**General Instruction:**
1. This Question Paper has 5 Sections A-E.
2. **Section A** has 20 MCQs carrying 1 mark each.
3. **Section B** has 5 questions carrying 02 marks each.
4. **Section C** has 6 questions carrying 03 marks each.
5. **Section D** has 4 questions carrying 05 marks each.
6. **Section E** has 3 case based integrated units of assessment (04 marks each) with sub-parts of the values of 1, 1 and 2 marks each respectively.
7. All Questions are compulsory. However, an internal choice in 2 Qs of 5 marks, 2 Qs of 3 marks and 2 Questions of 2 marks has been provided. An internal choice has been provided in the 2marks questions of Section E
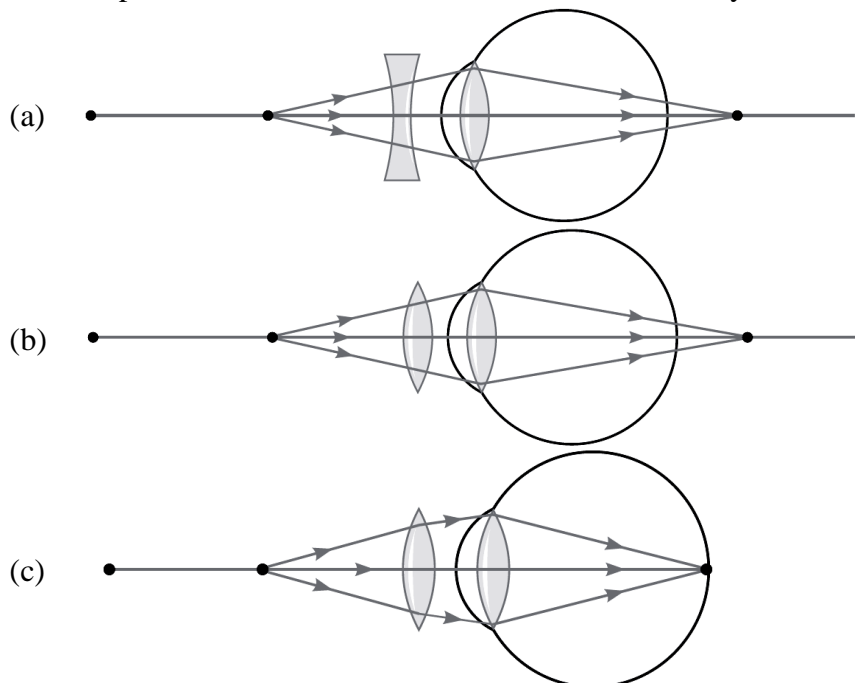8. Draw neat figures wherever required. Take π =22/7 wherever required if not stated.

SECTION – A
Questions 1 to 20 carry 1 mark each.

1. The image shows the ray diagram of a defected eye.
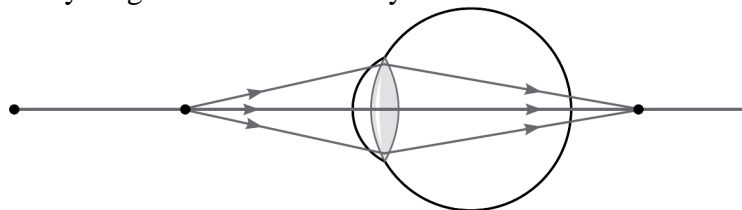
Which option shows the correction of the defect of the eye?

(a)

(b)

(c)

(d)   None of these

Ans: (c) This is the type of hypermetropic eye defect and it is connected by convex lens.

2. The image of an object placed in front of a convex mirror is formed at
   (a) the object itself
   (b) twice the distance of the object in front of the mirror
   (c) half the distance of the object in front of the mirror
   (d) behind the mirror

Ans: (d) behind the mirror

3. Sodium hydrogen carbonate when added to acetic acid evolves a gas.
   Which of the following statements are true about the gas evolved?
   (i) It turns lime water milky
   (ii) It extinguishes a burning splinter
   (iii) It dissolves in a solution of sodium hydroxide
   (iv) It has a pungent odour
   (a) (i) and (ii) (b) (i), (ii) and (iii) (c) (ii), (iii) and (iv) (d) (i) and (iv)

Ethanoic acid
NaHCO₃
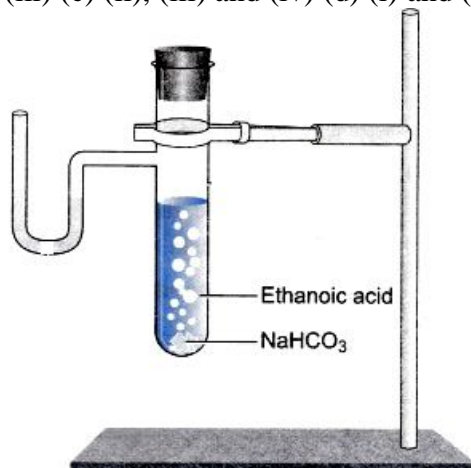
   Ans: (a) (i) and (ii)
   Reaction between Sodium hydrogen carbonate and acetic acid leads to the evolution of carbon-dioxide gas. CO2 turns the lime water milky and extinguish a burning splinter.
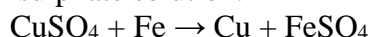
4. Common salt besides being used in kitchen can also be used as the raw material for making
   (I) washing soda (II) bleaching powder (III) baking soda (IV) slaked lime
   (a) (I) and (II)   (b) (I), (II) and (IV)   (c) (I) and (III)   (d) (I), (III) and (IV)
   Ans: (c) Baking soda and washing soda can be prepared from NaCl

