) The oxide is reduced by coke

$$ZnO + c \longrightarrow Zn + CO$$

(iv) The impure Zn thus obtained can be purified by electrolysis.

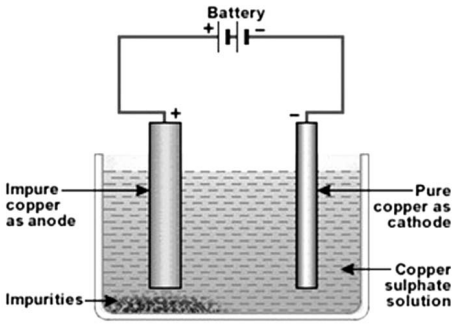
(b) (i) Copper from its sulphide ore can be extracted simply by heating in air.

The steps involved are

1. $2Cu_2S + 3O_{2(g)} \xrightarrow{\Delta} 2Cu_2O + 2SO\ 2$

2. $2Cu_2O + Cu_2S \xrightarrow{\Delta} 6Cu_{(s)} + SO_{2(g)}$

(ii)



Experimental set up for the electrolytic refining of copper.

19. (a) Mention any two components of blood.

(b) Trace the movement of oxygenated blood in the body.

(c) Write the function of valves present in between atria and ventricles.

(d) Write one structural difference between the composition of artery and veins.

Ans. (a) Two components of blood are (i) Blood plasma (ii) Blood cells

(b) Movement of oxygenated blood in the body as follows

(i) Pulmonary veins $\rightarrow$ Left atrium $\rightarrow$ Left ventricle $\rightarrow$ Systemicaorta $\rightarrow$ All part of the blood

(c) The valves in the heart are to prevent the backflow of blood when the atria or ventricles contract.

(d) Ateries are thick walled whereas veins are thin walled.

OR

(a) Define excretion.

(b) Name the basic filtration unit present in the kidney.

(c) Draw excretory system in human beings and label the following organs of excretory system which perform following functions :

(i) form urine

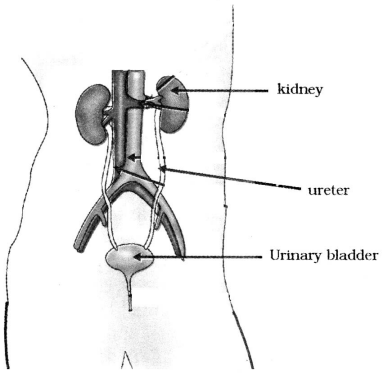
(ii) is a long tube which collects urine from kidney

(iii) store urine until it is passed out.

Ans. (a) The biological process involved in the removal of these harmful metabolic wastes from the body is called excretion.

(b) The nephron is the filtration units present in the kidney.

(c)



Excretory system in human beings

20. (a) The modern periodic table has been evolved through the early attempts of Dobereiner, Newland and Mendeleev. List one advantage and one limitation of all the three attempts.

(b) Name the scientist who first of all showed that atomic number of an element is a more fundamental property than its atomic mass.

(c) State Modern periodic law.

Ans. (a) **Dobereiner triad :**

Advantage : The three elements of a triad were found to process similar properties.

Limitation : Some elements which are dissimilar were being grouped into a triad.

Newland's octave :

Advantage : If the elements known at that time were arranged in the increasing order of their atomic weights, the properties of every eighth element were similar to those of the first one.

Limitation : This classification did not include elements beyond atomic weight 40 (calcium)

Mendeleev :

Advantage : The physical and chemical properties of elements are periodic function of their atomic weights.

Limitation : Position of rare earths was not clear. They were placed in group III A.

(b) Mendeleev

(c) The modern periodic law can be stated as physical and chemical properties of the elements are periodic functions of their atomic numbers.

21. (a) A student is unable to see clearly the words written on the black board placed at a distance of approximately 3 m from him. Name the defect of vision the boy is suffering from. State the possible causes of this defect and explain the method of correcting it.

(b) Why do stars twinkle ? Explain.

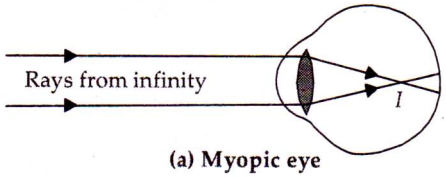
Ans. (a) Myopia is that defect of human eye by virtue of which it can see clearly the objects lying at short distance from it. But the far off objects cannot be seen clearly by the myopic eye.

Causes of Myopia : The two possible causes of this defect are :

Increase in the length of the eye ball, as if distance of retina from the eye lens has increased.

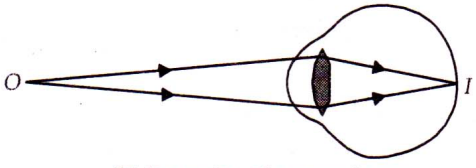
Decrease in focal length of the eye lens when the eye is fully relaxed. This is as if the ciliary muscles holding the eye lens do not relax fully and have some tension.

Correction : The image of a distant object (i.e., at infinity) is formed in front of the retina of eye suffering from myopia as shown in figure. (a)



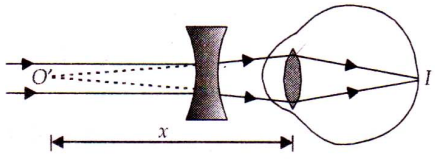
(a) Myopic eye

As the image of the object lying at infinity is not formed on the retina of the eye, so such object can not be seen clearly by the myopic eye. The far point of such an eye is near to the eye as shown in figure (b).



(b) Far point of a myopic eye

This defect can be corrected by using a concave lens of suitable focal length. So, a man suffering from this defect wears spectacles having concave lens of suitable focal length. The concave lens diverges the rays of light entering the eye from inf inity. Hence this lens makes the rays of light appear come from the far point (O') of the defective eye as shown in figure (c).



(c) Correction for myopia

Let x = distance of far point of myopic eye, f = focal length of concave lens to be used.

As the object to be seen is at infinity and its image is to be formed at the far point, therefore, $u = \infty$ and $v = -x$. Distance of far point O' from eye lens is taken same as the distance of far point O' from concave lens.

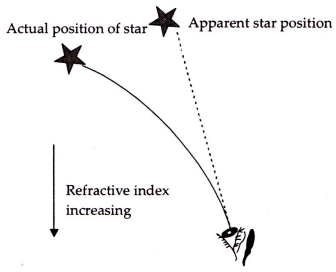
From, $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

or $f = -x$

Hence, focal length of concave lens used for correcting the myopic eye is equal to distance of far point of the myopic eye.

(b) **Twinkling of Stars**

Light emitted by stars passes through the atmosphere of the earth reaching our eyes. The atmosphere of the easth is not uniform but consists of many layers of different densities. The layers close to the surface of the earth are optically denser. As we go higher and higher, the density of layers and refractive index decreases progressively. As the light from a star enters the upper most layer of the atmosphere, it bends towards the normal as it enters the next layer.



This process continues till the light enters our eyes. So due to refraction of light, the apparent position of the star is different from the actual position of the star. Moreover, the different layers of the atmosphere are mobile and the temperature and the density of layers of atmosphere changes continuously. Hence, the apparent position of the star changes continuously. The change int he apparent position of the star continuously leads to the twinkling of a star.

OR

(a) Write the function of each of the following parts of human eye :
(i) Cornea (ii) Iris (iii) Crystalline lens (iv) Ciliary muscles

(b) Why does the sun appear reddish early in the morning ? Will this phenomenon be observed by an astronaut on the Moon ? Give reason to justify your answer.

Ans. (a) (i) **Cornea :** Its function is to act as a windoe to the world, i.e., to allow the light to enter the eye ball.

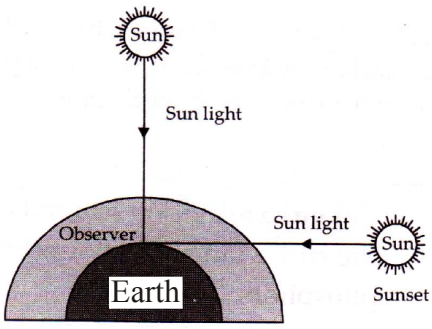
(ii) **Iris :** Its function is to control the amount of light entering in the eye.

(iii) **Crystalline lens :** Its function is to focus the images of the objects at different distances, clearly on the retina.

(iv) **Ciliary muscles :** Its function is to alter the focal length of the crystalline lens, so that the image of the objects at various distances if clearly focussed on the retina.

(b) **Colour of the sun at sunrise and sunset**

At the time of sunrise and sunset, the position of the sun is very far away from us. The sunlight travels longer distance through the atmosphere of the earth before reaching our eyes. Scattering of blue light is more than the scattering of red light. As a result of this, more red light reaches our eyes than any other colour. Therefore at sunset and sunrise sun appears red.

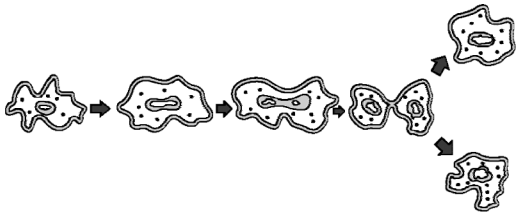


This phenomenon will not be observed by an stronour on moon, since there is no atmosphere so no scattering of light takes place, thus the sun appears dark

SECTION - B

22. Name the process by which an amoeba reproduces. Draw the various stages of its reproduction in a proper sequence.

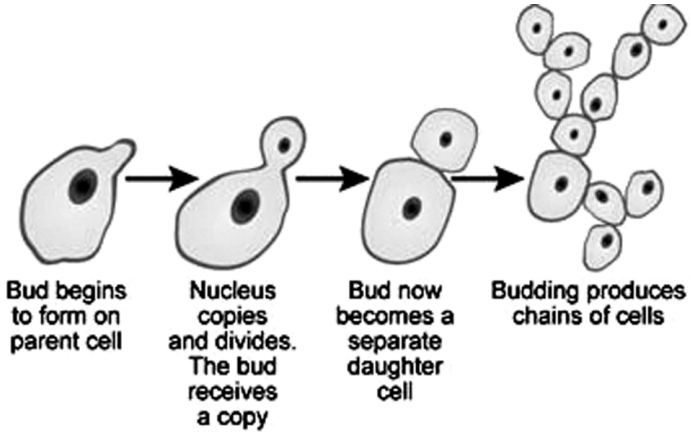
Ans. Amoeba reproduces by binary fission. Amoeba splits into two daughter cells in any plane.



OR

A student is viewing under a microscope a permanent slide showing various stages of asexual reproduction by budding in yeast. Draw diagrams of what he observes. (in proper sequence)

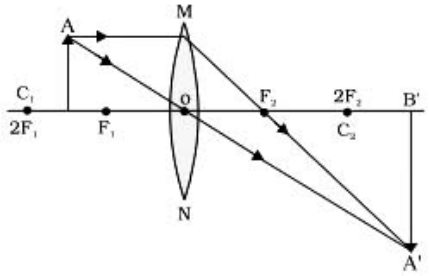
Ans.



23. An object of height 4.0 em is placed at a distance of 30 cm from the optical centre 'O' of a convex lens of focal length 20 cm. Draw a ray diagram to find the position and size of the image formed. Mark optical centre 'O' and principal focus 'F' on the diagram. Also find the approximate ratio of size of the image to the size of the object.

Ans. Given data :

$u = -30\,cm\,;\ f = +20\,cm\,;\ h_o = 4\,cm\,;\ v = ?\,;\ h_i = ?$



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

$$\Rightarrow \frac{1}{v} - \frac{1}{(-30)} = \frac{1}{20}$$

$$\Rightarrow \frac{1}{v} = \frac{1}{20} - \frac{1}{30}$$

$$v = 60\,cm$$

magnification ratio $= \frac{v}{u} = \frac{h_i}{h_o} = m$

$$\Rightarrow \frac{60\,cm}{30\,cm} = \frac{h_i}{4cm}$$

$$\Rightarrow h_i = 8\,cm$$

ratio of size of image to size of object $\Rightarrow \ \frac{h_i}{h_0} = \frac{8}{4} = 2$

24. A student added few pieces of aluminium metal to two test tubes A and B containing aqueous solutions of iron sulphate and copper sulphate. In the second part of her experiment, she added iron metal to another test tubes C and D containing aqueous solutions of aluminium sulphate and copper sulphate.

In which test tube or test tubes will she observe colour change ? On the basis of this experiment, state which one is the most reactive metal and why.

Ans. Test tube A : $2Al + 3FeSO_4 \rightarrow Al_2(SO_4)_3 + 3Fe$

Test tube B : $2Al + 3CuSO_4 \rightarrow Al_2(SO_4)_3 + 3Cu$

Test tube C : $2Fe + Al_2(SO_4)_3 \rightarrow FeSO_4 + 2Al$

Test tube D : $Fe + CuSO_4 \rightarrow FeSO_4 + Cu$

The colour charge in test tube (green) that is from blue to light green.

Aluminium is more reactive than iron because aluminium reacts with oxygen in air to form a larger of oxide which protects the aluminium from further oxidation. Therefore, Aluminium does not carrode as much as iron.

25. What is observed when a solution of sodium sulphate is added to a solution of barium chloride taken in a test tube ? Write equation for the chemical reaction involved and name the type of reaction in this case.

Ans. When sodium sulphate is added to Barium chloride it gives white ppt of barium sulphate which is insoluble in water. The reaction also creates sodium chloride, which remains dissolved in water and so cannot be seen.

It is double displacement type of reaction.

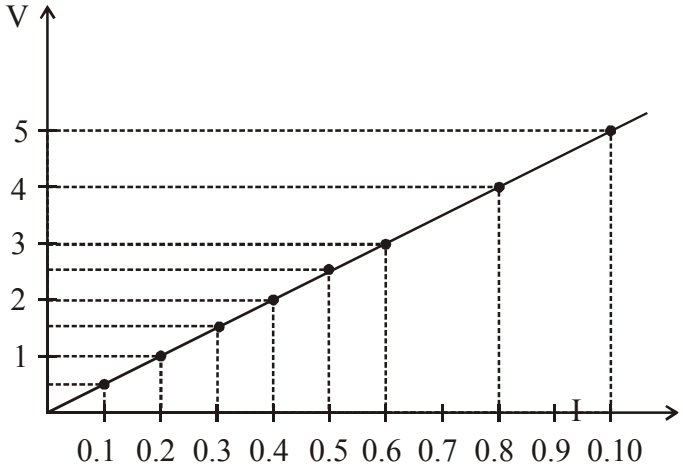
$$Na_2SO_4 + BaCl_2 \longrightarrow 2NaCl + BaSO_4$$

26. The values of current (I) flowing through a given resistor of resistance (R), for the corresponding values of potential difference (V) across the resistor are as given below:

V (volts)	0.5	1.0	1.5	2.0	2.5	3.0	4.0	5.0
I (amperes)	0.1	0.2	0.3	0.4	0.5	0.6	0.8	1.0

Plot a graph between current (I) and potential difference (V) and determine the resistance (R) of the resistor.

Ans. Resistance (R) = Slope of line $= \dfrac{1-0.5}{0.2-0.1} = \dfrac{0.5}{0.1} = 5\Omega$



27. List the steps of preparation of temporary mount of a leaf peel to observe stomata.

Ans. The following are the steps of preparation of temperory amount of a leaf peel to observe stomata.

(i) Remove a healthy leaf from the plotted plant.

(ii) Remove a part of the peel from the lower surface of the leaf by folding the leaf over and gently pulling the peel a part using forceps.

(iii) Put a few drops of saffranin stain in a watch glass.
(iv) After 2-3 minutes take out the peel and place it on a clean glass slide.
(v) Put a drop of glycerin over the peel and place a clean coverslip gently over it.
(vi) Remove the excess stain and glycerin with the help of blotting paper.
(vii) Observe the slide under the low-power and high-power magnifications of the compound microscope.

CBSE - X - 2017 EXAMINATION

SCIENCE

SET-3 Paper & Solution

Time: 3 Hrs. Max. Marks: 90

General Instructions:

1. The question paper comprises **two** Sections, **A and B**. You are to attempt both the sections.
2. All questions are **compulsory**.
3. There is no choice in any of the questions.
4. All questions of **Section A** and all questions of **Section B** are to be attempted separately.
5. Question numbers **1** to **3** in Section A are one-mark questions. These are to be answered in one word or in one sentence.
6. Question numbers **4** to **6** in Section A are two-mark questions. These are to be answered in about 30 words each.
7. Question numbers **7** to **18** in Section A are three-mark questions. These are to be answered in about 50 words each.
8. Question numbers **19** to **24** in Section A are five-mark questions. These are to be answered in about 70 words each.
9. Question numbers **25** to **33** in Section B are multiple choice questions based on practical skills. Each question is a one-mark question. You are to select one most appropriate response out of the four provided to you.
10. Question numbers **34** to **36** in Section B are two-marks questions based on practical skills. These are to be answered in brief.

SECTION A

Question 1. Write the molecular formula of the 2nd and 3rd member of the homologous series where the first member is ethyne.

Solution: The molecular formula of the 2nd and 3rd members of a homologous series where the first member is ethyne (C_2H_2) is formed by adding $-CH_2-$:

2nd member of alkyne series = propyne (C_3H_4) $CH_3 - CH_2 - C \equiv CH$

3rd member of alkyne series = butyne (C_4H_6) $CH_3 - CH_2 - C \equiv CH$

Marks: 1

Question 2. Why is variation important for a species?

Solution: Variation increases the chances of survival of a species in a constantly changing environment.

Marks: 1

Question 3. In the following food chain, 20,000 J of energy was available to the plants. How much energy would be available to man in this chain?

Plants $\rightarrow$ Sheep $\rightarrow$ Man

Solution: According to the 10% law, 2 J of energy will be available for the man in this chain.

Marks: 1

Question 4. An object is placed at a distance of 15 cm from a concave lens of focal length 30 cm. List four characteristic (nature, position, etc.) of the image formed by the lens.

Solution: Given,

u = -15 cm (It is to the left of the lens)

f = -30 cm (It is a concave lens)

Using the lens formula $\frac{1}{f} = \frac{1}{v} - \frac{1}{u}$

$$\frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{1}{(-30)} + \frac{1}{(-15)}$$

$\therefore \frac{1}{v} = -\frac{3}{30} = -\frac{1}{10}$

$\therefore$ v = -10 cm

The negative sign of the image distance shows that the image is formed on the left side of the concave mirror. Thus, the image formed by a mirror is virtual, erect and on the same side as the object.

Marks: 2

Question 5. You being an environmentalist are interested in contributing towards the conservation of nature resources. List four activities that you can do on your own.

Solution: Four activities which can be done as an environmentalist to conserve natural resources are

1) Using public transport for commuting instead of using a personal vehicle.

2) Avoid using clothes, accessories or articles made of animal skin.

3) Using energy-efficient electrical appliances to save electricity.

4) Ensuring no leakage of water taps and pipes at home.

Marks: 2

Question 6. Why are coal and petroleum categorized as natural resources? Given a reason as to why they should be used judiciously.

Solution: Coal and petroleum have been formed by natural processes. They have been formed by the degeneration of dead plant and animal biomass buried deep in the earth several million years ago.

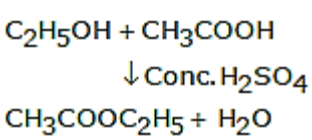
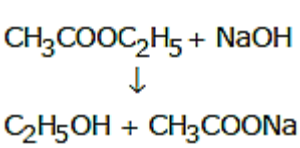
It has taken millions of years for the formation of these fossil fuels, and the present rate of consumption of these fossil fuels far exceeds the rate at which they are formed.

If exhausted, these resources will not be available for use in the near future, and hence, they should be used judiciously.

Marks: 2

Question 7. Distinguish between esterification and saponification reactions with the help of the chemical equations for each. State one use of each (i) esters, and (ii) saponification process.

Solution:

Esterification	Saponification
1. Carboxylic acid reacts with alcohols in the presence of a little conc. sulphuric acid to form esters.	1. On treating an ester with a base such as NaOH, it is converted back to alcohol and sodium salt of carboxylic acid.
2. Example: Ethanoic acid reacts with ethanol in the presence of a little conc. sulphuric acid to form esters. 	2. Example: Ethyl ethanoate on reaction with sodium hydroxide gives ethanol and sodium ethanoate. 

Use of esters:

Esters are used in synthetic flavours, perfumes, cosmetics, lacquers, paints and varnishes.

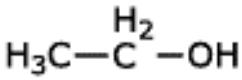
Use of saponification reaction:

It is used in the preparation of soaps on a commercial basis.

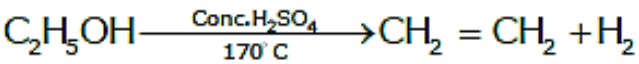
Marks: 3

Question 8. Write the structural formula of ethanol. What happens when it is heated with excess of conc. H_2SO_4 at 443 K? Write the chemical equation for the reaction stating the role of conc. H_2SO_4 in this reaction.

Solution: Structural formula of ethanol:



On adding conc. sulphuric acid to ethanol and heating the mixture up to 443 K (443 K - 273 = 170 °C) gives ethene.



The role of conc. H2SO4 in the above reaction is that it is used as a dehydrating agent and causes dehydration of ethanol.

Marks: 3

Question 9. What is periodicity in properties of elements with reference to the Modern Periodic Table? Why do all the elements of the same group have similar properties? How does the tendency of elements to gain electrons change as we move from left to right in a period? State the reason of this change?

Solution: Properties which reappear at regular intervals or in which there is gradual variation at regular intervals are called **periodic properties**, and the phenomenon is known as the periodicity of elements.

Elements in the same group or column have the same number of electrons in their outermost shell. Hence, elements of the same group have similar properties.

On moving across a period from left to right, the tendency to gain electrons increases. This is due to an increase in the nuclear pull and a decrease in atomic size.

Marks: 3

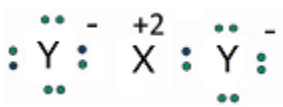
Question 10. Write the electronic configuration two elements X and Y whose atomic numbers are 20 and 17 respectively. Write the Molecular formula of the compound formed when element. X reacts with element Y. Draw electron-dot structure of the product and also state the nature of the bond formed between both the elements.

Solution: Atomic number of X = 20, electronic configuration = 2, 8, 8, 2

Atomic number of Y = 17, electronic configuration = 2, 8, 7

Molecular formula of the compound = XY_2

Electron-dot structure of the compound:

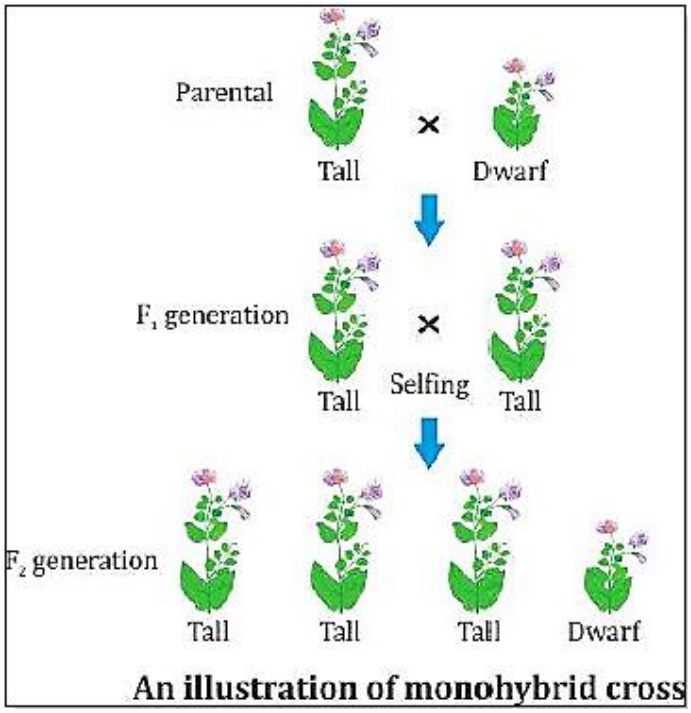


An ionic bond is formed between the two elements.

Marks: 3

Question 11. How did Mendel explain that it is possible that a trait is inherited but not expressed in an organism?

Solution: Mendel explained that it is possible that a trait is inherited but not expressed in an organism with the help of a monohybrid cross.



An illustration of monohybrid cross

1. He crossed pure-bred tall plants (TT) with pure-bred dwarf plants (tt).
2. The progeny he received in the first filial generation was tall. The dwarfness did not show up in the F_1 generation.
3. He then crossed the tall pea plants of the F_1 generation and found that the dwarf plants were obtained in the second generation. He obtained three tall plants and one dwarf plant.

Marks: 3

Question 12. What is an organic evolution? It cannot be equated with progress. Explain with the help of a suitable example.

Solution: Organic evolution can be defined as the slow, progressive, natural and sequential development in primitive organisms to form more complex organisms or a new species.

Marks: 3

Question 13. List the two types of reproduction. Which one of the two is responsible for bringing in more variations in its progeny and how?

Solution: Two types of reproduction:

1. Sexual reproduction
2. Asexual reproduction

Sexual reproduction is responsible for bringing in more variations in its progeny.

It takes place by the combination of male and female gametes.

Gametes are formed from one cell which involves copying of DNA and the cellular apparatus. DNA copying is not absolutely accurate, and errors result in new variations. With every DNA copied, a new variation is introduced, and this DNA copy may already have several variations accumulated from the previous generations.

Marks: 3

Question 14. What is vegetative propagation? State two advantages and two disadvantages of this method.

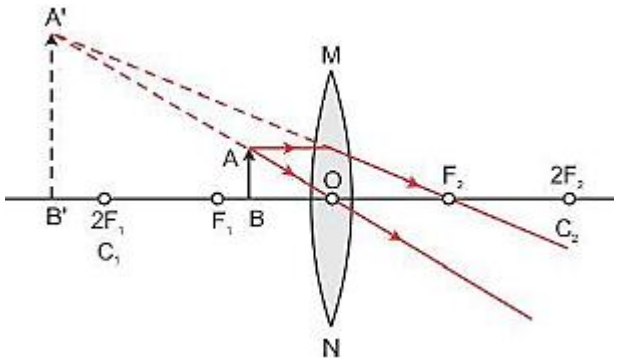
Solution: Vegetative propagation is a type of reproduction in which several plants are capable of producing naturally through their roots, stems and leaves.

Advantages of vegetative propagation:
Plants not capable of producing sexually are produced by this method.
It is a fast and certain method to obtain plants with desired features.
Disadvantages of vegetative propagation:
There is no possibility for variation.
The new plant grows in the same area as the parent plant which leads to competition for resources.
Marks: 3

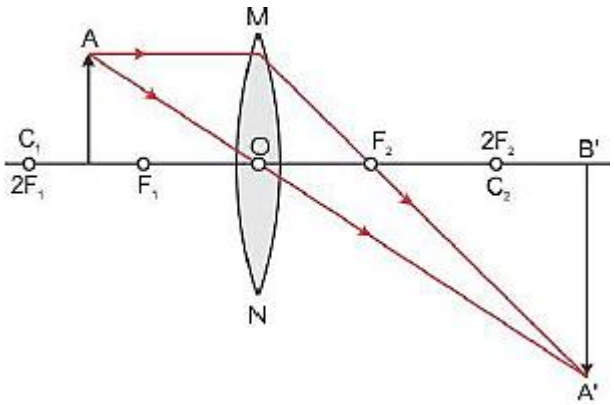
Question 15. List three techniques that have been developed to prevent pregnancy. Which one of these techniques is not meant for males? How does the use of these techniques have a direct impact on the health and prosperity of a family?
Solution: Techniques to prevent pregnancy:
Use of intra-uterine devices such as Lippes loop and Copper T
Use of condoms
Surgical methods (e.g., tubectomy)
Use of intra-uterine devices is not meant for males.
The use of these techniques will keep the mother in good health. With a small family size, parents will be able to provide quality resources to the child such as food, clothes and education. This will improve the overall mental and physical well-being of the family.
Marks: 3

Question 16. "A lens can form a magnified erect image as well as magnified inverted image of an object placed in front of it". State the nature of this lens and draw ray diagrams to justify the above statement. Mark the positions of O, F and 2F in the diagram.
Solution: Convex lens can form a magnified erect image as well as a magnified inverted image of an object placed in front of it.

Position of object	Position of image	Size of image	Nature of image
Between focus F_1 and optical centre O	On the same side of the lens as the object	Magnified	Virtual and erect



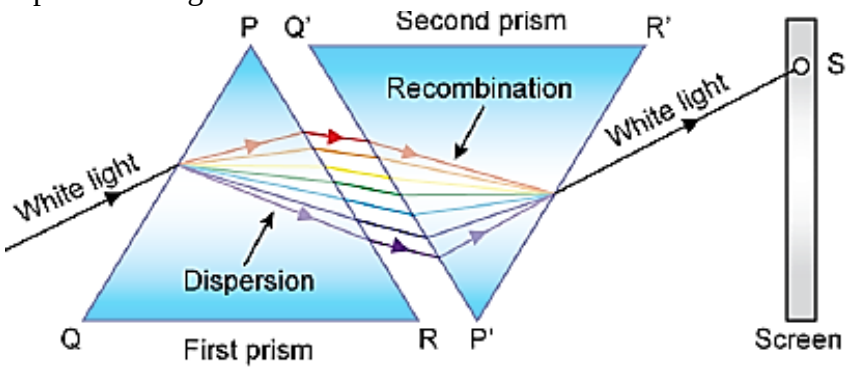
Position of object	Position of image	Size of image	Nature of image
Between F_1 and $2F_1$	Beyond $2F_2$	Magnified	Real and inverted



Marks: 3

Question 17. What is "dispersion of white light"? Draw a labelled diagram to illustrate the recombination of the spectrum of white light. Why it is essential that the two prisms used for the purpose should be identical and placed in an inverted position with respect to each other?

Solution: The phenomenon of splitting of white light into its constituent seven colours on passing through a glass prism is called dispersion of light.



It is essential to place the two identical prisms in an inverted position with respect to each other because the refraction produced by the second prism is equal and opposite to that produced by the first prism.

Marks: 3

Question 18. (a) Water is an elixir of life a very important natural resource. Your science teacher wants you to prepare a plan for a formative assessment activity, "How to save water, the vital natural resource". Write any two ways that you will suggest to bring awareness in your neighborhood, on how to save water'.

(b) Name and explain any one way by which the underground water table does not go down further.

Solution: Two ways by which awareness on how to save water can be created in the neighborhood:

1. By bringing to notice the current situation of drought in rural areas and its dreadful effects on humans and animals

2. Making people realise the importance of water in life and the shortage of water and its consequences in the near future

Khadin is one way of recharging groundwater.

A khadin consists of a 100-300-m long embankment called bund made of earth. The bund is built across the lower edge of the sloping farmland.

Rainwater from the catchment area flows down the slope and collects in front of the bund forming a reservoir.

Pathways through the bund allow excess water to flow through and collect in shallow wells dug behind the bund.

The water which collects in the reservoir and wells seeps into the land and recharges the groundwater.
Marks: 3

Question 19. With the help of one example for each, distinguish between the acquired traits and the inherited traits. Why are the traits/experiences acquired during the entire lifetime of an individual not inherited in the next generation? Explain the reason of this fact with an example.
Solution:

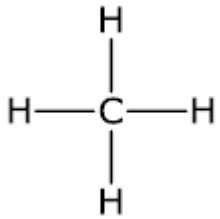
Acquired Trait	Inherited Trait
A trait or characteristic which develops in response to the environment and cannot be inherited.	A characteristic feature inherited from the previous generation.
Example: A person learns to swim.	Example: A girl has brown eyes just like her mother.

Only those traits are inherited which are developed because of changes in genes.
An acquired trait or experience is developed as a response to the environment; it is not inherited. These are not developed due to the changes in genes.
Example: Human beings experiencing weight loss due to starvation. There will be reduction in weight as a response to starvation. This will result in the reduction in the number of body cells or overall body-mass ratio of the individual. It will not have any effect on the genetic constitution of the individual. Because there is no change in the gene of the individual, it is not an acquired trait.
Marks: 5

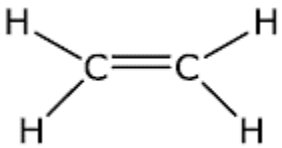
Question 20. (a) Write the functions of each of the following parts in a human female reproductive system:
(i) Ovary
(ii) Uterus
(iii) Fallopian tube
(b) Write the structure and functions of placenta in a human female.
Solution: (i) Ovary: It produces female gametes. One ovum is released by one ovary every month. It also secretes hormones oestrogen and progesterone.
(ii) Uterus: It protects and nourishes the developing embryo.
(iii) Fallopian tube: It passes down the ovum towards the uterus released by the ovary.
Structure of the placenta in human female:
1. The placenta is a disc which is embedded in the uterine wall.
2. It contains villi on the embryo side. The mother's end of the placenta has blood spaces which surround the villi.
Functions of the placenta in human female:
1. Nutrients and oxygen are received by the foetus from the mother's blood.
2. The foetus gives away waste products and carbon dioxide to the mother's blood for excretion.
Marks: 5

Question 21. Why certain compounds are called hydrocarbons? Write the general formula for homologous series of alkanes, alkenes and alkynes and also draw the structure of the first member of each series. Write the name of the reaction that converts alkenes into alkanes and also write a chemical equation to show the necessary conditions for the reaction to occur.
Solution: Certain compounds contain only carbon and hydrogen. So, these organic compounds are called hydrocarbons.

General formula for the homologous series of alkanes = C_nH_{2n+2}
First member of the alkane family is methane.



General formula for the homologous series of alkenes = C_nH_{2n}
First member of the alkene family is ethene.



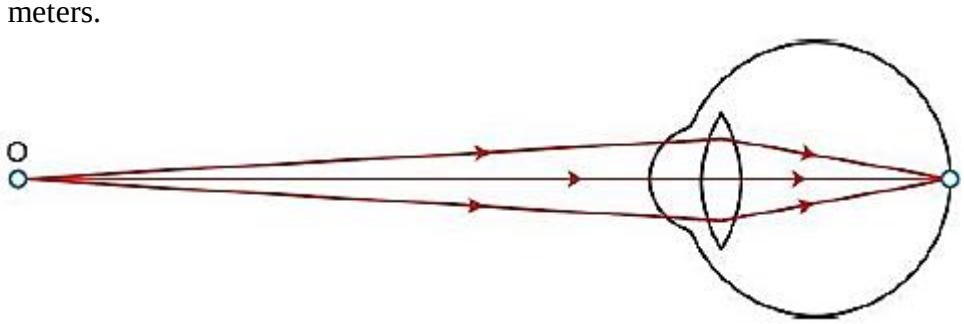
General formula for the homologous series of alkynes = C_nH_{2n-2}
First member of the alkyne family is ethyne.

Catalytic hydrogenation is the reaction used to convert alkenes to alkanes.

