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SAMPLE TEST PAPER 02 FOR CLASS X BOARD EXAM 2021
(SAMPLE ANSWERS)

SUBJECT: SCIENCE

MAX. MARKS : 80

CLASS : X

DURATION : 3 HRS

General Instructions:

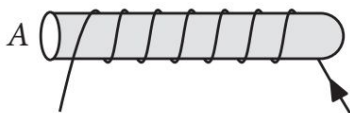
- (i) The question paper comprises four sections A, B, C and D. There are 36 questions in the question paper. All questions are compulsory.
- (ii) Section–A - question no. 1 to 20 - all questions and parts thereof are of one mark each. These questions contain multiple choice questions (MCQs), very short answer questions and assertion - reason type questions. Answers to these should be given in one word or one sentence.
- (iii) Section–B - question no. 21 to 26 are short answer type questions, carrying 2 marks each. Answers to these questions should be in the range of 30 to 50 words.
- (iv) Section–C - question no. 27 to 33 are short answer type questions, carrying 3 marks each. Answers to these questions should be in the range of 50 to 80 words.
- (v) Section–D - question no. 34 to 36 are long answer type questions carrying 5 marks each. Answer to these questions should be in the range of 80 to 120 words.
- (vi) There is no overall choice. However, internal choices have been provided in some questions. A student has to attempt only one of the alternatives in such questions.
- (vii) Wherever necessary, neat and properly labeled diagrams should be drawn.

SECTION – A

1. What is the role of the split ring in an electric motor?

Ans: Split ring acts as a commutator which reverses the direction of flow of current in a coil.

2. The figure shows a solenoid wound on a core of soft iron. Will the end A be a N-pole or S-pole, when the current flows in the direction shown?



Ans: S-pole.

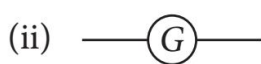
3. An electric wire of resistance 20 Ω takes a current of 5 A. Calculate the heat developed in 30 s.

Ans: Resistance, $R = 20 \text{ } \Omega$, Current, $I = 5 \text{ A}$, Time, $t = 30 \text{ s}$

Heat generated = $I^2Rt = (5\text{A})^2 \times 20 \text{ } \Omega \times 30 \text{ s} = 25 \times 20 \times 30 = 15000 \text{ J} = 15 \text{ kJ}$

OR

What do the following symbols mean in circuit diagrams?



Ans: (i) Variable resistor

(ii) Galvanometer

4. Name the substance which is absorbed in large intestine.

Ans: Water is absorbed in large intestine.

5. How do genes control traits?

Ans: Genes carry information for the production of proteins which, on the other hand, control the various body characteristics.

OR

Name one trait which is inherited and one trait which is acquired.

Ans: Inherited trait – Eye colour in humans Acquired trait – Reduction in body weight of an animals due to starvation.

6. What is root pressure?

Ans: Root pressure is a pressure developed in the xylem due to metabolic activity of the root cells. It is a hydrostatic pressure developed in the root system that pumps the water or sap in the root xylem.

OR

Define light reaction.

Ans: First phase of photosynthesis, which takes place only in the presence of light, is called light reaction or light dependent reaction. It takes place in granum part of chloroplast.

7. Which food product is preferred as primary substrate for respiration?

Ans: Glucose is preferred as primary substrate for respiration.

8. Give an example of a metal which (a) is a liquid at room temperature (b) can be easily cut with knife.

Ans: (a) Mercury (b) Sodium

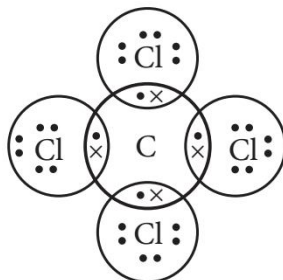
OR

Give reason why concentrated nitric acid can be stored in aluminium containers.

Ans: Concentrated nitric acid forms a protective layer of Al_2O_3 on the surface of aluminium. This layer of Al_2O_3 prevents any further reaction between the acid and the metal. So, it is safe to store concentrated nitric acid in aluminium containers.

9. Give the electron dot structures for (a) CCl_4 and (b) C_2H_2 .

(a) Carbon has 4 valence electrons and chlorine has 7 valence electrons.