5. What happens when calcium is treated with water?
   (I) It does not react with water
   (II) It reacts violently with water
   (III) It reacts less violently with water
   (IV) Bubbles of hydrogen gas formed stick to the surface of calcium
   (a) (I) and (IV) (b) (II) and (III) (c) (I) and (II) (d) (III) and (IV)
   Ans: (d) It is less reactive

6. Choose the correct path of urine in our body
   (a) kidney → ureter → urethra → urinary bladder
   (b) kidney → urinary bladder → urethra → ureter
   (c) kidney → ureters → urinary bladder → urethra
   (d) urinary bladder → kidney → ureter → urethra
   Ans: (c) kidney → ureters → urinary bladder → urethra
   Urine from nephron is brought to the collecting duct of kidneys where the urine enters the ureters. There are 2 ureters, each opening from one kidney into the urinary bladder. The urinary bladder stores urine and its size increases as the amount of urine collected increases. When the CNS gives a voluntary message the muscles of bladder contract and the bladder sphincter relaxes thus excreting urine out through the urethra.

7. In the reaction of iron with copper sulphate solution:
   $$CuSO_4 + Fe \rightarrow Cu + FeSO_4$$
   Which option in the given table correctly represents the substance oxidised and the reducing agent?

OPTION	Substance Oxidized	Reducing Agent

(a)	Fe	Fe
(b)	Fe	$FeSO_4$
(c)	Cu	Fe
(d)	$CuSO_4$	Fe

Ans: (a) Fe and Fe respectively.

Here, in the above reaction, Fe is oxidised to $FeSO_4$ and Fe is responsible for removing oxygen from $FeSO_4$, therefore, Fe is the reducing agent.

8. Given below is a diagrammatic representation of a process taking place in the human body.

CO$_2$

O$_2$

Blood

Red blood cell
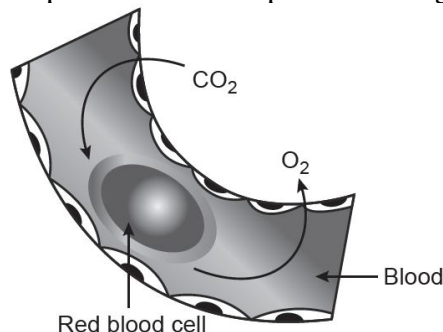
In which of these regions/organs could it be occurring?

(i) lungs (ii) heart (iii) brain

(a) only in (i)　　(b) only in (ii)　　(c) only in (i) and (ii)　　(d) in all - (i), (ii) and (iii)

Ans: (d) in all - (i), (ii) and (iii)

9. In the given food chain, suppose the amount of energy at the fourth trophic level is 5 kJ, what will be the energy available at the producer level?

Grass → Grasshopper → Frog → Snake → Hawk

(a) 5 k J　　　　(b) 50 k J　　　　(c) 500 k J　　　　(d) 5000 k J

Ans: (d) 5000 k J

Available energy level at a particular trophic level is 10 times the energy level at next tropic level. Hence, energy at a third level trophic level is 50kj. Second level trophic has 500 KJ energy and 1st level trophic level (Producer) has energy of 5000 KJ.

10. The percentage of solar radiation absorbed by all the green plants for the process of photosynthesis is about
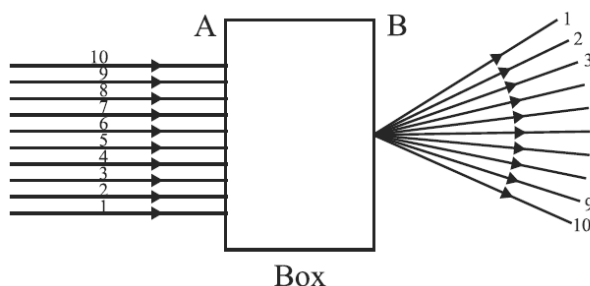
(a) 1 %　　　　(b) 5 %　　　(c) 8 %　　　(d) 10 %

Ans: (a) 1 %

Green plants utilize 1% of the radiation absorbed by leaf and use it for photosynthesis.

11. A beam of light is incident through the holes on side A and emerges out of the hole on the other face of the box as shown in the figure. Which of the following could be inside the box?