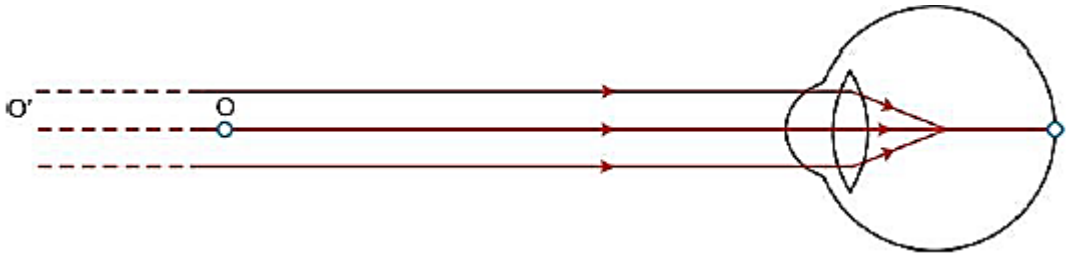
$$CH_2{=}CH_2 \quad + H_2 \xrightarrow[300^oC]{\text{Nickel}} C_2H_6$$

Marks: 5

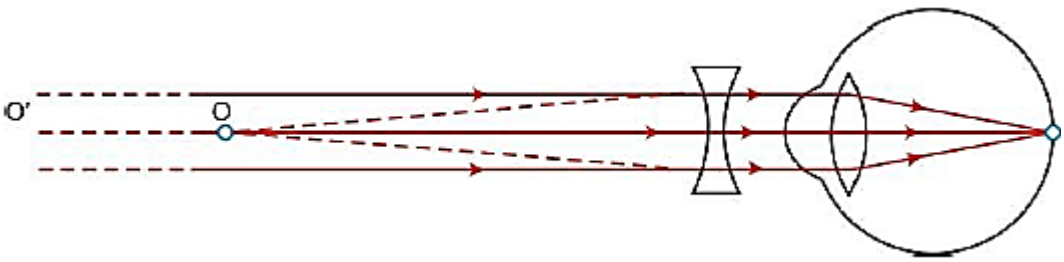
Question 22. (a) A student suffering from myopia is not able to see distinctly the object placed beyond 5 m. List two possible reasons due to which this defect of vision may have arisen. With the help of ray diagrams explain.
(i) Why the student is unable to see distinctly the objects placed beyond 5 cm from his eyes.
(ii) The type of the corrective lens used to restore proper vision and how this defect is corrected by the use of this lens.
(b) If, in this case, the numerical value of the focal length of the corrective lens is 5 m, find the power of the lens as per the new Cartesian sign convention.
Solution: (a) This defect may arise due to excessive curvature of the eye lens or elongation of the eyeball.
(i) A person with this defect has the far point nearer than infinity. Such a person may see clearly up to a distance of a few meters.



In a myopic eye, the image of a distant object is formed in front of the retina and not at the retina itself.



(ii) This defect can be corrected by using a concave lens of suitable power. A concave lens of suitable power will bring the image back onto the retina and thus the defect is corrected.



(b) Given: Focal length f = -5 m ($\because$ it is a concave lens)

Power, $P = \frac{1}{f\ (\text{in m})} = \frac{1}{-5} = -0.2\text{D}$

The negative sign indicates that it is a diverging lens or concave lens.

Marks: 5

Question 23. Analyse the following observation table showing variation of image distance (v) with object distance (u) in case of a convex lens and answer the questions that follow without doing any calculations:

S. No	Object Distance u (cm)	Image Distance v (cm)
1	– 100	+ 25
2	– 60	+ 30
3	– 40	+ 40
4	– 30	+ 60
5	– 25	+ 100
6	– 15	+ 120

(a) What is the focal length of the convex lens? Give reason to justify your answer.

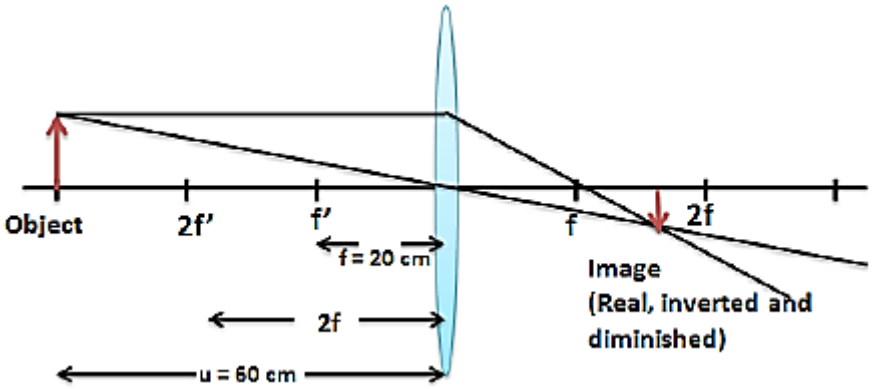
(b) Write the serial number of the observation which is not correct. On what basis have you arrived at this conclusion?

(c) Select an appropriate scale and draw a ray diagram for the observation at S. No. 2. Also find the approximate value of magnification.

Solution: (a) When the object distance and the image distance are the same, it means that the object is placed at 2f or the image is formed at 2f. From the table, it is clear that 2f = 40 cm. Therefore, the focal length of the convex lens is 20 cm.

(b) Serial number 6 is incorrect. Given that the object is placed at 15 cm which is between the focal length and the lens. Thus, the image should be formed on the same side as the object. The data given in the observation serial number 6 does not satisfy the condition.

(c)



Magnification, $m = \frac{v}{u}$

Let us consider the third observation where

u = -40 cm and v = 40 cm

$\therefore m = \frac{v}{u} = \frac{40}{-40}$

$\therefore$ m = -1

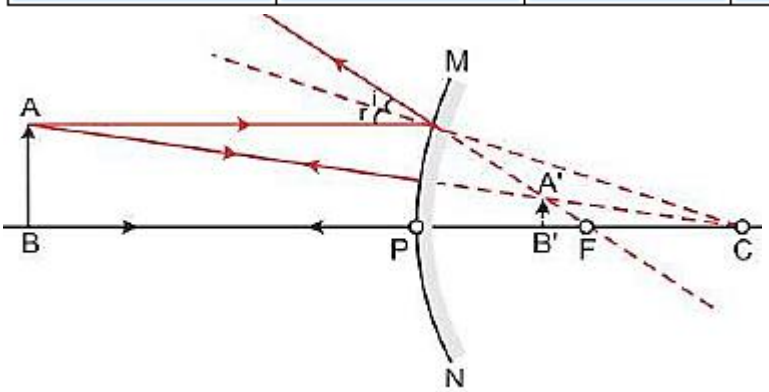
Marks: 5

Question 24. (a) If the image formed by a mirror for all position of the object placed in front of it is always diminished, erect and virtual, state the type of the mirror and also draw a ray diagram to justify your answer. Write one use such mirrors are put to and why.

(b) Define the radius of curvature of spherical mirrors. Find the nature and focal length of a spherical mirror whose radius of curvature is +24 cm.

Solution: (a) A convex mirror always forms a diminished, erect and virtual image of the object placed in front of it.

Position of object	Position of image	Size of image	Nature of image
Between infinity and the pole of the mirror	Between P and F behind the mirror	Diminished	Virtual and erect



Use of a convex mirror:

i. Convex mirrors are commonly used as rear view mirrors in vehicles.

ii. They are preferred because they always give an erect image, although diminished. Also, they have a wider field of view as they are curved outwards. Thus, convex mirrors enable the driver to view a much larger area than would be possible with a plane mirror.

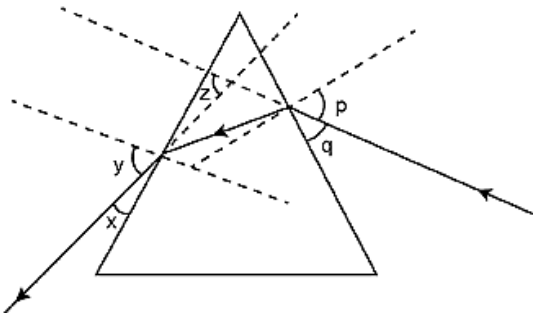
(b) The radius of curvature of a spherical mirror is the radius of the sphere of which the reflecting surface of the spherical mirror is a part and represented by R.
Radius of curvature R = 24 cm
Radius of curvature = 2 × focal length
i.e., R = 2 f
24 = 2 × f

$$f = \frac{24}{2} = 12$$

f = 12 cm
Marks: 5

SECTION B

Question 25. Study the following ray diagram:

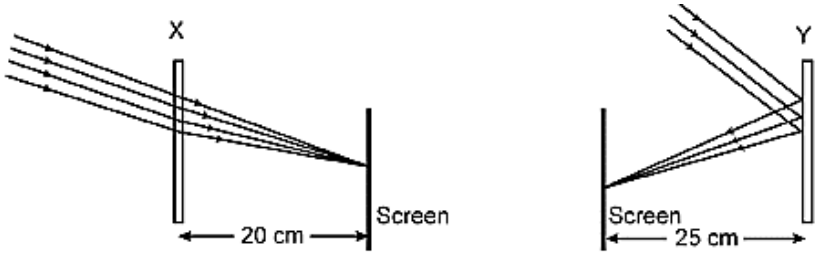


In this diagram, the angle of incidence, the angle of emergence and the angle of deviation respectively have been represented by
(A) y, p, z
(B) x, q, z
(C) p, y, z
(D) P, z, y
Solution: (A) y, p, z
The angle between the incident ray and the normal is known as the angle of incidence, and the angle between the emergent ray and the normal is known as the angle of emergence. The emergent ray is bent at an angle with the direction of the incident ray. This angle is called the angle of deviation.
Marks: 1

Question 26. A student very cautiously traces the path of a ray through a glass slab for different values of the angle of incidence ($\angle$i). He then measures the corresponding values of the angle of refraction ($\angle$r) and the angle of emergence ($\angle$e) for every value of the angle of incidence. On analysing these measurements of angles, his conclusion would be
(A) $\angle i > \angle r > \angle e$
(B) $\angle i = \angle e > \angle r$
(C) $\angle i < \angle r < \angle e$
(D) $\angle i = \angle e < \angle r$
Solution: (B) $\angle i = \angle e > \angle r$
Because the emergent ray is parallel to the incident ray, the angle of incidence is equal to the angle of emergence. The refracted ray travels from a rarer medium to a denser medium (considering the first refraction); it bends towards the normal. Thus, the angle of incidence is greater than the angle of refraction. If we consider the second refraction, then light travels from a denser medium to a rarer medium, due to

which it bends away from the normal after refraction. So, in this case, the angle of refraction is again less than the angle of emergence.
Marks: 1

Question 27. Study the given ray diagrams and select the correct statement from the following:



(A) Device X is a concave mirror and device Y is a convex lens, whose focal lengths are 20 cm and 25 cm respectively.
(B) Device X is a convex lens and device Y is a concave mirror, whose focal lengths are 10 cm and 25 cm respectively
(C) Device X is a concave lens and device Y is a convex mirror, whose focal lengths are 20 cm and 25 cm respectively.
(D) Device X is a convex lens and device Y is a concave mirror, whose focal lengths are 20 cm and 25 cm respectively.
Solution: (D) Device X is a convex lens and device Y is a concave mirror, whose focal lengths are 20 cm and 25 cm respectively.
Device X is a convex lens and device Y is a concave mirror whose focal lengths are 20 cm and 25 cm, respectively. A parallel ray of light incident on a concave mirror gets reflected, and the image is seen on a screen placed before it. A parallel ray of light incident on a convex lens converges to a point.
Marks: 1

Question 28. A student obtains a blurred image of a distant object on a screen using a convex lens. To obtain a distinct image on the screen he should move the lens.
(A) away from the screen
(B) towards the screen
(C) to a position very far away from the screen
(D) either towards or away from the screen depending upon the position of the object.
Solution: (B) Inverted and diminished
When the object is at infinity, the distance of the image from the lens will be equal to the focal length of the lens.
Marks: 1

Question 29. While studying the saponification reaction, what do you observe when you mix an equal amount of colorless vegetable oil and 20% aqueous solution of NaOH in a beaker?
(A) The color of the mixture has become dark brown
(B) A brisk effervescence is taking place in the beaker
(C) The outer surface of the beaker has become hot
(D) The outer surface of the beaker has become cold
Solution: (C) The outer surface of the beaker has become hot.

When 20% NaOH solution was added to the beaker containing vegetable oil, it was observed that the beaker's surface was warm when touched.
A whitish suspension was formed by heating the mixture of vegetable oil and 20% NaOH solution.
Marks: 1

Question 30. When you add a few drops of acetic acid to a test-tube containing sodium bicarbonate powder, which one of the following is your observation?
(A) No reaction takes place
(B) A colorless gas with pungent smell is released with brisk effervescence
(C) A brown colored gas is released with brisk effervescence
(D) Formation of bubbles of a colorless and odorless gas
Solution: (D) Formation of bubbles of a colorless and odorless gas.
$NaHCO_3 + HC_2H_3O_2 \rightarrow NaC_2H_3O_2 + H_2O + CO_2$
There is double displacement in which acetic acid reacts with sodium bicarbonate to form sodium acetate and carbonic acid.
$NaHCO_3 + HC_2H_3O_2 \rightarrow NaC_2H_3O_2 + H_2CO_3$
Carbonic acid is unstable and undergoes a decomposition reaction to produce carbon dioxide gas.
$H_2CO_3 \rightarrow H_2O + CO_2$
Carbon dioxide escapes from the solution as bubbles.
Marks: 1

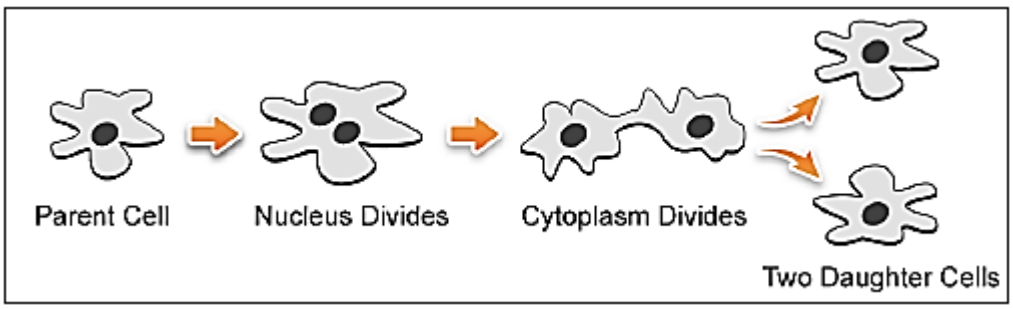
Question 31. A student requires hard water for an experiment in his laboratory which is not available in the neighbouring area. In the laboratory there are some salts, which when dissolved in distilled water can convert it into hard water. Select from the following groups of salts, a group, each salt of which when dissolved in distilled water will make it hard.
(A) Sodium chloride, Potassium chloride
(B) Sodium sulphate, Potassium sulphate
(C) Sodium sulphate, Calcium sulphate
(D) Calcium sulphate, Calcium chloride
Solution: (D) Calcium sulphate, calcium chloride
Hard water can be prepared by dissolving sulphates, chlorides or bicarbonate salts of Ca^{2+} or Mg^{2+} ions.
Marks: 1

Question 32. To perform an experiment to identify the different parts of an embryo of a dicot seed, first of all you require a dicot seed. Select dicot seeds from the following group:
Wheat, Gram, Maize, Pea, Barley, Ground-nut
(A) Wheat, Gram and Pea
(B) Gram, Pea and Ground-nut
(C) Maize, Pea and Barley
(D) Gram, Maize and Ground-nut
Solution: (B) Gram, Groundnut, Pea
Dicot seeds have two cotyledons.
Marks: 1

Question 33. The following vegetables are kept in a basket:

Potato, Tomato, Radish, Brinjal, Carrot, Bottle-gourd
Which two of these vegetables correctly represent the homologous structures?
(A) Carrot and Tomato
(B) Potato and Brinjal
(C) Radish and Carrot
(D) Radish and Bottle-gourd
Solution: (C) Radish and Carrot
The structures which are same in structure and origin but are modified to perform different functions are called homologous structures.
Although radish and carrot store food and are used as food, the nutrients which each provide are different.
Marks: 1

Question 34. Draw in sequence (showing the four stages), the process of binary fission in Amoeba.
Solution: Binary fission in amoeba:



Marks: 2

Question 35. A student focuses the image of a candle flame, placed at about 2 m from a convex lens of focal length 10 cm, on a screen. After that he moves gradually the flame towards the lens and each time focuses its image on the screen.
(A) In which direction does he move the lens to focus the flame on the screen?
(B) What happens to the size of the image of the flame formed on the screen?
(C) What difference is seen in the intensity (brightness) of the image of the flame on the screen?
(D) What is seen on the screen when the flame is very close (at about 5 cm) to the lens?
Solution: (a) As the candle is moved towards the lens, the image distance increases. Thus, the student moves the lens away from the screen to focus the image.
(b) The size of the image increases when the object is moved towards the lens.
(c) Intensity decreases.
(d) When the candle is moved very close to the lens, no image is formed on the screen. A virtual image is formed behind the candle on the same side of the screen.
Marks: 2

Question 36. Mention the essential material (chemicals) to prepare soap in the laboratory. Describe in brief the test of determining the nature (acidic/alkaline) of the reaction mixture of saponification reaction.
Solution: Chemicals required: Vegetable oil, common salt and 20% sodium hydroxide solution.
When a red litmus paper is dipped in the reaction mixture, the paper changes its colour to blue. Hence, the reaction mixture of the saponification reaction is basic in nature.
Marks: 2

CBSE – X – 2016 EXAMINATION

SCIENCE

SET-3 Paper & Solution

Time: 3 Hrs. Max. Marks: 90

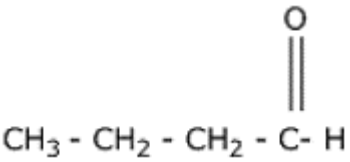
General Instructions:

1. The question paper comprises **two** Sections, **A and B**. You are to attempt both the sections.
2. All questions are **compulsory**.
3. There is no choice in any of the questions.
4. All questions of **Section A** and all questions of **Section B** are to be attempted separately.
5. Question numbers **1** to **3** in Section A are one-mark questions. These are to be answered in one word or in one sentence.
6. Question numbers **4** to **6** in Section A are two-mark questions. These are to be answered in about 30 words each.
7. Question numbers **7** to **18** in Section A are three-mark questions. These are to be answered in about 50 words each.
8. Question numbers **19** to **24** in Section A are five-mark questions. These are to be answered in about 70 words each.
9. Question numbers **25** to **33** in Section B are multiple choice questions based on practical skills. Each question is a one-mark question. You are to select one most appropriate response out of the four provided to you.
10. Question numbers **34** to **36** in Section B are two-marks questions based on practical skills. These are to be answered in brief.

SECTION A

Question 1. Write the name and structure of an aldehyde with four carbon atoms in its molecule.

Solution: 1-butanal



Marks: 1

Question 2. List two functions ovary of human female reproductive system.

Solution: Two functions of the ovaries of the human female reproductive system are

1. To produce ova, which are female gametes
2. To secrete the female hormones oestrogen and progesterone.

Marks: 1

Question 3. In a food chain of frog, grass, insect and snake, assign trophic level to frog.

Solution: Grass $\longrightarrow$ Insect $\longrightarrow$ Frog $\longrightarrow$ Snake

Frog is a secondary consumer.

Marks: 1

Question 4. The refractive indices of glass and water with respect to air are 3/2 and 4/3 respectively. If speed of light in glass is 2×10^8 m/s, find the speed of light in water.

Solution: Given: $n_g = 3/2$ and $n_w = 4/3$

Refractive index of glass, $n_g = \dfrac{\text{Speed of light in air}}{\text{Speed of light in glass}}$

$$\frac{3}{2} = \frac{\text{Speed of light in air}}{2\times10^8}$$

$$\therefore \text{ Speed of light in air } = \frac{3}{2}\times 2\times10^8 = 3\times10^8 \text{ m/s}$$

∴ Thus, the speed of light in air is 3×10^8 m/s.
Marks: 2

Question 5. List four stakeholders which may be helpful in the conservation of forests.
Solution: Four stakeholders which may help in the conservation of forests are
1. The Forest Department of the Government which owns the forest land and controls the resources from forests
2. People who live in and around the forest and are dependent on forest produce to lead their lives
3. Industrialists who use various forest products for their factories
4. Forest and wildlife activists who want to see forests in their original form.
Marks: 2

Question 6. The construction of large dams leads to social and environmental problems. List two problems of each category.
Solution: Social problems arise because the construction of dams causes the displacement of a large number of tribals and peasants who are then rendered homeless. They are neither given sufficient compensation or rehabilitation nor do they get any benefits from these projects.
Construction of dams leads to several environmental problems such as deforestation and loss of biodiversity because large areas of forest land get submerged in water leading to an ecological imbalance.
Marks: 2

Question 7. The position of eight elements in the Modern Periodic Table is given below where atomic numbers of elements are given in the parenthesis.

Period No.		
2	Li(3)	Be(4)
3	Na(11)	Mg(12)
4	K(19)	Ca(20)
5	Rb(37)	Sr(38)

(i) Write the electronic configuration of Ca.
(ii) Predict the number of valence electrons in Rb.
(iii) What is the number of shells in Sr?
(iv) Predict whether K is a metal or a non-metal.
(v) Which one of these elements has the largest atom in size?
(vi) Arrange Be, Ca, Mg and Rb in the increasing order of the size of their respective atoms.
Solution: (i) Electronic configuration of Ca (20): 2, 8, 8, 2
(ii) Rb belongs to Group 1, and all Group 1 elements have one valence electron.
(iii) Sr belongs to Period 5, and thus, it has five shells.
(iv) K is a metal with electronic configuration 2, 8, 8, 1. Thus, it will donate its one electron to acquire the noble gas configuration.
(v) The atomic size increases down the group and decreases across a period. Rb is the element which has the largest atomic size.
(vi) Be < Mg < Ca < Rb
Marks: 3

Question 8. Write three different chemical reactions showing the conversion of ethanoic acid to sodium ethanoate. Write balanced chemical equation in each case. Write the name of the reactants and the products other ethanoic acid and sodium ethanoate in each case.

Solution: Three different chemical reactions showing the conversion of ethanoic acid to sodium ethanoate:

$2CH_3COOH + Na_2CO_3 \longrightarrow 2CH_3COONa + H_2O + CO_2$

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

$CH_3COOH + NaOH \longrightarrow CH_3COONa + H_2O + CO_2$

Marks: 3

Question 9. An element `X' belong to 3rd period and group 13 of the Modern Periodic Table.

(a) Determine the valence electrons and the valency of `X'.

(b) Molecular formula of the compound formed when `X' reacts with an element `Y' (atomic number = 8).

(c) Write the name and formula of the compound formed when `X' combines with chlorine.

Solution: Period of X = 3

Group of X = 13

Atomic number of X = 13

Electronic configuration: 2, 8, 3

(a) Number of valence electrons = 3 and valency = 3

(b) Atomic number of Y = 8

Electronic configuration = 2, 6

Valency of Y = 2

Molecular formula of the compound formed when 'X' reacts with an element 'Y' is X_2Y_3.

(c) Atomic number of Cl = 17

Electronic configuration = 2, 8, 7

Valency of Y = 1

Molecular formula of the compound formed when 'X' reacts with an element 'Y' is XCl_3.

Marks: 3

Question 10. An element `X' has mass number 35 and number of neutrons 18. Write atomic number and electronic configuration of `X'. Also write group number, period number and valency of `X'.

Solution: Mass number of X = 35

Number of neutrons = 18

Atomic number = Mass number – Number of neutrons

= 35 – 18 = 17

Electronic configuration of X = 2, 8, 7

Group of X = 17

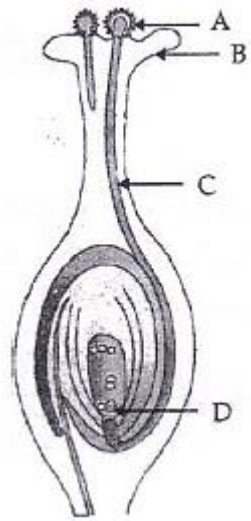
Period of X = 3

Valency of X = 1.

Marks: 3

Question 11. (a) List two reasons for the appearance of variations among the progeny formed by sexual reproduction.

(b)



(i) Name the part marked `A' in the diagram.
(ii) How dose `A' reachese part `B'?
(iii) State the importance of the part `C'.
(iv) What happens to the part marked `D' after fertilisation is over?
Solution: (a) Two reasons for the appearance of variations among the progeny formed by sexual reproduction are
1. Sexual reproduction results in new combinations of genes which are brought together during the formation of gametes.
2. Gene combinations are different in gametes.
(b)
(i) Part 'A' labelled is pollen grain.
(ii) Part 'B' is stigma. The pollen grain reaches the stigma during pollination.
(iii) Part 'C' is the pollen tube. The pollen tube carries the gametes to the embryo sac for fertilisation.
(iv) Part 'D' is the egg cell. After fertilisation with the male gametes, the egg cell forms the zygote.
Marks: 3

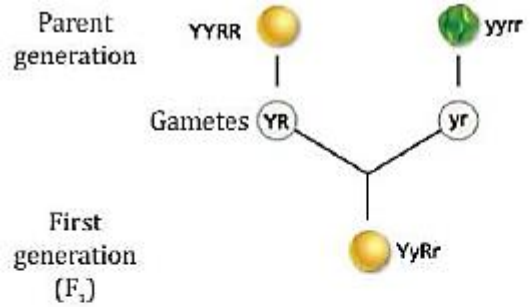
Question 12. Define reproduction. How does it help in providing stability to the population of species?
Solution: Reproduction is the ability of living organisms to produce living beings similar to them. Reproduction maintains the number of chromosomes specific to a species in each generation. Multicellular organisms have specialised cells in their gonads, which have only half the number of chromosomes and half the amount of DNA as compared to non-reproductive body cells. So, when these germ cells from 2 different individuals combine during sexual reproduction to form a new individual, it results in the re-establishment of the number of chromosomes and the DNA content in the new generation. Thus, it provides stability to the population of a species.
Marks: 3

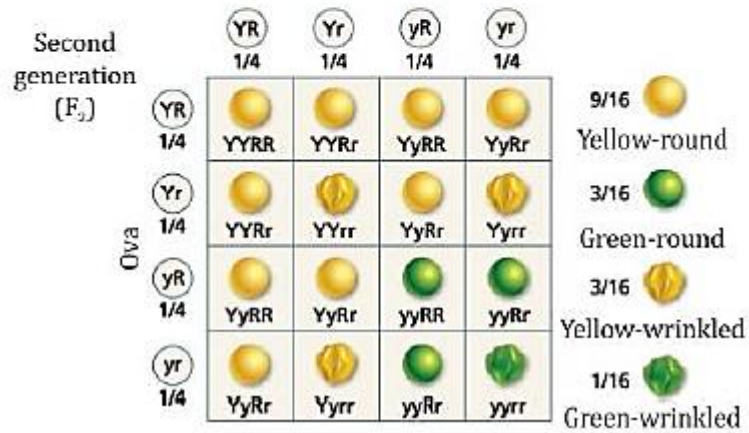
Question 13. Explain the term "Regeneration" as used in relation to reproduction of organisms. Describe briefly how regeneration is carried out in multicellular organisms like Hydra.
Solution: Regeneration is the ability of organisms to generate lost or damaged parts of the body.
When a hydra is bisected anywhere in the upper 7^{th} or 8^{th} part of the body column, the upper half will regenerate a foot at its basal end and the lower half will regenerate a head at its apical end; each half

generates the organ which it is missing. The regeneration is precise, and the head and foot are always formed specifically at the apical and basal ends, respectively.
Marks: 3

Question 14. "Two areas of study namely `evolution' and `classification' are interlinked". Justify this statement.
Solution: All living things are identified and categorised on the basis of their body design in form and function. After a certain body design comes into existence, it will shape the effects of all other subsequent design changes simply because it already exists. So, characteristics which came into existence earlier are likely to be more basic than characteristics which have come into existence later. This means that the classification of life forms will be closely related to their evolution. On connecting this idea of evolution to classification, it is seen that some groups of organisms with ancient body designs have not changed very much. However, other groups of organisms have acquired their particular body designs relatively recently. Because there is a possibility that complexity in design will increase over evolutionary time, it may not be wrong to say that older organisms are simpler, while younger organisms are more complex.
Marks: 3

Question 15. How do Mendel's experiment show that traits are inherited independently?
Solution: Mendel carried out dihybrid crosses by crossing two pea plants differing in contrasting traits of two characters. For example, he crossed a pea plant having yellow colour and round seed characters with another pea plant bearing green colour and wrinkled seed characters. In the F_2 generation, he obtained pea plants with two parental and two recombinant phenotypes as yellow round and green wrinkled (parental) and yellow wrinkled and green round (recombinant). This indicated that traits separated from their original parental combinations and got inherited independently.





Marks: 3

Question 16. The activities of man had adverse effects on all forms of living organisms in the biosphere. Unlimited exploitation of nature by man disturbed the delicate ecological balance between the living and non-living components of the biosphere. The unfavourable conditions created by man himself threatened the survival not only of himself but also of the entire living organisms on the mother earth. One of your classmates is an active member of `Eco club' of your school which is creating environmental awareness amongst the school students, spreading the same in the society and also working hard for preventing environmental degradation of the surroundings.
(a) Why is it necessary to conserve our environment?
(b) State the importance of green and blue dust-bins in the safe disposal of the household waste.
(c) List two values exhibited by your classmate who is an active member of Eco-club of your school.
Solution: (a) It is necessary to conserve our environment because
(i) It helps in protecting the ozone layer.
(ii) It helps in maintaining animal and human food chains.
(iii) It provides us with many useful products such as medicines and wood.
(b) Disposal of household waste is carried out in green and blue bins, respectively. It will be very useful in the separate disposal of biodegradable and non-biodegradable wastes. This will also ensure the application of 3Rs—reduce, reuse and recycle.
(c) Two values exhibited are
(i) Creating environmental awareness among students and society.
(ii) Working hard on prevention of environmental degradation of surroundings.
Marks: 3

Question 17. The image formed by a spherical mirror is real, inverted and is of magnification –2. If the image is at a distance of 30 cm from the mirror, where is the object placed? Find the focal length of the mirror. List two characteristics of the image formed if the object is moved 10 cm towards the mirror.
Solution: Given: Magnification, m = –2
Distance of the image, v = –30 cm

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

$$\therefore u = -\frac{v}{m} = -\frac{(-30)}{(-2)}$$

$\therefore$ u = –15 cm
Substituting these values in the mirror formula

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

$$= \frac{1}{(-30)} + \frac{1}{(-15)}$$

$$\frac{1}{f} = -\frac{1}{10}$$

$\therefore$ f = –10 cm
When the object is moved 10 cm towards the mirror the new position of the object is
u' = – (15 – 10) = –5 cm
Substituting the new value in the mirror formula

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

$$\frac{1}{v'} = \frac{1}{f} - \frac{1}{u'} = \frac{1}{10} - \frac{1}{(-5)}$$

$$\frac{1}{v'} = \frac{1}{10}$$

$\therefore$ v' = 10 cm

Thus, the image is located 10 cm behind the mirror.

And magnification, $m' = -\frac{v'}{u'} = -\frac{10}{(-5)}$

m' = 2

Since magnification is positive the image is erect and virtual.

Thus, the image is erect, virtual and magnified in nature.

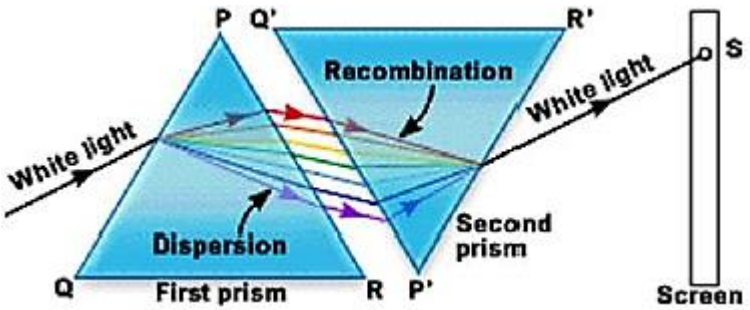
Marks: 3

Question 18. Describe an activity to show that colours of white light splitted by a glass prism can be recombined to get white light by another identical glass prism. Also draw ray diagram to show the recombination of the spectrum of white light.

Solution: The seven colours of a spectrum can be recombined to give back white light as

1. Two identical glass prisms are placed such that their refracting surfaces are in opposite direction (placed inverted). When a beam of light is allowed to fall on the surface of one prism, a patch of ordinary white light is obtained on a screen placed behind the second prism.

2. The first prism disperses the white light into seven coloured rays. The second prism receives all the seven coloured rays from the first prism and recombines them into original white light. This is because the refraction produced by the second prism is equal and opposite to that produced by the first prism. Hence, the light coming out of the second prism will be white.



Marks: 3

Question 19. It is desired to obtain an erect image of an object, using concave mirror of focal length of 12 cm.

(i) What should be the range of distance of an object placed in front of the mirror?

(ii) Will the image be smaller or larger than the object? Draw ray diagram to show the formation of image in this case.

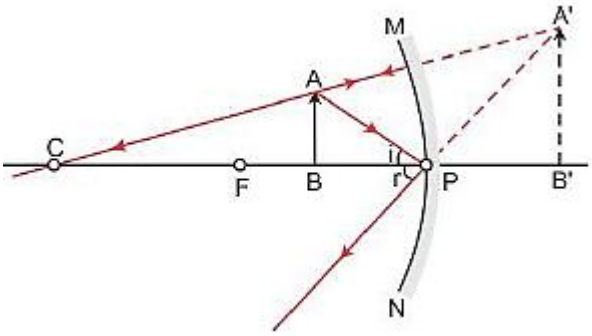
(iii) Where will the image of this object be, if it is placed 24 cm in front of the mirror? Draw ray diagram for this situation also justify your answer.

Show the positions of pole, principal focus and the centre of curvature in the above ray diagrams.

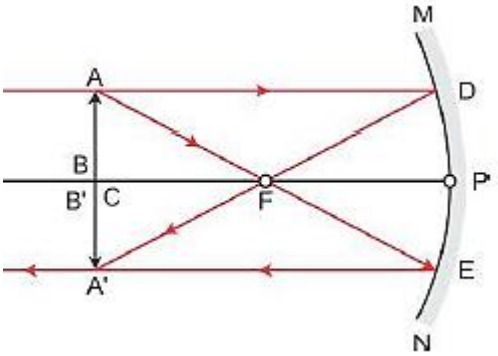
Solution: (i) To obtain an erect image, the object should be placed within the focus, i.e., between the pole and the focus. Here, the focal length of the mirror is 12 cm.

Hence, the object should be placed at a distance less than 12 cm.

(ii) The image will be larger than the object (enlarged).



(iii) Since f = 12 cm $\rightarrow$ Centre of curvature = 2f = 24 cm
For an object placed at a distance 24 cm, i.e., at the centre of curvature of a concave mirror, the image formed will be real, inverted and of the same size as that of the object.

