SAMPLE PAPER TEST 04 FOR BOARD EXAM 2025

SUBJECT: SCIENCE **MAX. MARKS : 80**

CLASS : X **DURATION : 3 HRS**

General Instruction:

1. This question paper consists of 39 questions in 5 sections.
2. All questions are compulsory. However, an internal choice is provided in some questions. A student is expected to attempt only one of these questions.
3. **Section A** consists of 20 objective type questions carrying 1 mark each.
4. **Section B** consists of 6 Very Short questions carrying 02 marks each. Answers to these questions should in the range of 30 to 50 words.
5. **Section C** consists of 7 Short Answer type questions carrying 03 marks each. Answers to these questions should in the range of 50 to 80 words
6. **Section D** consists of 3 Long Answer type questions carrying 05 marks each. Answer to these questions should be in the range of 80 to 120 words.
7. **Section E** consists of 3 source-based/case-based units of assessment of 04 marks each with sub-parts.

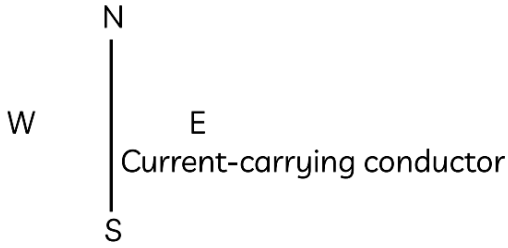
SECTION – A

Questions 1 to 20 carry 1 mark each.

1. What is the difference in the molecular mass of any two adjacent homologues?
(a) 14 amu (b) 15 amu (c) 16 amu (d) 17 amu

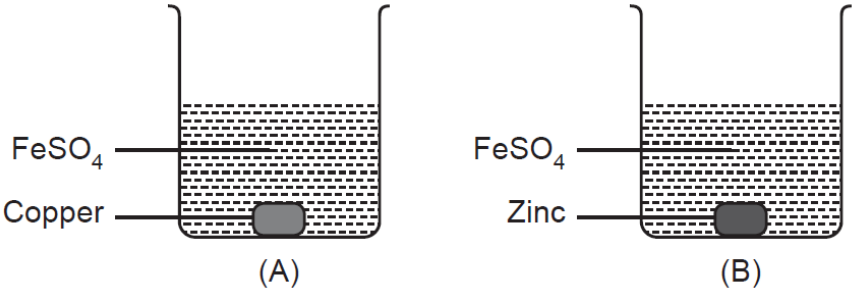
2. What is the focal length of a plane mirror?
(a) Infinity (b) Zero (c) 1 (d) + 1

3. A current-carrying conductor is held as shown:



In which direction should current be passed in the conductor in order to produce a clockwise magnetic field around the conductor?
(a) North to South (b) South to North (c) East to West (d) West to East

4. Two beakers A and B contain iron sulphate solution. In the beaker A is placed a small piece of copper and in the beaker B is placed a small piece of zinc. It is found that a grey deposit forms on the zinc but not on the copper. It is concluded that

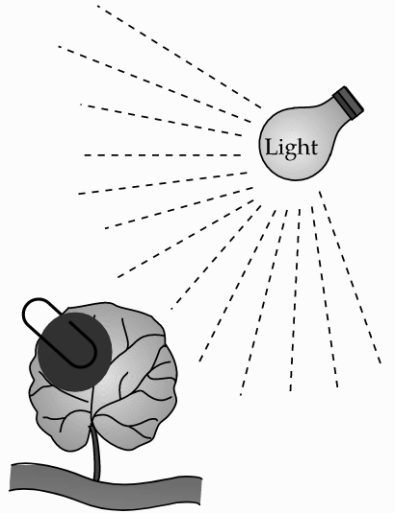


(a) zinc is most reactive metal followed by iron and copper
(b) zinc is most reactive metal followed by copper and then iron
(c) iron is most reactive metal followed by zinc and copper
(d) iron is most reactive metal followed by copper and then zinc

5. In a study it was found that fused ear lobes were found in more numbers within a population rather than free ear lobes. What can you infer from the above observation with respect to dominant/ recessive trait?
(a) Fused ear lobes – dominant (b) Free ear lobes – dominant
(c) Fused ear lobes – recessive (d) Both are dominant

6. At the time of short circuit, the electric current in the circuit:
(a) vary continuously (b) does not change (c) reduces substantially (d) increases heavily

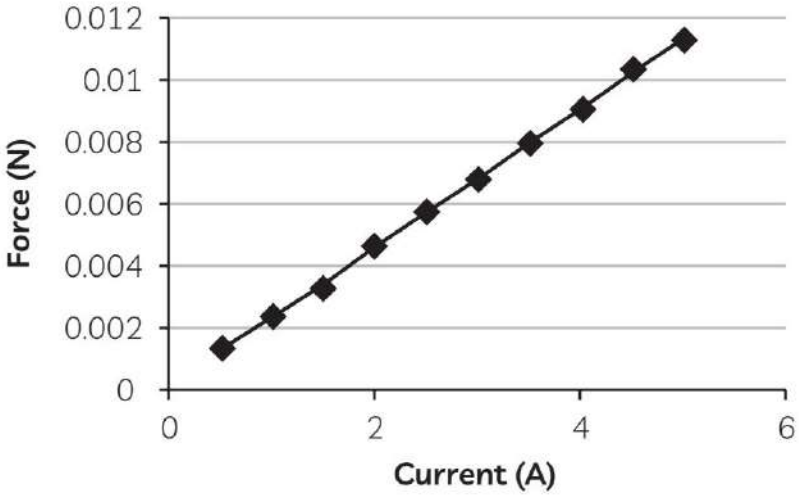
7. The diagram below shows a leaf that was covered by a piece of black paper for a period of 3 days. After 3 days, the paper was removed. On testing, it was found that the area under the black paper tested negative for starch and the rest tested positive for starch. What was the experiment trying to test?



(a) If plants make their own food
(b) If light is required for plants to make food
(c) If plants can respire in the absence of light
(d) If plants can survive even in the absence of light

8. For a current in a long straight solenoid N-pole and S-pole are created at the two ends. Among the following statements, the incorrect statement is:
(a) The field lines inside the solenoid are in the form of straight lines which indicates that the magnetic field is the same at all points inside the solenoid.
(b) The strong magnetic field produced inside the solenoid can be used to magnetise a piece of magnetic material like soft iron, when placed inside the coil.
(c) The pattern of the magnetic field associated with the solenoid is different from the pattern of the magnetic field around a bar magnet.
(d) The N-pole and S-pole exchange position when the direction of current through the solenoid is reversed.

9. The graph below shows the variation of force acting on a conductor with current:



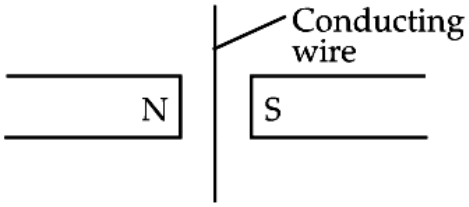
After analyzing the graph, a student noted the following. Select the correct statement:
(a) The force acting on a conductor increases exponentially with increase in current.
(b) The force acting on a conductor decreases exponentially with increase in current.
(c) The force acting on a conductor increases linearly with increase in current.
(d) The force acting on a conductor decreases linearly with increase in current.

10. 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

11. 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

12. 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

13. A straight wire is placed between two poles of a magnet as shown in figure. If an alternating current passing through a wire then wire will



(a) Move into the page only (b) Move out of the page only
(c) Move out and into the page (d) Remain stationary

14. 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)

15. 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)

16. Manish's mother was baking cake in the kitchen. When Manish came back from school, he detected smell of hot cake from the drawing room. Why?
(a) Due to the presence of olfactory receptors in forebrain
(b) Due to the presence of taste buds
(c) Due to the presence of olfactory receptors in midbrain
(d) Due to the presence of olfactory receptors in hindbrain

Q. no 17 to 20 are Assertion - Reasoning based questions. These consist of two statements – **Assertion (a)** and **Reason (R)**. Answer these questions selecting the appropriate option given below:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true and R is not the correct explanation of A
(c) A is true but R is false
(d) A is false but R is true

17. Assertion (A): In Fleming's left hand rule, the direction of magnetic field, force and current are mutually perpendicular.
Reason (R): Fleming's left hand rule is applied to measure the induced current.