(a) Concave lens　　　　(b) Rectangular glass slab
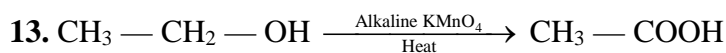
(c) Prism　　　　(d) Convex lens

Box

Ans: (a) Concave lens

12. In peas, a pure tall plant (TT) is crossed with a short plant (tt). The ratio of pure tall plants to short plants in F2 is

(a) 1 : 3　　　　(b) 3 : 1　　　　(c) 1 : 1　　　　(d) 2 : 1

Ans: (c) 1 : 1

13. $CH_3 — CH_2 — OH \xrightarrow[\text{Heat}]{\text{Alkaline KMnO}_4} CH_3 — COOH$

In the above given reaction, alkaline KMnO4 acts as
(a) reducing agent (b) oxidising agent (c) catalyst (d) dehydrating agent
Ans: (b) oxidising agent

14. A conducting wire carries 10^{21} electrons in 4 minutes. What is the current flowing through the wire?
(a) 40 A   (b) 7 A   (c) 4 A   (d) 0.7 A
Ans: (d) 0.7 A

$$q = ne \Rightarrow q = 10^{21} \times 1.6 \times 10^{-19} = 1.6 \times 10^2 C$$

$$Now, I = \frac{q}{t} = \frac{1.6 \times 10^2}{240} = 0.7 A$$

15. An electric toaster has a power rating of 200 W. It operates for 1 hour in the morning and 1 hour in the evening. How much does it cost to operate the toaster for 10 days at Rs. 5 per kW h?
(a) Rs. 20 (b) Rs. 400 (c) Rs. 5000 (d) Rs. 10000
Ans: (a) Rs. 20
Total energy consumed = Pt = 200 × 2 × 10 = 4000 Wh = 4 kWh
Now, Total cost = 5 × 4 = Rs. 20

16. Choose the incorrect statement from the following regarding magnetic lines of force
(a) The direction of magnetic field at a point is taken to be the direction in which the north pole of a magnetic compass needle will point
(b) Magnetic field lines are closed curves
(c) If magnetic field lines are parallel and equidistant, they represent zero field strength
(d) Relative strength of magnetic field is shown by the degree of closeness of the field lines
Ans: (c) If magnetic field lines are parallel and equidistant, they represent zero field strength

DIRECTION: In the question number 17 and 20, a statement of **Assertion (A)** is followed by a statement of **Reason (R)**.
Choose the correct option
(a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)
(b) Both assertion (A) and reason (R) are true and reason (R) is not the correct explanation of assertion (A)
(c) Assertion (A) is true but reason (R) is false.
(d) Assertion (A) is false but reason (R) is true.

17. Assertion(A): The sex of a child in human beings will be determined by the type of chromosome he/she inherits from the father.
Reason(R): A child who inherits 'X' chromosome from his father would be a girl (XX), while a child who inherits a 'Y' chromosome from the father would be a boy (XY).
Ans: (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)

18. Assertion (A): In electrolysis of water, the volume of hydrogen liberated is twice the volume of oxygen formed.
Reason (R): Water (H_2O) has hydrogen and oxygen in the ratio of 1 : 2 by volume.
Ans: (c) A is true but R is false.

19. Assertion(A): Large concave mirrors are used to concentrate sunlight to produce heat in solar cookers.
Reason(R): Concave mirror converges the light rays falling on it to a point.

Ans: (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)

20. **Assertion (A):** Myopia is the defect of the eye in which only nearer objects are seen by the eye.
Reason (R): The eye ball is elongated.
Ans: (a) Both assertion (A) and reason (R) are true and reason (R) is the correct explanation of assertion (A)

SECTION – B
Questions 21 to 25 carry 2 marks each.

21. What is the role of saliva in the digestion of food?
Ans: Saliva contains an enzyme called salivary amylase which digests the starch (complex molecule) present in food into sugar (maltose).

22. Give the pair of contrasting traits of the following characters in pea plant and mention which is dominant and recessive.
(i) yellow seed (ii) round seed
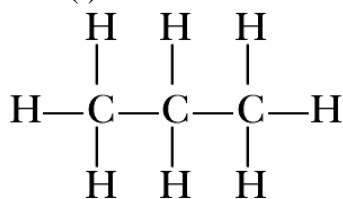Ans: (i) yellow — dominant
green — recessive
(ii) round — dominant
wrinkled — recessive

23. (i) Write the number of covalent bonds in the molecule of propane, C3H8.
(ii) Which element exhibits the property of catenation to maximum extent and why?
Ans: (i) There are ten covalent bonds:

$$
\begin{array}{ccc}
H & H & H \\
| & | & | \\
H\!-\!C\!-\!C\!-\!C\!-\!H \\
| & | & | \\
H & H & H
\end{array}
$$

(ii) Carbon exhibits the property of catenation due to strong C—C bond.
OR
Catenation is the ability of an atom to form bonds with other atoms of the same element. It is exhibited by both carbon and silicon. Compare the ability of catenation of the two elements. Give reasons.
Ans: Carbon exhibits catenation much more than silicon or any other element due to its smaller size which makes the C—C bonds strong while the Si—Si bonds are comparatively weaker due to its large size.