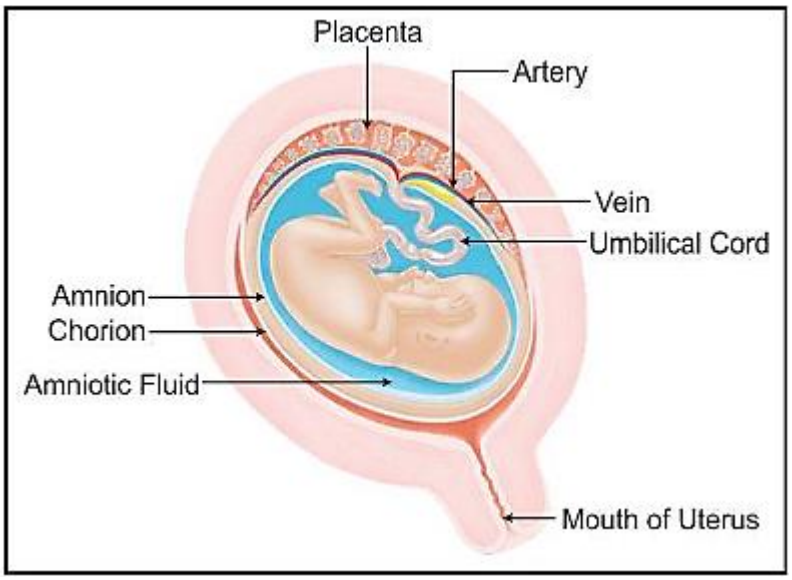


Marks: 5

Question 20. Define evolution. How does it occur? Describe how fossils provide us evidences in support of evolution.
Solution: Evolution is the formation of more complex organisms from pre-existing simpler organisms over a certain period. Accumulation of variation in genetic material forms the basis of evolutionary processes. Fossils provide a unique view into the history of life by showing the forms and features of life in the past. Fossils tell us how species have changed across long periods of the Earth's history.
Importance of fossils in the evolutionary process:
1. Some invertebrates living on the sea bed died and were buried in the sand.
2. More sand was accumulated and formed sandstone under pressure.
3. After millions of years, dinosaurs living in the area died and their bodies were buried in the mud.
4. The mud got compressed into the rock, just above the rock containing earlier invertebrate fossils.
5. Again millions of years later, the bodies of horse-like creatures dying in the area were fossilised in the rocks above the earlier rocks.
6. Much later, because of erosion and water flow, some rocks wore out and exposed the horse-like fossils.
Marks: 5

Question 21. What is placenta? Describe its structure. State its functions in case of a pregnant human female.
Solution: The placenta is an organ attached to the lining of the womb during pregnancy. The placenta is composed of both maternal tissue and tissue derived from the embryo. It contains blood spaces on the mother's side and villi on the embryo's side.
Functions of the placenta:
1. It provides food and oxygen to the foetus.

2. The foetus gives away waste products and carbon dioxide to the mother's blood for excretion.



Marks: 5

Question 22. A carbon compound `P' on heating with excess conc. $H_2SO_4$ forms another carbon compound `Q' which on addition of hydrogen in the presence of nickel catalyst forms a saturated carbon compound `R'. One molecule of `R' on combustion forms two molecules of carbon dioxide and three molecules of water. Identify P, Q and R and write chemical equations for the reactions involved.

Solution: $P \xrightarrow{\text{Excess } H_2SO_4} Q \xrightarrow{H_2/\text{Nickel catalyst}} R \xrightarrow{O_2} 2CO_2 + 3H_2O$

$P \xrightarrow{\text{Excess } H_2SO_4} Q$

$CH_3CH_2OH \xrightarrow{\text{Excess } H_2SO_4} CH_2 = CH_2$

$Q \xrightarrow{H_2/\text{Nickel catalyst}} R$

$CH_2 = CH_2 \xrightarrow{H_2/\text{Nickel catalyst}} CH_3 - CH_3$

$R \xrightarrow{O_2} 2CO_2 + 3H_2O$

$CH_3 - CH_3 \xrightarrow{O_2} 2CO_2 + 3H_2O$

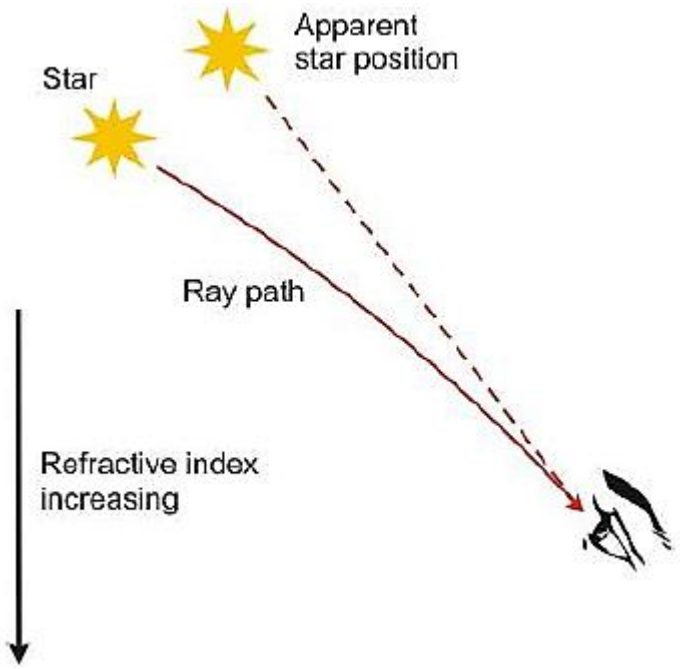
$CH_3CH_2OH \xrightarrow{\text{Excess } H_2SO_4} CH_2 = CH_2 \xrightarrow{H_2/\text{Nickel catalyst}} CH_3 - CH_3 \xrightarrow{O_2} 2CO_2 + 3H_2O$

P	Q	R
Ethanol	Ethene	Ethane

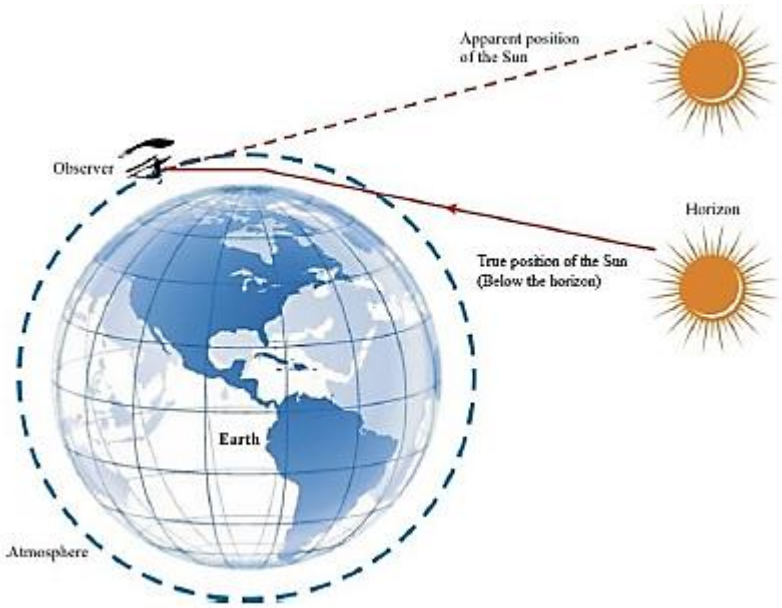
Marks: 5

Question 23. What is atmospheric refraction? Use this phenomenon to explain the following natural events:
(a) Twinkling of stars
(b) Advanced sun-rise and delayed sun-set.
Draw diagrams to illustrate your answers.

Solution: (a) Stars emit light on their own; when this light travels through the Earth's atmosphere which has variable optical density, the continuously changing atmosphere refracts the light from the stars in different amounts from one moment to the next. The light seems to be bright and dim as it keeps changing because of continuous refraction through the different layers of the atmosphere of the Earth. Hence, we say light twinkles at night.



(b) The sunrise is advanced because of the atmospheric refraction of sunlight. An observer on the Earth sees the Sun two minutes before the Sun reaches the horizon. A ray of sunlight entering the Earth's atmosphere follows a curved path because of atmospheric refraction before reaching the Earth. This happens because of a gradual variation in the refractive index of the atmosphere. For an observer on the Earth, the apparent position of the Sun is slightly higher than the actual position. Hence, the Sun is seen before it reaches the horizon.



The increased atmospheric refraction of sunlight occurs also at sunset. In this case, the observer on the Earth continues to see the setting Sun for two minutes after the Sun has dipped below the horizon, thus delaying the sunset. The advanced sunrise and delayed sunset increase the duration of the day by four minutes.
Marks: 5

Question 24. (a) Define focal length of a divergent lens.
(b) A divergent lens of focal length 30 cm forms the image of an object of size 6 cm on the same side as the object at a distance of 15 cm from its optical center. Use lens formula to determine the distance of the object from the lens and the size of the image formed.

(c) Draw a ray diagram to show the formation of image in the above situation.

Solution: (a) The focal length of a diverging lens is half the value of its radius of curvature. Conventionally, the sign of the focal length of the diverging lens is taken as negative.

(b) Given:

f = −20 cm (It is a diverging lens.)

v = −15 cm (Image is formed on the same side of the lens.)

Using the lens formula,

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

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

$$=\frac{1}{(-15)}+\frac{1}{(-30)}=-\frac{1}{30}$$

$$\therefore u=-30 \text{ cm}$$

Given: Height of the object, h = 6 cm

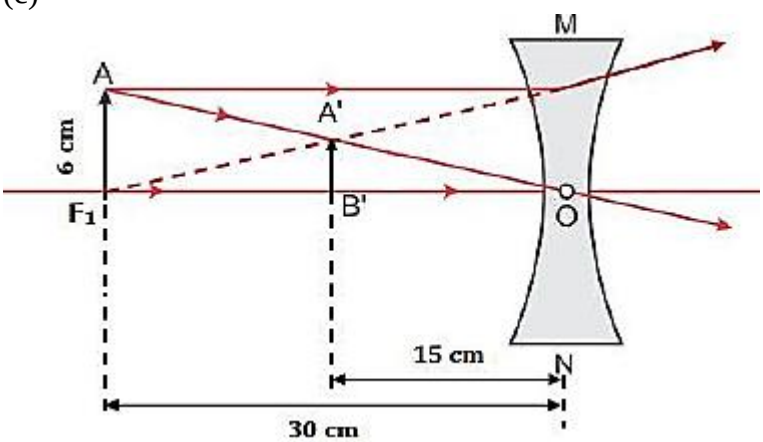
Height of the image, h' = ?

Magnification, $m = \frac{v}{u}=\frac{h'}{h}$

$$\therefore h'=h\frac{v}{u}=6\times\frac{(-15)}{(-30)}$$

$$\therefore h'=3 \text{ cm}$$

(c)



Marks: 5

SECTION B

Question 25. A student while observing an embryo of a pea seed in the laboratory listed various parts of the embryo as given below:

Testa, Tegmen, Radicle, Plumule, Micropyle, Cotyledon.

On examining the list the teacher remarked that only three parts are correct.

Select three correct parts from the above list:

(a) Testa, Radicle, Cotyleddon

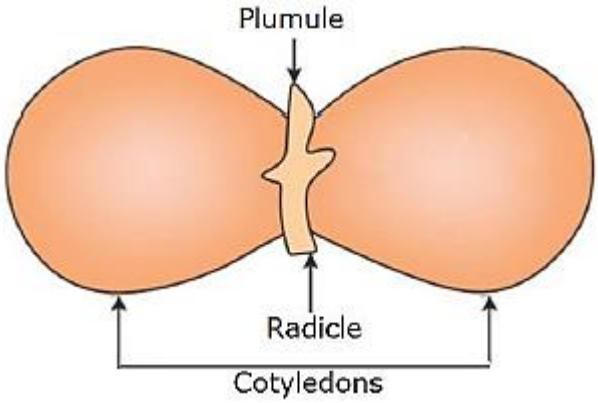
(b) Tegmen, Radicle, Micropyle

(c) Cotyledon, Plumule, Testa

(d) Radicle, Cotyledon, Plumule

Solution: (d) Radicle, Cotyledon, Plumule

A dicot embryo consists of radicle, plumule and a pair of cotyledons. Testa, tegmen and micropyle are the parts of the seed coat.



Marks: 1

Question 26. If you are asked to select a group of two vegetables, out of the following, having homologous structures which one would you select?

(a) Carrot and radish

(b) Potato and sweet potato

(c) Potato and tomato

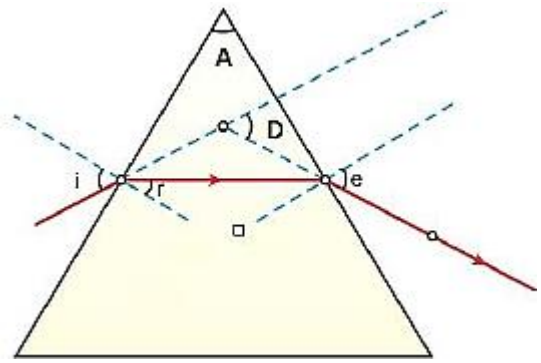
(d) Lady finger and potato

Solution: (a) Carrot and radish

Homologous structures are fundamentally same in structure and origin but are modified to perform different functions in different organisms. They indicate common ancestry. From the given plants, carrot and radish are homologous structures because they both are underground roots. While potato is a stem, sweet potato is a root, tomato is a fruit and lady finger is a vegetable.

Marks: 1

Question 27. In the following ray diagram the correctly marked angle are:



(a) ∠i and ∠e

(b) ∠A and ∠D

(c) ∠i, ∠e and ∠D

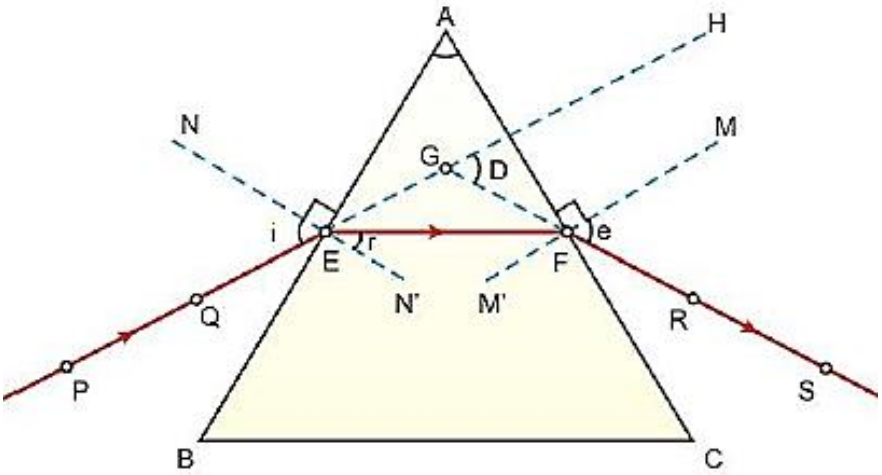
(d) ∠r, ∠A and ∠D

Solution: (d) ∠r, ∠A and ∠D

The angle between the normal and the incident ray is the angle of incidence.

The angle between the normal and the emergent ray is the angle of emergence.

The correctly marked angles are shown in the diagram below:



Marks: 1

Question 28. In your laboratory you trace the path of light rays through a glass slab for different values of angle of incidence ($\angle$i) and in each case measure the values of the corresponding angle of refraction ($\angle$r) and angle of emergence ($\angle$e). On the basis of your observations your correct conclusion is:

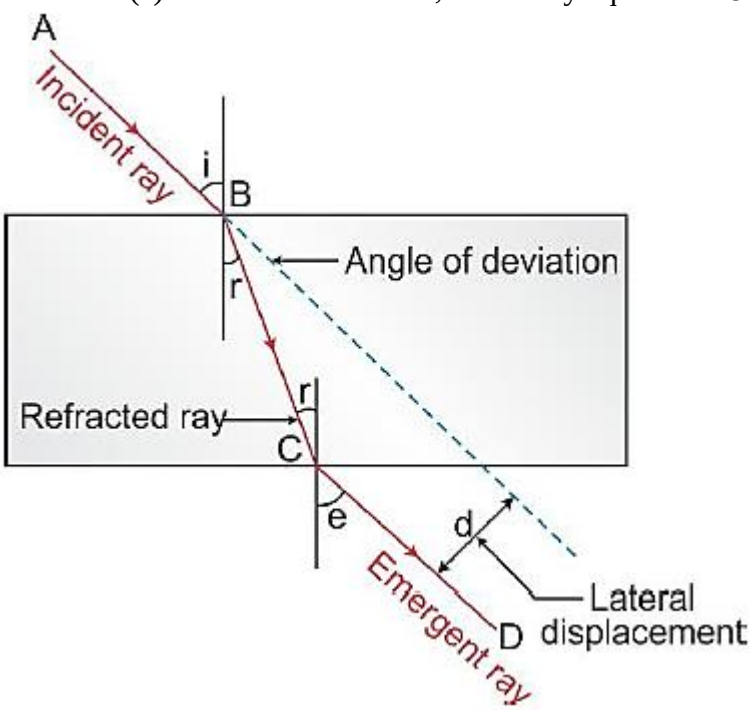
(a) $\angle$i is more than $\angle$r, but nearly equal to $\angle$e

(b) $\angle$i is less then $\angle$r, but nearly equal to $\angle$e

(c) $\angle$i is more than $\angle$e, but nearly equal to $\angle$r

(d) $\angle$i is less than $\angle$e, but nearly equal to $\angle$r

Solution: (a) $\angle$i is more than $\angle$r, but nearly equal to $\angle$e



On entering a glass slab, the incident light gets refracted. According to Snell's law, we get

$$\mu = \frac{\sin i}{\sin r}$$

For glass $\mu > 1$

$\therefore \sin r < \sin i$

or $r < i$

In refraction of light through a glass slab, the emergent ray is parallel to the incident ray. Thus, $\angle i = \angle e$.
Marks: 1

Question 29. To determine the approximate value of the focal length of a given concave mirror, you focus the image of a distant object formed by the mirror on a screen. The image obtained on the serene, as compared to the object is always:
(a) Laterally inverted and diminished
(b) Inverted and diminished
(c) Erect and diminished
(d) Erect and highly diminished
Solution: (b) inverted and diminished
Images obtained on the screen are always diminished and inverted in nature.
Marks: 1

Question 30. Suppose you have focused on a screen the image of candle flame placed at the farthest end of the laboratory table using a convex lens. If your teacher suggests you to focus the parallel rays of the sun, reaching your laboratory table, on the same screen, what you are expected to do is to move the:
(a) lens slightly towards the screen
(b) lens slightly away from the screen
(c) lens slightly towards the sun
(d) lens and screen both towards the sun
Solution: (a) lens slightly towards the screen
To focus the parallel rays of the Sun, the lens should be slightly moved towards the screen.
Marks: 1

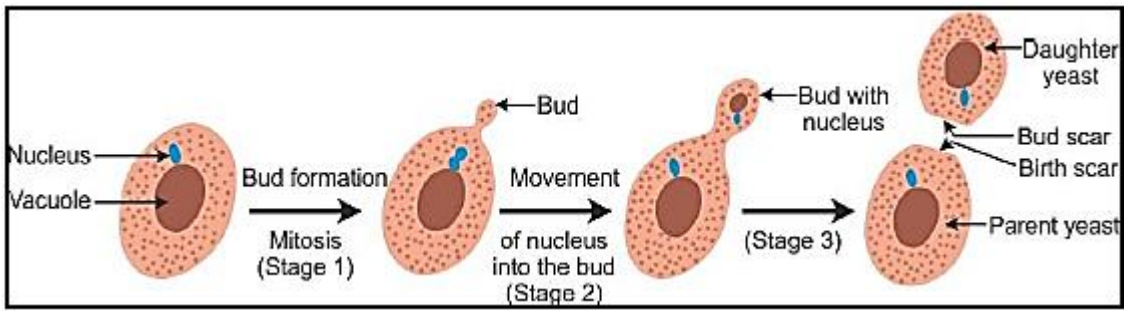
Question 31. For preparing soap in the laboratory we require an oil and a base. Which of the following combinations of an oil and a base would be best suited for the preparation of soap?
(a) Castor oil and calcium hydroxide
(b) Turpentine oil and sodium hydroxide
(c) Castor oil and sodium hydroxide
(d) Mustard oil and calcium hydroxide
Solution: (a) P and Q
Dissolving chloride salts of calcium or magnesium in distilled water will make the water hard and lather formation will take place with difficulty.
Marks: 1

Question 32. A student puts a drop of reaction mixture of a saponification reaction first a blue litmus paper and then on a red litmus paper. He may observe that:
(a) There is no change in the blue litmus paper and the red litmus paper turns white.
(b) There is no change in the red litmus paper and the blue litmus paper turns red.
(c) There is no change in the blue litmus paper and the red litmus paper turns blue.
(d) No change in colour is observed in both the litmus papers.
Solution: (c)

The molecules of soap are sodium or potassium salts of long chain carboxylic acids. So, when a student puts a drop of reaction mixture of a saponification reaction first on a blue litmus paper and then on a red litmus paper, he will observe that there is no change in the blue litmus paper and the red litmus paper turns blue.
Marks: 1

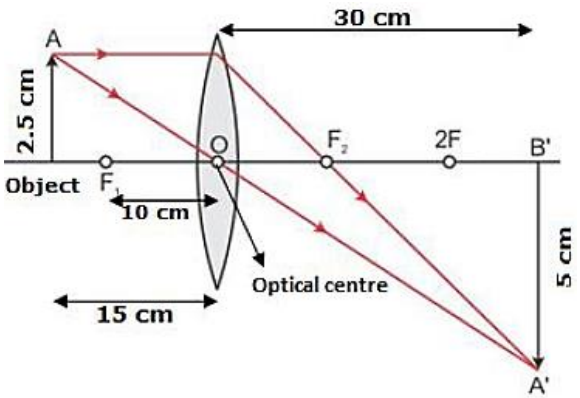
Question 33. In the neighbourhood of your school, hard water required for an experiment is not available. Select from the following group of salts available in your school, a group each member of which, if dissolved in distilled water, will make it hard:
(a) Sodium chloride, calcium chloride
(b) Potassium chloride, sodium chloride
(c) Sodium chloride, magnesium chloride
(d) Calcium chloride, magnesium chloride
Solution: (d) Calcium chloride, magnesium chloride
Dissolving chloride salts of calcium or magnesium in distilled water will make the water hard, and lather formation will take place with difficulty.
Marks: 1

Question 34. A student is observing a permanent slide showing sequentially the different stages of asexual reproduction taking place in yeast. Name this process and draw diagrams, of what he observes, in a proper sequence.
Solution: Yeast reproduces asexually by the process of budding. Different stages of budding as observed by the student are depicted below:



Marks: 2

Question 35. An object of height 2.5 cm is placed at a distance of 15 cm from the optical centre `O' of a convex lens of focal length 10 cm. Draw a ray diagram to find the position and size of the image formed. Mark optical `O', principal focus F and height of the image on the diagram.
Solution: Ray diagram:



Marks: 2

Question 36. A student adds a spoon full of powdered sodium hydrogen carbonate to a flask containing ethanoic acid. List two main observations, he must note in his note book, about the reaction that takes place. Also write chemical equation foe the reaction.

Solution: Two main observations about the reaction:

(i) Brisk effervescence of carbon dioxide which turns lime water milky.

(ii) It is a neutralisation reaction and heat is released.

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

Marks: 2

CBSE-X-2015 EXAMINATION

SCIENCE

SET-3

Paper & Solution

Time: 3 Hrs. Max. Marks: 90

General Instructions:

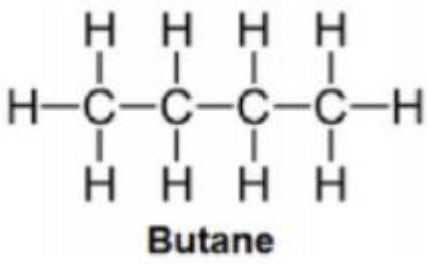
1. The question paper comprises **two** Sections, **A and B**. You are to attempt both the sections.
2. All questions are **compulsory**.
3. All questions of **Section A** and all questions of **Section B** are to be attempted separately.
4. Question numbers **1** to **3** in Section A are one-mark questions. These are to be answered in one word or in one sentence.
5. Question numbers **4** to **7** in Section A are two-mark questions. These are to be answered in about 30 words each.
6. Question numbers **8** to **19** in Section A are three-mark questions. These are to be answered in about 50 words each.
7. Question numbers **20** to **24** in Section A are five-mark questions. These are to be answered in about 70 words each.
8. Question numbers **25** to **42** in Section B are multiple choice questions based on practical skills. Each question is a one-mark question. You are to select one most appropriate response out of the four provided to you.

SECTION A

1. Write the number of covalent bonds in the molecule of butane, C_4H_{10}.

Answer:

There are thirteen covalent bonds—ten C-H and three C-C bonds—present in a molecule of butane.



Butane

2. Name two simple organisms having the ability of regeneration.

Answer:

Hydra and Planaria have the ability of regeneration.

3. Which of the following are always at the second tropic level of food chains?

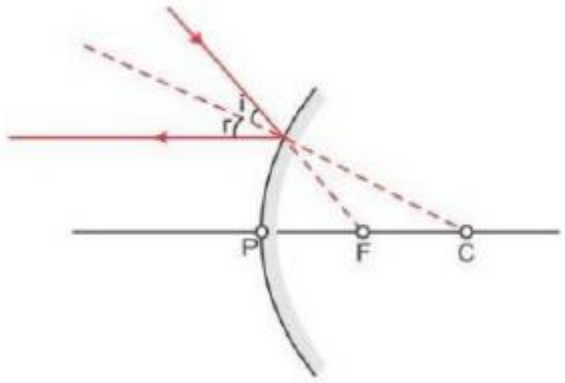
Answer:

Primary consumers (green plants) are always at the second trophic level.

4. Draw a ray diagram to show the path of the reflected ray corresponding to an incident ray of light parallel to the principal axis of a convex mirror and show the angle of incidence and angle of reflection on it.

Answer:

A light ray is incident on a convex mirror parallel to the principal axis. The ray diagram is shown below.



In the above diagram, 'i' is the angle of incidence and 'r' is the angle of reflection.

5. Why is sustainable management of natural resources necessary? Out of the two—reuse and recycle—which, in your opinion, is better to practice? Give reason.

Answer:

Sustainable management of natural resources is necessary to preserve the natural resources for the future generations and also to control environmental pollution.

Reusing is better than recycling because recycling requires a large amount of energy and money, but reusing creates lesser air and water pollution.

6. What is meant by biodiversity? List two advantages of conserving forests and wild life.

Answer:

The existence of many different kinds of plants and animals in an environment is called biodiversity.

Two advantages of conserving forests and wild life:

i. They add to the natural beauty of the environment.

ii. They provide valuable things which are required for our survival.

7. Write the name and general formula of a chain of hydrocarbons in which an addition reaction with hydrogen is possible. State the essential condition for an addition reaction. Stating this condition, write a chemical equation giving the name of the reactant and the product of the reaction.

Answer:

The addition of hydrogen is possible in alkenes and alkynes. This is because of the presence of double and triple bonds, respectively.

The general formula of alkenes is $C_n H_{2n}$ and that of alkynes is $C_n H_{2n-2}$ Conditions for addition reactions are

- Presence of an unsaturated compound, i.e. an unsaturated hydrocarbon.
- Presence of a species to be added to an unsaturated compound.
- Presence of a catalyst such as finely divided palladium or nickel.

$$CH_2 = CH_2 + H_2 \xrightarrow{Ni} CH_3 - CH_3$$

ETHENE ETHANE

$$CH_3 - C = CH + 2H_2 \xrightarrow{Ni} CH_2 = CH - CH_3$$

PROPYNE PROPENE

8. List two tests for experimentally distinguishing between an alcohol and a carboxylic acid and describe how these tests are performed.

Answer:

Carboxylic acid can be distinguished from an alcohol by performing the following tests:

i. Test with 3 $NaHCO_3$ solution in water.

On adding carboxylic acid to baking soda, carbon dioxide is liberated with brisk effervescence.

On adding a solution of baking soda to alcohol, no brisk effervescence occurs.

ii. Test with blue litmus solution.

Carboxylic acid turns blue litmus red. There is no change in colour when a blue litmus solution is added to alcohol.

Answer:

Given below are some elements of the modern periodic table. Atomic number of the element is given in parentheses.

A (4), B (9), C (14), D(19), E(20)

(a) Select the element that has one electron in the outermost shell. Also, write the electronic configuration of this element.

(b) Which two elements amongst these belong to the same group? Give reasons for your answer.

(c) Which two elements amongst these belong to the same period? Which one of the two has bigger atomic radius?

Answer:

(a) Element D (19) has one electron in its outermost shell.

Its electronic configuration is 2, 8, 8, 1.

(b) Elements A (4) and E (20) have two electrons in their outermost shells.

Electronic configuration of A: 2, 2

Electronic configuration of E: 2, 8, 8, 2

Since they both have a valency of two, they belong to group 2 of the periodic table.

(c) Elements A (4) and B (9) belong to the second period, and elements D (19) and E (20) belong to the fourth period of the periodic table.

Since the effective nuclear charge which pulls the outermost electron closer to the nucleus increases from left to right in a period, the atomic radii of the elements decreases.

A (4) has a bigger atomic radius than B (9) and D (19) has a bigger atomic radius than E (20).

10. Taking the example of an element of atomic number 16, explain how the electronic configuration of the atom of an element relates to its position in the modern periodic table and how valency of an element is calculated on the basis of its atomic number.

Answer:

Atomic number of the element = 16

Electronic configuration = 2, 8, 6

The period number is equal to the number of shells which starts filling up in it.

The atom of an element has three shells. So, the period number is 3.

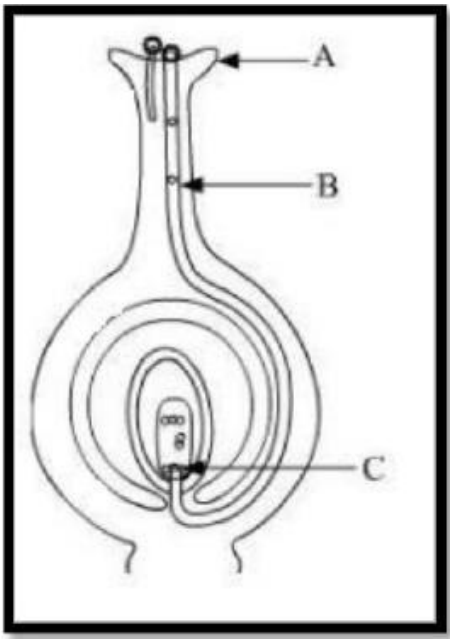
The atom of an element has six valence electrons in the outermost shell.

So, the group number of the element will be 16 (6 + 10).

The valency of an element is determined by the number of valence electrons present in the outermost shell.

The atom of an element has six valence electrons in the outermost shell, so the valency of the element is 2.

11. Name the parts A, B and C shown in the diagram and write their functions



Answer:
A - Stigma
Function: Pollen lands and germination starts
B - Pollen tube
Function: It carries the pollen to the egg cell for fertilisation.
C - Egg cell
Function: It fuses with the male gamete to form a zygote.

12. List any four methods of contraception used by humans. State in brief two advantages of adopting such preventive methods.
Answer:
Four methods of contraception used by humans—
Intrauterine devices, oral contraceptive methods, surgical methods and natural methods (coitus interrupts).
Two advantages of adopting such preventive methods:
i. Helps in preventing unwanted pregnancies
ii. Reduces the chance of getting STDs such as AIDS

13. What are chromosomes? Explain how in sexually reproducing organisms the number of chromosomes in the progeny is maintained.
Answer:
Chromosomes are thread-like structures found in the nucleus at the time of cell division. They are made of proteins and DNA.
In sexually reproducing organisms, the gametes undergo meiosis, and hence, each gamete contains only half a set of chromosomes. When two gametes fuse, the zygote formed contains the full set of chromosomes. Hence, the formation of gametes by meiosis helps to maintain the number of chromosomes in the progeny.

14. Explain the following:
(a) Speciation
(b) Natural Selection
Answer:

(a) Speciation: The process by which new species develop from the existing species is known as speciation. The factors which could lead to speciation are:
i. Geographical isolation of population caused by various types of barriers such as mountain ranges, rivers and seas. This leads to reproductive isolation because of which there is no flow of genes between separated groups of population.
ii. Genetic drift caused by drastic changes in the frequencies of particular genes by chance alone.
iii. Variations caused in individuals because of natural selection.
(b) Natural Selection: Natural selection is the process of evolution of a species whereby characteristics which help individual organisms to survive and reproduce are passed on to their offspring, and those characteristics which do not help are not passed on. Charles Darwin proposed the theory of natural selection. According to him, nature selects the fittest.
There are always changes in the progeny when an animal reproduces by sexual reproduction.
Example: If one of the progeny of deer is tall and the other is short, then the tall one with long legs will survive. Because the progeny with short height cannot reach the leaves of tall trees and cannot get food, they will starve and hence die. Thus, it proves the theory of natural selection.

15. Explain with an example for each, how the following provides evidences in favour of evolution in organisms:
(a) Homologous organs
(b) Analogous organs
(c) Fossils
Ans.
(a) Homologous organs: Organs which have the same basic structure but different functions are called homologous organs.
Example: The forelimbs of a man, lizard, frog, bird and bat have the same basic design of bones, but they perform different functions. The forelimbs of a man are used for grasping, the forelimbs of a lizard are used for running, the forelimbs of a frog are used to prop up the front ends of the body when at rest and the forelimbs of a bird and bat are modified for flying. Hence, all these organisms use their forelimbs for performing different functions, but the forelimbs have originated from the same structural pattern.
(b) Analogous organs: Organs which have different basic structure but similar appearance and perform similar functions are called analogous organs. Example: The wings of an insect and a bird have different structures, but they perform the same function of flying. Because the wings of insects and birds have different structures but perform similar functions, they are analogous organs.
(c) Fossils: The remains of dead animals or plants which lived in the remote past are known as fossils. The fossils provide evidence for evolution. For example, a fossil bird called Archaeopteryx looks like a bird, but it has many other features which are found in reptiles. It has feathered wings like those of birds but teeth and tail like those of reptiles. Therefore, Archaeopteryx is a connecting link between the reptiles and birds and hence suggests that birds have evolved from reptiles.

16. With the help of scattering of light, explain the reason for the difference in colours of the Sun as it appears during sunset/sunrise and noon.
Answer:
At the time of sunrise and sunset, when the Sun is near the horizon, sunlight travels a greater distance through the atmosphere to reach us. During this time, most of the shorter wavelengths present in it are scattered away from our line of sight by the molecules of air and other fine particles in the atmosphere. So,

light reaching us directly from the rising or setting Sun consists mainly of the longer wavelength red colour because of which the Sun appears red.
Thus, at sunrise and sunset, the Sun and the surrounding sky appear red. At noon, the Sun is overhead. So, the sunlight has to travel a relatively shorter distance. Hence, there is only slight scattering of shorter wavelengths of blue and violet colour. Therefore, the Sun appears mostly white.

17.An object of height 5 cm is placed perpendicular to the principal axis of a concave lens of focal length 10 cm. If the distance of the object from the optical centre of the lens is 20 cm, determine the position, nature and size of the image formed using the lens formula.
Answer:
Given: Height of the object = h = 5 cm
Focal length of the concave lens = f = −10 cm
Object distance = u = −20 cm
Using the lens formula, we get

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

$$\Rightarrow \frac{1}{-10}=\frac{1}{v}-\frac{1}{-20}$$

$$\Rightarrow -\frac{1}{10}=\frac{1}{v}-\frac{1}{-20}$$

$$\Rightarrow -\frac{1}{10}-\frac{1}{20}=\frac{1}{v}$$

$$\Rightarrow \frac{-2-1}{20}=\frac{1}{v}$$

$$\Rightarrow \frac{-3}{20}=\frac{1}{v}$$

$$\Rightarrow v=6.67cm$$

Hence, the image is formed 6.67 cm in front of the lens on the same side as the object.
Because v is negative, we can say that the image is virtual.
From the magnification formula for the lens, we get

$$m=\frac{h'}{h}=\frac{v}{u}$$

$$h'=\frac{vh}{u}$$

$$\Rightarrow h'=\frac{-6.67(5)}{-20}$$

$$\Rightarrow h'=1.67$$

Hence, the size of the image is h′ = 1.67 cm.
Because the height of the image is positive and smaller than the height of the object, the image is erect and diminished. So, we can conclude that the image is virtual, erect and diminished.