(b)



10. A spherical mirror produces an image of magnification -1 on a screen placed at a distance of 50 cm from the mirror. Write the type of mirror.

Ans: Concave mirror.

11. Wire A and wire B has the following ratios:

$$\frac{\text{length } L_A}{\text{length } L_B} = \frac{5}{18}; \frac{\text{diameter } D_A}{\text{diameter } D_B} = \frac{2}{3}; \frac{\text{resistivity } \rho_A}{\text{resistivity } \rho_B} = \frac{4}{9}.$$

What is the ratio of the resistance of wire A to the resistance of wire B?

Ans:

We know that, $R = \rho \frac{l}{A}$

$$R_A : R_B = \left[\frac{(5 \times 4)}{(2)^2} \right] : \left[\frac{(18 \times 9)}{(3)^2} \right] = 5 : 18$$

12. Can ever there be a magnet with no pole?

Ans: Yes, there can be a magnet with no pole e.g., in case of a toroid carrying current.

OR

Can a magnet be created artificially?

Ans: Artificial magnets can be created by taking iron, nickel and cobalt with other elements.

13. Why copper-T cannot protect a woman from sexually transmitted diseases?

Ans: Copper-T is an intrauterine device which acts as contraceptive but does not provide protection against sexually transmitted diseases as it does not provide any barrier against mixing of body fluids from two individuals.

For question numbers 14-16, 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.

14. **Assertion:** When a concave mirror is held under water, its focal length remain unchanged.

Reason: The focal length of a concave mirror depends on the medium in which it is placed.

Ans: (c): Focal length is the property of mirror, and is independent of the medium in which it is placed.

15. **Assertion:** When a mixture of hydrogen and chlorine is placed in sunlight, hydrogen chloride is formed.

Reason: It is an example of combustion reaction.

Ans: (c): Hydrogen and chlorine combine to give hydrogen chloride, which is a combination reaction.

OR

Assertion: On heating lead nitrate, nitrogen gas is produced.

Reason: Heating of lead nitrate is an example of decomposition reaction.

Ans: (d): $2\text{Pb}(\text{NO}_3)_2(\text{s}) \xrightarrow{\Delta} 2\text{PbO}(\text{s}) + 4\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$

16. **Assertion:** There is always interaction between neighbouring or distant ecosystems.

Reason: An ecosystem is recognised as self - regulating and self - sustaining entity.

Ans: (b): A biotic community cannot live in isolation. The biotic community together with the physical environment forms an interacting system called the ecosystem. Ecosystems are self-regulating and self-sustaining units. All ecosystems are interconnected by flow of energy and transfer of materials with the neighbouring ecosystems, or even with distant ecosystems.

Answer Q. No 17 - 20 contain five sub-parts each. You are expected to answer any four subparts in these questions.

17. Read the following and answer any four questions from 17(i) to 17(v).

Element	Symbol	Character
Fluorine	F	Most non-metallic
Chlorine	Cl	Non-metallic
Bromine	Br	
Iodine	I	

(i) Non-metallic character decreases down the group because

- (a) atomic size increases down the group
 (b) atomic size decreases down the group
 (c) atomic radii decreases down the group
 (d) None of these.
- (ii) Halogen belongs to
 (a) Group 1 (b) Group 2 (c) Group 17 (d) Group 18
- (iii) Which is the least electronegative element among the following?
 (a) F (b) Cl (c) Br (d) I
- (iv) The electronic configuration of chlorine is
 (a) 2, 8, 8 (b) 2, 8, 7 (c) 2, 8 (d) 2, 8, 8, 7
- (v) Number of valence electrons in halogen
 (a) 2 (b) 7 (c) 5 (d) 8

Ans:

- (i) (a): As we go down in a group, size of atom goes on increasing due to this, the attraction of the nucleus for the incoming electron decreases. Therefore, tendency of element to gain electron to form negative ions decreases. Hence, non-metallic or electronegative character decreases.
- (ii) (c): Group-17
- (iii) (d)
- (iv) (b)
- (v) (b)

18. Read the following and answer any four questions from 18(i) to 18(v).

Atoms of eight elements A, B, C, D, E, F, G and H have the same number of electronic shells but different number of electrons in their outermost shell. It was found that elements A and G combine to form an ionic compound. This compound is added in a small amount to almost all vegetable dishes during cooking. Oxides of elements A and B are basic in nature while those of E and F are acidic. The oxide of D is almost neutral.