24. Which among the following are physical or chemical changes?
(i) Evaporation of petrol
(ii) Burning of Liquefied Petroleum Gas (LPG)
(iii) Heating of an iron rod to red hot
(iv) Curdling of milk
(v) Sublimation of solid ammonium chloride
Ans: (i) Physical change (ii) Chemical change (iii) Physical change
(iv) Chemical change (v) Physical change

25. An electric oven of 2 kW power rating is operated in a domestic electrical circuit of 220 V that has a current rating of 5 A. What result do you expect? Explain.
Ans: Given: Power of oven, P = 2 kW = 2000 W
Voltage used, V = 220 V
Current in circuit, I = P/V = 2000/220 A = 9.1 A

This is greater than 5 A which is current rating of oven. This implies that oven will be damaged or if there is fuse in series circuit of oven, the fuse will blow.

OR

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: Current in first bulb, $I_1 = P_1/V = 100 \text{ W}/220\text{V} = 5/11 = 0.45\text{A}$

Current in the second bulb, $I_2 = P_2/V = 60 \text{ W}/220\text{V} = 3/11 = 0.27\text{A}$

26. What is translocation? Why is it essential for plants?

Ans: The transport of food from the leaves to other parts of the plant is called translocation. Leaves of the plants perform photosynthesis and produce carbohydrates (sugar) in the form of food which are translocated to the other parts of the plant through phloem. This allow plants to have access to raw materials needed during photosynthesis by leaves.

SECTION – C
Questions 27 to 33 carry 3 marks each.

27. Size of image of an object formed by a mirror having a focal length of 20 cm, is observed to be reduced to 1/3rd of its size. At what distance the object has been placed from the mirror? What is the nature of the image and the mirror?

Ans: An image smaller in size can be formed both by a concave mirror as well as a convex mirror.

Case I: When mirror is concave, the image is real.

Here, $m = -\dfrac{1}{3}, f = -20cm$

$Now, m = -\dfrac{v}{u} = -\dfrac{1}{3} \Rightarrow v = \dfrac{u}{3}$

Using, $\dfrac{1}{f} = \dfrac{1}{v} + \dfrac{1}{u} \Rightarrow \dfrac{1}{-20} = \dfrac{3}{u} + \dfrac{1}{u} \Rightarrow \dfrac{4}{u} = \dfrac{1}{-20} \Rightarrow u = -80cm$

$\Rightarrow v = \dfrac{u}{3} = -\dfrac{80}{3}cm$

$\therefore$ Image is real and inverted.

Case II: When mirror is convex, the image is virtual

Here, $m = \dfrac{1}{3}, f = 20cm$

$Now, m = -\dfrac{v}{u} = \dfrac{1}{3} \Rightarrow v = \dfrac{-u}{3}$

Using, $\dfrac{1}{f} = \dfrac{1}{v} + \dfrac{1}{u} \Rightarrow \dfrac{1}{20} = \dfrac{-3}{u} + \dfrac{1}{u} \Rightarrow \dfrac{-2}{u} = \dfrac{1}{20} \Rightarrow u = -40cm$

$\Rightarrow v = \dfrac{-u}{3} = \dfrac{40}{3}cm$

$\therefore$ Image is virtual and erect.

28. (i) Why are budding, fragmentation and regeneration all considered as asexual types of reproduction?
(ii) With neat diagrams explain the process of regeneration in Planaria.

Ans: (i) Because these methods involve only one parent / organisms are formed as a result of mitotic division / progeny (organisms) are similar in their genetic makeup and no variations.
(ii) Planaria can be cut into any number of pieces and each piece grows through specialized cells into a complete organism.
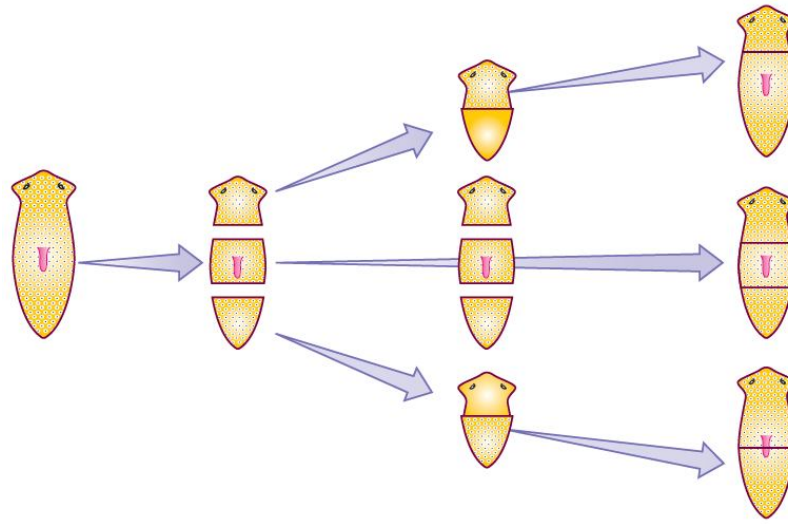
OR

Reproduction is one of the most important characteristics of living beings. Give three reasons in support of the statement.

Ans: Reproduction is an energy-consuming process which is not essential for the survival of an individual. But it is highly essential for all living beings because of the following reasons :

(i) Reproduction helps in increasing the number of members of a population.

(ii) By replacing the dead members with the new ones, it minimizes the risk of extinction of a species.