18. Differentiate between biodegradable and non-biodegradable substances with the help of one example each. List two changes in habit that people must adopt to dispose non-biodegradable waste, for saving the environment.

Answer:

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

The changes which people must adopt to dispose non-biodegradable wastes for saving the environment are environment are

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

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

19.Write the importance of ciliary muscles in the human eye. Name the defect of vision that arises due to gradual weakening of the ciliary muscles. What types of lenses are required by the person suffering from this defect to see the objects clearly?

Akshay, sitting in the last row in his class, could not see clearly the words write on the blackboard. When the teacher noticed it, he announced if any student sitting in the front row could volunteer to exchange his seat with Akshay. Salman immediately agreed to exchange his seat with Akshay. He could now see the words written on the blackboard clearly. The teacher thought it fit to send the message to Akshay's parents advising them to get his eyesight checked. In the context of the above event, answer the following questions:

(a) Which defect of vision is Akshay suffering from? Which type of lens is used to correct this defect?

(b) State the values displayed by the teacher and Salman.

(c) In your opinion, in what way can Akshay express his gratitude towards the teacher and Salman?

Answer:

The curvature of the eye lens can be adjusted by the ciliary muscles. This changes the focal length of the lens. The defect which arises because of the gradual weakening of the ciliary muscles is known as presbyopia. A bifocal lens can be used to correct presbyopia. Answers to the context questions:

(a) Akshay is not able to see from a far distance, so he is suffering from myopia or nearsightedness. A concave lens should be used to correct this defect.

(b) The teacher displayed presence of mind and pro-activeness, and she is of a considerate nature. Salman displayed the virtue of friendship and is caring in nature.

(c) Akshay should thank the teacher and Salman in front of the entire class.

20. What is meant by power of a lens? Define its SI unit. [5] You have two lenses A and B of focal lengths +10 cm and –10 cm, respectively. State the nature and power of each lens. Which of the two lenses will form a virtual and magnified image of an object placed 8 cm from the lens? Draw a ray diagram to justify your answer. [5]

Answer:

The power of a lens is defined as the reciprocal of its focal length. It is represented by the letter P. The power P of a lens of focal length f is given as

$$p = \frac{1}{f}$$

The SI unit of power is dioptre (D).

Given: Focal length of lens A, FA = +10 cm = +0.1 m

Focal length of lens B, FB = −10 cm = −0.1 m
To calculate the power of lens A:
The power of lens A,

$$p = \frac{1}{f_A}$$

$$\Rightarrow p = \frac{1}{+0.1}$$

$$\Rightarrow p = +10D$$

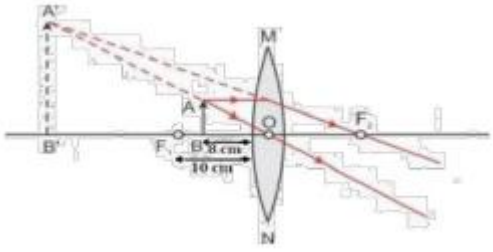
The positive sign indicates that it is a converging or convex lens.
To calculate the power of lens B:
The power of lens B,

$$p = \frac{1}{f_B}$$

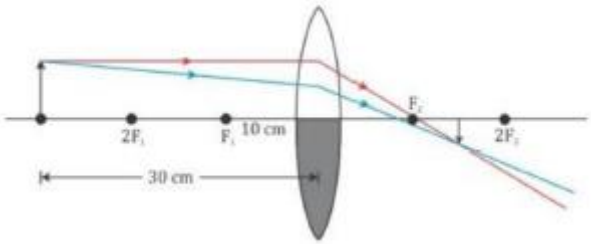
$$\Rightarrow p = \frac{1}{-0.1}$$

$$\Rightarrow p = -10D$$

The negative sign indicates that it is a diverging or concave lens.
In a convex lens, when the object is placed between the pole and focus, the image formed is always virtual and magnified.
On the other hand, a concave lens produces virtual, erect but diminished image. Here the object is placed 8 cm from the lens which is at a distance less than the focal length, i.e. less than 10 cm. Thus, the 8 cm position of the object placed in front of the convex lens will produce a virtual and magnified image. The diagram for the same is as shown below:



21. One half of a convex lens of focal length 10 cm is covered with a black paper.
Can such a lens produce an image of a complete object placed at a distance of 30 cm from the lens?
Draw a ray diagram to justify your answer. A 4 cm tall object is placed perpendicular to its principal axis of a convex lens of focal length 20 cm. The distance of the object from the lens is 15 cm. Find the nature, position and the size of the image.
Answer:
A convex lens can produce the complete image of the object even though half of the lens is covered. This is because light coming from the object can be refracted from the other half of the lens. However, the intensity of light will be reduced.



Given: Height of the object = h = 4 cm
Focal length of the convex lens = f = 20 cm
Object distance = u = −15 cm
Using the lens formula, we get

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

$$\Rightarrow \frac{1}{20}=\frac{1}{v}-\frac{1}{-15}$$

$$\Rightarrow \frac{1}{20}=\frac{1}{v}+\frac{1}{15}$$

$$\Rightarrow \frac{1}{20}-\frac{1}{15}=\frac{1}{v}$$

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

$$\Rightarrow v=-60$$

Hence, the image is formed 60 cm in front of the lens on the same side as the object.
Because v is negative, we can say that the image is virtual. From the magnification formula for the lens, we get

$$m=\frac{h'}{h}=\frac{v}{u}$$

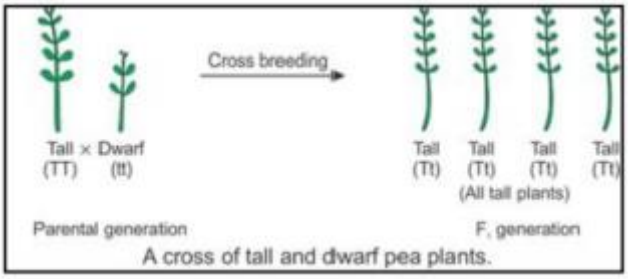
$$h'=\frac{vh}{u}$$

$$\Rightarrow h'=\frac{-60(4)}{-15}$$

$$\Rightarrow h'=16cm$$

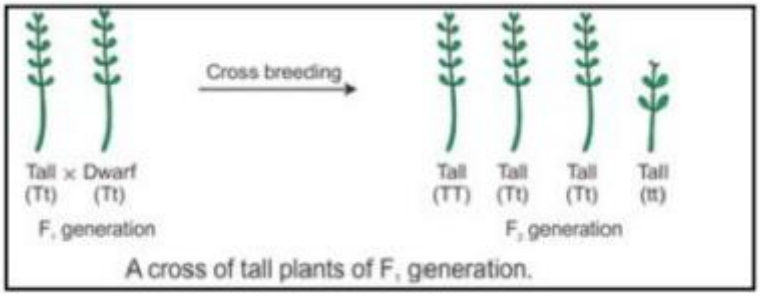
Hence, the size of the image is h′ = 16 cm.
Because the height of the image is positive and greater than the height of the object, the image is erect and magnified. So, we can conclude that the image is virtual, erect and magnified.

22.How do Mendel's experiments show that the
(a) traits may be dominant or recessive
(b) traits are inherited independently
Answer:
(a) Mendel crossed pure bred tall pea plants with pure bred dwarf pea plants and found that only tall pea plants were produced in the first generation and there were no dwarf pea plants. He concluded that the first generation showed the traits of only one of the parent plants—tallness. The trait of the other parent plant—dwarfness— did not show up in the progeny of the first generation.



A cross of tall and dwarf pea plants.

He then crossed the tall pea plants obtained in the first generation (F1 generation) and found that both tall plants and dwarf plants were obtained in the second generation (F2 generation) in the ratio of 3:1.
Mendel noted that the dwarf trait of the parent pea plant which disappeared in the first generation progeny reappeared in the second generation. In this way, Mendel's experiments with tall and dwarf pea plants showed that the traits may be dominant and recessive.



A cross of tall plants of F, generation.

(b) When Mendel crossed pure-bred tall pea plants with pure-bred dwarf pea plants, he found that only tall pea plants were produced in the F1 generation. When he further crossed the tall pea plants of the F1 generation, he found that the tall plants and dwarf plants were obtained in the ratio 3:1 in the F2 generation. Mendel noted that all the pea plants produced in the F2 generation were either tall or dwarf. There were no plants with intermediate height (or medium height) in between the tall and dwarf plants.
In this way, Mendel's experiment showed that the traits (like tallness and dwarfness) are inherited independently. This is because if the traits of tallness and dwarfness had blended (or mixed up), then medium-sized pea plants would have been produced.

23.
(a) Name the human male reproductive organ that produces sperms and also secretes a hormone. Write the functions of the secreted hormone.
(b) Name the parts of the human female reproductive system where
i. fertilisation takes place
ii. Implantation of the fertilised egg occurs Explain how the embryo gets nourishment inside the mother's body.
Answer:
(a) Testes produce sperms and secrete a hormone called testosterone. The function of testosterone is to control the development of male sex organs and male features such as a deeper voice, moustache, beard and more body hair as compared to females.
(b) i. Fertilisation takes place in the oviduct or fallopian tubes.
ii. Implantation of the fertilised egg occurs in the uterus. After implantation, a disc-like special tissue called placenta develops between the uterus wall and the embryo. The placenta helps in the exchange of nutrients, oxygen and waste products between the embryo and the mother. Thus, it provides nourishment to the growing embryo

24. Both soap and detergent are some type of salts. What is the difference between them? Describe in brief the cleansing action of soap. Why do soaps not form lather in hard water? List two problems that arise due to the use of detergents instead of soaps.

Answer:

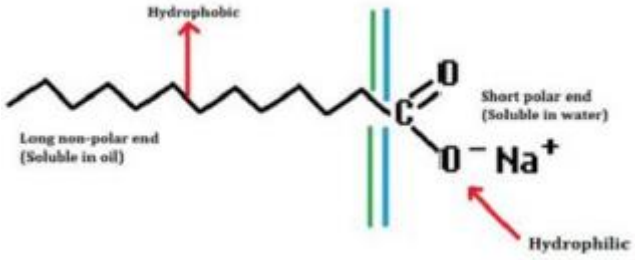
Difference between soap and detergent: The molecules of soap are sodium or potassium salts of long-chain carboxylic acids. Detergents are generally ammonium or sulphonate salts of long chain carboxylic acids.

Cleansing action of soap can be described as follows:

• A soap molecule has a tadpole-shaped structure.

• At one end (long non-polar end) of the soap molecule is a hydrocarbon chain which is insoluble in water but soluble in oil.

• At the other end (short polar end) of the soap molecule, there is a carboxylate ion which is hydrophilic, i.e. water soluble but insoluble in oil.



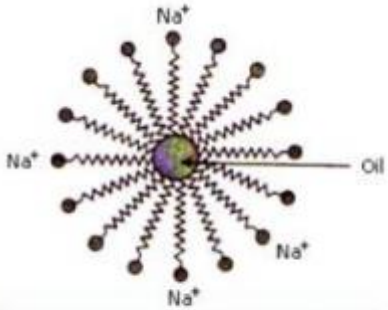
• Soap on mixing with water forms a concentrated solution and causes foaming.

• The long non-polar end of soap gravitates towards and surrounds the dirt and absorbs the dust in it.

• The short polar end with the carboxylate ion repels the water away from the dirt.

• A spherical aggregate of soap molecules is formed in the soap solution in water and is called a micelle.

•Thus, the soap molecule dissolves the dirt and our clothes get clean. Soaps do not form lather in hard water because Hard water contains calcium and magnesium salts. Soap molecules react with calcium and magnesium salts to form an insoluble precipitate called scum. Two problems arise because of the use of detergents instead of soap:



Formation of Micelles

i. Soaps are biodegradable, while detergents are non-biodegradable; hence, detergents accumulate in the environment and cause problems.

ii. Certain phosphate additives are added to detergents. These phosphate additives act as nutrients for algae which form a thick green scum over the river water and upset the animal life in the river.

SECTION B

25. A student traces the path of a ray of light through a rectangular glass slab for the different values of angle of incidence. He observes all possible precautions at each step of the experiment. At the end of the experiment, on analyzing the measurements, which of the following conclusions is he likely to draw?

(A) $\angle i = \angle e < \angle r$

(B) $\angle i - \angle e < \angle r$

(C) $\angle i > \angle e > \angle r$

(D) $\angle i = \angle e > \angle r$

Answer:

(A) $\angle i = \angle e < \angle r$

In refraction through a rectangular slab, the angle of incidence is equal to the angle of emergence. Also, the angle of refraction should be smaller than the angle of incidence.

26.A student traces the path of a ray of light through a triangular glass prism for different values of angle of incidence. On analyzing the ray diagrams, which one of the following conclusions is he likely to draw?

(A) The emergent ray is parallel to the incident ray.

(B) The emergent ray bends at an angle to the direction of the incident ray.

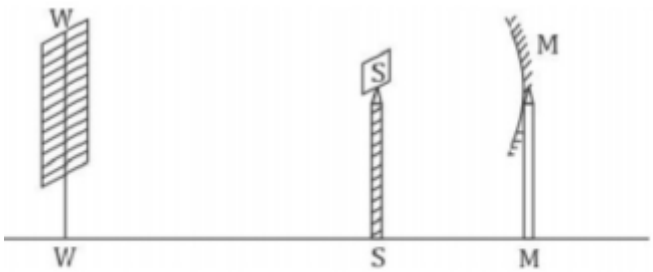
(C) The emergent ray and the refracted ray are at right angles to each other.

(D) The emergent ray is perpendicular to the incident ray.

Answer:

(B) The emergent ray bends at an angle to the direction of the incident ray. In refraction of light through a glass prism, there is deviation or change in the path of light passing through the prism.

27.A student obtains a sharp image of the distant window (W) of the school laboratory on the screen (S) using the given concave mirror (M) to determine its focal length. Which of the following distances should he measure to get the focal length of the mirror?



(A) MW

(B) MS

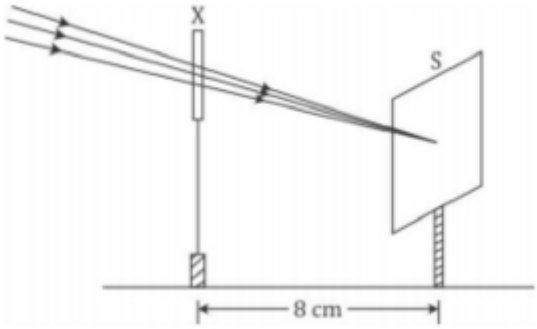
(C) SW

(D) MW – MS

Answer:

(B) MS The focal length of a concave mirror is the distance between its pole and principal focus. That is, the distance of the image formed (screen) from the concave mirror will be equal to the focal length of the concave mirror.

28.A student used a device (X) to obtain/focus the image of a well illuminated distant building on a screen (S) as shown below in the diagram. Select the correct statement about the device (X).



(A) This device is a concave lens of focal length 8 cm.
(B) This device is a convex mirror of focal length 8 cm.
(C) This device is a convex lens of focal length 4 cm.
(D) This device is a convex lens of focal length 8 cm.
Answer:
(D) This device is a convex lens of focal length 8 cm. The incident rays after passing through the lens converge at the focus. So, the device 'X' is a converging or a convex lens. The distance between the lens and the screen gives the focal length of the lens.

29. Given below is the list of vegetables available in the market. Select from these the two vegetables having homologous structures: Potato, sweet potato, ginger, radish, tomato, carrot, okra (Lady's finger)

(A) Potato and sweet potato
(B) Radish and carrot
(C) Okra and sweet potato
(D) Potato and tomato
Answer:
(B) Radish and carrot Radish and carrot are homologous structures as these are modifications of the root. Tomato and okra are fruits. Potato is a modification of the stem.

30. A student was asked to observe and identify the various parts of an embryo of a red kidney bean seed. He identified the parts and listed them as under: [1]
I. Tegmen
II. Testa
III. Cotyledon
IV. Radicle
V. Plumule
The correctly identified parts among these are
(A)I, II and III
(B)II, III and IV
(C)III, IV and V
(D)I, III, IV and V
Answer:
(C) III, IV and V An embryo has two large cotyledons and one embryo axis or tigellum. The upper end of the embryo axis is the plumule, and the lower end of the embryo axis which projects beyond the cotyledons

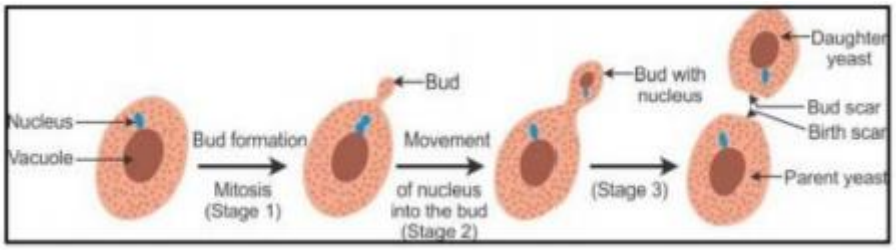
is the radical. The testa is the thick outer seed coat, and the tegmen is the inner transparent seed coat of seeds.

31. While preparing soap a small quantity of common salt is generally added to the reaction mixture of vegetable oil and sodium hydroxide. Which one of the following may be the purpose of adding common salt?
(A)To reduce the basic nature of the soap
(B)To make the soap neutral
(C) To enhance the cleansing power of the soap
(D)To favour the precipitation of the soap
Answer:
(D) To favour the precipitation of the soap During saponification, the soap formed remains in a suspended form in the mixture. It is precipitated as a solid from the suspension by adding common salt to the suspension. This process is called salting out of soap.

32.A student takes about 4 ml of distilled water in four test tubes marked P, Q, R and S. He then dissolves in each test tube an equal amount of one salt in one test tube, namely sodium sulphate in P, potassium sulphate in Q, calcium sulphate in R and magnesium sulphate in S. After that he adds an equal amount of soap solution in each test tube. On shaking each of these test tubes well, he observes a good amount of lather (foam) in the test tube marked.
(A)P and Q
(B)Q and R
(C) P, Q and S
(D)P, R and S
Answer:
(A) P and Q Lather (foam) is formed by the reaction of soap solution with sodium sulphate and potassium sulphate in the test tubes P and Q, respectively. They are dissolved in water to give a neutral solution. Sulphates, chlorides and bicarbonates of calcium and magnesium make the water hard. Thus, the lather is not formed in the test tubes R and S.

33. What do we observe on pouring acetic acid on red and blue litmus papers? [1]
(A)Red litmus remains red and blue litmus turns red.
(B)Red litmus turns blue and blue litmus remains blue.
(C) Red litmus turns blue and blue litmus turns red.
(D)Red litmus becomes colourless and blue litmus remains blue.
Answer:
(A) Red litmus remains red and blue litmus turns red. Acids turn blue litmus paper red.
They have no effect on red litmus paper.

34. Students were asked to observe the permanent slides showing different stages of budding in yeast under high power of a microscope.
(a) Which adjustment screw (coarse/fine) were you asked to move to focus the slides?
(b) Draw three diagrams in correct sequence showing budding in yeast.
Answer:
(A) A fine screw is used to focus the slides of budding in yeast under high power of a microscope.
(B) Sequence showing budding in yeast:



35. When you add sodium hydrogen carbonate to acetic acid in a test tube, a gas liberates immediately with brisk effervescence. Name this gas. Describe the method of testing this gas.

Answer:

Carbon dioxide gas gets liberated. When a pinch of sodium hydrogen carbonate is added to acetic acid in a test tube, a brisk effervescence is produced because of the liberation of carbon dioxide gas. When this gas is passed through the lime water, it turns lime water milky.

This shows that the gas liberated is carbon dioxide gas. The chemical reaction can be represented as

$CH_3COOH\ (aq) + NaHCO_3(s) \rightarrow CH_3COONa\ (aq) + H_2O(l) + CO_2(g) \uparrow$

36. A 4 cm tall object is placed on the principal axis of a convex lens. The distance of he object from the optical centre of the lens is 12 cm and its sharp image is formed at a distance of 24 cm from it on a screen on the other side of the lens. If the object is now moved a little away from the lens, in which way (towards the lens or away from the lens) will he have to move the screen to get a sharp image of the object on it again? How will the magnification of the image be affected?

Answer:

Given that Object distance, u = −12 cm

Image distance, v = 24 cm

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

$$\Rightarrow \frac{1}{f} = \frac{1}{24} - \frac{1}{-12}$$

$$\Rightarrow \frac{1}{f} = \frac{1}{24} + \frac{1}{12}$$

$$\Rightarrow \frac{1}{f} = \frac{1+2}{24} =$$

$$\Rightarrow \frac{-1}{f} = \frac{3}{24}$$

$$\Rightarrow f = 8cm$$

$\therefore$ The focal length of the lens is 8 cm.

Now if the object is moved away from the lens, the screen has to be moved towards the lens. This is because when we move the object away from the lens, the object distance is increased. Hence, by the lens formula, the image distance decreases.

Magnification is given as

$$m = \frac{v}{u}$$

Because the image distance (v) decreases, the value of magnification also decreases.

CBSE – X – 2014 EXAMINATION

SCIENCE

SET-3 Paper & Solution

Time: 3 Hrs. Max. Marks: 90

General Instructions:

1. The question paper comprises **two** Sections, **A and B**. You are to attempt both the sections.
2. All questions are **compulsory**.
3. All questions of **Section A** and all questions of **Section B** are to be attempted separately.
4. Question numbers **1** to **3** in Section A are one-mark questions. These are to be answered in one word or in one sentence.
5. Question numbers **4** to **7** in Section A are two-mark questions. These are to be answered in about 30 words each.
6. Question numbers **8** to **19** in Section A are three-mark questions. These are to be answered in about 50 words each.
7. Question numbers **20** to **24** in Section A are five-mark questions. These are to be answered in about 70 words each.
8. Question numbers **25** to **42** in Section B are multiple choice questions based on practical skills. Each question is a one-mark question. You are to select one most appropriate response out of the four provided to you.

SECTION A

Question 1. The atomic numbers of three elements A, B and C are 12, 18 and 20 respectively. State, giving reason, which two elements will show similar properties.

Solution: The elements are,

A-(Atomic number 12) = **Magnesium**

B-(Atomic number 18) = **Argon**

C-(Atomic number 20) = **Calcium**

Element Calcium and magnesium will show similar properties as they belong to same group (Group II) of the periodic table. They have same number of valence electrons and they both are metals. While argon is a noble gas.

Marks: 1

Question 2. No two individuals are absolutely alike in a population. Why?

Solution: No two individuals are absolutely alike in a population due to variations taking place during the process of DNA copying.

Marks: 1

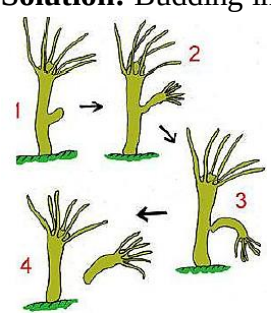
Question 3. Write one negative effect of affluent lifestyle of few persons on the environment.

Solution: Affluent lifestyle of few persons leads to exploitation and overconsumption of natural resources which ultimately results in their scarcity.

Marks: 1

Question 4. Draw labelled diagrams to illustrate budding in *Hydra*.

Solution: Budding in Hydra:



Marks: 2

Question 5. "A concave mirror of focal length 15 cm can form a magnified, erect as well as inverted image of an object placed in front of it." Justify this statement stating the position of the object with respect to the pole of the mirror in both the cases for obtaining the images.
Solution: For magnified and erect image the object is placed between pole P and focus F.
For magnified and inverted image the object is placed either at focus or anywhere between F and C.
Marks: 2

Question 6. State with reason any two possible consequences of elimination of decomposers from the Earth.
Solution: Consequences of elimination of decomposers:
i. If all the decomposers of earth are eliminated then the dead bodies of plants and animals would not be decomposed into simpler non-polluting substances so whole of the earth in no time would have heaps of dead bodies of plants and animals. They would start giving foul smell and life would become impossible on earth.
ii. Elimination of decomposers would cause imbalance of nutrients as they break complex organic material into simpler substances in different nutrient cycles.
Marks: 2

Question 7. What is water harvesting? How can this technique help in the conservation of water?
Solution: Water harvesting refers to all the processes and steps that are taken for scientific conservation of fresh water.
Water harvesting helps in the conservation of water as:
(i). It increases the ground water resources.
(ii). It reduces storm water discharge, urban floods and overloading of sewage treatment plants.
Marks: 2

Question 8. Study the following table in which positions of six elements A, B, C, D, E and F are shown as they are in the modern periodic table:

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

On the basis of the above table, answer the following questions:
(i) Name the element which forms only covalent compounds.
(ii) Name the element which is a metal with valency three.
(iii) Name the element which is a non-metal with valency three.
(iv) Out of D and E, which is bigger in size and why?
(v) Write the common name for the family to which the elements C and F belong.
Solution:

Group → / Period ↓	1	2	3-12	13	14	15	16	17	18
2	A (Li)					B (N)			C (Ne)
3				D (Al)	E (Si)				F (Ar)

(i) Element E - Silicon forms only covalent compounds.
(ii) Aluminium is a metal with the valency 3.
(iii) Nitrogen is a non-metal with the valency 3.
(iv) Out of D (Aluminium) and E (Silicon), aluminium has a larger size than silicon. This is because atomic size decreases across the period.
(v) Common name for the family to which the elements C (Neon) and F (Argon) belong is 'Noble gas' or 'Inert gas'.
Marks: 3

Question 9. The elements Be, Mg and Ca each having two electrons in their outermost shells are in periods 2, 3, and 4 respectively of the modern periodic table. Answer the following questions, giving justification in each case:
(i) Write the group to which these elements belong.
(ii) Name the least reactive element.
(iii) Name the element having largest atomic radius.
Solution: (i) Elements Be, Mg and Ca belong to Group II.
(ii) Beryllium (Be) is the least reactive element. This is because, as we move down the group, number of shells increases and the effective nuclear charge decreases. Thus, the tendency to lose electrons increases.
(iii) Calcium has the largest atomic radius. Since, number of shells increases down the group atomic radius also increases.
Marks: 3

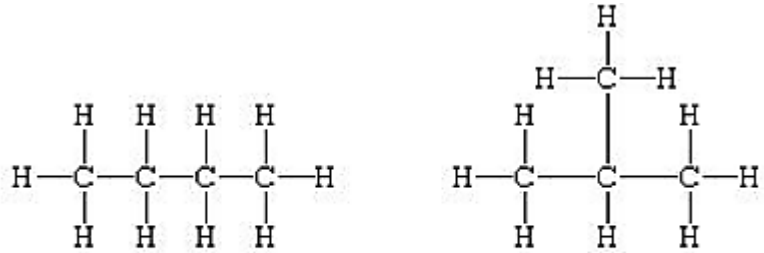
Question 10. A carboxylic acid (molecular formula $C_2H_4O_2$) reacts with an alcohol in the presence of an acid catalyst to form a compound 'X'. The alcohol on oxidation with alkaline $KMnO_4$ followed by acidification gives the same carboxylic acid $C_2H_4O_2$.
Write the name and structure of
(i) carboxylic acid, (ii) alcohol and (iii) the compound 'X'.
Solution: Ethanoic acid reacts with ethanol in the presence of concentrated sulphuric acid as a catalyst to produce the ester, ethyl ethanoate. The reaction is slow and reversible.

$$\underset{\text{Ethanoic acid}}{CH_3-COOH} + \underset{\text{Ethyl alcohol}}{CH_3-CH_2-OH} \underset{KMnO_4}{\overset{H_2SO_4}{\rightleftharpoons}} \underset{\text{Ethyl ethanoate}}{CH_3\overset{O}{\overset{\|}{C}}-O-CH_2CH_3} + \underset{\text{Water}}{H_2O}$$

(i) CH_3-COOH:- Ethanoic acid
(ii) CH_3 - CH_2 - OH:- Ethyl alcohol or Ethanol
(iii) Compound $X = CH_3\overset{O}{\overset{\|}{C}}-O-CH_2CH_3$:- Ethyl ethanoate.
Marks: 3

Question 11. Define the term ‘structural’ isomerism'. Explain why propane cannot exhibit this property. Draw the structures of possible isomers of butane, C_4H_{10}.
Solution: Structural isomerism: Molecules having same molecular formula but different structure are said to be structural isomers.
Propane has the chemical formula C_3H_8 and it is represented as CH_3-CH_2-CH_3. In alkanes, isomerism arises when a particular compound can be represented in the form of both straight chain and branched chain. Also, the branching cannot be done from the first or the last carbon atom of the structure.

The structural formulae of propane show that they do not have sufficient number of carbon atoms to exist in the form of branched isomer. Hence, they do not exhibit structural isomerism.
Isomers of Butane: There are two isomers. N-butane and iso-butane



n-butne **iso-butane**

C_4H_{10} C_4H_{10}

Marks: 3

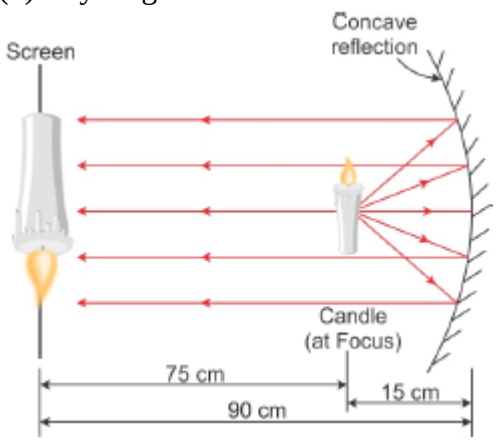
Question 12. A student wants to project the image of a candle flame on a screen 90 cm in front of a mirror by keeping the flame at a distance of 15 cm from its pole.
(a) Suggest the type of mirror he should use.
(b) Determine the linear magnification in this case.
(c) Find the distance between the object and its image.
(d) Draw ray diagram to show the image formation in this case.
Solution: (a) Concave mirror
(b) Linear magnification of a concave mirror is given by:

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

$$= \frac{-(-90)}{(-15)}$$

$= -6$

(c) The distance between the object and image = 90 – 15 = 75 cm.
(d) Ray diagram:

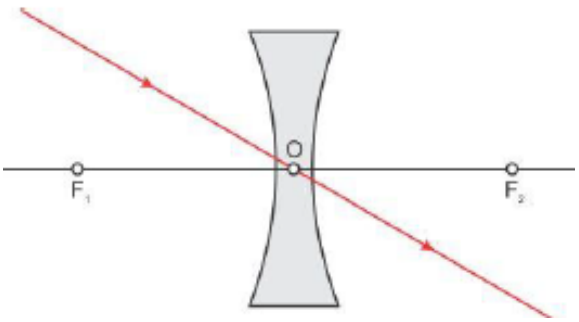


Marks: 3

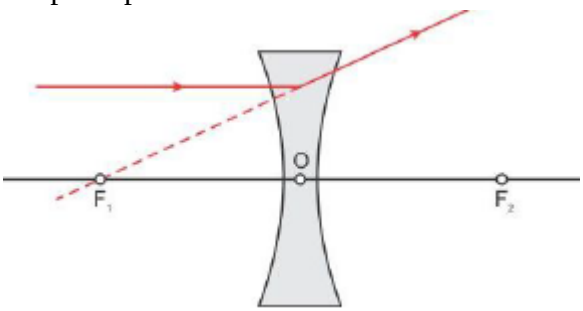
Question 13. Draw a ray diagram to show the path of the refracted ray in each of the following cases:
A ray of light incident on a concave lens is
(i) passing through its optical centre.
(ii) parallel to its principal axis.

(iii) directed towards its principal focus.

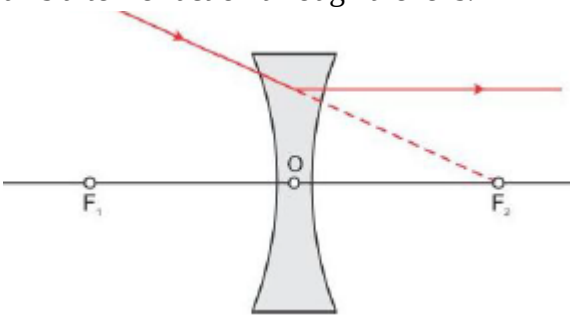
Solution: (i) A ray of light passing through the optical centre of the concave lens will emerge without any deviation.



(ii) A ray of light parallel to the principal axis, after refraction from a concave lens, appears to diverge from the principal focus on the same side of the lens.

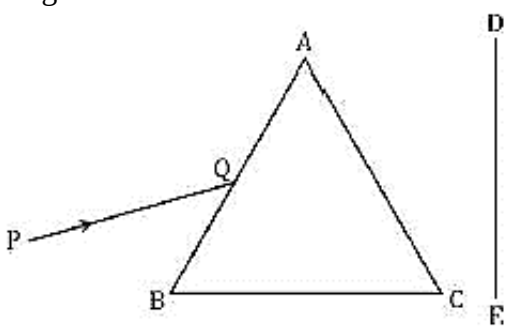


(iii) A ray of light directed towards the principal focus of a concave lens, becomes parallel to its principal axis after refraction through the lens.



Marks: 3

Question 14. A narrow beam PQ of white light is passing through a glass prism ABC as shown in the diagram.



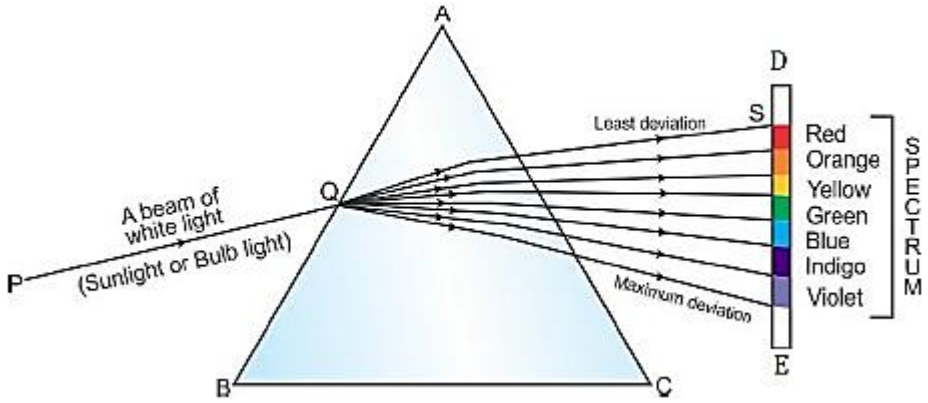
Trace it on your answer sheet and show the path of the emergent beam as observed on the screen DE.

(i) Write the name and cause of the phenomenon observed.

(ii) Where else in nature is this phenomenon observed?

(iii) Based on this observation, state the conclusion which can be drawn about the constituents of white light.

Solution:



(i) Dispersion of light

Cause: The dispersion of white light occurs because colors of white light travel at different speeds through glass prism. Different colours undergo different deviations on passing through prism.

(ii) Rainbow is the example of dispersion of light observed in nature.

It is caused due to dispersion of sunlight by water droplets in the atmosphere. It always forms in the direction opposite to the sun.