- (i) To which group or period of the periodic table, do the listed elements belong?
 (a) 2nd period (b) 3rd period (c) 4th period (d) 5th period
- (ii) What happens in their metallic character when one moves from A to G?
 (a) Gradually decreases (b) Gradually increases (c) Remains same (d) None of these
- (iii) Which two of these elements could definitely be metals?
 (a) A and B (b) B and C (c) C and D (d) A and D
- (iv) Which one of the eight elements is most likely to be found in gaseous state at room temperature?
 (a) A (b) B (c) D (d) H
- (v) If the number of electrons in the outermost shell of elements C and G are 3 and 7 respectively, write the formula of the compound formed by the combination of C and G.
 (a) CG (b) CG₃ (c) CG₂ (d) C₂G₃

Ans: (i) (b) The listed elements belong to third period; it includes Na, Mg, Al, Si, P, S, Cl and Ar.

(ii) (a) The metallic character gradually changes to non-metallic character.

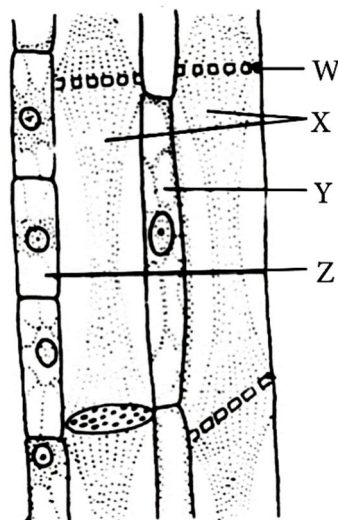
(iii) (a) Compound A (Na) and B (Mg) are definitely metals as their oxides are basic in nature.

(iv) (d) Element H (Ar), is likely to be found in gaseous state at room temperature as it is the 8th element of the group so it would have 8 electrons in its outermost shell which is the electronic configuration of a noble gas.

(v) (b) They will form CG_3 , i.e., $AlCl_3$ (aluminium chloride).

19. Read the following and answer any four questions from 19(i) to 19(v).

The transport of food from the leaves to other parts of the plant is called translocation. Phloem translocates the food made in the leaves. Phloem is made of many cells joined end to end to form long tubes as shown in given figure.



(i) Identify the correct pair of labelled parts with the help of this figure.

- (a) W – Sieve plate, Y – Companion cell
- (b) X – Sieve plate, Z – Companion cell
- (c) Y – Sieve tubes, Z – Sieve plate
- (d) X – Companion cell, Y – Phloem parenchyma

Ans: (a): The given figure is L.S of phloem in which W represents sieve plate, X represents sieve tubes, Y represents companion cell and Z represents phloem parenchyma.

(ii) Name the labelled part which contains cytoplasm but no nucleus.

- (a) Sieve tube
- (b) Companion cell
- (c) Phloem parenchyma
- (d) Sieve plate

Ans: (a): Sieve tubes (X) are living cells which contain cytoplasm but no nucleus.

(iii) In which direction phloem translocates the food?

- (a) Upward
- (b) Downward
- (c) Backward
- (d) Either (a) or (b)

Ans: (d): The movement of food in phloem can be upward or downward depending on the needs of the plant.

(iv) The phloem tissue in plants is responsible for the transport of

- (a) amino acids
- (b) hormones
- (c) sugar
- (d) all of these.

Ans: (d): The phloem translocates the food (sugar) made in the leaves. Besides food molecules, phloem also transports amino acids, hormones synthesised in shoot tips and root tips and other metabolites.

(v) Which of the following is not a part of phloem?

- (a) Companion cells
- (b) Tracheids
- (c) Sieve plate
- (d) Sieve tube

Ans: (b): Components of phloem are sieve tubes, companion cells, phloem parenchyma and sieve plates. Tracheids are constituent of xylem tissue.

20. Read the following and answer any four questions from 20(i) to 20(v).

When Deepak studied the electrical circuits and the current flowing through them, he became curious about the range of the currents we come across in daily life. He collected the data and presented in a tabular form as shown here.