18. 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).

19. Assertion (a): Non–biodegradable substances are those substances which cannot be broken down into simpler harmless substances in nature.
Reason (R): Non–biodegradable substances can cause air pollution and make the air poisonous when burnt.

20. Assertion (a): The effect of root pressure in transport of water is more important during daytime.
Reason (R): Transpiration pull is the major driving force in movement of water during the day.

SECTION – B

Questions 21 to 25 carry 2 marks each.

21. What is the role of saliva in the digestion of food?

22. 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.

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.

23. (i) Write the number of covalent bonds in the molecule of propane, C_3H_8.
(ii) Which element exhibits the property of catenation to maximum extent and why?

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.

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

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

26. Give reasons for the following observations:
(a) Covalent compounds are poor conductors of electricity.
(b) Highly reactive metals cannot be obtained from their oxides by heating them with carbon.

SECTION – C

Questions 27 to 33 carry 3 marks each.

27. Identify the acid and base which form sodium hydrogen carbonate. Write chemical equation in support of your answer. State whether this compound is acidic, basic or neutral. Also, write its pH value.

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

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

OR

List in tabular form three distinguishing features between autotrophic nutrition and heterotrophic nutrition.

30. Give reasons for the following:
(a) Ionic compounds have high melting and boiling point
(b) Ionic compounds conduct electricity in molten state
(c) Ionic compounds are solid at room temperature and are somewhat hard.

31. (a) What is a solenoid ?
(b) Draw the pattern of magnetic field lines of (i) a current carrying solenoid and (ii) a bar magnet.

OR

Suppose your parents have constructed a two room house and you want that in the living room there should be a provision of one electric bulb, one electric fan, a refrigerator and a plug point for appliances of power upto 2 kilowatt. Draw a circuit diagram showing electric fuse and earthing as safety devices.

32. Sahil took five solutions A, B, C, D and E and tested with universal indicator showed pH as 4, 1, 11, 7 and 9 respectively. Which solution is: (a) Neutral (b) Strongly alkaline (c) Strongly acidic (d) Weakly acidic (E) Weakly alkaline?
Arrange the pH in increasing order of hydrogen ion concentration.

33. (a) Describe how a squirrel uses its hormonal system to react to a dangerous situation.
(b) How do sensory and motor neurons differ from one another?

SECTION – D

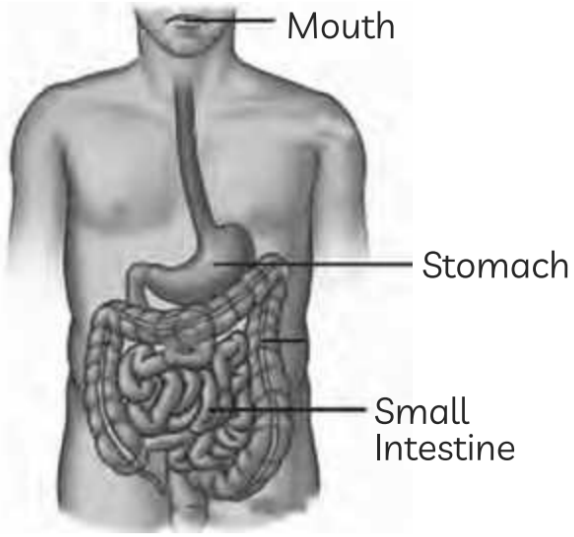
Questions 34 to 36 carry 5 marks each.

34. A student wants to project the image of a candle flame on a screen 60 cm in front of a mirror by keeping the candle flame at a distance of 15 cm from its pole.
(a) Which type of mirror should the student use?
(b) Find the magnification of the image produced.
(c) Find the distance between the object and its image.
(d) Draw a ray diagram to show the image formation in this case and mark the distance between the object and its image.

OR

(a) Name the lens which can be used as a magnifying glass. For which position of the object a convex lens form: (i) a real and inverted image of the same size as that of the object? (ii) a virtual and erect image? Draw ray diagram to justify your answer in each case.
(b) One half of a convex lens is covered with a black paper. Will this lens produce a complete image of the object? Draw ray diagram to justify your answer.

35. Name three different glands associated with the structures labelled in digestive system as shown in figure. Also write their secretions and their functions.



OR

(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.

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.

OR

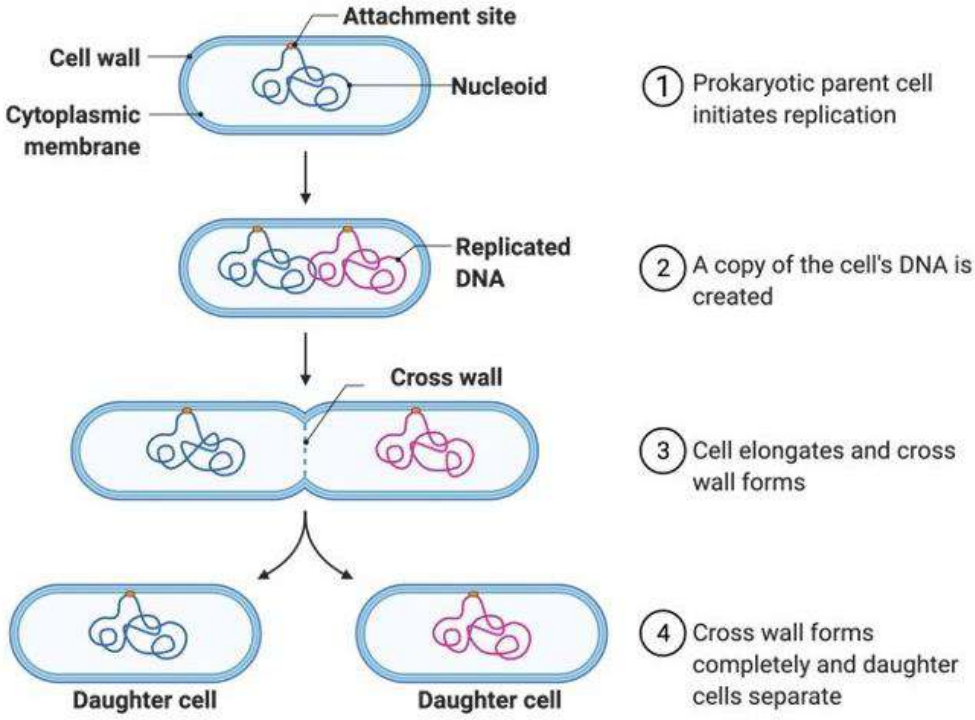
(a) Explain why carbon forms covalent bond ? Give two reasons for carbon forming a large number of compounds.
(b) Explain the formation of ammonia molecule.

SECTION – E (Case Study Based Questions)

Questions 35 to 37 carry 4 marks each.