(iii) White light is a mixture of seven colours. The sequence of colours given by the prism is Violet, Indigo, Blue, Green, Yellow, Orange and Red. **VIBGYOR** is the acronym for this sequence. The red light bends the least and violet light bends the most.

Marks: 3

Question 15. "Energy flow in a food chain is unidirectional" Justify this statement. Explain how the pesticides enter a food chain and subsequently get into our body.

Solution: The flow of energy in the ecosystem is said to be unidirectional because the energy lost as heat from the living organisms of a food chain cannot be reused by plants in photosynthesis.

Pesticides are non-biodegradable wastes which pass along the food chain from crops to man or other animals and birds and harm them.

Marks: 3

Question 16. Write one difference between asexual and sexual mode of reproduction. Which species is likely to have better chances of survival - the one reproducing asexually or the one reproducing sexually? Justify your answer.

Solution: The difference between asexual and sexual reproduction is that only one parent is needed in asexual reproduction whereas two parents are needed in sexual reproduction.

The organisms reproducing sexually have better chances of survival because it promotes diversity of characters in an offspring due to combinations of genes which can lead to variation whereas in asexual reproduction evolutionary change is not possible as only one parent is involved therefore no variation takes place.

Marks: 3

Question 17. What is the effect of DNA copying, which is not perfectly accurate, on the reproduction process? How does the amount of DNA remain constant though each new generation is a combination of DNA copies of two individuals?

Solution: The DNA copying which is not perfectly accurate in the reproduction process results in variations in populations for the survival of species.

The amount of DNA remains constant because the gametes are special type of cells called reproductive cells which contain only half the amount of DNA as compared to the normal body cells of an organism.
Marks: 3

Question 18. List three main factors responsible for the speciation and briefly describe each one of them.
Solution: The process by which new species develop from the existing species is known as speciation. The important factors which could lead to speciation are:
i. Geographical isolation of a population caused by various type of barriers such as mountain ranges, rivers and seas.
ii. Genetic drift caused by drastic changes in the frequencies of particular genes by chance alone.
iii. Variations caused in individuals due to natural selection.
Marks: 3

Question 19. "A trait may be inherited, but may not be expressed." Justify this statement with the help of a suitable example.
Solution: Some traits are determined by the combined effect of more than one pair of genes. These are referred to as polygenic or continuous, traits.
An example of this is human stature. The combined size of all of the body parts from head to foot determines the height of an individual. There is an additive effect. The sizes of all of these body parts are, in turn, determined by numerous genes. Human skin, hair, and eye color are also polygenic traits because they are influenced by more than one allele at different loci. The result is the perception of continuous gradation in the expression of these traits.
Marks: 3

Question 20. List two reasons for carbon forming a large number of compounds. Name the type of bonding found in most of its compounds. Why does carbon form compounds mainly by this kind of bonding?
Give reason why the carbon compounds
(i) generally have low melting and boiling points.
(ii) do not conduct electricity in molten state.
Solution: The two characteristic properties of the carbon element which leads to the formation of a very large number of organic compounds are: Catenation and Tetravalency.
Catenation: Carbon has the unique ability to form bonds with other atoms of carbon, giving rise to large molecules. This property is called catenation.
Tetravalency: Carbon has a valency of four. So, it is capable of bonding with four other atoms of carbon or atoms of some other mono-valent element.
1. *Covalent bonding* is found in most of the carbon compounds.
2. Carbon form compounds mainly by covalent bonding because-
The bonds that carbon forms with most other elements are very strong making these compounds exceptionally stable. One reason for the formation of strong bonds by carbon is its small size. This enables the nucleus to hold on to the shared pairs of electrons strongly. The bonds formed by elements having larger atoms are much weaker.
(i) Carbon compounds generally have low melting points and boiling points because-
The force of attraction between the molecules of carbon compounds is not very strong. These weak intermolecular forces make them very easy to pull apart from each other. Since they are easy to separate, carbon compounds have low melting and boiling points.

(ii) Carbon compounds do not conduct electricity in molten state because bonding in carbon compounds does not involve any formation of ions.
Marks: 5

Question 21. (a) List the parts of the human eye that control the amount of light entering into it. Explain how they perform this function.
(b) Write the function of retina in human eye.
(c) Do you know that the corneal-impairment can be cured by replacing the defective cornea with the cornea of the donated eye? How and why should we organise groups to motivate the community members to donate their eyes after death?
Solution: (a) The iris and pupil are the two parts of human eye that controls the amount of light entering the eyes. The iris automatically adjusts the size of the pupil according to the intensity of light received by the eye.
If the amount of light received by the eye is large (as during the daytime), then the iris contracts the pupil (makes the pupil small) and reduces the amount of light entering the eye. On the other hand, if the amount of light received by the eye is small (as in a dark room or during night), the iris expands the pupil (makes the pupil large) so that more light may enter the eyes. Thus, the iris regulates (or controls) the amount of light entering the eye by changing the size of the pupil.
(b) The retina acts as a screen on which the image is formed in the eye. The retina has a large number of light-sensitive cells. When the image falls on the retina then these light-sensitive cells get activated and generate electrical signals.
(c) Yes.
There is a need for awareness among various communities about eye donation after death as it will help a person suffering from an eye ailment to get the treatment.
The following steps can be taken to organize groups to motivate them:
(i) The person who is taking the initiative can communicate with people and after realizing people who are like minded should gather them and form an awareness group.
(ii) The group should then approach various communities and organizations in their area and promote their campaign.
(iii) They can also approach various hospitals and clinics to promote the campaign.
Marks: 5

Question 22. (a) Explain the following terms related to spherical lenses:
(i) optical centre
(ii) centres of curvature
(iii) principal axis
(iv) aperture
(v) principal focus
(vi) focal length
(b) A converging lens has focal length of 12 cm. Calculate at what distance the object should be placed from the lens so that it forms an image at 48 cm on the other side of the lens.
Solution: (a)
(i) *Optical centre*:
The central point of the lens is known as optical centre. It is represented as O. The optical centre of a lens has a property that a ray of light passing through it does not suffer any deviation and goes straight.

(ii) *Centre of Curvature*:
The centre of sphere of part of which a lens is formed is called the centre of curvature of the lens. Since concave and convex lenses are formed by the combination of two parts of spheres, therefore they have two centres of curvature. One centre of curvature is usually denoted by C1 and second is denoted by C2.
(iii) *Principal Axis*:
The principal axis of a lens is a line passing through the optical centre of the lens and perpendicular to both the faces of the lens.
(iv) *Aperture*:
The diameter of sphere of part of which a lens is formed is called the aperture.
(v) *Principal Focus*:
The convex lens converge the rays incident on it after refraction, to a point on the principal axis. This point is known as principal focus of the convex lens.
The rays incident on concave lens appear to diverge from a point on the principal axis. This point is known as the principal focus of concave lens.
(vi) *Focal Length*:
The focal length of a lens is the distance between optical centre and principal focus of the lens.
(b) Given,
Image distance: v = +48 cm (It is on the other side of the lens)
Focal length: f = +12 cm (It is a converging lens or convex lens)
Object distance: u =? (To be calculated)
Now, putting these values in the lens formula:

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

$$\Rightarrow \frac{1}{12}=\frac{1}{48}-\frac{1}{u}$$

$$\Rightarrow \frac{1}{u}=\frac{1}{48}-\frac{1}{12}$$

$$\Rightarrow \frac{1}{u}=\frac{1-3}{48}$$

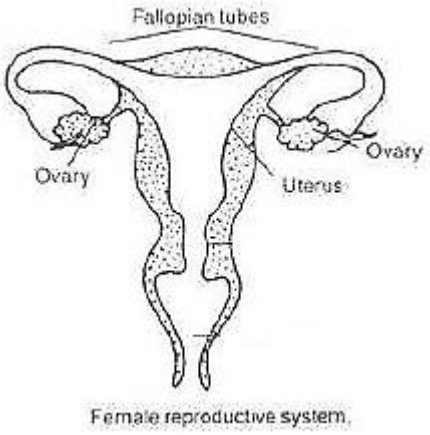
$$\Rightarrow \frac{1}{u}=\frac{-1}{24}$$

$$\Rightarrow u = -24 \text{ cm}$$

Therefore, the object should be placed at a distance of 24 cm from the convex lens. The minus sign with the object distance shows that the object is on its left side.
Marks: 5

Question 23. (a) Draw a sectional view of human female reproductive system and label the part where
(i) eggs develop.
(ii) fertilisation takes place.
(iii) fertilised egg gets implanted.
(b) Describe, in brief, the changes the uterus undergoes
(i) to receive the zygote.
(ii) if zygote is not formed.
Solution: (a) (i) Ovary
(ii) Fallopian tubes

(iii) Uterus



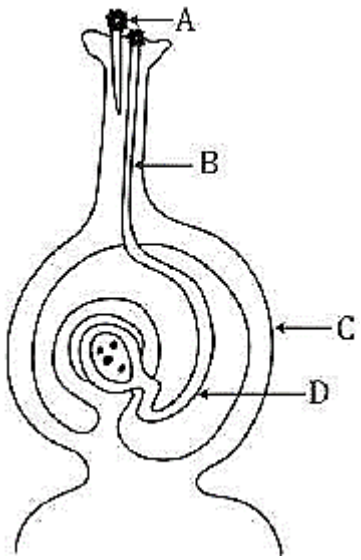
Female reproductive system

(b) (i) If the uterus receives the zygote, the female becomes pregnant. The embryonic development of the zygote starts immediately. The embryo moves down into the uterus forming a thick and soft lining of blood vessels around itself. This process is called implantation. After implantation, a special tissue develops between the uterine wall and the embryo called placenta, where the exchange of nutrients, oxygen and waste products takes place.

(ii) If the egg released by the ovary is not fertilized and the zygote is not formed, then the thick lining of the uterus breaks down and comes out through the vagina in the form of blood and mucous. This is called menstruation.

Marks: 5

Question 24. (a) Name the parts labelled as A, B, C and D in the diagram given below:



(b) What is pollination? State its significance.

(c) How does fertilisation occur in flowers? Name the parts of the flower that develop into (i) seed, and (ii) fruit after fertilisation.

Solution: (a) A - Pollen grain

B - Pollen tube

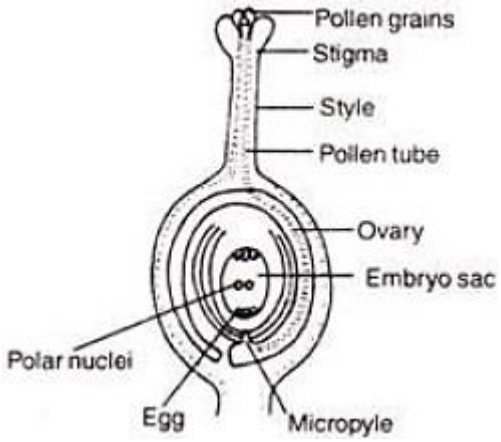
C - Ovary

D - Female germ cell

(b) Pollination is the process of transfer of pollen grains from anther to stigma of the flower.

Significance of pollination: Pollination is a significant event because it precedes fertilization. It brings the two types of gametes closer for the process of fertilization.

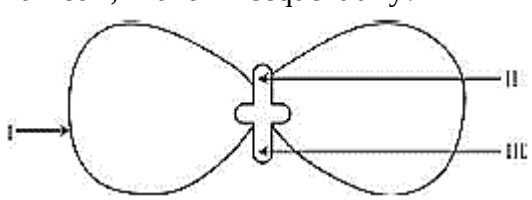
Also, cross pollination introduces variations in the plants due to mixing of different genes which increases adaptability towards environment or surroundings.
(c) Fertilization in plants: In plants, pollination is followed by fertilization. Once the pollen grains are deposited on the stigma, they form tubes called pollen tubes. The pollen tubes grow through the ovules and reach the ovary where ovules are located. The pollen tube normally enters the ovule through a small opening called micropyle. Inside the ovule, the pollen tube releases two male gametes into the embryo sac.



The embryo sac of the ovule contains the egg. One male gamete fuses with the egg. This fusion of male and female gamete is called syngamy and its product is called zygote. The other male gamete fuse with two polar bodies and this process is called triple fusion, where three nuclei are involved in the fusion process, one male gamete and two polar nuclei. Thus, inside each embryo sac, two fusions, syngamy and triple fusion, takes place. This mechanism of two fusions occurring in an embryo sac is called double-fertilization. After fertilization, ovules develop into the seeds and ovary develops into the fruit.
Marks: 5

SECTION B

Question 25. In the following diagram showing the structure of embryo of a dicot seed, what are the parts marked I, II and III sequentially?



(A) Plumule, Cotyledon, Radicle
(B) Plumule, Radicle, Cotyledon
(C) Cotyledon, Plumule, Radicle
(D) Radicle, Plumule, Cotyledon
Solution: (A)
In the figure, the part marked I is Plumule, II is Cotyledon and III is Radicle.
Marks: 1

Question 26. Study the following statements:
I. Wings of birds and wings of bats are homologous organs.
II. Wings of birds and wings of insects are modified forelimbs.
III. Wings of birds and wings of insects are analogous organs.
IV. Wings of birds and forelimbs of horse are homologous organs.

The correct statements are
(A) I and II
(B) II and Ill
(C) III and IV
(D) I and IV
Solution: (C)
III and IV are the correct statements.
Marks: 1

Question 27. Which of the following pairs of two vegetables represent the correct homologous structures?
(A) Sweet potato and potato
(B) Sweet potato and tomato
(C) Carrot and potato
(D) Radish and carrot
Solution: (D)
Radish and carrot are the modifications of roots. Hence, they are the homologous structures.
Marks: 1

Question 28. When you study a slide showing different stages of budding in yeast, you observe the following stages:
I. The bud may get separated from the parent body and develop into a new individual.
II. The body of the bud develops and gives rise to another baby bud.
III. A bud comes out in any direction from the body of the parent cell.
IV. Thus they may form a colony.
The proper sequence of the above stages is
(A) II, I, III, IV
(B) II, III, I, IV
(C) III, II, l, IV
(D) III, I, II, IV
Solution: (C)
This is the correct sequence of budding in yeast.
Marks: 1

Question 29. A student has to focus his compound microscope to observe a prepared slide showing different stages of binary fission in Amoeba. The steps he is likely to follow are listed below in a haphazard manner:
I. Adjust the diaphragm and the mirror of the microscope so that sufficient light may enter to illuminate the slide.
II. Fix the slide on the stage carefully.
III. Adjust the microscope to high power and focus.
IV. Adjust the microscope to low power and focus.
The correct sequence of the above steps to observe the slide under the microscope is
(A) I, II, IV, III
(B) II, I, IV, III
(C) II, IV, I, III
(D) I, IV, II, III

Solution: (B)
This is the correct sequence.
Marks: 1

Question 30. A student takes about 2 mL ethanoic acid in a dry test tube and adds a pinch of sodium hydrogen carbonate to it. He reports the following observations:
I. Immediately a colourless and odourless gas evolves with a brisk effervescence.
II. The gas turns lime water milky when passed through it.
III. The gas burns with an explosion when a burning splinter is brought near it.
IV. The gas extinguishes the burning splinter that is brought near it.
The correct observations are
(A) I, II and III
(B) II, III and IV
(C) III, IV and I
(D) I, II and IV
Solution: (D)
Statements I, II and IV are true. The carbon dioxide gas gets liberated. It is colourless, odourless and turns lime water milky. The gas extinguishes the burning splinter when brought near it. This is because; carbon dioxide does not burn or support combustion.
Marks: 1

Question 31. In an experiment to study the properties of ethanoic acid, a student takes about 3 mL of ethanoic acid in a dry test tube. He adds an equal amount of distilled water to it and shakes the test tube well. After some time he is likely to observe that
(A) a colloid is formed in the test tube.
(B) the ethanoic acid dissolves readily in water.
(C) the solution becomes light orange.
(D) water floats over the surface of ethanoic acid.
Solution: (B)
Ethanoic acid is readily soluble in water.
Marks: 1

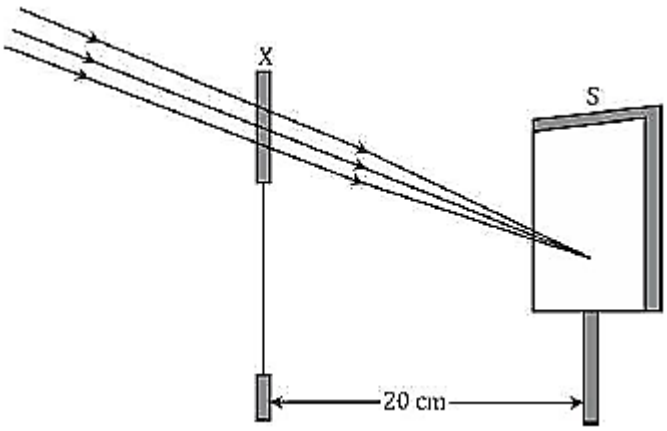
Question 32. We need 20% aqueous solution of sodium hydroxide for the study of saponification reaction. When we open the lid of the bottle containing solid sodium hydroxide we observe it in which form?
(A) Colourless transparent beads
(B) Small white beads
(C) White pellets/flakes
(D) Fine white powder
Solution: (C)
Sodium hydroxide is present in the form of white flakes or pellets.
Marks: 1

Question 33. While studying saponification reaction, a student measures the temperature of the reaction mixture and also finds its nature using blue/red litmus paper. On the basis of his observations the correct conclusion would be

(A) the reaction is exothermic and the reaction mixture is acidic.
(B) the reaction is endothermic and the reaction mixture is acidic.
(C) the reaction is endothermic and the reaction mixture is basic.
(D) the reaction is exothermic and the reaction mixture is basic.
Solution: (C)
The reaction is endothermic and the reaction mixture is basic in nature.
Saponification is defined as the hydrolysis of an ester under basic conditions leading to the formation of sodium salt of fatty acids. It is an endothermic reaction meaning it absorbs surrounding heat.
Marks: 1

Question 34. In a locality, hard water, required for an experiment, is not available. However, the following salts are available in the school laboratory:
1. Sodium sulphate
2. Calcium sulphate
3. Magnesium chloride
4. Sodium chloride
5. Calcium chloride
6. Potassium sulphate
Which of the above salts may be dissolved in water to obtain hard water for the experiment?
(A) 2, 3 and 5
(B) 1, 2 and 5
(C) 1, 2, 4 and 6
(D) 3 and 5 only
Solution: (A)
Hard water is an impure form of water having high mineral contents like, Calcium, Magnesium, sulphides, chlorides, bicarbonates etc.
Marks: 1

Question 35. A student focused the Sun rays using an optical device 'X' on a screen S as shown.

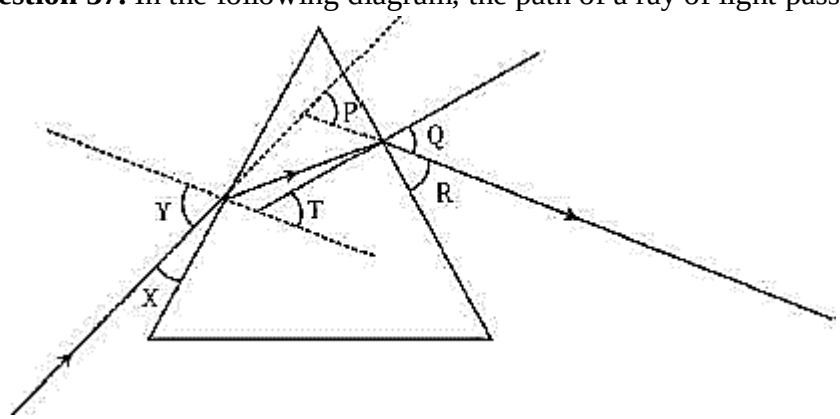


From this it may be concluded that the device 'X' is a (select the correct option)
(A) Convex lens off focal length 10 cm.
(B) Convex lens of radius of curvature 20 cm.
(C) Convex lens of focal length 20 cm.
(D) Concave mirror of focal length 20 cm.
Solution: (C)

Optical device 'X' is a convex lens as sun rays are focused on the screen.
Marks: 1

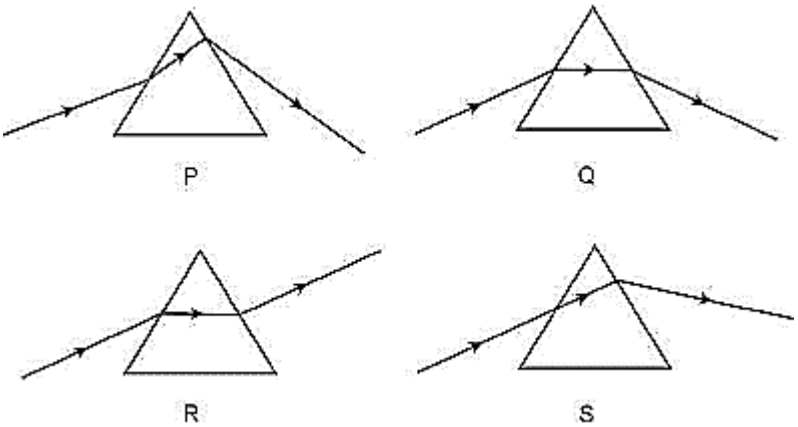
Question 36. A student has obtained an image of a well-illuminated distant object on a screen to determine the focal length, F1of the given spherical mirror. The teacher then gave him another mirror of focal length, F2 and asked him to obtain a focused image of the same object on the same screen. The student found that in order to focus the same object using the second mirror, he has to move the mirror away from the screen. From this observation, it may be concluded that both the spherical mirrors given to the student were (select the correct option)
(A) Concave and $F_1 < F_2$
(B) Concave and $F_1 > F_2$
(C) Convex and $F_1 < F_2$
(D) Convex and $F_1 > F_2$
Solution: (A)
Since the image is focused, the spherical mirror is a concave mirror.
For second mirror the distance is increased to focus the image on the screen. Hence, focal length is more than that of first mirror.
Marks: 1

Question 37. In the following diagram, the path of a ray of light passing through a glass prism is shown:



In this diagram the angle of incidence, the angle of emergence and the angle of deviation respectively are (select the correct option):
(A) X, R and T
(B) Y, Q and T
(C) X, Q and P
(D) Y, Q and P
Solution: (D)
Marks: 1

Question 38. Study the following diagrams in which the path of a ray of light passing through a glass prism as traced by four students P, Q, R and S is shown:



The student who has traced the path correctly is

(A) P

(B) Q

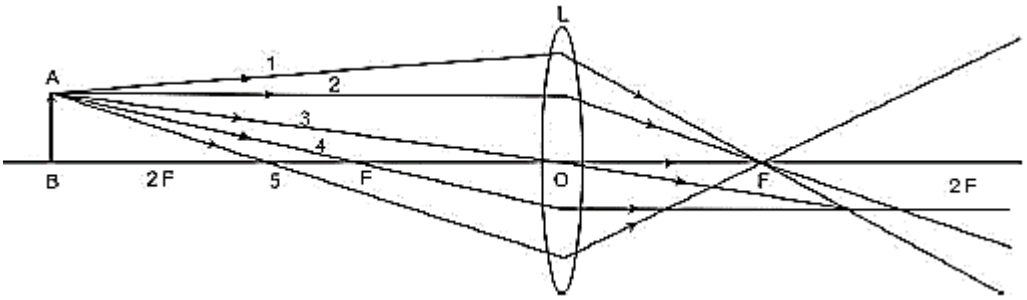
(C) R

(D) S

Solution: (B)

Marks: 1

Question 39. A student is using a convex lens of focal length 18 cm to study the image formation by it for the various positions of the object. He observes that when he places the object at 27 cm, the location of the image is at 54 cm on the other side of the lens. Identify from the following diagram the three rays that are obeying the laws of refraction and may be used to draw the corresponding ray diagram.



(A) 1, 2 and 4

(B) 1, 3 and 5

(C) 2, 4 and 5

(D) 2, 3 and 4

Solution: (D)

Ray 2, 3 and 4 are obeying the laws of refraction.

Ray 2 is parallel to the principal axis and passes through the principal focus after refraction.

Ray 3 passes from the optical centre of the lens and emerges without any deviation.

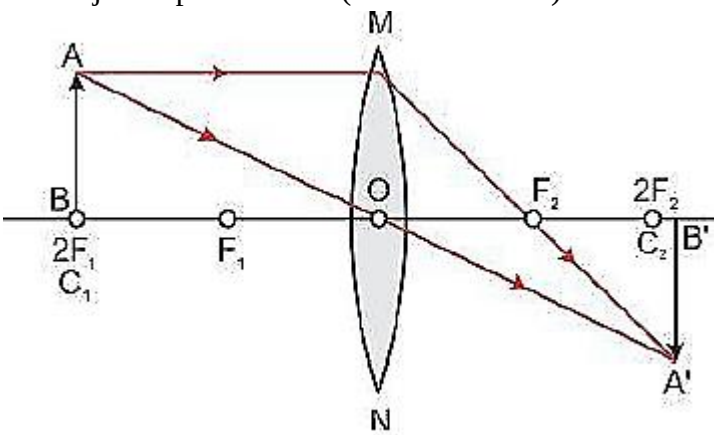
Ray 4 is passing through the principal focus and after refraction from a convex lens emerges parallel to the principal axis.

Ray 1 and 5 cannot pass through the focus after refraction as they are not parallel to the principal axis.

Marks: 1

Question 40. A student is using a convex lens of focal length 10 cm to study the image formation by a convex lens for the various positions of the object. In one of his observations, he may observe that when the object is placed at a distance of 20 cm from the lens, its image is formed at (select the correct option)

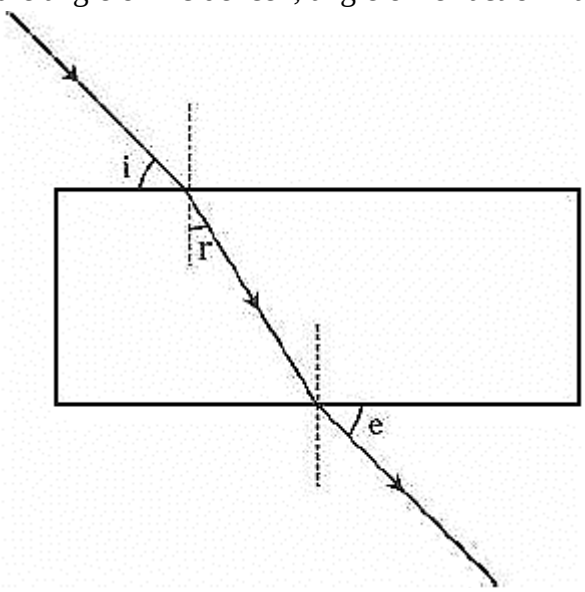
(A) 20 cm on the other side of the lens and is of the same size, real and erect.
(B) 40 cm on the other side of the lens and is magnified, real and inverted.
(C) 20 cm on the other side of the lens and is of the same size, real and inverted.
(D) 20 cm on the other side of the lens and is of the same size, virtual and erect.
Solution: (C)
Focal length f = 10 cm
The object is placed at 2F (2 × 10 = 20 cm). Hence the image is also formed at 2F.



Position of object	Position of image	Size of image	Nature of image
At $2F_1$	At $2F_2$	Same size	Real and inverted

Marks: 1

Question 41. A student traces the path of a ray of light passing through a rectangular glass slab and marks the angle of incidence i, angle of refraction r and angle of emergence e, as shown.



The correctly marked angle(s) is/are
(A) ∠i only
(B) ∠e only
(C) ∠r only
(D) ∠i and ∠e
Solution: (C)

Other angles are not taken with respect to normal.
Marks: 1

Question 42. After tracing the path of a ray of light passing through a rectangular glass slab for four different values of the angle of incidence, a student reported his observations in tabular form as given below:

S. No	∠i	∠r	∠e
I	30^0	19^0	29^0
II	40^0	28^0	40^0
III	50^0	36^0	50^0
IV	60^0	40^0	59^0

The best observation is
(A) I
(B) II
(C) III
(D) IV
Solution: (A)
For glass slab, ∠i = ∠e
Refractive index of glass = 1.5
$\frac{\sin 30°}{\sin 19°} \approx 1.5$
$\angle 30° \approx \angle 29°$
Marks: 1

CBSE – X – 2013 EXAMINATION

SCIENCE

SET-1 Paper & Solution

Time: 3 Hrs. Max. Marks: 90

General Instructions:

1. The question paper comprises **two** Sections, **A and B**. You are to attempt both the sections.
2. There is no overall choice. However, internal choice has been provided in all the five questions of five marks category. Only one option in such question is to be attempted.
3. All questions of **Section-A** and **Section-B** are to be attempted separately.
4. Question numbers **1** to **3** in Section A are one-mark questions. These are to be answered in one word or in one sentence.
5. Question numbers **4** to **7** in Section A are two marks questions, to be answered in about 30 words each.
6. Question numbers **8** to **19** in Section A are three marks questions, to be answered in about 50 words each.
7. Question numbers **20** to **24** in Section A are five marks questions, to be answered in about 70 words each.
8. Question numbers **25** to **42** in Section B are multiple choice questions based on practical skills. Each question is a one-mark question. You are to select one most appropriate response out of the four provided to you.

SECTION A

Question 1. How many horizontal rows are there in the modern periodic table and what are they called?
Solution: There are 7 horizontal rows in the modern periodic table. They are called periods.
Marks: 1

Question 2. List any two factors that could lead to speciation.
Solution: Geographical isolation and genetic drift could lead to speciation.
Marks: 1

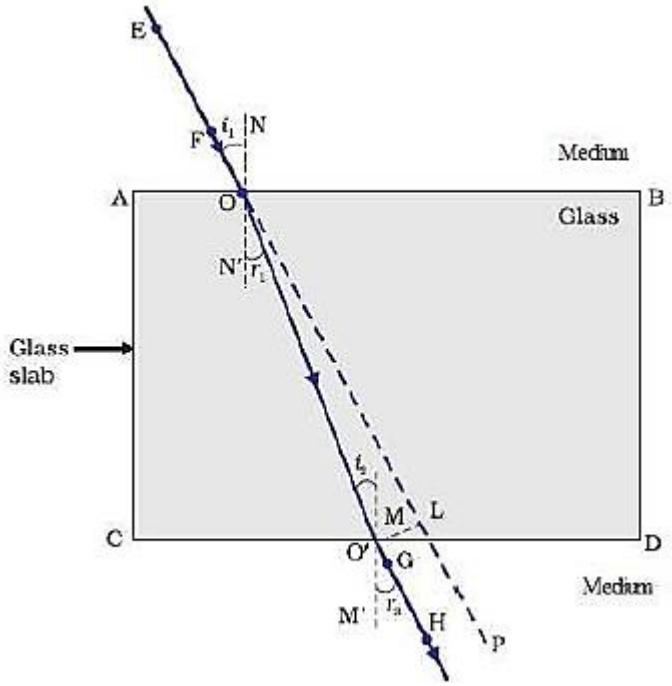
Question 3. Mention one negative effect of our affluent life style on the environment.
Solution: Exploitation and overconsumption of natural resources will ultimately result in their scarcity.
Marks: 1

Question 4. Mention two functions of the human testis.
Solution: (a) They produce male germ cells i.e., sperms.
(b) They act as endocrine glands and secrete the hormone testosterone which controls secondary sexual characters in males.
Marks: 2

Question 5. Every one of us can do something to reduce our consumption of various natural resources. List four such activities based on the 3-R approach.
Solution: (a) Use of materials such as paper should be preferred as they can be reused and recycled.
(b) Materials like glass and some plastics can be recycled on heating and get easily converted into different products like toys, containers which can be reused again.
(c) e-wastes such as unused computers, mobiles etc. can be repaired and used again.
(d) Household wastes such as vegetable wastes etc. can be used as manure for plants.
Marks: 2

Question 6. 'A ray of light incident on a rectangular glass slab immersed in any medium emerges parallel to itself.' Draw a labelled ray diagram to justify the statement.

Solution: When a ray of light is incident on a rectangular glass slab immersed in a medium, the emergent ray comes out parallel to the incident ray. The path of the light ray is as shown:



EF is the incident ray and GH is the emergent ray which is parallel to the incident ray.
Marks: 2

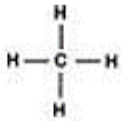
Question 7. We often observe domestic waste decomposing in the bylanes of residential colonies. Suggest ways to make people realise that the improper disposal of waste is harmful to the environment.
Solution: Some of ways to make people realise that the improper disposal of waste is harmful to the environment are:
(a) Improper disposal of waste will serve as a breeding ground for mosquitoes and will create favourable conditions for the spread of various diseases.
(b) Improper disposal of waste will release harmful gases in the environment which makes the environment unclean and unhygienic for normal living of organisms.
(c) The waste will flow to water bodies along with the rain water and become a threat to aquatic organisms.
Marks: 2

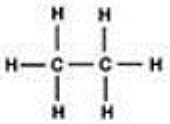
Question 8. Name the oxidising agent used for the conversion of ethanol to ethanoic acid. Distinguish between ethanol and ethanoic acid on the basis of (i) litmus test, (ii) reaction with sodium carbonate.
Solution: Alkaline potassium permanganate ($KMnO_4$) or acidified potassium dichromate ($K_2Cr_2O_7$) can be used as an oxidising agent for conversion of ethanol to ethanoic acid.
i. Litmus test: Ethanoic acid turns blue litmus solution red whereas ethanol being neutral in nature has no effect on litmus solution.
ii. Reaction with sodium carbonate: Ethanoic acid reacts with sodium carbonate to form sodium ethanoate and carbon dioxide gas is evolved.
$2CH_3COOH + Na_2CO_3 \rightarrow 2CH_3COONa + H_2O + CO_2$
Ethanol does not react with sodium carbonate.
$CH_3CH_2OH + Na_2CO_3 \rightarrow$ No reaction
Marks: 3

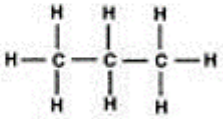
Question 9. (a) Differentiate between alkanes and alkenes. Name and draw the structure of one member of each.

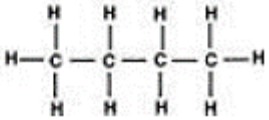
(b) Alkanes generally burn with clean flame. Why?

Solution: (a) Alkanes: Hydrocarbons in which the carbon atoms are joined by single covalent bonds are called Alkanes. They have general formula C_nH_{2n+2}, where n is the number of carbon atoms. Suffix, -ane is used while naming alkanes.

Methane 

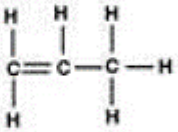
Ethane 

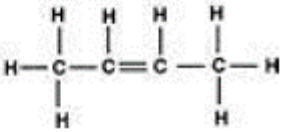
Propane 

Butane 

Alkenes: Hydrocarbons in which the carbon atoms are joined by a double bond are called Alkenes. They have general formula C_nH_{2n}, where n is the number of carbon atoms. Suffix, -ene is used while naming alkenes.

Ethene 

Propene 

Butene 

(b) Alkanes generally burn with clean flame because in them, the percentage of carbon is comparatively low as compared to other unsaturated hydrocarbons. Hence they get oxidised completely by the oxygen present in air.

Marks: 3

Question 10. Given below are some elements of the modern periodic table:

$_4$Be, $_9$Fe, $_{14}$Si, $_{19}$K, $_{20}$Ca

i. Select the element that has one electron in the outermost shell and write its electronic configuration.

ii. Select two elements that belong to the same group. Give reasons for your answer.

iii. Select two elements that belong to the same period. Which one of the two has bigger atomic size?