S. No.	Description	Magnitude of current
1	Domestic appliance	Few amperes
2	Lightning	Ten thousand amperes
3	Nervous system	Microamperes
4	Galvanometer	Few milliamperes
5	Semiconductors	Few milliamperes

(i) As domestic appliance carry electric current of the order of few amperes, the precaution to be taken while using electricity is

- (a) use insulated tools (b) use aluminium or steel ladder
(c) use broken plugs (d) avoid water when working with electricity

(ii) The electrical appliances in a house are connected in

- (a) series (b) parallel
(c) either in series or parallel (d) both in series and parallel.

(iii) Which of the following has maximum current?

- (a) Lightning (b) Galvanometer (c) Nervous system (d) Semiconductors

(iv) The function of galvanometer in a circuit is

- (a) to detect potential difference
(b) to detect electric current
(c) to measure resistance
(d) none of these.

(v) In domestic electric circuit, the live wire is generally of

- (a) red colour (b) black colour (c) green colour (d) none of these.

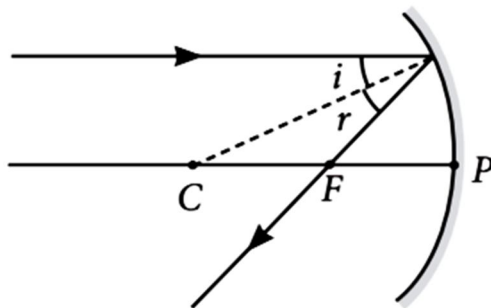
Ans:

- (i) (d): One should not touch electrical appliances with wet hands, proper earthing should be used.
(ii) (b): In parallel combination each load gets same potential from the source. We can use separate on/off switches with each appliance. In case any one appliance fails, then the circuit will not break. So, it is safe and convenient to connect household circuit in parallel combination.
(iii) (a): Lightning has maximum current.
(iv) (b): Galvanometer is an instrument that can detect the presence of electric current in a circuit.
(v) (a)

SECTION – B

21. 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 concave mirror. Mark the angle of incidence and angle of reflection on it.

Ans:



OR

The absolute refractive indices of glass and water are $\frac{4}{3}$ and $\frac{3}{2}$ respectively. If the speed of light in glass is 2×10^8 m/s, calculate the speed of light in (i) vacuum, (ii) water.

Ans:

Given that : $n_g = \frac{4}{3}$, $n_w = \frac{3}{2}$, $v_g = 2 \times 10^8$ m/s

Absolute refractive index of a medium, $n_m = \frac{c}{v}$

where, c is the speed of light in vacuum and v is the speed of light in medium.

(i) $\therefore n_g = \frac{c}{v_g}$

or $c = n_g \times v_g = \frac{4}{3} \times 2 \times 10^8 = \frac{8}{3} \times 10^8$ m/s

(ii) As, $n_{gw} = \frac{n_g}{n_w} = \frac{v_w}{v_g}$

$\therefore \frac{4/3}{3/2} = \frac{v_w}{2 \times 10^8}$ or $v_w = \frac{8}{9} \times 2 \times 10^8$

$\Rightarrow v_w = \frac{16}{9} \times 10^8$ m/s

22. Write the frequency of alternating current (A.C.) in India. How many times per second it changes its direction?

Ans: The frequency of A.C. in India is 50 Hz and it changes direction twice in each cycle. Therefore, it changes direction $2 \times 50 = 100$ times in one second.

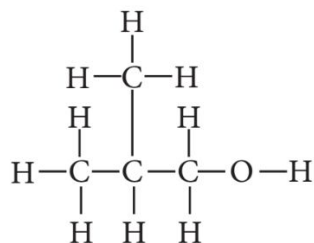
23. Define a food web. Write its significance for ecosystem.

Ans: A system of interconnected food chains between various organisms so as to form a number of feeding connections amongst different organisms of a biotic community is called a food web. A food web maintains ecological balance by maintaining the interdependence of different organisms.

24. When electricity is passed through an aqueous solution of sodium chloride, three products are obtained. Why is the process called chlor-alkali?

Ans: Electrolysis of an aqueous solution of sodium chloride gives NaOH, Cl_2 and H_2 . Due to the products Cl_2 and NaOH, the process is called chlor-alkali process (Chlor for chlorine and alkali for sodium hydroxide).