37. Case Study – 1

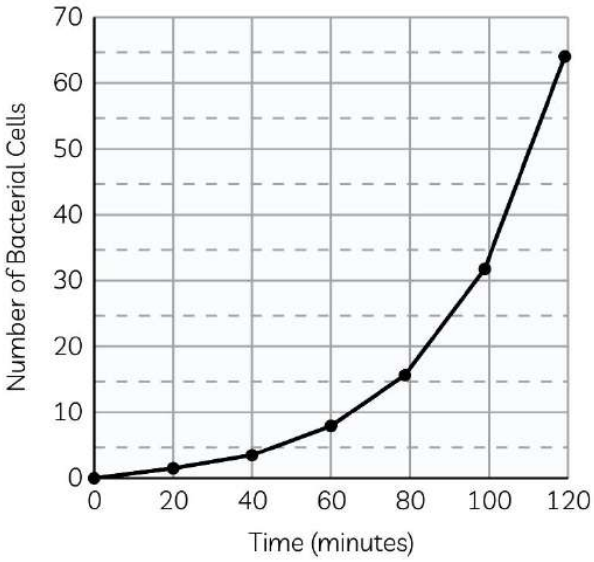
Bacteria follow an asexual mode of reproduction, called binary fission. A single bacterium divides into two daughter cells. These are identical to the parent cell as well as to each other. Replication of DNA within parent bacterium marks the beginning of the fission. Eventually, cell elongates to form two daughter cells.
The diagram shows the process of binary fission in bacteria



The rate and timing of reproduction depend upon the conditions like temperature and availability of nutrients. When there is a favorable condition, E. coli or Escherichia coli produces about 2 million bacteria every 7 hours.
(a) (i) What is the process of the division of a cell into several cells during reproduction in Plasmodium?
(ii) A Planaria worm is cut horizontally in the middle into two halves P and Q such that the part P contains the whole head of the worm. Another Planaria worm is cut vertically into two halves R and S in such a way that both the cut pieces R and S contain half head each. Which of the cut pieces of the two Planaria worms could regenerate to form the complete respective worms?
(b) The rapid spreading of bread would on slices of bread is due to spore formation. Explain spore formation.

OR

(b) Suppose a bacterium reproduces by binary fission every 20 minutes. The new cells survive and reproduce at the same rate. The graph below shows how the bacterial population would grow from a single bacterium. What do you conclude?



38. Case Study – 2

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.

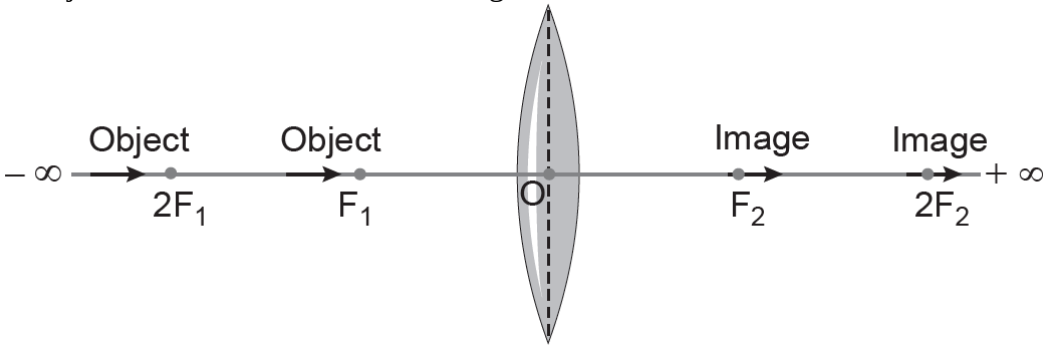
Ethene is burnt in the presence of oxygen to form carbon dioxide, water and releases heat and light.

39. Case Study - 3

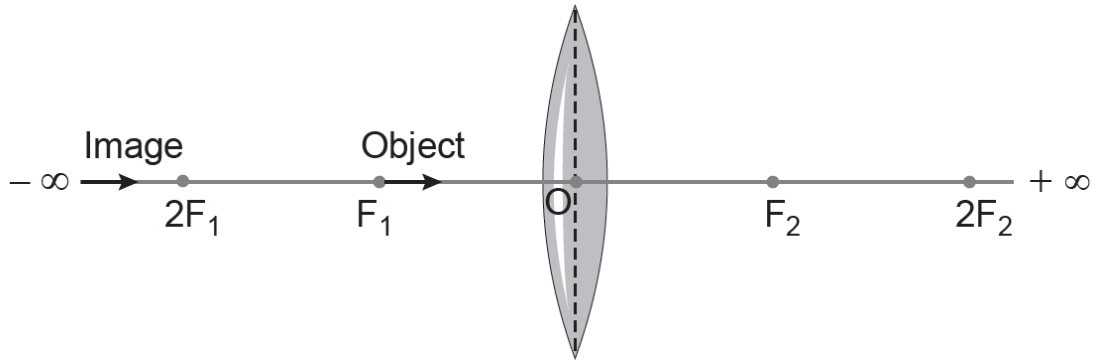
The image formed by a convex lens depends on the position of the object in front of the lens. When the object is placed anywhere between focus and infinity, the image formed by convex lens is real and inverted. The image is not obtained on the screen when the object is placed between focus and the lens.

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?

SAMPLE PAPER TEST 04 FOR BOARD EXAM 2025

SUBJECT: SCIENCE **(ANSWERS)** **MAX. MARKS : 80**
CLASS : X **DURATION : 3 HRS**

General Instruction:

1. This question paper consists of 39 questions in 5 sections.
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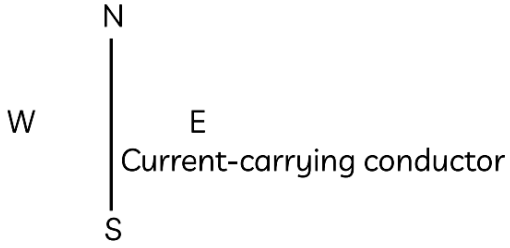
SECTION – A

Questions 1 to 20 carry 1 mark each.

1. What is the difference in the molecular mass of any two adjacent homologues?
(a) 14 amu (b) 15 amu (c) 16 amu (d) 17 amu
Ans: (a) 14 amu
Two successive homologues would differ by one carbon atom and two hydrogen atoms in terms of atoms in their molecules and thus differ by 14 amu in terms of molecular mass.

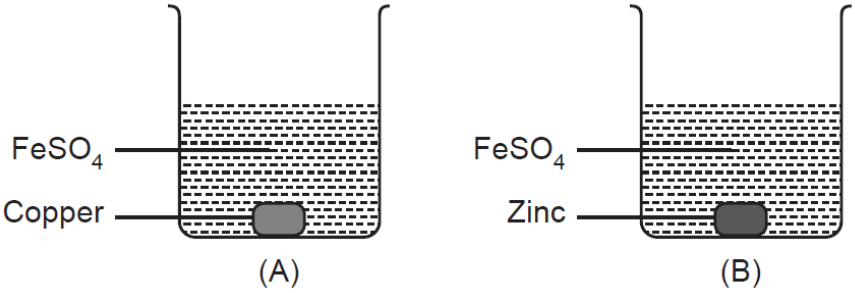
2. What is the focal length of a plane mirror?
(a) Infinity (b) Zero (c) 1 (d) + 1
Ans: (a) Infinity
The focal length of a plane mirror is infinity. The focal length of a plane mirror is infinity as the image can be formed at infinite distance inside the mirror. This is due to the parallel rays after reflection through a plane mirror meet again at infinity.

3. A current-carrying conductor is held as shown:



In which direction should current be passed in the conductor in order to produce a clockwise magnetic field around the conductor?
(a) North to South (b) South to North (c) East to West (d) West to East
Ans: (a) North to South
The direction of current in the conductor should be from top to bottom i.e., from North to South direction. It is given that the current-carrying conductor is held in exactly vertical direction. In order to produce a clockwise magnetic field around the conductor, the current should be passed in the conductor from top to bottom. It is concluded by applying right-hand thumb rule.