(iii) It brings about variations in species, thus, leading to their evolution.

29. What are reflex actions? Give two examples. Explain a reflex arc.

Ans: The sudden involuntary movement in a voluntary organ; in response to a stimulus; is called reflex action.

Examples of reflex action:

(a) Moving your hand away from a hot iron plate

(b) Blinking of eyes

Reflex Arc: Reflex arc is a path of electrical impulse during a reflex action. It is composed of sensory neuron, spinal cord, motor neuron and muscle.

Steps of reflex arc

➢ The sensory neuron picks signals from the stimulus and carries the signals to the spinal cord.

➢ Spinal cord process the signals and sends a message through the motor neuron.

➢ Motor neuron transmits the signals to the effector muscle so that the muscle can take immediate action.

30. Read the following information:

I. Resistivity of copper is lower than that of aluminium which in turn is lower than that of constantan.

II. Six wires labelled as A, B, C, D, E, F have been designed as per the following parameters:

Wire	Length	Diameter	Material	Resistance
A	l	$2d$	Aluminium	R_1
B	$2l$	$d/2$	Constantan	R_2
C	$3l$	$d/2$	Constantan	R_3
D	$l/2$	$3d$	Copper	R_4
E	$2l$	$2d$	Aluminium	R_5
F	$l/2$	$4d$	Copper	R_6

Answer the following questions using the above data:

(i) Which of the wires has maximum resistance and why?

(ii) Which of the wires has minimum resistance and why?

(iii) Arrange R_1, R_3 and R_5 in ascending order of their values. Justify your answer.

Ans: (i) Wire C has maximum resistance because it has maximum length, least thickness and highest resistivity.

(ii) Wire F has the minimum resistance since it has least length, maximum thickness and least resistivity. (Using $R = \rho l/A$)

(iii) $R_3 > R_5 > R_1$ (Using relation $R = \rho l/A$ and comparing)

31. The flow of energy between various components of the environment has been extensively studied. Give an outline of the findings.

Ans: (i) Flow of energy is unidirectional.

(ii) Terrestrial plants take about 1% of the Sun's energy and change it to chemical energy.

(iii) A great deal of energy is lost as heat/in digestion/in doing work/in growth and reproduction.

(iv) Only 10% of organic matter is present at each trophic level (and available to next trophic level).

(v) Food chains are mainly of 3-4 trophic levels (because of 10% law) .

(vi) The number of producers are maximum (the number reduces in subsequent trophic levels).

(vii) Food webs are more common (as compared to isolated food chains).

(viii) Biological magnification can be observed.

32. In an industrial process used for the manufacture of sodium hydroxide, a gas 'A' is formed as a by-product. The gas 'A' reacts with lime water to give a compound 'B' which is used as a bleaching agent in the chemical industry. Identify 'A' and 'B'. Also give the chemical equations of the reactions involved.
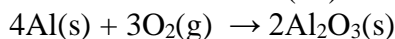
Ans: A — Cl_2 (Chlorine gas)

B — $CaOCl_2$ (Calcium oxychloride)

$$2NaCl + 2H_2O \rightarrow 2NaOH + Cl_2 + H_2$$
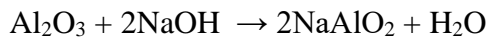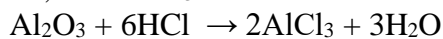$$Cl_2 + Ca(OH)_2 \rightarrow CaOCl_2 + H_2O$$
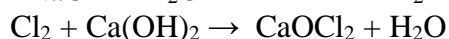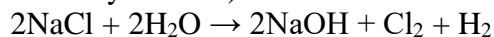
OR

A metal A, which is used in thermite process, when heated with oxygen gives an oxide B, which is amphoteric in nature. Identify A and B. Write down the reactions of oxide B with HCl and NaOH.

Ans: A is aluminium (Al). It reacts with oxygen to form aluminium oxide, Al_2O_3.

$4Al(s) + 3O_2(g) \rightarrow 2Al_2O_3(s)$

So, B is Al_2O_3.

$Al_2O_3 + 6HCl \rightarrow 2AlCl_3 + 3H_2O$

$Al_2O_3 + 2NaOH \rightarrow 2NaAlO_2 + H_2O$

33. A silver article generally turns black when kept in the open for a few days. The article when rubbed with toothpaste again starts shining.

(i) Why do silver articles turn black when kept in the open for a few days? Name the phenomenon involved.

(ii) Name the black substance formed and give its chemical formula.

Ans: (i) Metals such as silver when attacked by substances around it such as moisture, acids, gases, etc, are said to corrode and this phenomenon is called corrosion.

(ii) The black substance is formed because silver (Ag) reacts with H_2S present in air. It forms thin black coating of silver sulphide (Ag_2S).
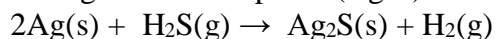
$$2Ag(s) + H_2S(g) \rightarrow Ag_2S(s) + H_2(g)$$
$$\text{Black}$$

SECTION – D
Questions 34 to 36 carry 5 marks each.

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

Ans: Pollination is defined as the transfer of pollen from anther or stamen to stigma of the flower.