Solution: i. $_{19}$K has one electron in the outermost shell and its electronic configuration is 2, 8, 8, 1.

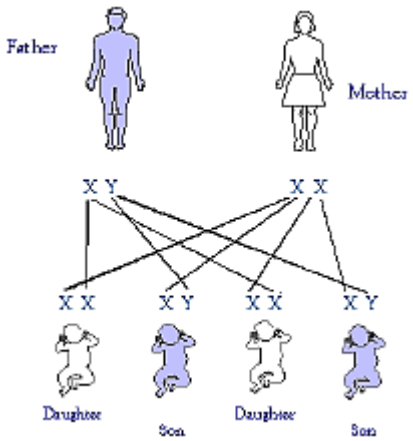
ii. $_4$Be and $_{20}$Ca belongs to same group i.e., Group 2.

Electronic configuration:
$_4$Be – 2, 2
$_{20}$Ca – 2, 8, 8, 2
$_4$Be and $_{20}$Ca have same number of valence electrons in outermost shell i.e., 2 so they belong to same group.
iii. $_9$F and $_4$Be belongs to the same period i.e., period 2.
Electronic configuration:
$_9$F - 2, 7
$_4$Be - 2, 2
$_4$Be has a bigger atomic size than $_9$F because the atomic radius decreases as we move from left to right in a period due to increase in nuclear charge which tends to pull the electrons closer to the nucleus and hence size of atom reduces.
Marks: 3

Question 11. An element X (atomic number 17) reacts with an element Y (atomic number 20) to form a compound.
(a) Write the position of these elements in the modern periodic table.
(b) Write the formula of the compound formed.
Justify your answer in each case.
Solution: (a) Element X (atomic number 17)
Electronic configuration of X: 2, 8, 7
No. of electrons in outermost shell = 7
So, Group number = 17
No. of shells = 3
So, Period to which the element belongs = 3
Element Y (atomic number 20)
Electronic configuration of Y: 2, 8, 8, 2
No. of electrons in outermost shell = 2
So, Group number = 2
No. of shells = 4
So, Period to which the element belongs = 4
(b) X has 7 valence electrons so, it needs 1 electron to complete its octet and Y has 2 valence electrons so, it can donate its 2 electrons to acquire the octet configuration. Hence, X will gain 1 electron and Y will lose 2 electrons, so the chemical reaction is:
$X_2 + Y \rightarrow YX_2$
X = Cl (At. No. = 17) and Y = Ca (At. No. = 20)
So, $Cl_2 + Ca \rightarrow CaCl_2$
Marks: 3

Question 12. 'The sex of a newborn child is a matter of chance and none of the parents may be considered responsible for it.' Justify this statement with the help of flow chart showing determination of sex of a newborn.
Solution: In human beings, females have two X chromosomes and males have one X and one Y chromosome. Therefore, the females are represented as XX and males as XY. At the time of mating, large number of sperms are ejaculated from the male reproductive organ (penis), into the female reproductive organ i.e., vagina. They travel towards the fallopian tubes, where only one sperm meets with the egg.

The process of fusion of the sperm and ovum is called fertilisation. The sperm has either X or Y chromosome and egg has only X chromosome. So, if a sperm carrying Y chromosome fuses with the egg, the newly born child will be male and if a sperm carrying X chromosome fuses with the egg, the newly born child will be female. There is an equal chance of fusion of either X or Y chromosome with the egg so we can say that the sex of a new born child is a matter of chance and none of the parent is responsible for it. Sex determination in humans is shown below:



Marks: 3

Question 13. Tabulate two distinguishing features between acquired traits and inherited traits with one example of each.

Solution:

Acquired traits	Inherited traits
i. The acquired traits are the traits which are experienced by an individual during his life time.	i. Inherited traits are the characteristics which one acquires from his/ her ancestors.
ii. These involve changes in non-reproductive tissues (or somatic cells), which cannot be passed on to the germ cells or progeny.	ii. These involve changes in the DNA. Hence, they are transmitted to the progeny.
iii. Example- cut-tail of mice, learning to dance etc.	iii. Example- height, eye colour, skin color etc.

Marks: 3

Question 14. Write two examples each of sexually transmitted diseases caused by (i) virus, (ii) bacteria. Explain how the transmission of such diseases can be prevented?

Solution: Sexually transmitted diseases by virus:

Genital Herpes is caused by the Herpes Simplex virus and AIDS is caused by HIV.

Sexually transmitted diseases by bacteria:

Gonorrhea is caused by Nisseria gonorrhoeae and Syphilis is caused by Treponema pallidum.

Prevention of transmission of STD's:

i. Having sex with infected or any unknown person should be avoided.

ii. Sharing of needles, syringes etc. must be prohibited.

iii. The surgical and dental instruments should be sterilised properly before use.

iv. Avoid blood transfusions from infected person. Blood should be tested before transfusion.

v. Adequate medical treatment should be provided to the pregnant woman to protect the child from getting infected.

Marks: 3

Question 15. (a) Explain the process of regeneration in Planaria.
(b) How is regeneration different from reproduction?
Solution: (a) Regeneration in Planaria:
In Planaria, any part of the body which gets cut is capable of regeneration or developing into a complete organism. Regeneration is carried out by specialized cells which proliferate and make large numbers of cells. From these mass of cells, different cells undergo changes to become various cell types and tissues. These changes take place in an organised sequence referred to as development.
(b)

Regeneration	Reproduction
1. It is a type of asexual mode of reproduction in which only single parent is involved.	1. It includes both sexual and asexual mode of reproduction in which either single parent or both the parents are involved respectively.
2. This mode of reproduction is dependent on a cut in an organism.	2. This mode of reproduction is independent of cut in an organism.
Example - Planaria.	Example - Sexual reproduction in humans.

Marks: 3

Question 16. An object of height 5 cm is placed perpendicular to the principal axis of a concave lens of focal length 10 cm. Use lens formula to determine the position, size and nature of the image, if the distance of the object from the lens is 20 cm.
Solution: Given that:
The height of the object h_o = 5 cm
Focal length of the lens = −10 cm
Object distance, u = −20 cm
Using lens formula,

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

$$\frac{1}{v}-\frac{1}{-20}=\frac{1}{-10}$$

$$\frac{1}{v}=\frac{1}{-10}-\frac{1}{20}$$

$$\Rightarrow v=\frac{-20}{3}=-6.66 \text{ cm}$$

Negative sign implies that the image is formed on the same side as the object.

We know that magnification, $m = \frac{v}{u}=\frac{-20/3}{-20}=\frac{1}{3}$

Since magnification is positive, so image is virtual and erect.
Let h_i be the height of the image.

We also know that: $m = \frac{v}{u}=\frac{h_i}{h_o}$

$$\frac{1}{3}=\frac{h_i}{5}$$

$$h_i=\frac{5}{3}=1.66 \text{ cm}$$

As $h_i < h_o$
The image formed is smaller than the object.
Marks: 3

Question 17. Mention the types of mirrors used as (i) rear view mirrors, (ii) shaving mirrors. List two reasons to justify your answers in each case.
Solution: i. Rear view mirrors: Convex mirrors
Reason: (a) They produce virtual and erect images of the objects. (b) They have a wider field of view as they are curved outwards.
ii. Shaving mirrors: Concave mirrors
Reason: (a) Image formed is magnified so that the details of the object can be seen clearly. (b) Image formed is virtual and erect when the object is placed close to the mirror.
Marks: 3

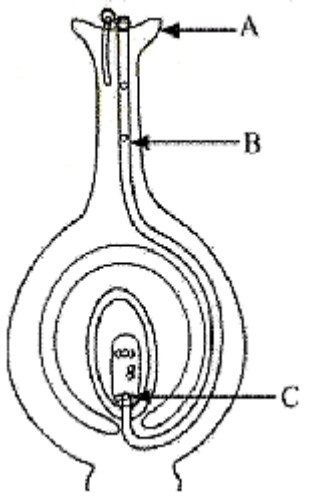
Question 18. State the difference in colours of the Sun observed during sunrise/ sunset and noon. Give explanation for each.
Solution: During sunrise and sunset, Sun is red in colour while at noon, the Sun appears white.
At the time of sunrise and sunset, the Sun is near the horizon. The rays from the Sun have to travel a much larger part of the atmosphere to reach an observer on earth. So, most of the blue light gets scattered away. The red colour which has the largest wavelength is scattered the least and enters into our eyes. Hence, the Sun appears red at the time of sunrise and sunset.
At noon, the sun is nearly overhead. The sunlight has to pass through much smaller portion of the Earth's atmosphere. The scattering is much less and the Sun looks white.
Marks: 3

Question 19. (a) What is an ecosystem? List its two main components.
(b) We do not clean ponds or lakes, but an aquarium needs to be cleaned regularly. Explain.
Solution: Ecosystem is a self-sustaining system where the biotic and abiotic organisms of various Communities live with each other.
(a) The two components of the ecosystem are- Biotic and Abiotic. Biotic system consists of all the living organisms of particular area like humans, animals etc. and the nonliving component consists of air, minerals, soil, water and sunlight.
(b) Ponds are an example of a natural ecosystem whereas an aquarium is an example of an artificial ecosystem. Ponds do not need to be cleaned but aquarium needs to be cleaned because an aquarium does not contain soil and decomposing bacteria which helps in degrading complex organic substances into simple inorganic substances. But ponds or lakes have this ability of self-purification, and therefore these do not need to be cleaned.
Marks: 3

Question 20. (a) Write the function of placenta in females.
(b) List four ways of preventing pregnancy. State two advantages of using such preventive methods.
Solution: (a) Placenta is a disc like tissue which develops between the uterus wall and embryo.
Role of placenta:
i. Exchange of water between mother and the foetus.
ii. Exchange of nutrients.

iii. Exchange of respiratory gases.
iv. Excretion of nitrogenous wastes from foetus. Nitrogenous waste crosses the placenta and is removed by mother's kidney.
v. Antibodies also cross the placenta and provide immunity to the baby.
(b) Ways of preventing pregnancy:
i. Natural methods: In this method, sexual act is avoided from the 10^{th} day to the 17^{th} day of the menstrual cycle, since during this period ovulation is expected.
Therefore, the chances of fertilisation are very high.
ii. Barrier methods: In this method, the fertilisation of ovum and sperm is prevented with the help of physical devices such as condoms and diaphragm.
iii. Oral contraceptives: In this method, tablets or drugs are taken orally. These contain small doses of hormones which prevent the release of eggs and prevent fertilisation.
Marks: 5

Question 21. (a) Identify A, B and C in the given diagram and write their functions.
(b) Mention the role of gamete and zygote in sexually reproducing organisms.

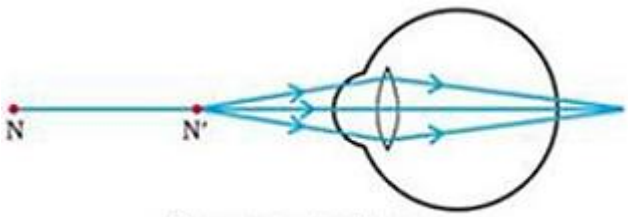


Solution: (a) A - Stigma.
Function - The stigma is a sticky surface where the pollen grains land and germinate.
B - Pollen tube.
Function - It carries the pollen grains to the egg cell for fertilisation.
C - Egg cell.
Function - It fuses with the male gamete and leads to the formation of the zygote.
(b) Role of gametes - Gametes play an important role in sexually reproducing organisms as they carry the entire genetic information of the organism. These gametes upon fusion result in the formation of the zygote, which develops into a new individual. Any deformation in the gametes will lead to deformity in the newly formed offspring.
Role of zygote - Zygote is the diploid cell formed by the fusion of male and female gametes during fertilisation in sexual reproduction. Zygote is the first stage in the development process of an organism and it contains all the genetic information of both the parents essential for the growth of the new organism.
Marks: 5

Question 22. (a) A person cannot read newspaper placed nearer than 50 cm from his eyes. Name the defect of vision he is suffering from. Draw a ray diagram to illustrate this defect. List its two possible causes. Draw a ray diagram to show how this defect may be corrected using a lens of appropriate focal length.

(b) We see advertisements for eye donation on television or in newspaper. Write the importance of such advertisements.

Solution: (a) The person is suffering from Hypermetropia i.e., far-sightedness. It is a defect of vision due to which a person cannot see nearby objects clearly though he can see distant objects clearly. In this defect the image of the nearby object is formed behind the retina of eye.



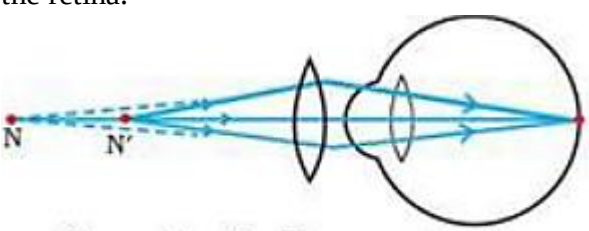
Hypermetropic eye

Hypermetropia is caused due to:

i. decrease in length of the eyeball

ii. increase in focal length of the eye lens

This defect can be corrected using a convex lens of appropriate focal length so that the image gets formed on the retina.



Correction for Hypermetropic eye

(b) Eye donations:

Our eyes can live even after our death, so by donating our eyes, we can give vision to a blind person and give them an opportunity to see the world. By giving such advertisements in newspapers, we can make more people aware for this noble cause and raise the number of eye donations for blind people.

Marks: 5

Question 23. State Snell's law of refraction of light. Write an expression to relate refractive index of a medium with speed to light in vacuum.

The refractive index of a medium 'a' with respect to medium 'b' is 2/3 and the refractive index of medium 'b' with respect to medium 'c' is 4/3. Find the refractive index of medium 'c' with respect to medium 'a'.

Solution: Snells' law of refraction: The ratio of the sine of angle of incidence to the sine of angle of refraction is constant for a pair of media.

Mathematically, it can be given as follows:

When light travels from medium a to medium b, such that 'i' is the angle of incidence and 'r' is the angle of refraction, then

$$\frac{\sin i}{\sin r} = {}^{a}n_{b}$$

where, ${}^{a}n_{b}$ is the relative refractive index of medium 'b' with respect to medium 'a'.

Relation between refractive index (n) of a medium and the speed of light in vacuum is:

$$n = \frac{\text{Speed of light in vacuum (c)}}{\text{Speed of light in medium (c)}}$$

Given that:

Refractive index of a with respect to b, ${}^{b}n_a = \frac{n_a}{n_b} = \frac{2}{3}$ ..... (i)

Refractive index of b with respect to c, ${}^{c}n_b = \frac{n_b}{n_c} = \frac{4}{3}$ ..... (ii)

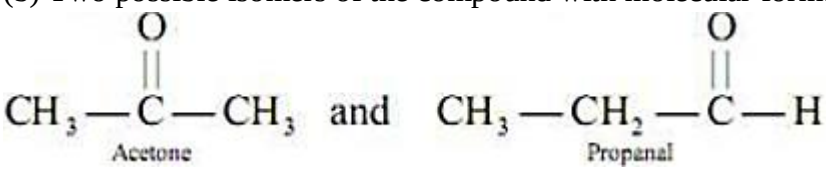
$\therefore$ Refractive index of c with respect to a, ${}^{a}n_c = \frac{n_c}{n_a} = \frac{n_c}{n_b} \times \frac{n_b}{n_a}$

${}^{a}n_c = \frac{3}{4} \times \frac{3}{2}$ -------- Using eq. (i) and (ii)

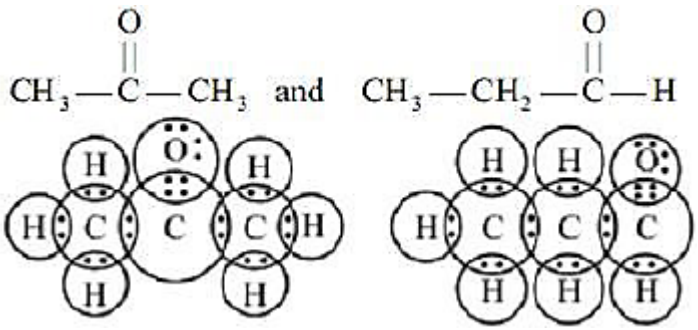
${}^{a}n_c = \frac{9}{8}$

Marks: 5

Question 24. (a) Define the term 'isomers'
(b) Draw two possible isomers of the compound with molecular formula C3H6O and write their names.
(c) Give the electron dot structures of the above two compounds.
Solution: (a) Compounds having same molecular formula but different structural formula are known as isomers.
(b) Two possible isomers of the compound with molecular formula C_3H_6O:



(c) Electron dot structure:



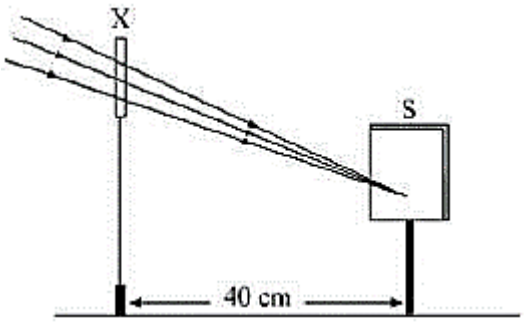
Marks: 5

SECTION B

Question 25. A student obtained a sharp image of a burning candle, placed at the farther end of a laboratory table, on a screen using a concave mirror. For getting a better value of focal length of the mirror, what should the student do?
(a) He should move the mirror away from the screen.
(b) He should move the mirror slightly towards the screen.
(c) He should move the mirror as well as the screen towards the newly selected object.
(d) He should move only the screen towards the newly selected object.
Solution: (b) He should move the mirror slightly towards the screen.
When an object is at infinity, image is formed at the focus and when an object is beyond C then image is formed between C and F. As the object is farther, image will be closer to F. So, the student should move the mirror slightly towards the screen.

Marks: 1

Question 26. A student focused the image of a distant object using a device 'X' on a white screen 'S' as shown in the figure. If the distance of the screen from the device is 40 cm, select the correct statement about the device.



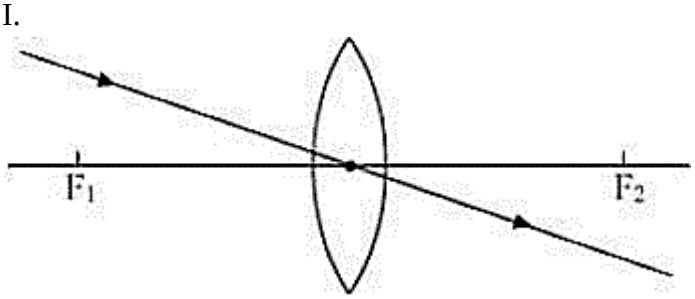
(a) The device X is a convex lens of focal length 20 cm.
(b) The device X is a concave mirror of focal length 40 cm.
(c) The device X is a convex mirror of radius of curvature 40 cm.
(d) The device X is a convex lens of focal length 40 cm.

Solution: (d) The device X is a convex lens of focal length 40 cm.
The parallel rays from the distant object fall on the convex lens and converge at its second principal focus (i.e., where the screen is placed). Then the distance between the screen and the convex lens gives the approximate focal length of the lens i.e., 40 cm.

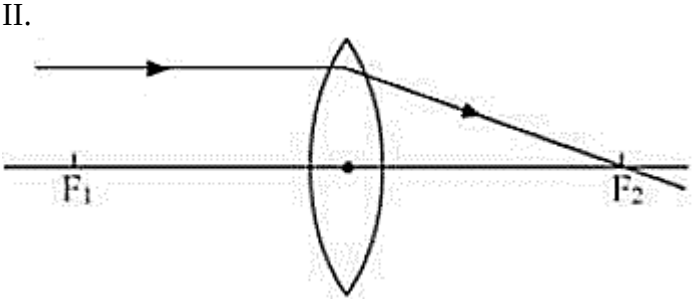
Marks: 1

Question 27. Study the following ray diagrams:

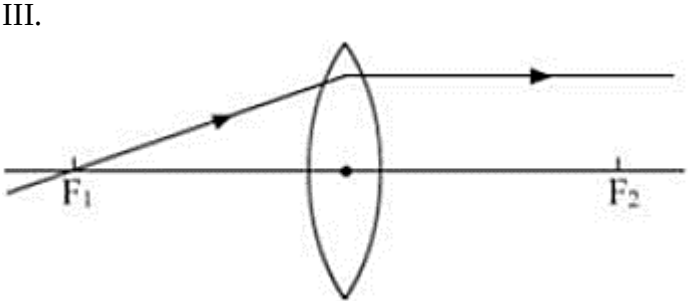
I.



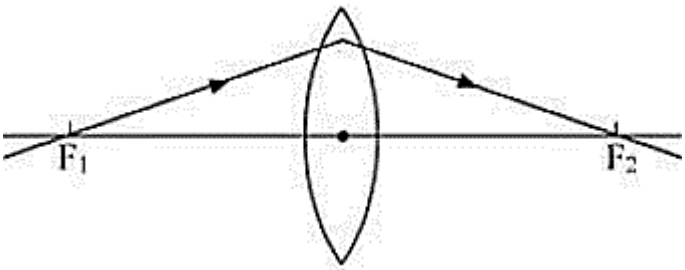
II.



III.

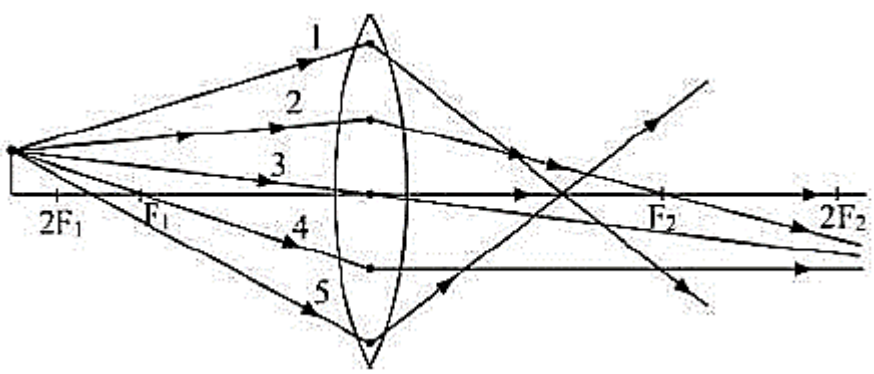


IV.



The diagrams showing the correct path of the ray after passing through the lens are:
(a) II and III only
(b) I and II only
(c) I, II and III
(d) I, II and IV
Solution: (c) Ray diagrams I, II and III are correct.
The light ray passing through the optical centre of the lens does not deviate. The light ray parallel to the principal axis passes through the second focus of the lens. The light ray passing through the first focus becomes parallel to the principal axis after passing through the lens.
Marks: 1

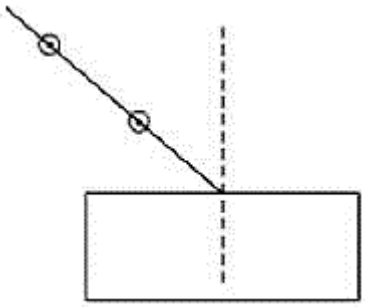
Question 28. Out of the five incident rays shown in the figure find the three rays which are obeying the laws of refraction and may be used for locating the position of the image formed by a convex lens:



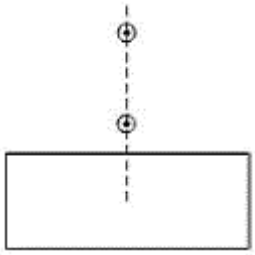
(a) 1, 2 and 3
(b) 2, 3 and 4
(c) 3, 4 and 5
(d) 1, 2 and 4
Solution: (b) Rays 2, 3 and 4 obey the laws of refraction.
Ray (2) is parallel to the principal axis and passes through the second focus of the lens.
Ray (3) passes through the optical centre and does not deviate.
Ray (4) passes through the first focus of the lens and goes parallel to the principal axis.
Marks: 1

Question 29. Select from the following the best set-up for tracing the path of a ray of light through a rectangular glass slab:

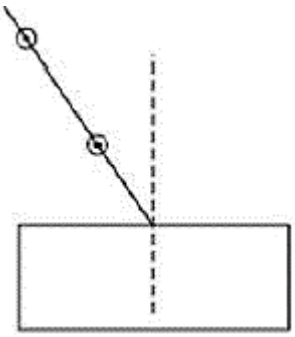
I.



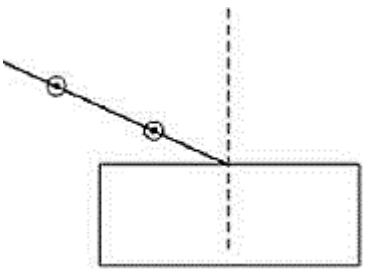
II.



III.



IV.



(a) I
(b) II
(c) III
(d) IV

Solution: (a) I

The best set up is given in figure I. The incoming light should not fall perpendicularly as the light will emerge straight and refraction cannot be traced. The light rays should not be very close or far from the normal as the emergent rays are difficult to trace.

Marks: 1

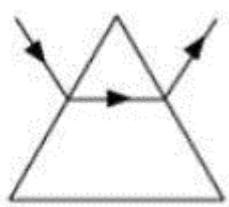
Question 30. After tracing the path of rays of light through a glass slab for three different angles of incidence, a student measured the corresponding values of angle of refraction 'r' and angle of emergence 'e' and recorded them in the table given below:

S. No	∠i	∠r	∠e
I	30°	20°	31°
II	40°	25°	40°
III	50°	31°	49°

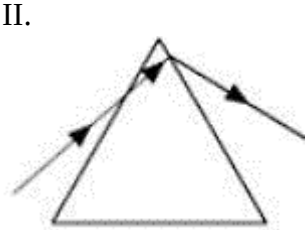
The correct observations are:
(a) I and II
(b) II and III
(c) I and III
(d) I, II and III
Solution: (d) I, II and III
For light rays passing through a glass slab, the following conditions should hold true:
1. $\angle i \approx \angle e$ and $\angle r < \angle i$
2. Also, with the increase in incident angle, the refracted angle also increases.
Both of these conditions are satisfied in all the three observations.
Marks: 1

Question 31. In an experiment to trace the path of a ray of light through a glass prism for different values of angle of incidence a student would find that the emergent ray:
(a) is parallel to the incident ray
(b) perpendicular to the incident ray
(c) is parallel to the refracted ray
(d) bends at an angle to the direction of the incident ray
Solution: (d) bends at an angle to the direction of incident ray
As the light gets refracted twice at different angles the emergent ray bends at an angle to the direction of incident ray.
Marks: 1

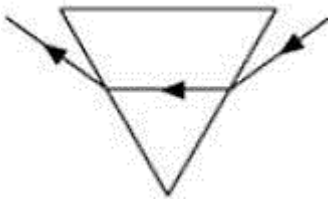
Question 32. While performing an experiment to trace the path of a ray of light passing through a glass prism, four students marked the incident ray and the emergent ray in their diagrams in the manner shown below. Which one is correct?
I.



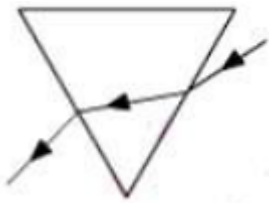
II.



III.



IV.



(a) I
(b) II
(c) III
(d) IV

Solution: (c) III

When light goes form a rarer medium to a denser medium; it bends towards the normal and vice-versa. This condition is fulfilled in figure (III).

Marks: 1

Question 33. Study the different conclusions draw by students of a class on the basis of observations of preserved/available specimens of plants and animals.

I. Potato and sweet potato are analogous organs in plants and animals.
II. Wings of insects and wings of birds are homologous organs in animals.
III. Wings of insects and wings of bats are analogous organs in animals.
IV. Thorns of citrus and tendrils of cucurbita are analogous organs in plants

The correct conclusions are:

(a) I and II
(b) II and IV
(c) III and IV
(d) I and III

Solution: (a) I and II

Analogous organs are those which do not share a common ancestry but perform common functions. Hence, wings of insects and wings of bats are analogous organs in animals and potato and sweet potato are analogous organs in plants.

Marks: 1

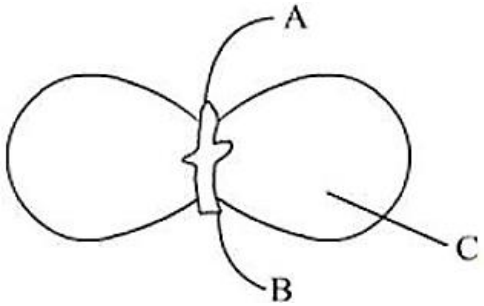
Question 34. You have potato, carrot, radish, sweet potato, tomato and ginger bought from the market in your jute bag. Identify two vegetables to represent the correct homologous structures.

(a) Potato and sweet potato
(b) Carrot and tomato
(c) Potato and tomato
(d) Carrot and radish

Solution: (d) Carrot and Radish

Homologous structures are similar in origin but perform different functions. Carrot and radish are underground roots. So, they are considered homologous structures.
Marks: 1

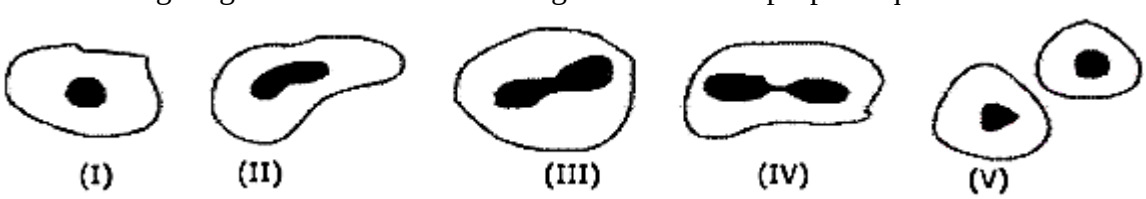
Question 35. In the figure, the parts marked A, B and C are sequentially:



(a) Plumule, Cotyledon and Radicle
(b) Radicle, Cotyledon and Plumule
(c) Radicle, Plumule and Cotyledon
(d) Plumule, Radicle and Cotyledon
Solution: (d) Plumule, Radicle and Cotyledon
In the figure, the part marked A is Plumule, B is Radicle and C is Cotyledon.
Marks: 1

Question 36. Select the correct statements for the process of budding in yeast:
I. A bud arises from a particular region on a parent body.
II. A parent cell divides into two daughter cells; here the parental identity is lost.
III. Before detaching from the parent body a bud may form another bud.
IV. A bud when detached from the parent body grows into a new individual.
(a) II, III and IV
(b) I, II and III
(c) III, IV and I
(d) None of the above
Solution: (d) None of the above
Yeast reproduces asexually by the process of budding.
Budding is a type of asexual reproduction in which a new organism is formed from a bud of an existing organism. A small bud is formed at a specific position on the parent cell. The nucleus of parent cell splits and a part of it enters inside the newly formed bud. The bud develops into a new cell or daughter organism. The new organism remains attached to the parent organism till it matures. After attaining maturity it separates from the parent body.
Marks: 1

Question 37. A student after observing a slide showing different stages of binary fission in Amoeba draws the following diagrams. However these diagrams are not in proper sequence.



The correct sequence is:
(a) I, V, IV, III, II
(b) I, V, III, IV, II
(c) I, III, IV, V, II
(d) None of these
Solution: (d) None of these
The correct procedure in reproduction in Amoeba is,
(a) Chromosome is replicated.
(b) Chromosome splits into daughter strands.
(c) Cytokinesis splits the Amoeba into two daughter cells.
(d) Two Amoebae with identical DNA.
Marks: 1

Question 38. Read the following statements:
I. When a red litmus paper is dipped into the reaction mixture of a saponification reaction, it turns blue and the reaction is exothermic.
II. When a blue litmus paper is dipped into the reaction mixture of a saponification reaction, its colour does not change and the reaction is exothermic.
III. When a red litmus paper is dipped into the reaction mixture of a saponification reaction, its colour does not change and the reaction is endothermic.
IV. When a blue litmus paper is dipped into the reaction mixture of a saponification reaction, its colour does not change and the reaction is endothermic.
Which of the above statements are correct?
(a) I and II
(b) II and III
(c) III and IV
(d) I and IV
Solution: (a) I and II
Soap solution is basic in nature because it is formed from a strong base NaOH. Hence it turns red litmus paper blue and does not change the color of blue litmus paper. The saponification reaction is exothermic in nature. The correct statements are I and II.
Marks: 1

Question 39. A student prepared 20% sodium hydroxide solution in a beaker containing water. The observations noted by him are given below.
I. Sodium hydroxide is in the form of pellets.
II. It dissolves in water readily.
III. The beaker appears cold when touched from outside.
IV. Red litmus paper turns blue when dipped into the solution.
The correct observations are:
(a) I, II, and III
(b) II, III and IV
(c) III, IV and I
(d) I, II and IV
Solution: (d) I, II and IV

Sodium hydroxide is in the form of small white pellets and is soluble in water. Being basic in nature, it turns red litmus paper blue. The correct observation is I, II and IV.
Marks: 1

Question 40. Hard water required for an experiment is not available in a school laboratory. However, following salts are available in the laboratory. Select the salts which may be dissolved in water to make it hard for the experiment.
1. Calcium Sulphate
2. Sodium Sulphate
3. Calcium Chloride
4. Potassium Sulphate
5. Sodium Hydrogen Carbonate
6. Magnesium Chloride
(a) 1, 2 and 4
(b) 1, 3 and 6
(c) 3, 5 and 6
(d) 2, 4 and 5
Solution: (b) 1, 3 and 6
Hard water contains Ca^{2+} and Mg^{2+} ions. Thus the salts which can be added to water to make it hard are calcium sulphate, calcium chloride and magnesium chloride i.e., the salts 1, 3 and 6.
Marks: 1

Question 41. In an experiment to study the properties of acetic acid, a student takes about 2 ml of acetic acid in a dry test tube. He adds about 2 ml of water to it and shakes the test tube well. He is likely to observe that:
(a) The acetic acid dissolves readily in water.
(b) The solution becomes light orange.
(c) Water floats over the surface of acetic acid.
(d) Acetic acid floats over the surface of water.
Solution: (a) The acetic acid dissolves readily in water.
The acetic acid dissolves readily in water to form a clear solution.
Marks: 1

Question 42. A student takes 2 ml acetic acid in a dry test tube and adds a pinch of sodium hydrogen carbonate to it. He makes the following observations:
I. A colourless and odourless gas evolves with a brisk effervescence.
II. The gas turns lime water milky when passed through it.
III. The gas burns with an explosion when a burning splinter is brought near it.
IV. The gas extinguishes the burning splinter which is brought near it.
The correct observations are:
(a) I, II and III
(b) II, III and IV
(c) III, IV and I
(d) IV, I and II
Solution: (d) IV, I and II

When acetic acid is taken in a dry test tube and sodium hydrogen carbonate is added to it, a colourless and odourless gas evolves with a brisk effervescence i.e., CO_2.

$$\underset{\text{acetic acid}}{CH_3COOH} + \underset{\text{Sodium hydrogen carbonate}}{NaHCO_3} \rightarrow \underset{\text{Sodium acetate}}{CH_3COONa} + H_2O + \underset{\text{carbon dioxide}}{CO_2}$$

When CO_2 is passed through lime water, it turns lime water milky because of formation of calcium carbonate ppt.

$$\underset{\text{lime water}}{Ca(OH)_{2(aq)}} + CO_{2(g)} \rightarrow \underset{\text{(white ppt)}}{CaCO_{3(s)}} + H_2O$$

CO_2 being a non-supporter of combustion extinguishes the burning splinter when it is brought near it. So, the correct observations are IV, I and II.