4. Two beakers A and B contain iron sulphate solution. In the beaker A is placed a small piece of copper and in the beaker B is placed a small piece of zinc. It is found that a grey deposit forms on the zinc but not on the copper. It is concluded that

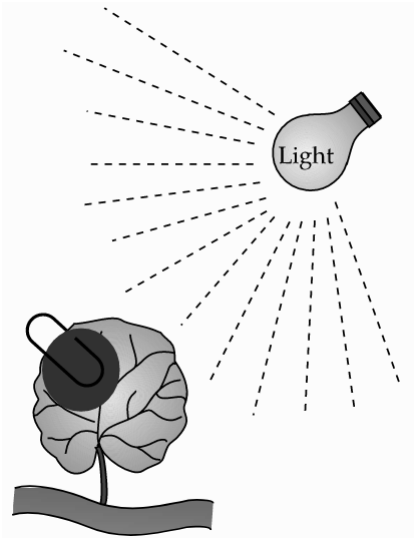


(a) zinc is most reactive metal followed by iron and copper
(b) zinc is most reactive metal followed by copper and then iron
(c) iron is most reactive metal followed by zinc and copper
(d) iron is most reactive metal followed by copper and then zinc
Ans. (a) zinc is most reactive metal followed by iron and copper

5. In a study it was found that fused ear lobes were found in more numbers within a population rather than free ear lobes. What can you infer from the above observation with respect to dominant/ recessive trait?
(a) Fused ear lobes – dominant (b) Free ear lobes – dominant
(c) Fused ear lobes – recessive (d) Both are dominant
Ans: (a) Fused ear lobes – dominant
It can be inferred from the observation that fused ear lobes is a dominant trait whereas free ear lobes are a recessive trait.

6. At the time of short circuit, the electric current in the circuit:
(a) vary continuously (b) does not change (c) reduces substantially (d) increases heavily
Ans: (d) increases heavily
A short circuit in an electrical circuit allows a current to travel along an unintended path, often where essentially no (or a very low) electrical impedance is encountered. An example of it is when the positive and negative terminals of a battery are connected with a low-resistance conductor, like a wire. With low resistance in the connection, a high current exists, causing the cell to deliver a large amount of energy in a short time. Hence, during a short circuit, the current in the circuit increases heavily.

7. The diagram below shows a leaf that was covered by a piece of black paper for a period of 3 days. After 3 days, the paper was removed. On testing, it was found that the area under the black paper tested negative for starch and the rest tested positive for starch. What was the experiment trying to test?

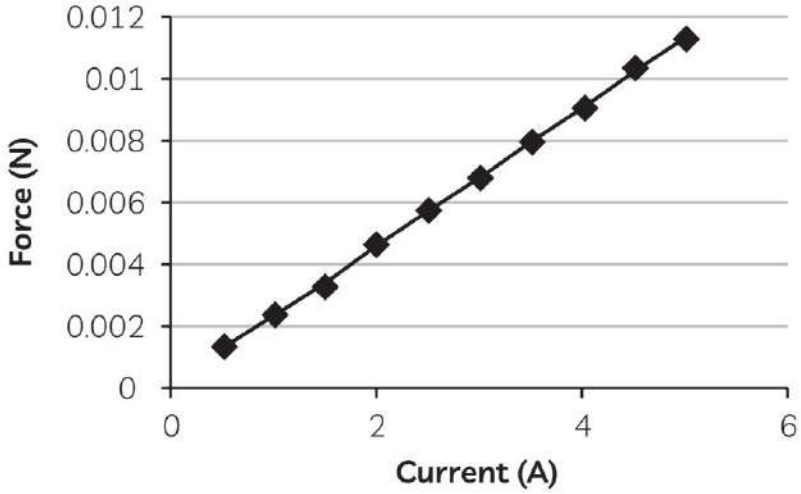


(a) If plants make their own food
(b) If light is required for plants to make food
(c) If plants can respire in the absence of light
(d) If plants can survive even in the absence of light

Ans: (b) If light is required for plants to make food
Leaf exposed to sunlight give iodine test, proving that sunlight is necessary for photosynthesis.

8. For a current in a long straight solenoid N-pole and S-pole are created at the two ends. Among the following statements, the incorrect statement is:
(a) The field lines inside the solenoid are in the form of straight lines which indicates that the magnetic field is the same at all points inside the solenoid.
(b) The strong magnetic field produced inside the solenoid can be used to magnetise a piece of magnetic material like soft iron, when placed inside the coil.
(c) The pattern of the magnetic field associated with the solenoid is different from the pattern of the magnetic field around a bar magnet.
(d) The N-pole and S-pole exchange position when the direction of current through the solenoid is reversed.
Ans: (c) The pattern of the magnetic field associated with the solenoid is different from the pattern of the magnetic field around a bar magnet.
A solenoid behaves like a bar magnet. Hence, the pattern of the magnetic field associated with the solenoid is same as the pattern of the magnetic field around a bar magnet.

9. The graph below shows the variation of force acting on a conductor with current:



After analyzing the graph, a student noted the following. Select the correct statement:
(a) The force acting on a conductor increases exponentially with increase in current.
(b) The force acting on a conductor decreases exponentially with increase in current.
(c) The force acting on a conductor increases linearly with increase in current.
(d) The force acting on a conductor decreases linearly with increase in current.
Ans: (c) The force acting on a conductor increases linearly with increase in current.
The graph between the force and current is a straight line which shows that force varies linearly with current.

10. 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

11. 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?

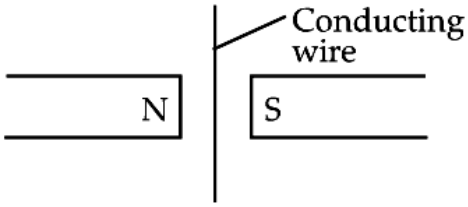
Grass → Grasshopper → Frog → Snake → Hawk

(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.

12. 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

13. A straight wire is placed between two poles of a magnet as shown in figure. If an alternating current passing through a wire then wire will



(a) Move into the page only (b) Move out of the page only
(c) Move out and into the page (d) Remain stationary
Ans: (c) Move out and into the page
The direction of the current flowing in the conducting wire change alternatively when it is connected to an alternating current supply.

14. 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

15. 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

16. Manish's mother was baking cake in the kitchen. When Manish came back from school, he detected smell of hot cake from the drawing room. Why?
(a) Due to the presence of olfactory receptors in forebrain
(b) Due to the presence of taste buds
(c) Due to the presence of olfactory receptors in midbrain
(d) Due to the presence of olfactory receptors in hindbrain
Ans: (a) Due to the presence of olfactory receptors in forebrain
Our nose contains olfactory receptors that can recognize the aroma of hot food. The olfactory lobes of the forebrain receive this information via nerve impulse and interpret it.

Q. no 17 to 20 are Assertion - Reasoning based questions. These consist of two statements – **Assertion (a)** and **Reason (R)**. Answer these questions selecting the appropriate option given below:
(a) Both A and R are true and R is the correct explanation of A
(b) Both A and R are true and R is not the correct explanation of A
(c) A is true but R is false
(d) A is false but R is true

17. Assertion (A): In Fleming's left hand rule, the direction of magnetic field, force and current are mutually perpendicular.
Reason (R): Fleming's left hand rule is applied to measure the induced current.
Ans: (c) Assertion (A) is true but reason (R) is false.
It is used to find the direction of force in a current carrying conductor in the presence of magnetic field.

18. 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)

19. Assertion (a): Non–biodegradable substances are those substances which cannot be broken down into simpler harmless substances in nature.
Reason (R): Non–biodegradable substances can cause air pollution and make the air poisonous when burnt.
Ans: (b) Both A and R are true and R is not the correct explanation of A.
Non-biodegradable substances are the substances that cannot be broken down into simpler substances by biological processes. They persist in the environment for a long time and may cause harm to the various members of the ecosystem. Non-biodegradable substances like plastic can cause air pollution when they are burnt.

20. Assertion (a): The effect of root pressure in transport of water is more important during daytime.
Reason (R): Transpiration pull is the major driving force in movement of water during the day.
Ans: (d) A is false but R is true.
The effect of root pressure in transport of water is more important during night time as during the day, when stomata are open, the transpiration pull becomes the major driving force in the transport of water in the xylem.

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).