Types of pollination:

(i) **Self pollination:** Transfer of pollen from anther or stamen to stigma occurs in the same flower or to the flower of same plant.

(ii) **Cross pollination:** Pollen is transferred from anther or stamen of one flower to stigma of another flower of another plant of same species.

Agents of pollination: Wind, water, insects and animals. (Any two)

After pollination, a tube grows out of the pollen grain and travels through the style to reach the female germ cell in the ovary, which results in fertilization.

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

(i) Write the reaction that occurs when glucose breaks down anaerobically in yeast.

(ii) Write the mechanism by which fishes breathe in water.

(iii) Name the balloon like structures present in lungs. List its two functions.

(iv) Name the respiratory pigment and write its role in human beings.

Ans: (i) Glucose $\xrightarrow{\text{In cytoplasm}}$ Pyruvate $\xrightarrow{\text{In absence of oxygen}}$ Ethanol + CO_2 Energy

(ii) Fishes take in water through the mouth and force it past the gills where the dissolved oxygen is taken up by the blood.

(iii) The balloon like structures are called alveoli. Their functions are:

(a) They contain an extensive network of blood vessels which exchange gases.

(b) They increase surface area of absorption of gases.

(iv) Haemoglobin is the respiratory pigment. Due to its high affinity for oxygen, it helps in its transport from alveoli to the tissues.

35. Draw the pattern of the field lines of the magnetic field around a current carrying straight conductor passing through and held perpendicular to a horizontal cardboard. State right-hand thumb rule and explain how this rule is useful to determine the direction of the magnetic field in the above case, if the direction of current in the conductor is vertically downwards.

Ans:
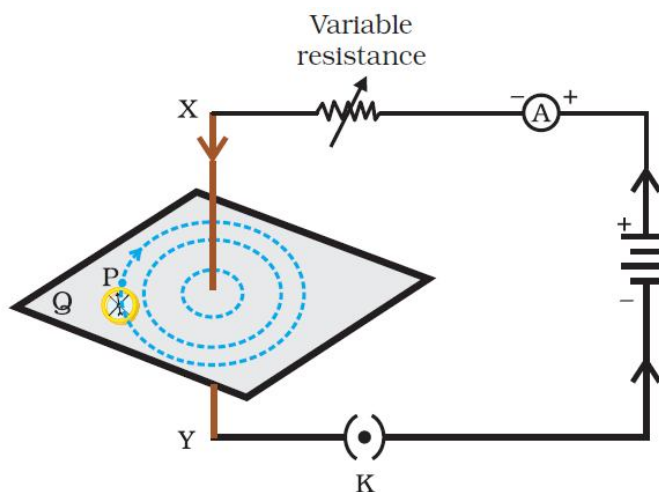
Maxwell Right Hand Thumb Rule: It states that suppose you are holding a current carrying conductor in your right hand in such a way that your thumb points in the direction of the current. Then the way or direction in which your fingers will encircle will give the direction of magnetic field lines.

As in this case, the current flows downwards, so the magnetic field lines go clockwise.
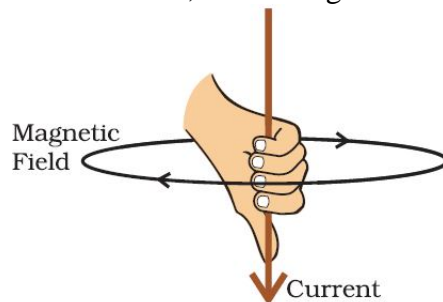
<div align="center">OR</div>

With the help of a labelled diagram, explain the distribution of magnetic field due to a current through a circular loop. Why is it that if a current carrying coil has n turns the field produced at any point is n times as large as that produced by a single turn?

Ans: The pattern of the magnetic field lines near the wires of the coil are concentric circles. The curvature of these curves goes on increasing as we move away from the wire. At the centre of the circular loop, the field lines are nearly straight.
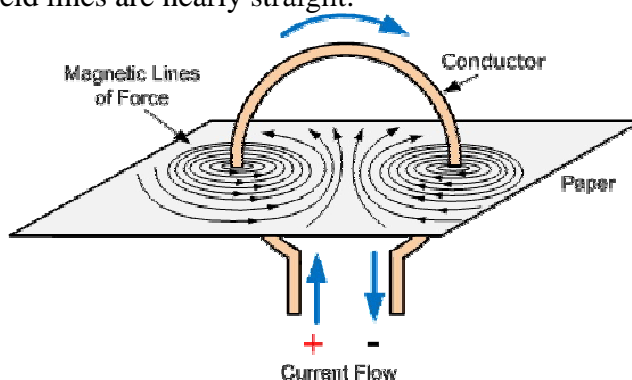

The magnetic field produced by a current carrying wire at a given point depends directly on the current passing through it. Therefore, if there is a circular coil having n turns, the field produced is n-times as large as that produced by a single turn. This is because the current in each circular turn has the same direction, and the field due to each turn then just adds up.

36. Why are certain compounds 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.

Ans: Compounds containing carbon and hydrogen are called hydrocarbons. Oxides, carbonates, hydrogen carbonates of carbon are not called hydrocarbons as they are inorganic compounds.