Marks: 1

CBSE – X – 2012 EXAMINATION

SCIENCE

SET-3 Paper & Solution

Time: 3 Hrs. Max. Marks: 80

General Instructions:

1. The question paper comprises **two** Sections, **A and B**. You are to attempt both the sections.
2. All questions are **compulsory**.
3. There is no overall choice. However, internal choice has been provided in all the three questions of five marks category. Only one option in such question is to be attempted.
4. All questions of **Section A** and all questions of **Section B** are to be attempted separately.
5. Question numbers **1** to **4** in Section A are one-mark questions. These are to be answered in one word or in one sentence.
6. Question numbers **5** to **13** in Section A are two-mark questions. These are to be answered in about 30 words each.
7. Question numbers **14** to **22** in Section A are three-mark questions. These are to be answered in about 50 words each.
8. Question numbers **23** to **25** in Section A are five-mark questions. These are to be answered in about 70 words each.
9. Question numbers **26** to **41** in Section B are multiple choice questions based on practical skills. Each question is a one-mark question. You are to select one most appropriate response out of the four provided to you.

SECTION A

Question 1. Name the functional group present in each of the following organic compounds:

i. CH_3COCH_3

ii. C_2H_5COOH

Solution: i. Ketone

ii. Carboxylic acid

Marks: 1

Question 2. Which phenomenon is responsible for making the path of light visible?

Solution: Tyndall effect is the phenomenon responsible for making the path of light visible.

Marks: 1

Question 3. Which class of carbon compounds are responsible for the depletion of ozone layer at the higher level of the atmosphere?

Solution: Chlorofluorocarbons (CFCs) are responsible for the depletion of the ozone layer.

Marks: 1

Question 4. Select two non-biodegradable substances from the following waste generated in a kitchen: Spoilt food, paper bags, milk bags, vegetable peels, tin cans, used tea leaves.

Solution: Milk bags and tin cans.

Marks: 1

Question 5. Define the term puberty. List two changes observed in girls at the time of puberty.

Solution: It is the age at which the reproductive system becomes functional in human beings. The changes observed in girls at the time of puberty are:

i. Breast enlargement.

ii. Fat tissue starts depositing in areas like the breasts, hips, buttocks and thighs.

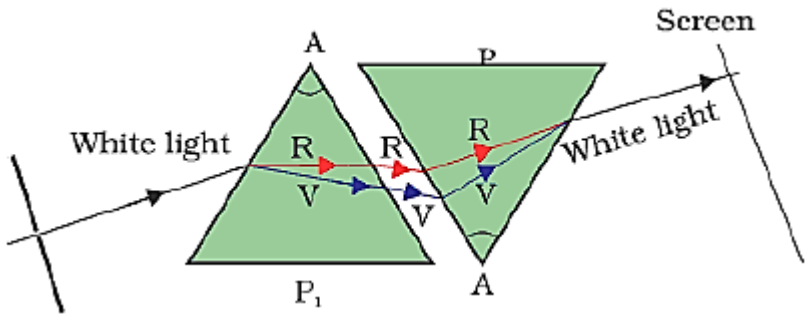
Marks: 2

Question 6. What is meant by asexual reproduction? List any two of its different forms.
Solution: It is a mode of reproduction in which new individuals are produced from a single parent without the involvement of fusion of gametes. The two forms of asexual reproduction are - budding and binary fission.
Marks: 2

Question 7. What are the advantages of water stored in the ground?
Solution: Advantages of water stored in the ground:
i. Stored ground water does not evaporate.
ii. It does not provide breeding grounds for mosquitoes like stagnant water collected in ponds or artificial lakes.
iii. It provides moisture for vegetation over a wide area.
iv. Ground water stored does not get contaminated by human and animal wastes.
Marks: 2

Question 8. "Burning fossil fuels is a cause of global warming." Justify this statement.
Solution: Fossil fuels like coal and petroleum are huge reservoirs of carbon and its compounds. On burning fossil fuels, huge reservoirs of carbon present in fossil fuels get converted to carbon dioxide and go into air. The amount of carbon dioxide thus increases in the atmosphere which leads to an increased green house effect leading to excessive heating of the Earth i.e., global warming.
Marks: 2

Question 9. When we place a glass prism in the path of a narrow beam of white light, a spectrum is obtained. What happens when a second identical prism is placed in an inverted position with respect to the first prism? Draw a labelled ray diagram to illustrate it.
Solution: When a second identical prism is placed in an inverted position with respect to the first prism, recombination of the spectrum occurs and it forms white light again.



Marks: 2

Question 10. List four properties of the image formed by a concave mirror when an object is placed between the focus and pole of the mirror.
Solution: When an object is placed between the focus and the pole of a concave mirror, the image formed is:
i. Virtual
ii. Enlarged
iii. Behind the mirror
iv. Erect
Marks: 2

Question 11. An element 'M' has atomic number 12.
(a) Write its electronic configuration.
(b) State the group to which 'M' belongs.
(c) Is 'M' a metal or a non-metal?
(d) Write the formula of its oxide.
Solution: (a) The electronic configuration of M is 2, 8, 2
(b) M belongs to the 2^{nd} group
(c) M is a metal
(d) MO
Marks: 2

Question 12. How can the valency of an element be determined if its electronic configuration is known? What will be the valency of an element of atomic number 9?
Solution: An element's valency is determined by the number of electrons in its outer shell. Hence the number of valence electrons obtained from the electronic configuration of the element gives the valency i.e., the number of electrons lost, gained or shared by the element to attain a noble gas configuration.
The valency of an element of atomic number 9 would be 1 since the number of valence electrons in its outer shell is 7 so it needs only one electron to attain the noble gas configuration.
Marks: 2

Question 13. A star at times appears bright and at times fainter. What is this effect called? State the reason for this effect.
Solution: This effect is called twinkling effect. Atmospheric refraction is the reason behind this effect. Since the stars are very far, they can be taken as point sized objects. As the path of rays coming from the stars keep varying due to atmospheric refraction, the apparent position of the stars fluctuates and the amount of light entering our eyes also varies resulting in a twinkling effect.
Marks: 2

Question 14. F, Cl and Br are elements each having seven valence electrons. Which of these:
i. has the largest atomic radius
ii. is most reactive?
Justify your answer stating reason for each.
Solution: i. F, Cl and Br all are in the same group and thus have the same effective nuclear charge. Br has the largest atomic radius among all because it uses the largest number of electron energy levels since the valence electrons are placed in larger orbitals i.e. the principal quantum number increases on going down the group.
ii. Fluorine is the most reactive since it has the greatest tendency to gain electrons because it has a higher effective nuclear charge and uses fewer energy levels than Br and Cl.
Marks: 3

Question 15. Explain the meaning of sexually transmitted diseases (STD's). Give two examples of STD's each, caused due to
i. bacterial infection
ii. viral infection.

State in brief how the spread of such diseases may be prevented.
Solution: Sexually transmitted diseases (STD's) are diseases which are usually passed through sexual contact with an infected partner.
i. Sexually transmitted diseases caused due to bacterial infection: Gonorrhea and Syphilis.
ii. Sexually transmitted diseases caused due to viral infection: AIDS and Herpes.
A key strategy in the prevention of STD's involves screening, diagnosis and treatment of patients as well as their sexual partners to interrupt transmission.
Prevention of transmission of STD's:
(a) Having sex with an infected or any unknown person should be avoided.
(b) Sharing of needles, syringes etc. must be prohibited.
(c) Surgical and dental instruments should be sterilised properly before use.
(d) Avoid blood transfusion from an infected person. Blood should be tested before transfusion.
(e) Adequate medical treatment should be provided to the pregnant woman to protect the child from getting infected.
Marks: 3

Question 16. Distinguish between homologous organs and analogous organs. In which category would you place wings of a bird and wings of bat? Justify your answer giving a suitable reason.
Solution:

Homologous Organs	Analogous Organs
Homologous organs are organs which are dissimilar in shape, size and function but their origin, basic plan and development are similar.	Analogous organs are organs which are similar in shape and function but their origin, basic plan and development are dissimilar.

Wings of a bird and bat should be placed in the category of analogous organs as they are similar in function but are different in their structure and development.
Marks: 3

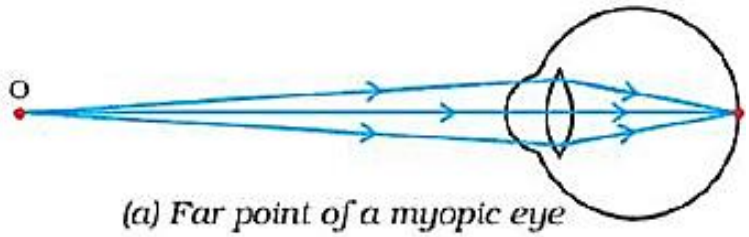
Question 17. Define the term 'evolution'. 'Evolution cannot be equated with progress'. Justify this statement.
Solution: Evolution is a gradual change in the characteristics of a population of animals or plants over successive generations.
Evolution cannot be equated with progress. There is no real 'progress' in the idea of evolution. Evolution is simply the generation of diversity and the shaping of the diversity by environmental selection. The only progressive trend in evolution seems to be that more and more complex body designs have emerged over time. However again, it is not as if the older designs are inefficient! One of the simplest life forms, bacteria inhabits the most inhospitable habitats like hot springs, deep-sea thermal vents and the ice in Antarctica.
Marks: 3

Question 18. A blue colour flower plant denoted by BB is crossbred with a white colour flower plant denoted by bb.
(a) State the colour of flower you expect in their F_1 generation plants.
(b) What must be the percentage of white flower plants in F_2 generation if flowers of F_1 plants are self-pollinated?
(c) State the expected ratio of the genotypes BB and Bb in the F_2 progeny.
Solution: (a) Blue

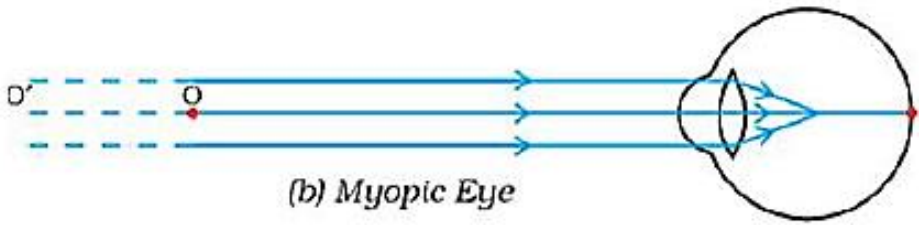
(b) 25%
(c) 1 : 2
Marks: 3

Question 19. Complete the following equations:
(a) $CH_4 + O_2 \rightarrow$
(b) $C_2H_5OH \xrightarrow{\text{Hot conc. } H_2SO_4}$
(c) $CH_3COOH + NaOH \rightarrow$
Solution: (a) $CH_4 + O_2 \rightarrow CO_2 + H_2O$ + Heat and light
(b) $C_2H_5OH \xrightarrow{\text{Hot conc. } H_2SO_4} CH_2 = CH_2 + H_2O$
(c) $NaOH + CH_3COOH \rightarrow CH_3COONa + H_2O$
Marks: 3

Question 20. A student cannot see a chart hanging on a wall placed at a distance of 3 m from him. Name the defect of vision he is suffering from. How can it be corrected? Draw ray diagrams for the:
i. defect of vision
ii. for its correction
Solution: The student is suffering from myopia or short sightedness. It is a defect of vision due to which a person cannot see the distant objects clearly though he can see nearby objects clearly.
It can be corrected by using a concave lens of suitable focal length.
i. Ray diagram for defect myopia:

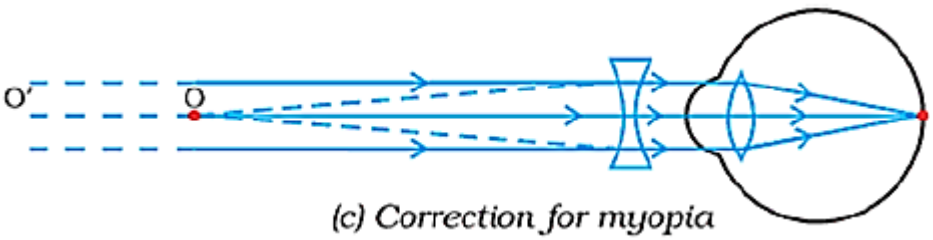


(a) Far point of a myopic eye



(b) Myopic Eye

ii. Ray diagram for the correction of this defect:



(c) Correction for myopia

Marks: 3

Question 21. State the type of mirror preferred as
i. Rear view mirrors in vehicles
ii. Shaving mirrors. Justify your answer giving two reasons in each case

Solution: i. Convex mirror is used as rear view mirror because: (1) It has a large field of view. (2) It produces erect image of the objects behind the vehicle.
ii. Concave mirror is used as shaving mirror, because: (1) It produces enlarged image when object is placed close to it. (2) It produces an erect image.
Marks: 3

Question 22. The image of a candle flame placed at a distance of 36 cm from a spherical lens is formed on a screen placed at a distance of 72 cm from the lens. Identify the type of lens and calculate its focal length. If the height of the flame is 2.5 cm, find the height of the image.
Solution: Given that:
Object distance, u = −36 cm
Image distance, v = 72 cm
As the image is obtained on a screen it is a real image and hence the spherical lens will be a convex lens.
Focal length f = ?
According to lens formula,

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

Substituting the values, we get:

$$\frac{1}{72}-\frac{1}{-36}=\frac{1}{f}$$

$$\frac{1}{f}=\frac{1}{72}+\frac{1}{36}$$

$$f=\frac{72}{36}$$

f = 24 cm
Therefore the focal length of the lens = 24 cm
It is given that:
Object height, h_1 = 2.5 cm
Image height, h_2 =?
We know that magnification, m = $\frac{v}{u}=\frac{h_2}{h_1}$

$$\Rightarrow h_2=h_1\times\frac{v}{u}$$

$$h_2=2.5\times\frac{72}{-36}$$

h_2 = -5 cm
The image of the flame formed will be inverted and have a height of 5 cm.
Marks: 3

Question 23. List the sign conventions for reflection of light by spherical mirrors. Draw a diagram and apply these conventions in the determination of focal length of a spherical mirror which forms a three times magnified real image of an object placed 16 cm in front of it.

OR

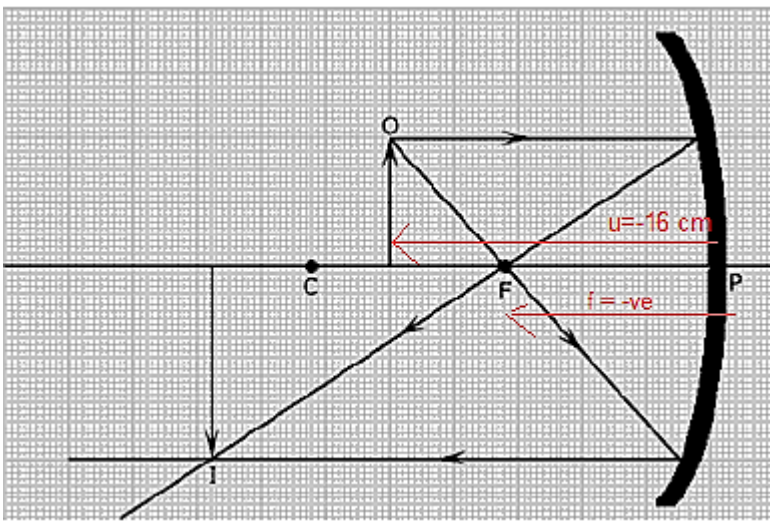
State the law of refraction of light which defines the refractive index of a medium with respect to the other. Express it mathematically. How is refractive index of any medium 'A' with respect to a medium 'B' related to the speed of propagation of light in two media A and B? State the name of this constant when one medium is vacuum or air. The refractive indices of glass and water with respect to vacuum are 3/2 and 4/3 respectively. If the speed of light in glass is 2×10^8 m/s, find the speed of light in

i. vacuum

ii. water

Solution: Sign conventions of spherical mirror:

1. Object is always placed to the left of mirror.
2. All distances are measured from the pole of the mirror.
3. Distances measured in the direction of the incident ray are positive and the distances measured in the direction opposite to that of the incident ray are negative.
4. Distances measured along the y-axis (upwards) above the principal axis are positive and that measured along the y-axis (downwards) below the principal axis are negative.



Given that:

Object distance, u = −16 cm

Magnification, m = 3

We know that magnification for a spherical mirror, $m = -\frac{v}{u} = \frac{h_2}{h_1}$

i.e., $-\frac{v}{u} = 3$

$\Rightarrow v = -3u$

Using mirror formula:

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

$$\frac{1}{f} = \frac{1}{-16} + \frac{1}{-3 \times -16}$$

$$\frac{1}{f} = \frac{48}{-4}$$

u = −12 cm

Negative sign of focal length implies that the focal length is being measured against the direction of incident light and it is a concave mirror.

OR

Snell's law of refraction states that the ratio of sine of angle of incidence in the first medium to the sine of angle of refraction in the second medium is a constant and is termed as the refractive index of the second medium with respect to the first medium,

$$\frac{\sin i}{\sin r} = {}^{1}n_{2}$$

where i and r are the angle which the incident and refracted rays respectively make with the normal.

The constant ${}^{1}n_{2}$ is called the refractive index of the second medium (2) relative to the first medium (1).

Relation between refractive index of any medium 'A' with respect to a medium 'B' and the speed of propagation of light in two media A and B:

$${}^{B}n_{A} = \frac{\text{Speed of light in medium B}}{\text{Speed of light in medium A}}$$

When one medium is vacuum or air, this constant is called absolute refractive index.

Given:

Refractive index of glass, $n_g = \frac{3}{2}$

Refractive index of water, $n_w = \frac{4}{3}$

Speed of light in glass, $v_g = 2 \times 10^8$ m/s

Let speed of light in vacuum be c,

We know that, $n_g = \frac{c}{v_g}$

$$c = n_g \times v_g = \frac{3}{2} \times 2 \times 10^8 = 3 \times 10^8 \text{ m/s}$$

Let v_w be the speed of light in water.

$$\therefore n_w = \frac{c}{v_w}$$

$$v_w = \frac{c}{n_w} = \frac{3 \times 10^8}{\frac{4}{3}} = 2.25\ 10^8 \text{ m/s}$$

Speed of light in vacuum = 3×10^8 m/s

Speed of light in water = $2.25 \times 10s^8$ m/s

Marks: 5

Question 24. What is the difference between the chemical composition of soaps and detergents? State in brief the soaps in removing an oily spot from a shirt. Why soaps are not considered suitable for washing when water is hard?

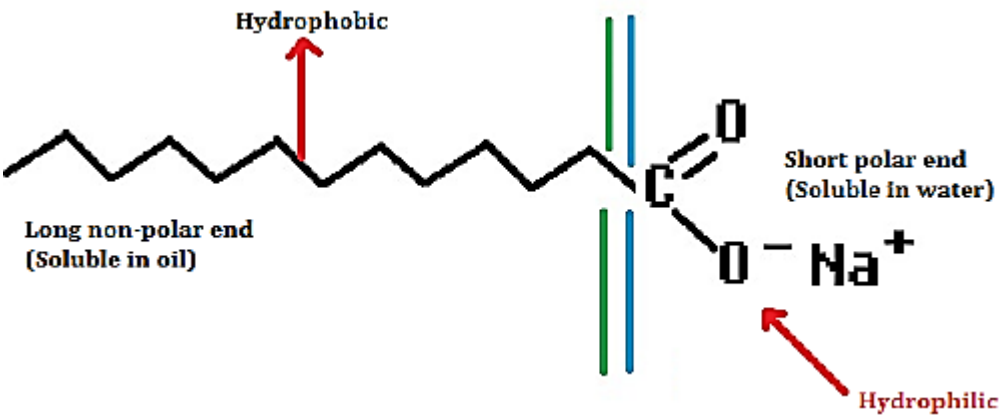
OR

List in tabular form three physical and two chemical properties on the basis of which ethanol and ethanoic acid can be differentiated.

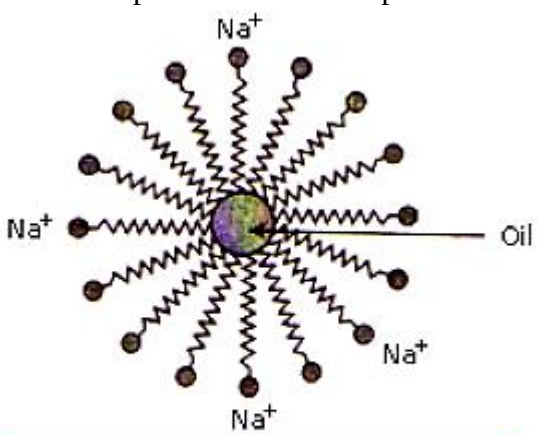
Solution: Detergents are generally ammonium or sulphonate salts of long chain carboxylic acids whereas molecules of soap are sodium or potassium salts of long-chain carboxylic acids.

Action of soap:

1. Soaps are cleansing agents capable of reacting with water and dislodge the unwanted particles from cloth or skin.
2. The molecules of soap are sodium or potassium salts of long chain carboxylic acids.
3. A soap molecule has a tadpole shaped structure.
4. One end (long non polar end) of a soap molecule is a hydrocarbon chain which is insoluble in water but soluble in oil.
5. The other end (short polar end) of a soap molecule is a carboxylate ion which is hydrophilic i.e., water soluble but insoluble in oil.



6. Soap on mixing with water forms a concentrated solution and causes foaming.
7. The long non-polar end of soap gravitates towards and surrounds the dirt and absorbs the dust in it.
8. The short polar end with the carboxylate ion turns the water away from the dirt.
9. A spherical aggregate of soap molecules is formed in the soap solution in water and is called a micelle.
10. The soap molecule thus helps in dissolving the dirt in water and help to wash our clothes clean.



Formation of Micelles

Hard water contains calcium and magnesium salts. When soap is used in hard water it forms an insoluble substance scum which remains even after washing hence soaps are not considered suitable for washing in hard water.

OR

Difference in physical properties:

S. No.	Ethanol	Ethanoic acid
1.	It exists only in liquid form.	It can exist both in liquid as well as solid form.
2.	It belongs to the functional group alcohols.	It belongs to the functional group carboxylic acids.
3.	It has a specific smell but not like vinegar.	It smells like vinegar.

Difference in chemical properties:

S. No.	Ethanol	Ethanoic acid
1.	Reaction with sodium bicarbonate: No salt formation occurs and carbon dioxide gas is also not evolved.	Reaction with sodium bicarbonate: It will react with sodium bicarbonate to form a salt and carbon dioxide gas will be released.
2.	It does not give litmus test i.e., no change in the colour of litmus solution..	It turns blue litmus red.

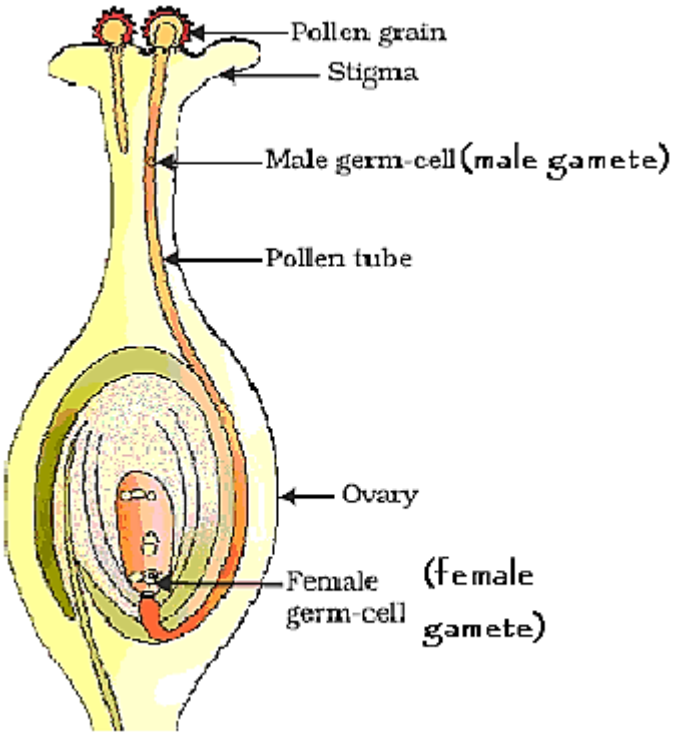
Marks: 5

Question 25. Define the terms pollination and fertilisation. Draw a diagram of a pistil showing pollen tube growth into the ovule and label the following: pollen grain, male gamete, female gamete and ovary.

OR

Describe in brief the role of
i. testis
ii. seminal vesicle
iii. vas deferens
iv. ureter
v. prostate gland in human male reproductive system.

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



Germination of pollen on stigma

OR

i. Testis: It is the organ which produces sperms and the male sex hormone, testosterone.
ii. Seminal vesicle: It produces fluid which makes up a significant percentage of semen.

iii. Vas deferens: Vas deferens is a tube transporting spermatozoa from the epididymis to the prostate part of the urethra.
iv. Ureter: It carries urine from the kidneys to the urinary bladder.
v. Prostate gland in human male reproductive system: It contributes additional fluid to the ejaculate. Prostate fluids also help to nourish the sperms.
Marks: 5

SECTION B

Question 26. After observing the prepared slides of binary fission in Amoeba and budding in yeast, the following observations were reported:
a. Single cells of Amoeba and Yeast were undergoing binary fission and budding respectively.
b. Cytokinesis was observed in the Yeast cell.
c. Elongated nucleus was dividing to form two daughter nuclei in Amoeba.
d. A chain of buds were observed due to reproduction in Amoeba.
The correct observation(s) is/are:
(a) d, a and c
(b) c and d
(c) b only
(d) a and c
Solution: (d) a and c
The correct observations are:
i. Single cells of Amoeba and Yeast were undergoing binary fission and budding respectively.
ii. Elongated nucleus was dividing to form two daughter nuclei in Amoeba.
Marks: 1

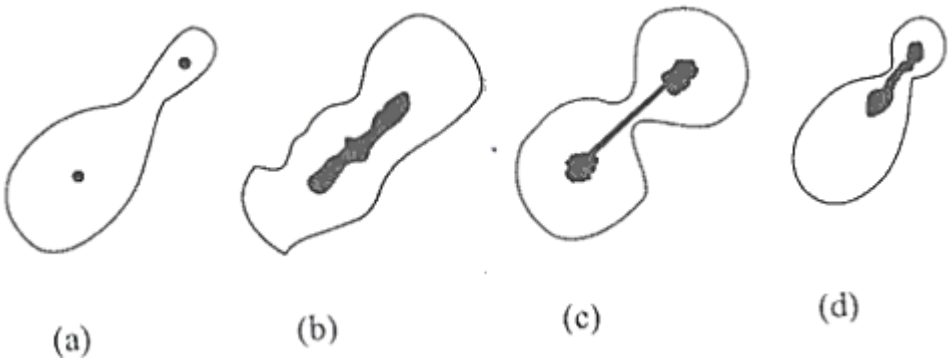
Question 27. A student after viewing a prepared slide illustrates budding in yeast in the following order which is not correct:

The correct order should be:
(a) b, d, e, c, a
(b) b, e, d, c, a
(c) b, c, d, e, a
(d) b, d, c, e, a
Solution: (d) b, d, c, e, a
The correct sequence is b, d, c, e, a
Marks: 1

Question 28. A student has to observe a permanent slide of binary fission in Amoeba. Find the correct sequence of steps given below for focusing the object under a microscope.

a. Place the slide on the stage, look through the eye-piece and adjust the mirror to get proper illumination.
b. Focus the slide sharp using fine adjustment screw.
c. Look through the eye-piece and raise the objective lens using coarse adjustment screw till the object is focused.
d. Look through the eye-piece and move the slide till the object is visible.
(a) a, c, d, b
(b) d, c, b, a
(c) a, b, d, c
(d) a, d, c, b
Solution: (d) a, d, c, b
The correct sequence is a, d, c, b
Marks: 1

Question 29. After viewing different slides, a student draws the following diagrams. Select the one which depicts binary fission in Amoeba:



(a) d
(b) b
(c) a
(d) c
Solution: (c) a
Figure (a) shows binary fission in Amoeba.
Marks: 1

Question 30. Dry raisins were soaked in water for 2 hours to determine the percentage of water absorbed by raisins. Before final weighing of swollen raisins, the extra water left on the surface of soaked raisins was removed by:
(a) Dry cotton wool
(b) Hot air blower
(c) Gently rubbing with cotton cloth
(d) Filter paper
Solution: (d) Filter paper
Filter paper is used to soak raisins.
Marks: 1

Question 31. While performing the experiment with raisins to determine the percentage of water absorbed by them, a student made the following measurements:
Mass of water in the beaker = 40 g

Mass of raisins before soaking = 5 g
Mass of raisins after soaking for 2 hours = 8 g
Mass of water left in the beaker after three experiments = 35 g
The percentage of water absorbed by raisins is:
(a) $\frac{8g-5g}{8g}\times100$
(b) $\frac{40g-35g}{40g}\times100$
(c) $\frac{40g-35g}{35g}\times100$
(d) $\frac{8g-5g}{5g}\times100$
Solution: (d) $\frac{8g-5g}{5g}\times100$
Marks: 1

Question 32. Which of the following observations is true about dilute solution of acetic acid?
(a) It smells like vinegar and turns red litmus blue
(b) It smells like onion and turns blue litmus blue
(c) It smells like orange and turns red litmus blue
(d) It smells like vinegar and turns blue litmus red
Solution: (d) It smells like vinegar and turns blue litmus red
Acetic acid smells like vinegar and turns blue litmus red due to its acidic nature.
Marks: 1

Question 33. A student takes Na_2CO_3 powder in a test tube and pours some drops of acetic acid in it. He observes:
(a) No reaction in the test tube
(b) Colourless gas with pungent smell
(c) Bubbles of a colourless and odourless gas
(d) White fumes with smell of vinegar
Solution: (c) Bubbles of a colourless and odourless gas
Na_2CO_3 reacts with acetic acid to evolve carbon dioxide gas.
Marks: 1

Question 34. A student adds 4 ml of acetic to a test tube containing 4 ml of distilled water. He then shakes the test tube and leaves it to settle. After about 10 minutes he observes:
(a) A layer of water over the layer of acetic acid
(b) A layer of acetic acid over the layer of water
(c) A precipitate settling at the bottom of the test tube
(d) A clear colourless solution
Solution: (d) A clear colorless solution
Acetic acid is completely miscible with water in all proportions.
Marks: 1

Question 35. The colours of aqueous solutions of $CuSO_4$ and $FeSO_4$ as observed in the laboratory are:
(a) Pale green and light blue respectively
(b) Light blue and dark green respectively
(c) Dark blue and dark green respectively
(d) Dark blue and pale green respectively
Solution: (D) Dark blue and pale green respectively
Copper sulphate solution is blue coloured and iron sulphate solution is pale green.
Marks: 1

Question 36. A student prepared an aqueous solution of $CuSO_4$ in beaker X and an aqueous solution of $FeSO_4$ in beaker Y. He then dropped some iron pieces in beaker X and some zinc pieces in beaker Y. After about 10 hours, he observed that the solution in X and Y respectively appears:
(a) Blue and green
(b) Colourless and pale green
(c) Colourless and light blue
(d) Greenish and colourless
Solution: (d) Greenish and colourless

$$\underset{(X)}{Fe + CuSO_{4(aq)}} \rightarrow \underset{\text{Greenish}}{FeSO_{4(aq)}} + Cu$$

$$\underset{(Y)}{Zn + FeSO_{4(aq)}} \rightarrow \underset{\text{Colorless}}{ZnSO_{4(aq)}} + Fe$$

Marks: 1

Question 37. While tracing the path of a ray of light passing through a rectangular glass slab a student tabulated his observations as given below:

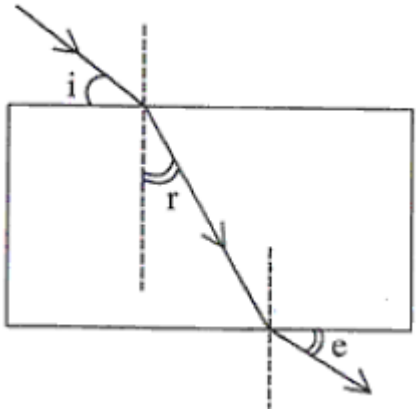
S.No.	∠i	∠r	∠e
I	60°	40°	61°
II	50°	36°	51°
III	40°	28°	39°
IV	30°	20°	31°

The correct observation is:
(a) I
(b) II
(c) III
(d) IV
Solution: (d) IV
The IV observation is the correct one. The ratio of sin i and sin r given by the fourth choice gives 1.5.
We know that

$$\frac{\sin i}{\sin r} = \frac{n_2}{n_1} = \frac{1.5}{1} = 1.5$$

Marks: 1

Question 38. A student traces the path of a ray of white light through a rectangular glass slab and marks the angles of incidence ($\angle$i), refraction ($\angle$r) and emergence ($\angle$e) as shown.



Which angle or angles have not been marked correctly?
(a) $\angle$i only
(b) $\angle$i and $\angle$r
(c) $\angle$r and $\angle$e
(d) $\angle$i and $\angle$e
Solution: (d) $\angle$i and $\angle$e
$\angle$i and $\angle$e are not marked correctly. Each angle is supposed to be marked from the normal.
Marks: 1

Question 39. To determine the focal length of a convex lens by obtaining a sharp image of a distant object we generally follow the following steps which are not in proper sequence.
a. Hold the lens between the object and the screen
b. Measure the distance between the lens and the screen
c. Select a well lit distant object
d. Place a screen opposite to the object on the lab table
e. Adjust the position of the lens to form a sharp image
The correct sequence of these steps is:
(a) c, a, d, e, b
(b) c, d, a, e, b
(c) c, d, e, a, b
(d) c, a, e, d, b
Solution: (b) c, d, a, e, b
The correct sequence will be c, d, a, e, b
Marks: 1

Question 40. A student obtained a sharp image of the grills of a window on a screen using a concave mirror. His teacher remarked that for getting better results a well lit distance object (preferably the Sun) should be focused on the screen. What should be done for this purpose?
(a) Move the screen and the mirror towards the object
(b) Move the screen and the mirror away from the object
(c) Move the screen slightly away from the mirror
(d) Move the mirror slightly towards the screen
Solution: (c) Move the screen slightly away from the mirror

The screen is moved away from the mirror so as to focus the object for a fixed position of the mirror and the object.
Marks: 1

Question 41. To determine focal length of a concave mirror a student obtains the image of a well lit distant object on a screen. To determine the focal length of the given concave mirror he needs to measure the distance between the:
(a) Cannot be determined
(b) Screen and the object
(c) Mirror and the object
(d) Mirror and the screen
Solution: (d) Mirror and the screen
The distance between mirror and the screen will give the focal length of the mirror as the mirror focuses the light on the screen.
Marks: 1

CBSE – X – 2011 EXAMINATION

SCIENCE

SET-1 Paper & Solution

Time: 3 Hrs. Max. Marks: 80

General Instructions:

1. The question paper comprises of **two** Sections, **A and B**. You are to attempt both the sections.
2. All questions are **compulsory**.
   There is no overall choice. However, internal choice has been provided in all the three questions of five marks category. Only one option in such question is to be attempted.
3. All questions of **Section A** and all questions of **Section B** are to be attempted separately.
4. Question numbers **1** to **4** in Section A are one-mark questions. These are to be answered in one word or in one sentence.
5. Question numbers **5** to **13** in Section A are two-mark questions. These are to be answered in about 30 words each.
6. Question numbers **14** to **22** in Section A are three-mark questions. These are to be answered in about 50 words each.
7. Question numbers **23** to **25** in Section A are five-mark questions. These are to be answered in about 70 words each.
8. Question numbers **26** to **41** in Section B are multiple choice questions based on practical skills. Each question is a one-mark question. You are to select one most appropriate response out of the four provided to you.