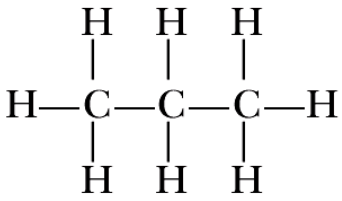
22. An electric oven of 2 kW power rating is operated in a domestic electrical circuit of 220 V that has a current rating of 5 A. What result do you expect? Explain.
Ans: Given: Power of oven, P = 2 kW = 2000 W
Voltage used, V = 220 V
Current in circuit, I = P/V = 2000/220 A = 9.1 A
This is greater than 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, $I_1 = P_1/V = 100\ W/220V = 5/11 = 0.45A$
Current in the second bulb, $I_2 = P_2/V = 60\ W/220V = 3/11 = 0.27A$

23. (i) Write the number of covalent bonds in the molecule of propane, C_3H_8.

(ii) Which element exhibits the property of catenation to maximum extent and why?
Ans: (i) There are ten covalent bonds:



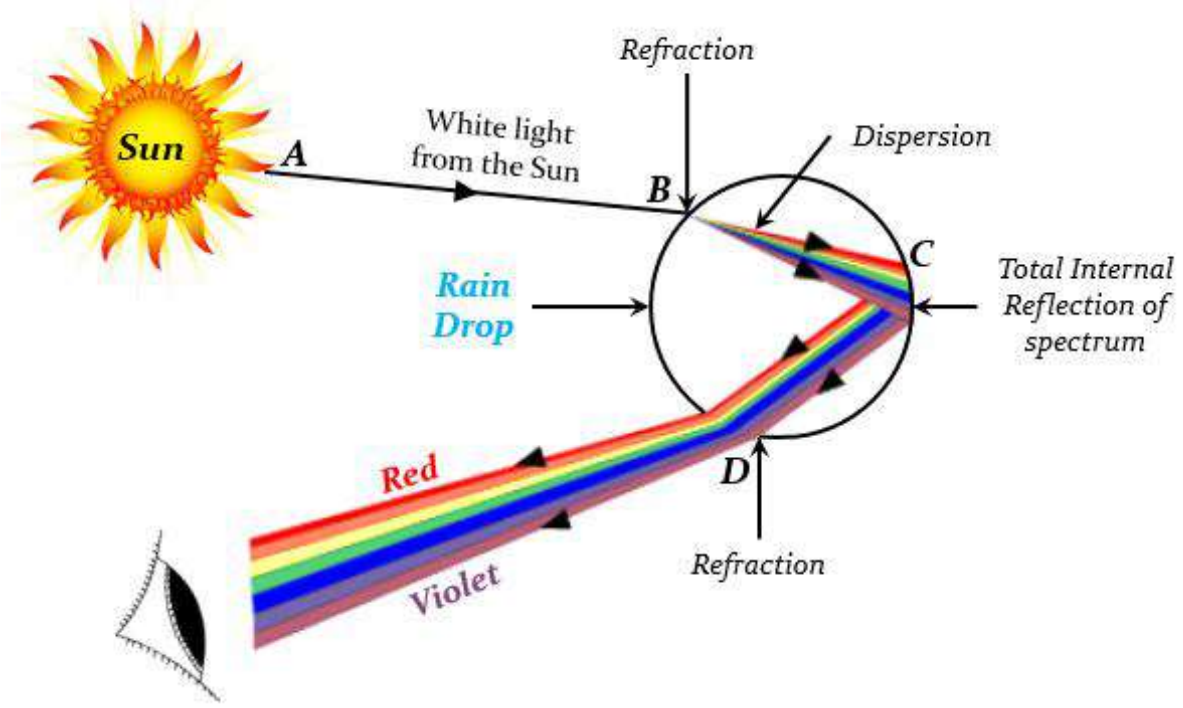
(ii) Carbon exhibits the property of catenation due to strong C—C bond.

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. 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.

25. What is a rainbow? Draw a well labelled diagram to show the formation of a rainbow.
Ans: Rainbow - A natural spectrum of sunlight appearing in the sky after a rain shower.



26. Give reasons for the following observations:
(a) Covalent compounds are poor conductors of electricity.
(b) Highly reactive metals cannot be obtained from their oxides by heating them with carbon.
Ans: (a) It is because covalent compounds do not form ions.
(b) It is because these metal, themselves are strong reducing agents. Therefore, cannot be reduced by reducing agent like carbon.

SECTION – C

Questions 27 to 33 carry 3 marks each.

27. Identify the acid and base which form sodium hydrogen carbonate. Write chemical equation in support of your answer. State whether this compound is acidic, basic or neutral. Also, write its pH value.

Ans: Acid - H_2CO_3

Base - NaOH

$NaOH + H_2CO_3 \rightarrow NaHCO_3 + H_2O$

Compound is basic in nature. pH value - ranges between 7 to 10.

28. 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.

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

Ans: When bright light is focused on our eyes, the Photoreceptors generate electric impulses and pass it to the sensory neurons. They carry the stimuli to the spinal cord which transports the message to the brain. The brain sends the response to the muscles of the eyelids to close by contracting the pupil.

Receptor → Sensory neuron → Spinal cord → Brain → Motor neuron → Eye → Contraction of eye muscles.

OR

List in tabular form three distinguishing features between autotrophic nutrition and heterotrophic nutrition.

S.No	Autotrophic nutrition	Heterotrophic nutrition
1.	It is a mode of nutrition in which organism prepare their own food.	It is a mode of nutrition in which organism cannot prepare their food and obtain it from different sources.
2.	The organisms falling in this category are not dependent on any other organism.	The organisms falling in this category are dependent on other organisms for their food.
3.	Organisms using this mode of nutrition are called as producers.	Organisms using this mode of nutrition are called as consumers.

30. Give reasons for the following:

(a) Ionic compounds have high melting and boiling point

(b) Ionic compounds conduct electricity in molten state

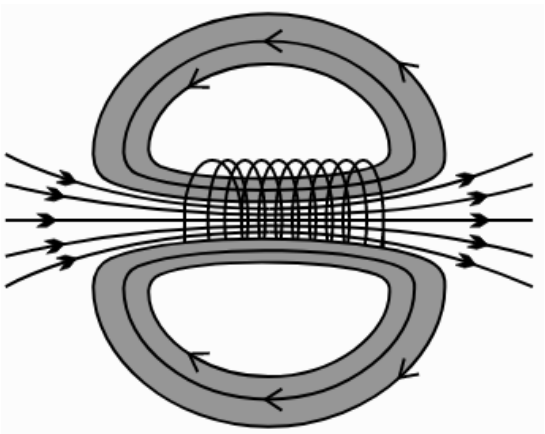
(c) Ionic compounds are solid at room temperature and are somewhat hard.

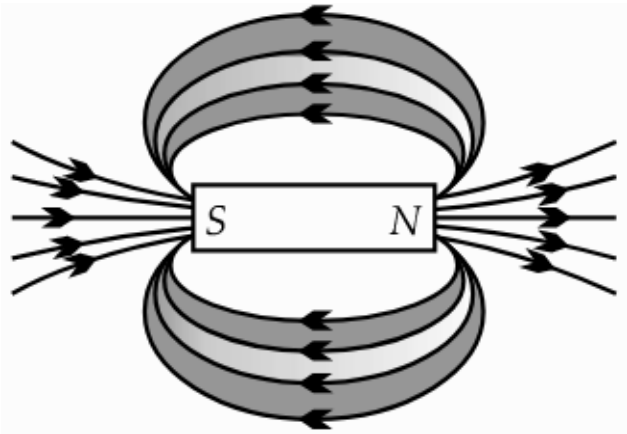
Ans: (a) Ionic compounds have high boiling and melting point due to the presence of strong bond between cations and anions. To break or overcome these strong forces of attraction, a large amount of energy is required.

(b) Ionic compounds conduct electricity in molten state. Conductivity depends on the presence of number of free ions. Solid ionic compounds cannot conduct electricity because of the absence of ions (electrons) in the crystal structure. When the ionic compound is present in molten state, crystal structure deforms and they can easily conduct electricity with the free ions.

(c) Ionic compounds are solid at room temperature and are somewhat hard. Due to the presence of strong force of attraction between the positive and negative ions a solid ionic compound formed becomes hard and solid at room temperature.