	General Formula	First Member's Structure
Alkanes	C_nH_{2n+2} where n = 1, 2, 3	H—C—H with H above and below, Methane
Alkenes	C_nH_{2n} where n = 2, 3....	$C=C$ Ethene
Alkynes	C_nH_{2n-2} where n = 2, 3....	$H—C \equiv C—H$ Ethyne

Addition Reaction converts alkenes (unsaturated) to alkanes (saturated)
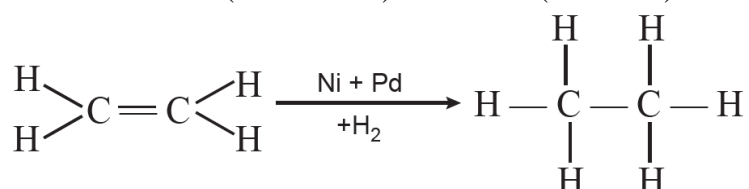
Reactions occur at high temperature and in presence of catalysts such as nickel or pallodium.

SECTION – E(Case Study Based Questions)
Questions 37 to 39 carry 4 marks each.

37. Case Study – 1

Humans use sexual mode of reproduction. But the actual transfer of germ cells between two people needs special organs for the sexual act. In mammals such as humans, the baby is carried in the mother's body for a long period and is breastfed later on. The female reproductive organs and breasts will need to mature to accommodate these possibilities. Hence some specialised

systems are involved in the process of sexual reproduction. The given graph shows the hormonal changes during a normal menstrual cycle.
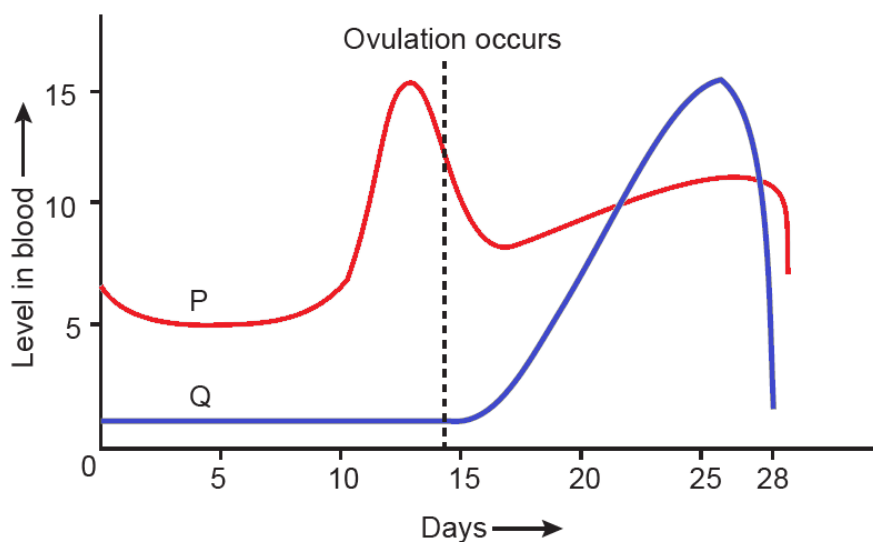
(i) What would be a likely consequence if the hormone represented by graph Q is lacking in an adult female?
(ii) What is funeral of unfertilised egg?
(iii) After the beginning of menstrual cycle, at which day progesterone reaches its peak? Give reason.

OR

(iii) (a) Name two simple organisms having the ability of regeneration.
(b) What is the role of the seminal vesicles and the prostate gland?
Ans: (i) The uterine lining might not be sufficiently stable for implantation of fertilised ovum.
(ii) Menstruation is also called funeral of egg since it is not fertilised.
(iii) According to the given chart of hormone regulation in the menstrual cycle, the progesterone level peaks at the 22nd day.

OR

(iii) (a) Planaria/Hydra/Earthworm.
(b) Seminal vesicles are a pair of thin-walled muscular elongated sacs which secrete fluid for nourishment of sperms.
Prostate glands also produce fluid which is released in the urethra along with secretion of seminal vesicle and helps in sperm mobility. The secretion of these accessory glands together with sperm is called semen. It affects the vaginal pH so that sperms move smoothly inside the vagina.

38. Case Study - 2
The image formed by a convex lens depends on the position of the object in front of the lens. When the object is placed anywhere between focus and infinity, the image formed by convex lens is real and inverted. The image is not obtained on the screen when the object is placed between focus and the lens.
The distance between the optical centre O of the convex lens and the focus point F_1 or F_2 is its focal length.