SECTION A

Question 1. Why is it necessary to conserve our environment?

Solution: Conservation of environment is required for preventing damage to the environment and depletion of natural resources.

Marks: 1

Question 2. Distinguish between biodegradable and non-biodegradable wastes.

Solution:

Biodegradable wastes	Non-biodegradable wastes
Substances which are easily decomposed by microorganisms are called biodegradable wastes.	Substances which are not decomposed by microorganisms are called non-biodegradable wastes.

Marks: 1

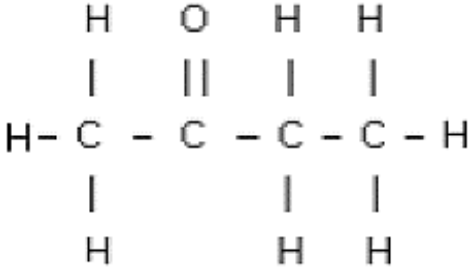
Question 3. What will be the colour of scattered sunlight when the size of the scattering particles is relatively large?

Solution: If the size of the scattering particles is relatively large, then the scattered light will appear white.

Marks: 1

Question 4. Draw the structure of Butanone molecule, $CH_3COC_2H_5$.

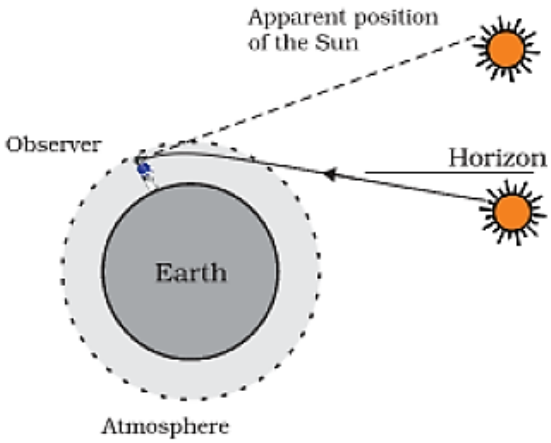
Solution: Structure of butanone, $CH_3COC_2H_5$



Marks: 1

Question 5. Explain with the help of a diagram, how we are able to observe the sunrise about two minutes before the Sun gets above the horizon.

Solution: Sunrise takes place when the sun is just above the horizon. But due to refraction of sunlight caused by the atmosphere, we can see the rising sun about 2 minutes before it is actually above the horizon. This happens because when the sun is slightly below the horizon, the sun's light coming from less dense air to more dense air is refracted downwards as it passes through the atmosphere. Because of this atmospheric refraction, the sun appears to be raised above the horizon when actually it is slightly below the horizon.



Marks: 2

Question 6. List any four reasons for vegetative propagation being practised in the growth of some type of plants.

Solution: Reasons for vegetative propagation:

i. It is done for plants which have lost the capacity to produce seeds.

ii. To produce plants which are genetically similar to the parent plant.

iii. It helps in producing those plants which either produce very few seeds or produce such seeds which are not viable.

iv. It can be used to produce plants which reach maturity and produce fruits and seeds faster.

Marks: 2

Question 7. State the role of

i. Seminal vesicle

ii. Prostate gland in the human body.

Solution: i. Seminal vesicles - secrete alkaline secretions which lower the pH of semen and provide nourishment.

ii. Prostate Gland - secretions of these glands keep the sperm active and mobile.

Marks: 2

Question 8. List any four disadvantages of using fossil fuels for the production of energy.

Solution: Disadvantages of using fossil fuels for the production of energy:

i. Burning of fossil fuels (e.g. coal and petroleum products) causes air pollution.

ii. The oxides of carbon, nitrogen and sulphur which are released on burning fossil fuels are acidic oxides. These cause acid rain which adversely affects our water and soil resources.

iii. Green house gases like carbon dioxide released during the combustion of fossil fuels enhances the process of global warming.

iv. Fossil fuels were formed over millions of years ago and have limited reserves. If we were to continue consuming these sources at such alarming rates, we would soon run out of energy.
Marks: 2

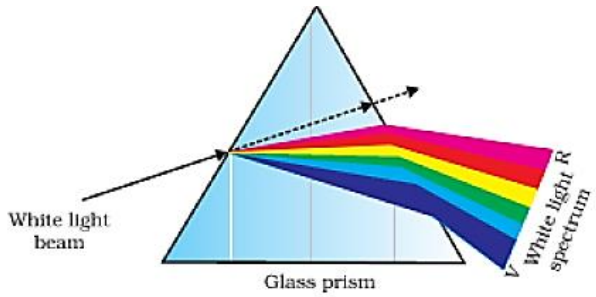
Question 9. Give two examples for each of the following:
i. Renewable sources or energy
ii. Non-renewable sources of energy
Solution: i. Solar energy and wind energy are the renewable sources of energy.
ii. Fossil fuels and uranium are the non-renewable sources of energy.
Marks: 2

Question 10. How does the metallic character of elements change along a period of the periodic table from the left to the right and why?
Solution: Metallic character decreases from left to right along a period of the periodic table because on moving from left to right, size of the atoms decreases and nuclear charge increases. Hence, the tendency to release electrons decreases. Thus, the electropositive character decreases.
Marks: 2

Question 11. In the modern periodic table, the element calcium (atomic number = 20) is surrounded by elements with atomic numbers 12, 19, 21 and 38. Which of these elements has physical and chemical properties resembling those of calcium and why?
Solution: Ca: Electronic configuration is: 2,8,8,2
The physical and chemical properties of elements with atomic number 12 and 38 will resemble those of calcium.
This is because they all belong to the second group and all of them have two electrons in the valence shell.
Marks: 2

Question 12. State any four characteristics of the image of the objects formed by a plane mirror.
Solution: Four characteristics of images formed by a plane mirror are:
i. The image formed by a plane mirror is always virtual.
ii. The image formed by a plane mirror is always erect.
iii. Size of the image is same as the size of the object and the image is laterally inverted.
iv. The image formed by a plane mirror is at the same distance behind the mirror as object is in front of it.
Marks: 2

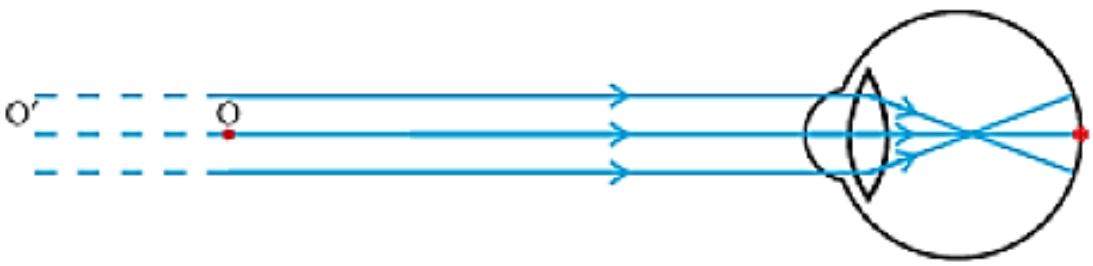
Question 13. Draw a diagram to show dispersion of white light by a glass prism. What is the cause of this dispersion?
Solution:



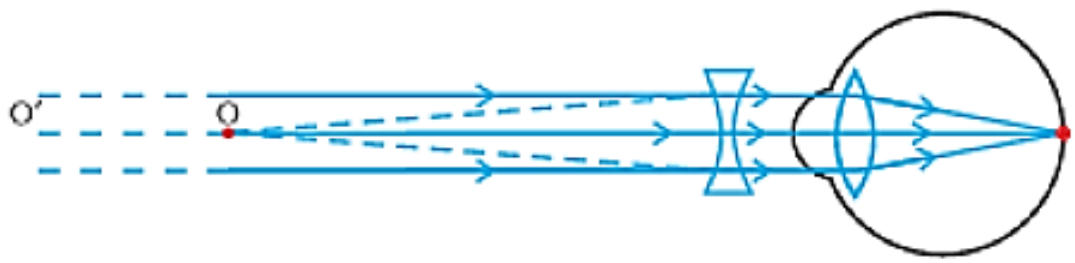
Dispersion of white light by the glass prism

Different colours of white light bend through different angles with respect to the incident ray, as they pass through a prism. Thus the rays of each colour emerge along different paths and become distinct. It is the band of distinct colours that we see in a spectrum.
Marks: 2

Question 14. (a) What is meant by the power of accommodation of an eye?
(b) A person with a myopic eye cannot see objects beyond 1.2 m directly. What should be the type of the corrective lens used? What would be its power?
Solution: (a) The process by which the ciliary muscles change the focal length of an eye lens to focus distant or near objects clearly on the retina is called the accommodation of the eye. The ability of the eye to do this is called the power of accommodation of the eye.
(b) The person is able to see nearby objects clearly, but he is unable to see objects beyond 1.2 m. This happens because the image of an object beyond 1.2 m is formed in front of the retina and not at the retina, as shown in the given figure.



To correct this defect of vision, the person must use a concave lens. The concave lens will bring the image back to the retina as shown in the given figure.



Focal length of the corrective lens used = − (Distance of far point of the myopic eye) = −1.2 m

Power of the lens $= \frac{1}{\text{focal length}} = \frac{1}{-12} = -0.83\text{D}$

Marks: 3

Question 15. What does HIV stand for? Is AIDS an infectious disease? List any four modes of spreading AIDS.
Solution: HIV stands for Human Immuno Deficiency Virus.
Yes, HIV is an infectious agent which spreads through sexual contact.
Modes by which can HIV spread:
i. Through sexual contact.
ii. From pregnant mothers to the growing foetus.
iii. Through transfusion of infected blood.
iv. By sharing of needles or syringes.
Marks: 3

Question 16. Describe any three ways in which individuals with a particular trait may increase in population.
Solution: Different ways in which individuals with a particular trait may increase in population are variation, natural selection and genetic drift.
Variation: Variation is defined as the occurrence of differences among the individuals. No two individuals are exactly alike. Variations arising during the process of reproduction can be inherited and lead to increased survival of the individuals.
Natural selection: It results in adaptations in population to fit their environment better. Thus, natural selection directs evolution in the population of a particular species.
Genetic drift: The change in the frequency of certain genes in a population over generations is called genetic drift.
Marks: 3

Question 17. State the evidence we have for the origin of life from inanimate matter.
Solution: J.B.S. Haldane suggested that life must have developed from the simple inorganic molecules which were present on Earth soon after it was formed. He speculated that the conditions on Earth at that time could have given rise to more complex organic molecules which were necessary for life. The first primitive organisms would arise from further chemical synthesis. Later on, Stanely L. Miller and Harold C. Urey conducted experiments to understand the origin of organic molecules. They created an atmosphere similar to that thought to exist on early Earth (this had molecules like ammonia, methane and hydrogen sulphide, but no oxygen) over water. This was maintained at a temperature just below 100 °C and sparks were passed through the mixture of gases to simulate lightning. At the end of a week, 15% of the carbon (from methane) had been converted to simple compounds of carbon including amino acids which make up protein molecules. This is considered as evidence for origin of life on the Earth from inanimate matter.
Marks: 3

Question 18. Give an example of body characteristics used to determine how close two species are in terms of evolution and explain it.
Solution: Homologous organs, analogous organs and vestigial organs help to identify evolutionary relationships.
Homologous organs are those organs which have similar basic structure but have been modified to perform different functions. *Example* - forelimbs of reptiles, frog, lizard, bird and humans are homologous organs. Such homologous characteristics help to identify an evolutionary relationship between apparently different species.
Analogous organs are those organs which are different in basic structure but perform the same function. *Example* - wings of bird and wings of bat.
Vestigial organs are certain reduced and non-functional organs present in some organisms. *Example* - vermiform appendix in human body.
Marks: 3

Question 19. Write chemical equations to show what happens when:
i. Ethanol is heated with concentrated sulphuric acid at 443 K.
ii. Ethanol reacts with ethanoic acid in the presence of an acid acting as a catalyst.
iii. An ester reacts with a base.
Solution: i. $CH_3CH_2OH \xrightarrow{\text{conc.sulphuric acid at 443 K}} CH_2 = CH_2 + H_2O$

ii. $CH_3CH_2OH + CH_3COOH \xrightarrow{acid} CH_3COOCH_2CH_3 + H_2O$

iii. $CH_3COOCH_2CH_3 + NaOH \longrightarrow CH_3COONa + CH_3CH_2OH$

Marks: 3

Question 20. The atomic number of an element is 16. Predict

i. the number of valence electrons in its atom

ii. its valency

iii. its group number

iv. whether it is a metal or a non-metal

v. the nature of oxide formed by it

vi. the formula of its chloride

Solution: Atomic number = 16

Electronic configuration = 2, 8, 6

i. Number of valence electrons in its atom = 6

ii. Valency = 2

iii. Group number =16

iv. It is a non-metal

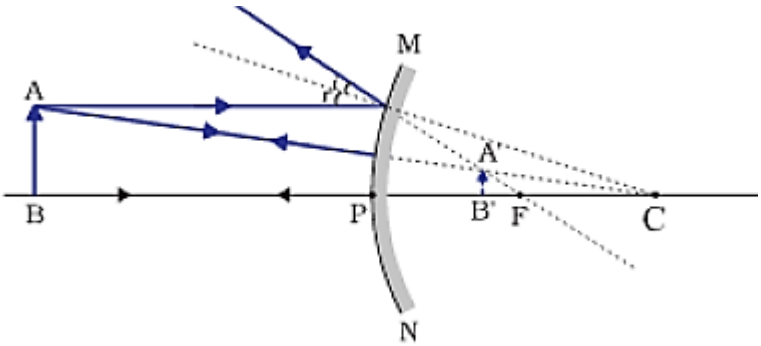
v. Acidic oxide

vi. XCl_2

Marks: 3

Question 21. An object is placed between infinity and the pole of a convex mirror. Draw a ray diagram and also state the position, the relative size and the nature of the image formed.

Solution:



An object is placed between infinity and the pole of a convex mirror, the image formed is:

i. Behind the mirror at focus (F),

ii. Virtual and erect,

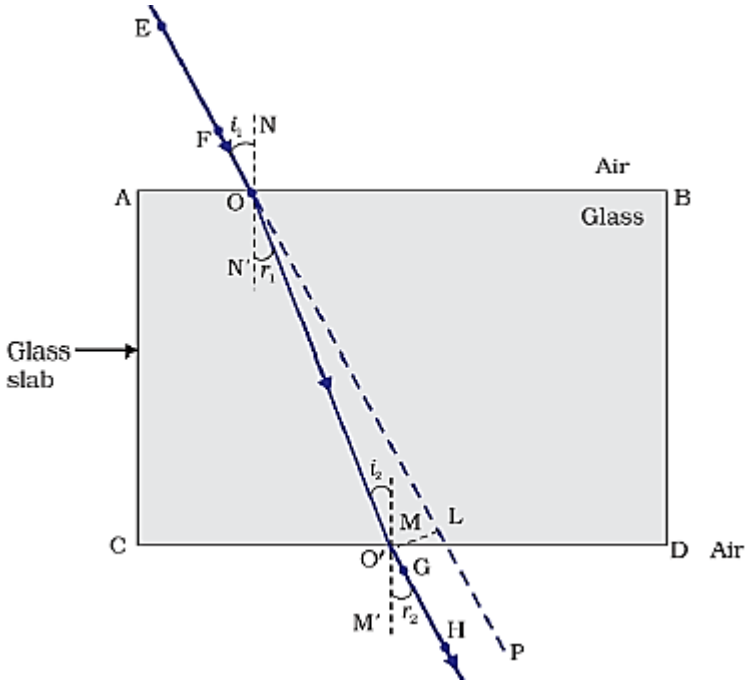
iii. Highly diminished

Marks: 3

Question 22. What is the principle of reversibility of light? Show that the incident ray of light is parallel to the emergent ray of light when light falls obliquely on a side of a rectangular glass slab.

Solution: The principle of reversibility of light states that light will follow exactly the same path if its direction of travel is reversed.

When light falls obliquely on a rectangular glass slab, the incident ray is parallel to the emergent ray; as shown in the figure. Angle of incidence is equal to the angle of emergence.



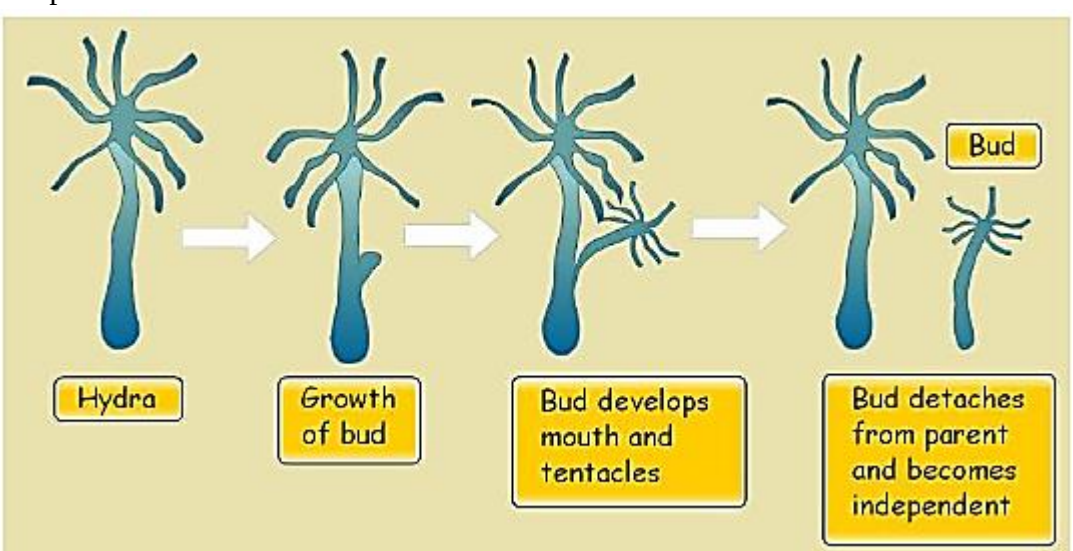
Marks: 3

Question 23. With the help of suitable diagrams, explain the various steps of budding in Hydra.

OR

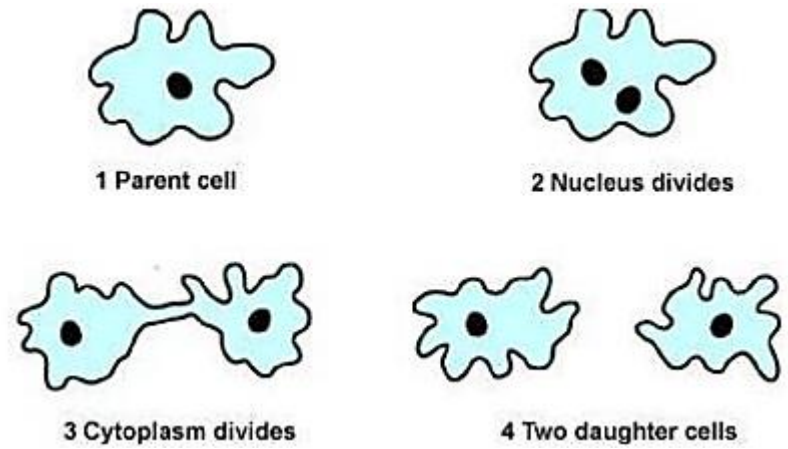
What is binary fission in organisms? With the help of suitable diagrams, describe the mode of reproduction in Amoeba.

Solution: In Hydra, a bud develops as an outgrowth due to repeated cell divisions at one specific site. These buds develop into tiny individuals and when fully mature, detach from the parent body and become new independent individuals.



OR

Binary fission is an asexual method of reproduction. Amoeba reproduces by this method. During this process, nuclear division takes place first, followed by the appearance of a constriction in the cell membrane, which gradually increases inwards and divides the cytoplasm into two parts. Finally, two daughter organisms are formed.



Marks: 5

Question 24. (a) State two properties of carbon which lead to a very large number of carbon compounds. (b) Why does micelle formation take place when soap is added to water? Why are micelles not formed when soap is added to ethanol?

OR

Explain isomerism. State any four characteristics of isomers. Draw the structures of possible isomers of butane, C_4H_{10}.

Solution: (a) Two properties of carbon which lead to a very large number of carbon compounds are:

i. Tetravalency: Carbon has valency 4 i.e., it is tetravalent. Hence, it is capable of bonding with four other atoms of other monovalent elements.

ii. Catenation: Carbon has the unique ability to form bonds with other atoms of carbon to form long chains.

(b) A soap molecule has two parts –one hydrophobic part and the other hydrophilic part. When added to water, the hydrophobic part arranges itself towards the dirt and the hydrophilic end arranges itself towards the water.

Micelle formation does not take place when soap is added to ethanol because the hydrophobic part of soap molecules is soluble in ethanol.

OR

Isomers are compounds with same molecular formula but different structures.

Four characteristics of isomers:

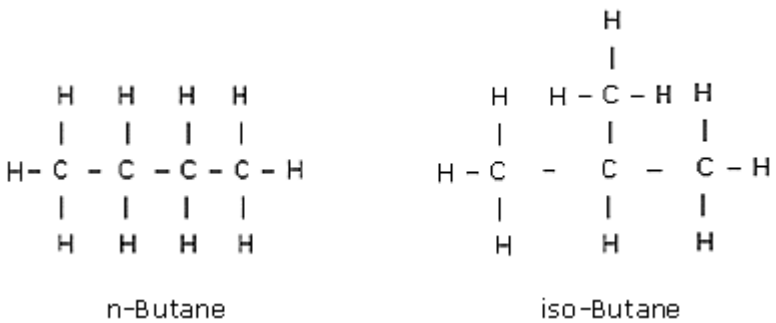
i. Isomers have different physical properties.

ii. Isomers may have same or different chemical properties.

iii. All isomers have the same number of atoms.

iv. Isomers have different structural arrangements.

Isomers of butane, C_4H_{10}.



Marks: 5

Question 25. (a) What is meant by 'power of a lens'?
(b) State and define the S.I. unit of power of a lens.
(c) A convex lens of focal length 25 cm and a concave lens of focal length 10 cm are placed in close contact with each other. Calculate the lens power of this combination.

OR

(a) Draw a ray diagram to show the formation of image of an object placed between infinity and the optical centre of a concave lens.
(b) A concave lens of focal length 15 cm forms an image 10 cm from the lens. Calculate
i. The distance of the object from the lens.
ii. The magnification for the image formed
iii. The nature of the image formed.

Solution: (a) The degree of convergence or divergence of light rays achieved by a lens is expressed in terms of its power. The power of a lens is defined as the reciprocal of its focal length. The power P of a lens of focal length f is given by:

$$P = \frac{1}{f\,(\text{in meters})}$$

(b) The S.I. unit of power of a lens is 'dioptre'.
1 dioptre is the power of a lens whose focal length is 1 metre.
(c) Focal length of convex lens = +25 cm

Power of convex lens, $P_1 = \frac{100}{25} = 4$ D

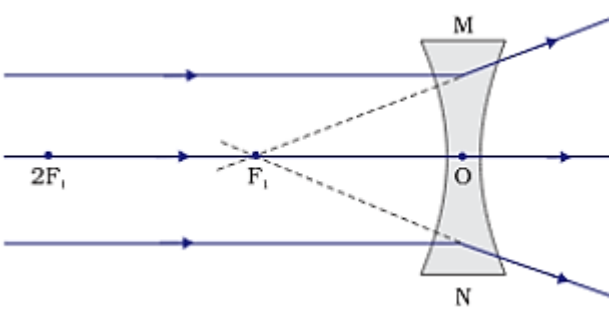
Focal length of concave lens = −10 cm

Power of concave lens, $P_2 = \frac{100}{-10} = -10$ D

Hence, power of this combination, $P = P_1 + P_2 = (4\text{ D}) + (-10\text{ D}) = -6$ D

OR

(a) Ray diagram showing the formation of image of an object placed between infinity and optical centre of a concave lens:



(b) A concave lens always forms a virtual, erect image on the same side of the object.
Focal length of concave lens, f = −15 cm
Image distance, v = −10 cm
i. Let 'u' be the object distance; then using lens formula:

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

or, $$\frac{1}{u} = \frac{1}{v} - \frac{1}{f}$$

Substituting the values,

$$\frac{1}{u}=\left(\frac{-1}{10}\right)-\left(\frac{-1}{15}\right)=\left(\frac{-1}{30}\right)$$

Or, u = −30 cm = −0.3 m

Thus, object distance is 30 cm

ii. Magnification, $m=\frac{v}{u}=\frac{-10}{-30}=\frac{1}{3}=0.33$

iii. The positive sign shows that the image is erect and virtual. The image is one-third the size of the object.

Marks: 5

SECTION B

Question 26. The shape of yeast cells is

(a) Only spherical

(b) Only oval.

(c) Irregular

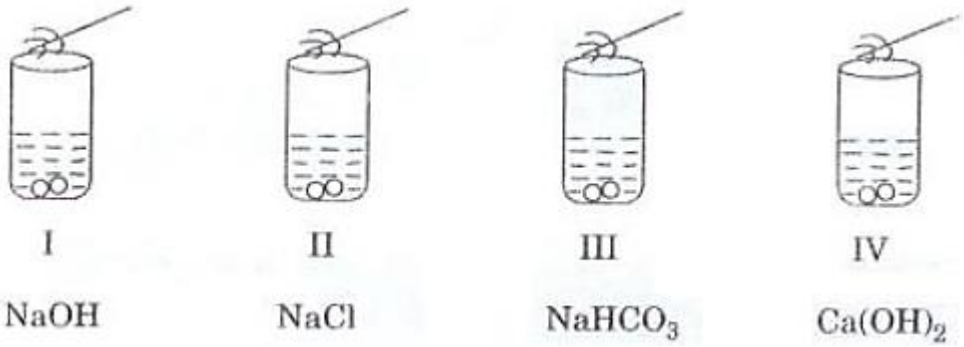
(d) Both oval and spherical.

Solution: (b) Only oval.

Yeast cells are usually oval.

Marks: 1

Question 27. A student added acetic acid to test tubes I, II, III and IV containing the labeled substances and then brought a burning splinter near the mouth of each test tube.



The splinter would be extinguished when brought near the mouth of test tube.

(a) I

(b) II

(c) III

(d) IV

Solution: (c) III

Sodium bicarbonate reacts with acetic acid to release carbon dioxide gas which is a nonsupporter of combustion.

Marks: 1

Question 28. Acetic add reacts with solid sodium hydrogen carbonate,

(a) Slowly forming no gas

(b) Vigorously with effervescence

(c) Slowly without effervescence

(d) Vigorously without gas formation

Solution: (b) Vigorously with effervescence
Acetic acid reacts with solid sodium hydrogen carbonate vigorously and effervescence is produced due to evolution of CO_2 gas.
Marks: 1

Question 29. Vapours of acetic acid smell:
(a) Pungent like vinegar
(b) Sweet like rose
(c) Suffocating like sulphur dioxide
(d) Odorless like water
Solution: (a) Pungent like vinegar
Vapours of acetic acid smell pungent like vinegar.
Marks: 1

Question 30. A clean aluminium foil was placed in an aqueous solution of zinc sulphate. When the aluminium foil was taken out of the zinc sulphate solution after 15 minutes, its surface was found to be coated with a silvery grey deposit. From the above observation it can be concluded that:
(a) Aluminium is more reactive than zinc
(b) Zinc is more reactive than aluminium
(c) Zinc and aluminium both are equally reactive
(d) Zinc and aluminium both are non-reactive
Solution: (a) Aluminium is more reactive than zinc
Aluminium is more reactive than zinc and is hence able to displace zinc from its solution.
Marks: 1

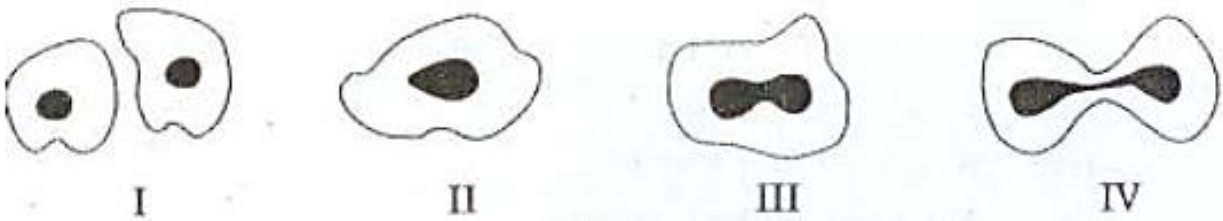
Question 31. The colour of raisins as used in the experiment, 'To determine the percentage of water absorbed by raisins', was
(a) White
(b) Yellow
(c) Dark brown
(d) Pink
Solution: (c) Dark brown
The raisins are dark brown in colour.
Marks: 1

Question 32. Following are the steps involved in the experiment- 'To determine the percentage of water absorbed by raisins'. They are not in proper sequence.
I. Soak the raisins in fresh water.
II. Weight dry raisins.
III. Weigh soaked raisins.
IV. Wipe out soaked raisins.
The correct sequence of steps is
(a) I, II, III, IV
(b) II, I, IV, III
(c) II, I, III, IV

(d) I, II, IV, III
Solution: (b) II, I, IV, III
The correct sequence is- II, I, IV, III
Marks: 1

Question 33. During the course of an experiment, to determine the percentage of water absorbed by raisins, the raisins are weighed
(a) Every half an hour.
(b) Every hour.
(c) Once- only after completing the experiment.
(d) Two times- Before soaking and after soaking for three hours.
Solution: (d) Two times− Before soaking and after soaking for three hours.
Raisins are weighed two times– before soaking and after soaking for three hours.
Marks: 1

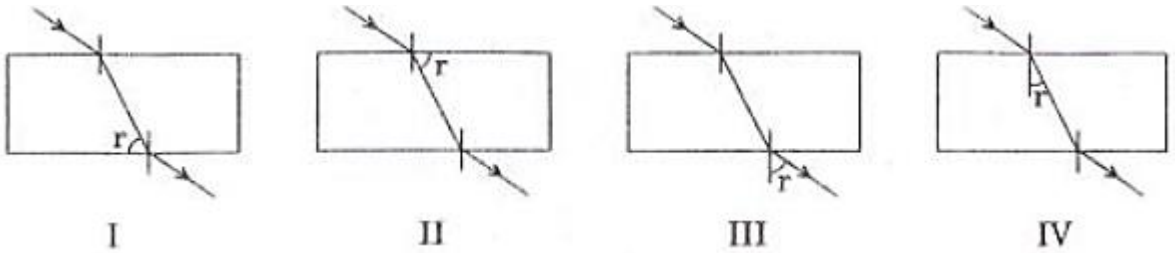
Question 34. The given figures illustrate binger fission in Amoeba in improper order.



The correct order is
(a) III, IV, II, I
(b) IV, III, II, I
(c) II, III, IV, I
(d) I, III, IV, II
Solution: (c) II, III, IV, I
The correct order of binary fission is- II, III, IV, I
Marks: 1

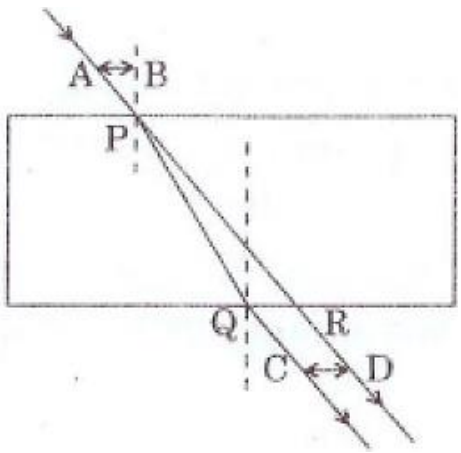
Question 35. The steps involved in observing a slide under a microscope are given below. They are not in proper sequence.
I. Focus the object under high power of the microscope.
II. Place the slide on the stage of the microscope.
III. Arrange the mirror to reflect maximum light to the slide.
IV. Focus the object under low power of the microscope.
The proper sequence of steps is
(a) II, III, IV, I
(b) I, II, III, IV
(c) IV, III, II, I
(d) III, I, II, IV
Solution: (a) II, III, IV, I
The steps to observe a slide under the microscope are- II, III, IV, I
Marks: 1

Question 36. In which diagram the angle of refraction r has been correctly depicted?



(a) I
(b) II
(c) III
(d) IV
Solution: (d) IV
Angle of refraction is measured with respect to the normal at the first point of incidence.
Marks: 1

Question 37. For a ray of light passing through a glass slab, the lateral displacement was correctly measured as:



(a) AB
(b) PQ
(c) CD
(d) PR
Solution: (c) CD
Lateral displacement is the sideways shift of the emergent ray from the direction of the incident ray.
Marks: 1

Question 38. Iron nails were dipped in an aqueous solution of copper sulphate. After about 30 minutes, it was observed that the colour of the solution changed from
(a) Colorless to light green.
(b) Blue to light green.
(c) Blue to colourless.
(d) Green to blue.
Solution: (b) Blue to light green
The blue coloured copper sulphate solution changes to light green iron sulphate solution after displacement of copper by iron from copper sulphate solution.
Marks: 1

Question 39. To find the focal length of a concave mirror, Sita should choose which one of the following
(a) A mirror holder and screen holder
(b) A screen holder and a scale
(c) A mirror holder, a screen holder and a scale
(d) A screen, a mirror, holders for them and a scale
Solution: (d) A screen, a mirror, holders for them and a scale
A screen, a mirror, holders for them and scale are needed to find the focal length of a concave mirror.
Marks: 1

Question 40. By using a convex lens, a student obtained a sharp image of his classroom window grill on a screen. In which direction should he move the lens to focus a distant tree instead of the grill?
(a) Towards the screen
(b) Away from the screen
(c) Very far away from the screen
(d) Behind the screen
Solution: (a) Towards the screen
The lens should be moved towards the screen because the distant tree can be considered an object at infinity whose image will be formed at the focus, while earlier the image of nearer grill was formed at a distance farther than the focal length.
Marks: 1

Question 41. To determine the focal length of a convex lens by obtaining a sharp image of a distant object, the following steps were suggested which are not in proper sequence.
I. Hold the lens between the object and the screen.
II. Adjust the position of the lens to form a sharp image.
III. Select a suitable distant object.
IV. Measure the distance between the lens and the screen.
The correct sequence of steps to determine the focal length of the lens is
(a) III, I, II, IV
(b) III, I, IV, II
(c) III, IV, II, I
(d) I, II, III, IV
Solution: (a) III, I, II, IV
The proper sequence to determine the focal length of a convex lens is:
III - Select a suitable distant object.
I - Hold the lens between the object and the screen.
II - Adjust the position of the lens to form a sharp image.
IV - Measure the distance between the lens and the screen.
Marks: 1