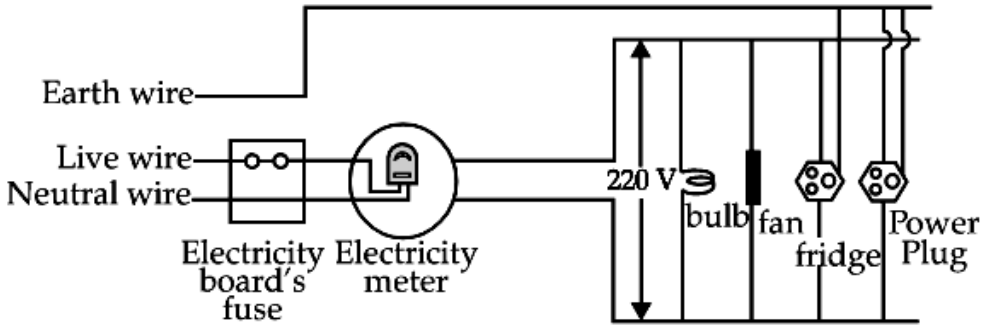
31. (a) What is a solenoid ?
(b) Draw the pattern of magnetic field lines of (i) a current carrying solenoid and (ii) a bar magnet.
Ans: (a) A coil of many turns of insulated copper wire wrapped closely in the shape of a cylinder is called solenoid.
(b)





OR

Suppose your parents have constructed a two room house and you want that in the living room there should be a provision of one electric bulb, one electric fan, a refrigerator and a plug point for appliances of power upto 2 kilowatt. Draw a circuit diagram showing electric fuse and earthing as safety devices.
Ans:



(i) Four components should be labelled.
(ii) All of them should be in parallel and there should be a fuse for safety.
(iii) Live and earth wires should be there.

32. Sahil took five solutions A, B, C, D and E and tested with universal indicator showed pH as 4, 1, 11, 7 and 9 respectively. Which solution is: (a) Neutral (b) Strongly alkaline (c) Strongly acidic (d) Weakly acidic (E) Weakly alkaline?
Arrange the pH in increasing order of hydrogen ion concentration.
Ans: Given pH for the solutions are A = 4, B = 1, C = 11, D = 7, E = 9.
Hydrogen ions concentration increases with decrease in pH value and thus strength of acid increases with decrease in pH value from 7 to 0. On the other hand, hydroxide ion's concentration decreases with increase in pH value and thus strength of bases increases with increase in pH value from 7 to 14. While neutral solution has pH value = 7.
Therefore, (a) Solution D is neutral having pH value equal to 7.
(b) Solution C is strongly alkaline as its pH value is equal to 11
(c) Solution B is strongly acidic as its pH value is equal to 1
(d) Solution A is weakly acidic as its pH value is equal to 4
(e) Solution E is weakly alkaline as its pH value is equal to 9

Hence arrangement of given pH value in increasing order of hydrogen ion concentration: C (11) < E (9) < D (7) < A (4) < B (1)

33. (a) Describe how a squirrel uses its hormonal system to react to a dangerous situation.
(b) How do sensory and motor neurons differ from one another?
Ans: (a) The hormone adrenaline is released into a squirrel's blood when it detects danger, increasing heart rate and blood flow to tissues. As a result, its cells and tissues receive energy more quickly, allowing it to flee dangerous situations.
(b) Sensory neurons transmit impulses to the central nervous system after receiving information from receptors. In order for a muscle, gland, or organ to respond, motor neurons carry messages from the control nervous system to those tissues.

SECTION – D

Questions 34 to 36 carry 5 marks each.

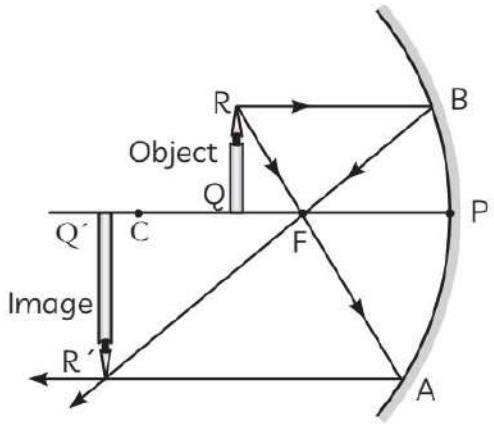
34. A student wants to project the image of a candle flame on a screen 60 cm in front of a mirror by keeping the candle flame at a distance of 15 cm from its pole.
(a) Which type of mirror should the student use?
(b) Find the magnification of the image produced.
(c) Find the distance between the object and its image.
(d) Draw a ray diagram to show the image formation in this case and mark the distance between the object and its image.
Ans: (a) The student should use a concave mirror, as it forms a real image on the same side of the mirror.
(b) Object distance, u = –15 cm Image distance, v = –60 cm

Magnification, $m = -\frac{v}{u} = -\frac{-60}{-15} = -4$

(c) Distance of image from the object = v – u = – 60 – (–15) = – 60 + 15 = –45
The image is formed at a distance of 45 cm from the object.
(d) By applying mirror formula,

$$\frac{1}{f} = \frac{1}{v} + \frac{1}{u} = \frac{1}{-60} + \frac{1}{-15} = \frac{-1-4}{60} = \frac{-5}{60} = \frac{1}{-12} \Rightarrow f = -12cm$$

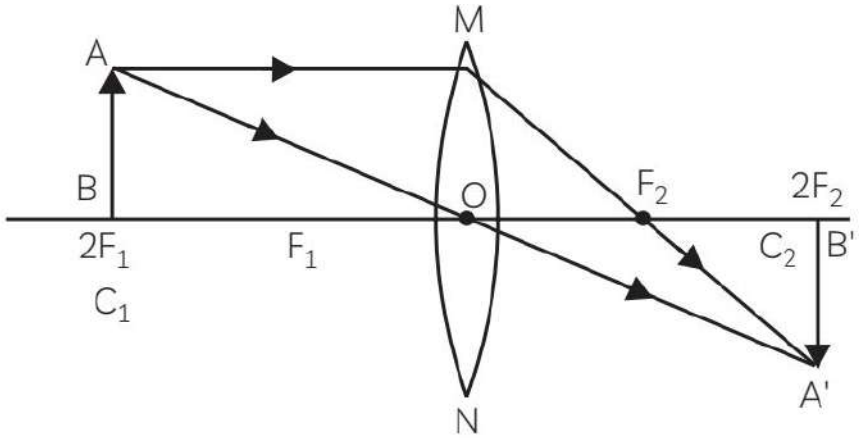
And C = -24 cm
Object will be between F and C and the image will be formed beyond C (centre of curvature). Image will be 4 times magnified, real and inverted.



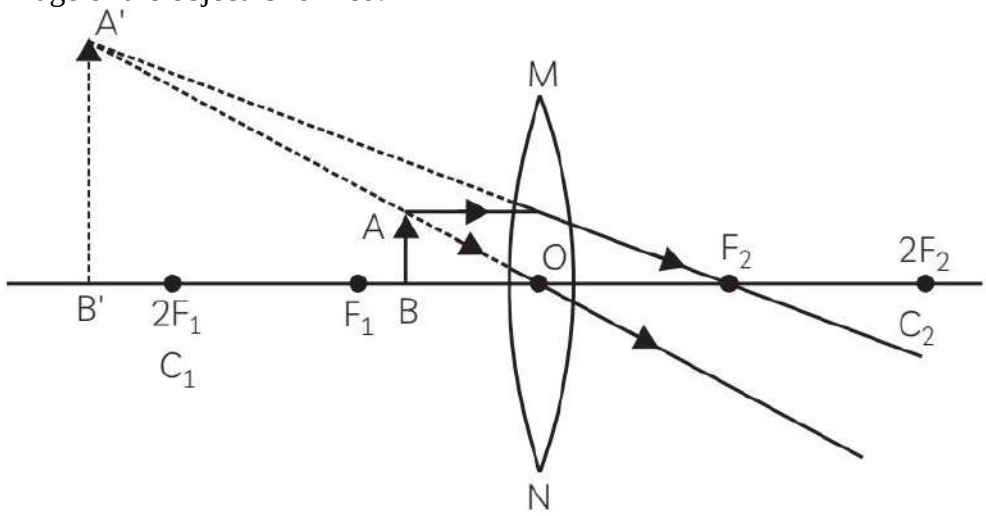
OR

(a) Name the lens which can be used as a magnifying glass. For which position of the object a convex lens form: (i) a real and inverted image of the same size as that of the object? (ii) a virtual and erect image? Draw ray diagram to justify your answer in each case.
(b) One half of a convex lens is covered with a black paper. Will this lens produce a complete image of the object? Draw ray diagram to justify your answer.
Ans: (a) Convex lens can be used as a magnifying glass,
Position of the object:

(i) When an object is placed at centre of curvature, a real, inverted and equal size image is obtained.