25. An organic molecule has the following structure:



- (i) To which homologous series does this molecule belong?
(ii) What is the general formula of this homologous series?

Ans: (i) Alcohols (ii) $\text{C}_n\text{H}_{2n+1}\text{OH}$

26. Grass → Grasshopper → Frog → Snake → Eagle

In the above food chain, which of the organism will have (i) maximum available energy? (ii) minimum available energy?

- Ans: (i) Grass will have the maximum available energy.
(ii) Eagle will have the minimum available energy.

OR

Why are microorganisms like bacteria and fungi important in the ecosystem?

Ans: Microorganisms like bacteria and fungi are important in the ecosystem because they decompose or break down the dead remains of animals and plants. This release the locked nutrients to be recycled in the ecosystem for reuse as raw materials by the producers.

SECTION – C

27. When an object is placed at a distance of 25 cm from a mirror, the magnification is m_1 . The object is moved 15 cm farther away with respect to the earlier position and the magnification becomes m_2 . If $m_1/m_2 = 4$, then calculate the focal length of the mirror.

Ans:

We know that, $m = -\frac{v}{u} = \frac{f}{f - u}$

Here, $m_1 = \frac{f}{f - (-25)} = \frac{f}{f + 25}$

and $m_2 = \frac{f}{f - (-25 - 15)} = \frac{f}{f + 40}$

Since $\frac{m_1}{m_2} = 4$, therefore, $\frac{f + 40}{f + 25} = 4$

Thus, $f + 40 = 4f + 100$ or $f = -20$ cm. The negative sign shows that the mirror is concave.

28. (a) Explain the terms: (i) Implantation (ii) Placenta
(b) What is the average duration of human pregnancy?

Ans: (a) (i) **Implantation:** The zygote gets embedded on the inner thick wall of uterus for further development, this process is called implantation.

(ii) **Placenta:** It is the special tissue in the form of a disc which is embedded in the uterine wall. It provides large surface area for glucose and oxygen to pass from mother to the embryo. The waste generated by the embryo also passes into the mother's blood through placenta.

(b) The average duration of human pregnancy is about nine months or 38 weeks.

29. Name the mode of reproduction that ensures variation in the offspring. What mechanism, do you think, is actually responsible for variation leading to the survival of the species?

Ans: Sexual mode of reproduction involving fusion of male and female gametes ensures variation in the offspring. Both male and female gametes are formed as a result of meiosis which is a reduction division in which the chromosome number becomes haploid. Meiosis is often

accompanied by crossing over of chromosomes that is responsible for variation in chromosomes. Fusion of gametes results in the formation of zygotes which show a variation from their parents and among themselves. Such variation leads to the survival of the species.

30. (i) Write Joule's law of heating.

(ii) Why tungsten is used for making bulb filaments of incandescent lamps?

(iii) Name any two electric devices based on heating effect of electric current.

Ans: (i) The Joule's law of heating implies that heat produced in a resistor is

(a) directly proportional to the square of current for a given resistance,

(b) directly proportional to resistance for a given current, and

(c) directly proportional to the time for which the current flows through the resistor. i.e., $H = I^2Rt$

(ii) (a) Tungsten is a strong metal and has high melting point (3380 °C).

(b) It emits light at high temperatures (about 2500°C).

(iii) Electric laundry iron and electric heater are based on heating effect of electric current.

OR

Two bulbs, 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: Since both the bulbs are connected in parallel to a 220 V supply, the voltage across each bulb is 220 V. Then Current drawn by 100 W bulb,

$$I_1 = \frac{\text{Power rating}}{\text{Voltage applied}} = \frac{100 \text{ W}}{220 \text{ V}} = 0.454 \text{ A}$$

Current drawn by 60 W bulb,

$$I_2 = \frac{60 \text{ W}}{220 \text{ V}} = 0.273 \text{ A}$$

Total current drawn from the supply line,

$$I = I_1 + I_2 = 0.454 \text{ A} + 0.273 \text{ A} = 0.727 \text{ A} = 0.73 \text{ A}$$

31. Differentiate between natural and artificial vegetative propagation in plants.

Ans: Differences between natural and artificial propagation in plants are as follows:

S. No.	Natural propagation	Artificial propagation
1	Some most common natural methods of vegetative propagation in plants are: Modified tuberous roots can be propagated vegetatively when planted in soil (e.g., Sweet potato).	It includes growing plants by man-made methods. Some common artificial methods are: Cutting of stem of sugarcane, grapes, etc., which when grown in soil develop into a new plant.
2	Underground modified stems such as rhizomes (e.g., ginger, banana, etc.), corms (e.g., Colocasia, etc.), bulbs (e.g., garlic, onion, etc.), tuber (potato), sucker (mint) and sub-aerial stems such as offset (Eichhornia), stolon (strawberry), etc. develop into new plants.	Grafting is a process in which branches of two similar plants, one potted plant and the other of a good quality plant are obliquely cut and placed over each other and tied by a tape and left for a month or so. A new plant thus develops.
3	Some plants develop adventitious buds on their leaves which develop into new plants (e.g., Bryophyllum).	In layering, the roots are artificially induced on the stem branches before they are detached from the parent plant for propagation.

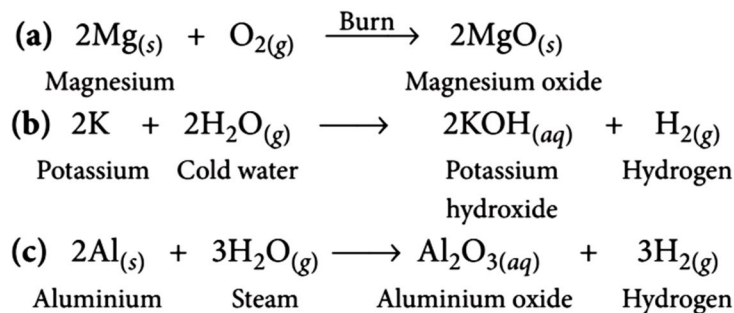
32. Write chemical equations for the reaction taking place when:

(a) magnesium ribbon is burnt in a jar of oxygen.

(b) potassium metal falls into a sink containing water.

(c) steam is passed over heated aluminium.

Ans:



33. (a) Write the name and formula of the 2nd member of homologous series having general formula $\text{C}_n\text{H}_{2n-2}$.

Ans: General formula, $\text{C}_n\text{H}_{2n-2}$ belongs to alkyne series. The second member of this series is propyne i.e., (C_3H_4) or $\text{CH}_3 - \text{C} \equiv \text{CH}$.

(b) Write the formula of the functional group present in alcohols, aldehydes, ketones and carboxylic acids.

Ans: The formulae for different functional groups are:

alcohols : $-\text{OH}$ group

aldehydes : $-\overset{\text{O}}{\parallel}{\text{C}}-\text{H}$ group

ketones : $-\overset{\text{O}}{\parallel}{\text{C}}-$ group

carboxylic acid : $-\overset{\text{O}}{\parallel}{\text{C}}-\text{OH}$ group.

SECTION – D

34. Identify the type of chemical reaction taking place when:

(i) 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.

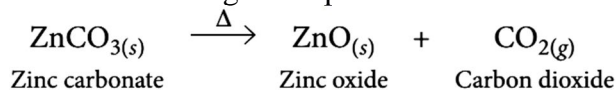
(ii) Take 3 g of barium hydroxide in a test tube, now add about 2 g of ammonium chloride and mix the contents with the help of a glass rod. Now touch the test tube from outside.

(a) What do you feel on touching the test tube?

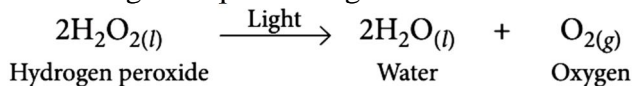
(b) State the inference about the type of reaction occurred.

(c) Write the balanced chemical equation of the reaction involved.

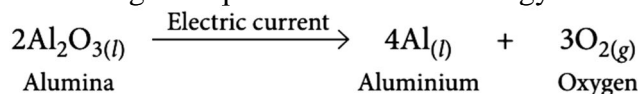
Ans: (i) Decomposition reaction involving absorption of heat:



Decomposition reaction involving absorption of light:



Decomposition reaction involving absorption of electrical energy:



(ii) (a) When barium hydroxide is added into ammonium chloride, the bottom of test tube is found to be cooler.