When the object shifts from $-\infty$ to F_1, the image moves from F_2 to $+\infty$.
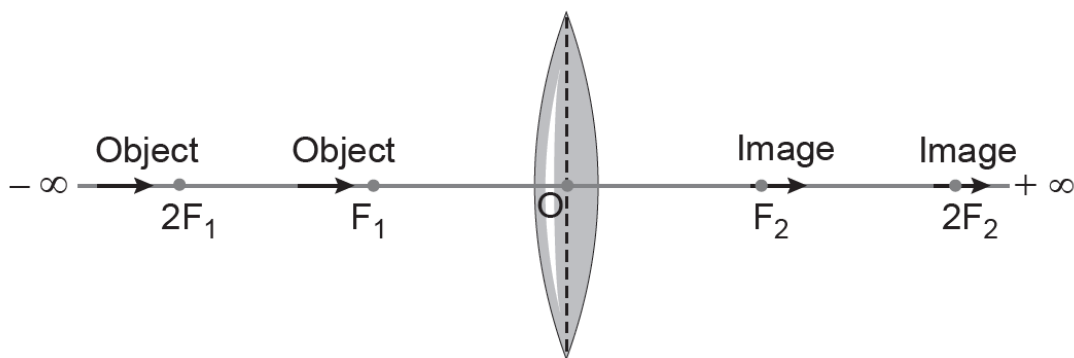
When the object shifts from F_1 to O, the image moves from $-\infty$ to O.
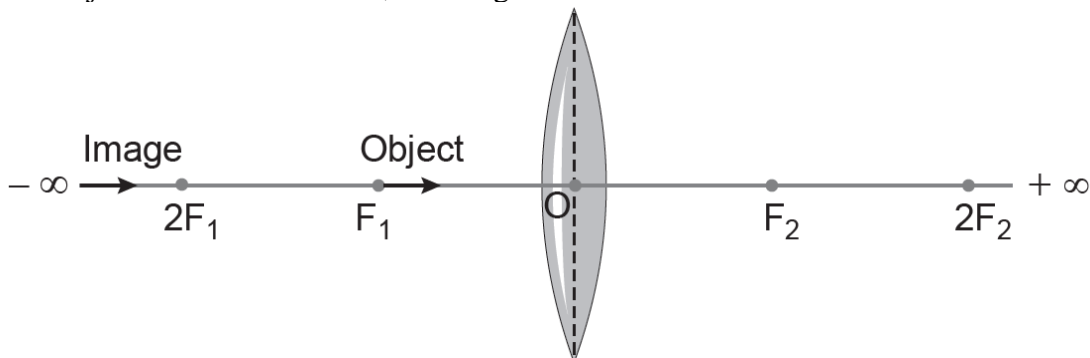
A student did an experiment with a convex lens. He put an object at different distances from the lens. In each case he measured the distance of the image from the lens. The results were recorded in the following table.

Object distance (in cm)	25	30	40	60	120
Image distance (in cm)	100	24	60	30	40

Unfortunately, his results are written in the wrong order.
(i) Arrange the image distance in the correct order (in cm).
(ii) Which of the object distances gives the biggest image? Give reason.
(iii) Find the focal length of this lens.

OR

(iii) What is the minimum distance between an object and its real image formed by a convex lens? Where should an object be placed to get a virtual image by convex lens?
Ans: (i) 100 cm, 60 cm, 40 cm, 30 cm, 24 cm
When object come closer to the lens up to F then image will be formed away from the lens and vice-versa.
(ii) 25 cm. When an object is placed between F and 2F of a convex lens, we get a real, inverted and magnified image.
(iii) When the object distance equals the image distance, they are at twice the focal length from the lens.
When 2F = 60 cm $\Rightarrow$ F = 30 cm
When an object is placed at focus (F = 30 cm) of a convex lens, the image formed is at infinity. But infinity is not any observation in the given table.
Hence, F = 30 cm is not possible.
Now, when 2F = 40 cm
$\therefore$ F = 20 cm

OR

(iii) When object is at $2F_1$ then image is formed at $2F_2$ then minimum distance between object and real image is $2f_1 + 2f_2 = 4f$ ($\because f_1 = f_2$).
When object is placed between F and O image formed is virtual, erect and magnified.

39. Case Study – 3

For an internal combustion engine to move a vehicle down the road, it must convert the energy stored in the fuel into mechanical energy to drive the wheels. In your car, the distributor and battery provide this starting energy by creating an electrical "spark", which helps in combustion of fuels like gasoline. Below is the reaction depicting complete combustion of gasoline in full supply of air:

$$2C_8H_{18} (l) + 25 O_2 (g) \rightarrow 16 X + 18 Y$$
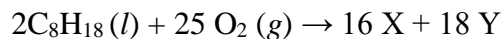
(i) Identify the types of chemical reaction occurring during the combustion of fuels? Name the product 'X' and 'Y'.

(ii) 'Although nitrogen is the most abundant gas in the atmosphere, it does not take part in combustion'. Justify the statement.

(iii) 'A student while walking on the road observed that a cloud of black smoke belched out from the exhaust stack of moving trucks on the road.' Give reason.

OR

(iii) Write the balanced chemical equations for the following reaction and identify the type of reaction.

Ethene is burnt in the presence of oxygen to form carbon dioxide, water and releases heat and light.

Ans: (i) Oxidation & Exothermic reaction.

(ii) This is because nitrogen is an inert gas.

(iii) This is because limited supply of air leads to incomplete combustion of fuel.

OR

(iii) $C_2H_4(g) + 3O_2(g) \rightarrow 2CO_2(g) + 2H_2O(g) + Heat + Light$

Redox reaction/Combustion reaction