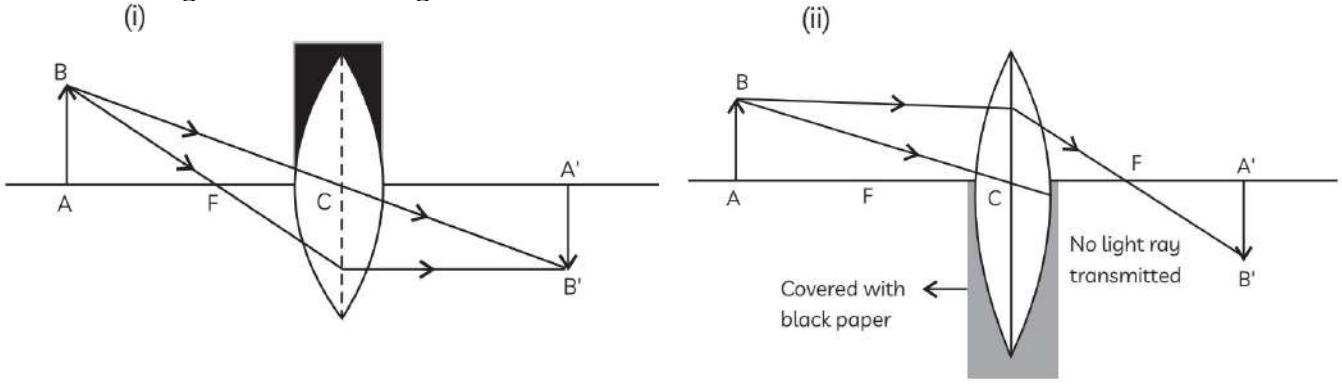
(ii) When an object is placed between the focus and the optical centre of a convex lens, a virtual and erect image of the object is formed.



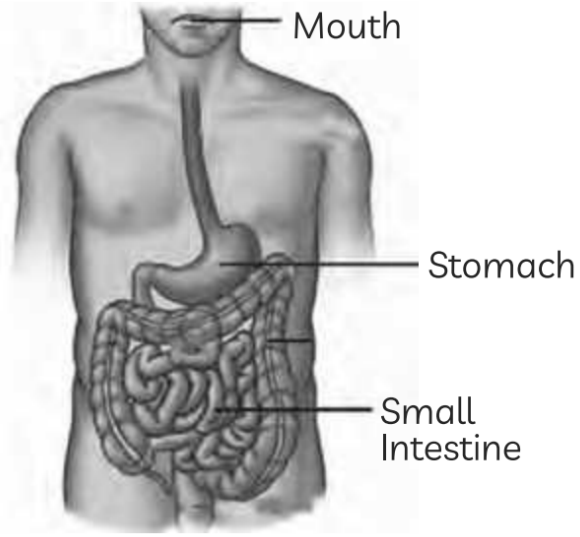
(b) Even when one half of the convex lens is covered with a black paper, the complete image of the object will be formed.

When the upper half of the lens is covered: In this situation, rays of light coming from the object will be refracted by the lower half of the lens. These rays meet at the other side of the lens to form the image of the given object, as shown in the following figure.

When the lower half of the lens is covered: In this situation, rays of light coming from the object will be refracted by the upper half of the lens. These rays meet at the other side of the lens to form the image of the given object, as shown in the following figure. We will get a sharp image but the brightness of the image will be less now.



35. Name three different glands associated with the structures labelled in digestive system as shown in figure. Also write their secretions and their functions.



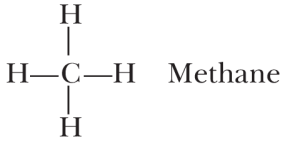
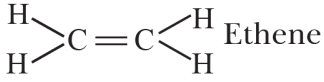
Ans: The different glands, their secretions and functions associated with the human digestive system are tabulated below:

Organ	Gland	Secretion	Enzymes	Action of Enzyme
Mouth	Salivary gland	Saliva	Salivary amylase	Breaks down starch to sugar
Stomach	Gastric glands	Gastric juices	1. Pepsin	Breaks down protein-peptone.
			2. HCl	Kills germs, creates acidic medium.
			3. Mucus	Protects the walls of stomach from the action of HCl acid.
Small Intestine	Liver	Bile Juice		Emulsification of fats and creates alkaline medium.

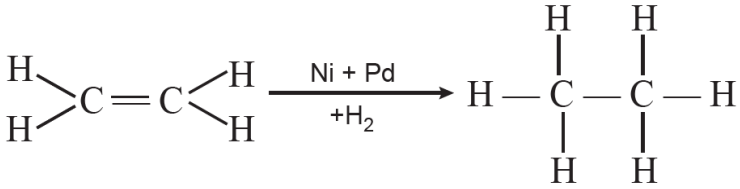
OR

(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.

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**	 Methane
Alkenes	C_nH_{2n} **where n = 2, 3....**	 Ethene
Alkynes	C_nH_{2n-2} **where n = 2, 3....**	H—C ≡ 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.

OR

(a) Explain why carbon forms covalent bond ? Give two reasons for carbon forming a large number of compounds.

(b) Explain the formation of ammonia molecule.

Ans: (a) Carbon has 4 electrons in its outermost shell, and needs to gain or loss 4 electrons to attain nobel gas configuration. Losing or gaining 4 electrons is not possible due to energy considerations, hence it shares electrons to form covalent bonds.

Two reasons for forming large number of compounds are:

1) Catenation: The unique ability of carbon to form bonds with other atoms of carbon giving rise to long chains of different types of compounds.

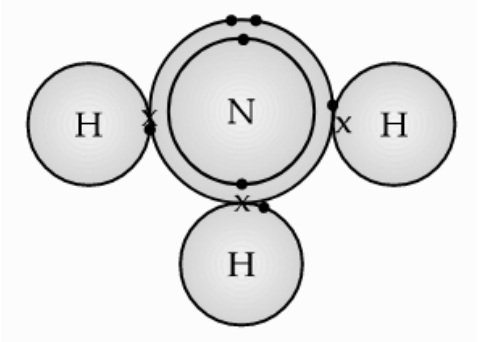
2) Tetravalency: since carbon has a valency of 4, it is capable of bonding with four other atoms of Carbon or atoms of elements like oxygen, hydrogen, nitrogen, sulphur, chlorine etc.

(b) Formation of NH_3 molecule

N - 2,5

H - 1

Three hydrogen atoms each share their 1 electron with nitrogen to form three covalent bonds and make an ammonia molecule (NH_3).