(b) It is an endothermic reaction.

(c) $\text{Ba}(\text{OH})_2 + 2\text{NH}_4\text{Cl} \rightarrow \text{BaCl}_2 + 2\text{NH}_4\text{OH}$

35. (a) Describe asexual reproduction in Amoeba.

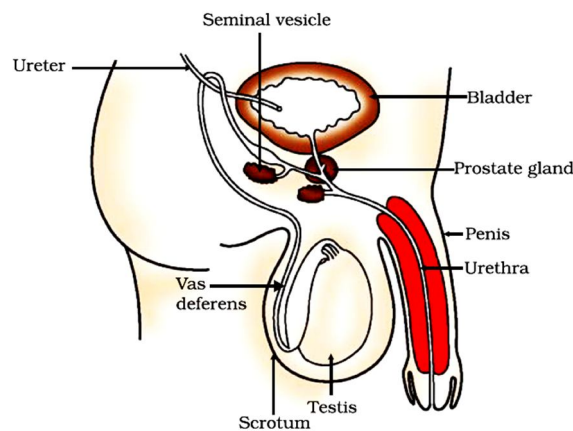
(b) Explain human male reproductive system with the help of a diagram.

Ans: (a) In Amoeba, asexual reproduction occurs by binary fission. During this, the nucleus divides into two equal halves. The nuclear division is followed by the appearance of a constriction in the cell membrane. The membrane then grows transversely inwards (i.e., centripetally) from near the middle of dividing cell which separates the cytoplasm into two equal parts, each with one nucleus. The two daughter cells separate and behave as two independent organisms.

(b) Human male reproductive system: It consists of testes, scrotum, vas deferens, urethra and penis.

(i) Testes: The human male possesses two testes, which are the primary reproductive organs, lying outside the abdominal cavity. The two testes are the male gonads, which are the sites where male gametes, i.e., sperms are made. The testes also produce the male sex hormone-testosterone. The testes of man produce sperms from puberty onwards, throughout his life.

(ii) Scrotum: It is a pouch of skin that is divided internally into right and left scrotal sacs by a muscular partition. The two testes lie in respective scrotal sacs. The scrotum acts as a thermoregulator and provides an optimal temperature for the formation of sperms. The sperms develop at a temperature 1–3°C lower than the normal internal body temperature. Side view of human male reproductive system is given as:



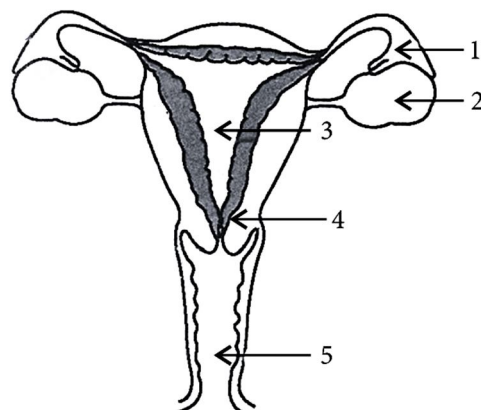
(iii) Vas deferens: This is a straight tube, about 40 cm long, which carries the sperms to the seminal vesicles. The sperms are stored temporarily in the seminal vesicle, where mucus and a watery alkaline fluid containing the sugar-fructose, mix with the sperms.

(iv) Urethra: It is about 20 cm long tube that arises from the urinary bladder to carry urine. It runs through the penis and opens to the outside through male genital pore. The contents of two seminal vesicles and sperms from vas deferens also join the urethra. Thus, urethra carries urine from the bladder, as well as sperms from the, vasa deferentia, through the penis.

(v) Penis: It is a long and thick muscular organ made up of mostly erectile tissue. At the time of sexual excitement, the erectile tissue gets filled with blood causing the penis to become erect. It is inserted into the vagina of the female where sperms are ejaculated for the purpose of reproduction.