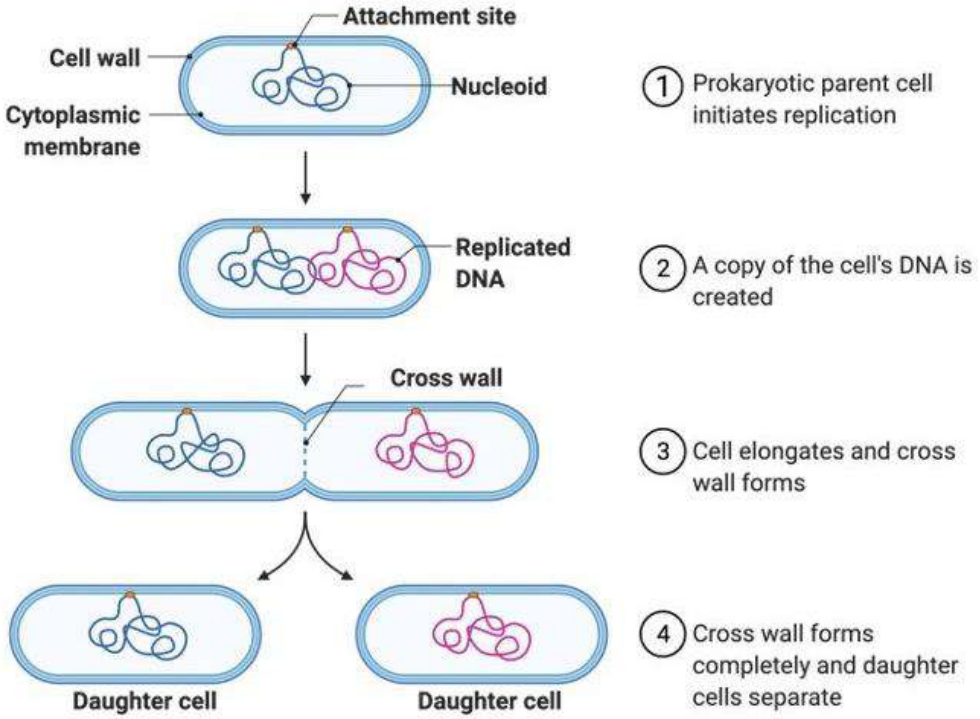
SECTION – E (Case Study Based Questions)

Questions 35 to 37 carry 4 marks each.

37. Case Study – 1

Bacteria follow an asexual mode of reproduction, called binary fission. A single bacterium divides into two daughter cells. These are identical to the parent cell as well as to each other. Replication of DNA within parent bacterium marks the beginning of the fission. Eventually, cell elongates to form two daughter cells.

The diagram shows the process of binary fission in bacteria



The rate and timing of reproduction depend upon the conditions like temperature and availability of nutrients. When there is a favorable condition, E. coli or Escherichia coli produces about 2 million bacteria every 7 hours.

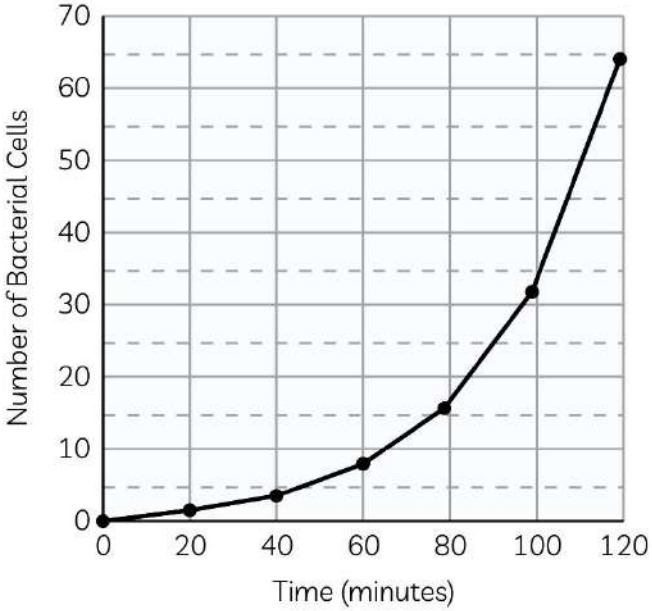
(a) (i) What is the process of the division of a cell into several cells during reproduction in Plasmodium?

(ii) A Planaria worm is cut horizontally in the middle into two halves P and Q such that the part P contains the whole head of the worm. Another Planaria worm is cut vertically into two halves R and S in such a way that both the cut pieces R and S contain half head each. Which of the cut pieces of the two Planaria worms could regenerate to form the complete respective worms?

(b) The rapid spreading of bread would on slices of bread is due to spore formation. Explain spore formation.

OR

(b) Suppose a bacterium reproduces by binary fission every 20 minutes. The new cells survive and reproduce at the same rate. The graph below shows how the bacterial population would grow from a single bacterium. What do you conclude?



Ans: (a) (i) Plasmodium reproduces by multiple fission whereby a single cell divides into a large number of cells.

(ii) P, Q, R and S

Each piece or fragment of Planaria grows into new individual by the method of regeneration. It is carried out by specialized cells.

(b) Spore formation is a common method of asexual reproduction. The hyphae develop sporangia. The nucleus of each sporangium divides several. times. Each nucleus gets surrounded by a bit of cytoplasm and develops into spore. Upon maturation, the sporangium ruptures and spores disperse to grow on to new substratum.

OR

(b) The growth of bacteria population increases exponentially with time. The variation of time and number of bacterial cells is not linear, as the graph is not a straight line. The growth pattern is an exponential increase in number of bacterial cells with time.

38. Case Study – 2

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

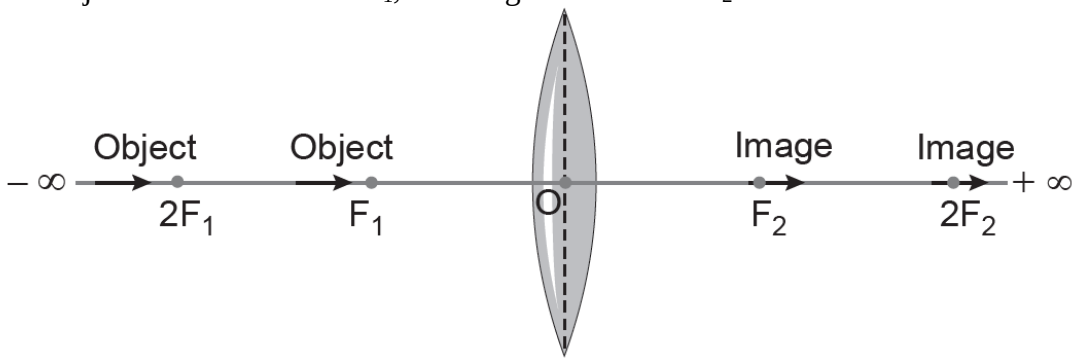
Redox reaction/Combustion reaction

39. Case Study - 3

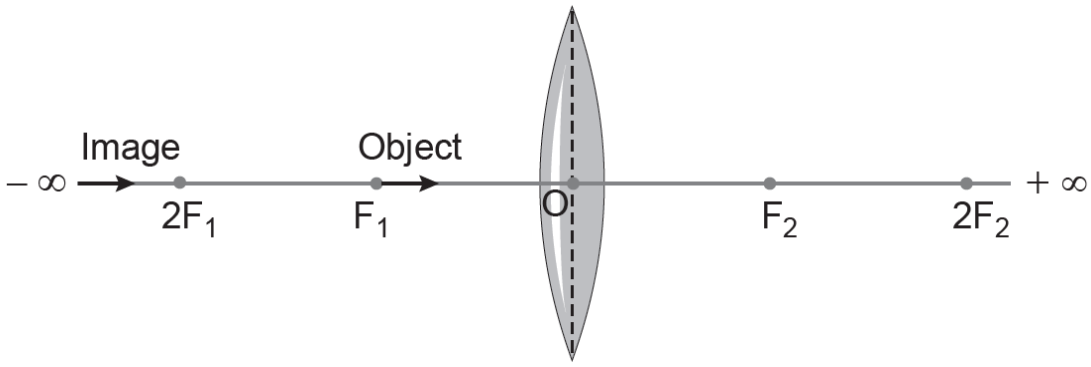
The image formed by a convex lens depends on the position of the object in front of the lens. When the object is placed anywhere between focus and infinity, the image formed by convex lens is real and inverted. The image is not obtained on the screen when the object is placed between focus and the lens.

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.