OR

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



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

Ans: (a) The given diagram is the sectional view of human female reproductive system. The labelled parts are:

1. Funnel of fallopian tube or oviduct
2. Ovary
3. Uterus or womb
4. Cervix
5. Vagina

(b) Contraception is the avoidance of pregnancy. There are several methods of contraception such as:

- (i) Barrier methods (condoms, diaphragm, etc.)
- (ii) Chemical methods (spermicide creams and jellies)
- (iii) Intrauterine Contraceptive Devices (IUCDs) (Lippes loop, CuT, etc.)
- (iv) Natural methods (rhythm method, coitus interruptus)
- (v) Surgical methods (vasectomy, tubectomy)

Three advantages of adopting contraceptive methods are:

- (i) They prevent frequent or unwanted pregnancies.
- (ii) They prevent the transfer of sexually transmitted diseases (STDs).
- (iii) They help to regulate the population growth.

36. (i) Explain the following terms related to spherical lenses:

- (a) optical centre (b) centre of curvature (c) principal axis
(d) aperture (e) principal focus (f) focal length

(ii) A converging lens has focal length of 12 cm. Calculate at what distance should the object be placed from the lens so that it forms a virtual image at 48 cm.

Ans: (i) (a) Optical centre: The centre point of a lens is known as the optical centre. It always lies inside the lens. A light beam passes through the optical centre without any deviation.

(b) Centre of curvature: It is defined as the centre of the sphere of which the lens is originally a part of. Because the spherical lens consists of two spherical surfaces, the lens has two centre of curvature.

(c) Principal axis: A straight line passing through the optical centre and principal focus of a spherical lens. This line is called the principal axis.

(d) Aperture: The diameter of the reflecting surface of spherical lens is called its aperture.

(e) Principal focus: If a number of rays parallel to the principal axis fall on a lens, the ray after refraction from the lens, appear to converge or to diverge from a point on the principal axis. This point on the principal axis is called the principal focus of the lens.

(f) Focal length: The distance between the optical centre and the principal focus of a spherical lens is called the focal length. It is represented by the letter f.

(ii) Given: $f = 12$ cm, $v = -48$ cm, $u = ?$

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

$$\frac{1}{12} = \frac{1}{u} + \frac{1}{48} \quad \text{or} \quad \frac{1}{12} - \frac{1}{48} = \frac{1}{u}$$

$$\Rightarrow \frac{4-1}{48} = \frac{1}{u} = \frac{3}{48} \quad \text{or} \quad u = 16 \text{ cm}$$

OR

(i) State the laws of refraction of light. Give an expression to relate the absolute refractive index of a medium with speed of light in vacuum.

(ii) The refractive indices of water and glass with respect to air are $\frac{4}{3}$ and $\frac{3}{2}$ respectively. If the speed of light in glass is 2×10^8 m s⁻¹, find the speed of light in air and water.

Ans: (i) Laws of refraction of light:

(a) The incident ray, the refracted ray and the normal to the interface of two transparent media at the point of incidence, all lie in the same plane.

(b) The ratio of sine of angle of incidence to the sine of the angle of refraction is constant for the light of a given colour and for the given pair of media. This law is also known as Snell's law of refraction.

$$\sin i / \sin r = \text{constant},$$

where i is the angle of incidence and r is the angle of refraction.

This constant value is called refractive index of the second medium with respect to the first when the light travels from first medium to second medium.

$$\Rightarrow \text{constant} = n_{21} = v_1/v_2$$

$$\therefore \sin i / \sin r = v_1/v_2$$

If n is the absolute refractive index of the medium, c is the velocity of light in vacuum and v is the speed of light in a given medium, then $n = c/v$.

(ii) Given: ${}_a n_g = \frac{3}{2}$, ${}_a n_w = \frac{4}{3}$

Speed of light in glass, $v = 2 \times 10^8$ m/s

We know, ${}_a n_g = \frac{\text{speed of light in air}}{\text{speed of light in medium}}$

$$\Rightarrow \frac{3}{2} = \frac{c}{2 \times 10^8} \Rightarrow c = 3 \times 10^8 \text{ m/s}$$

Now, ${}_a n_w = \frac{\text{speed of light in air}}{\text{speed of light in water}}$

$$\Rightarrow \frac{4}{3} = \frac{3 \times 10^8}{v} \Rightarrow v = \frac{9}{4} \times 10^8 \text{ m/s} = 2.25 \times 10^8 \text{ m/s}$$

