CBSE

Class X Science

Sample Paper 13

Time: 3 hrs **Total Marks: 80**

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.

(iii) 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.

(iv) Section–B - question no. 21 to 26 are short answer type questions, carrying 2 marks each. Answers to these questions should in the range of 30 to 50 words.

(v) Section–C - question no. 27 to 33 are short answer type questions, carrying 3 marks each. Answers to these questions should in the range of 50 to 80 words.

(vi) 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.

(vii) 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.

(viii) Wherever necessary, neat and properly labelled diagrams should be drawn.

SECTION A

1. State the main difference between an endothermic reaction and an exothermic reaction.(1)

OR

What is wrong with the following chemical equation?

$Mg + O \longrightarrow MgO$

Correct and balance it.

2. A boy dropped a bottle of hydrochloric acid on an egg shell and noticed bubbles of gas. Explain the chemical reaction involved. (1)

3. Which four quantities a, b, c and d are required to balance the equation? (1)

$aFe + bH_2SO_4 \rightarrow cFeSO_4 + dH_2$

(A) 1, 1, 1, 1

(B) 2, 2, 2, 1

(C) 2, 2, 2, 1

(D) 2, 1, 2, 2

4. What is the relation between resistance (R) of filament of a bulb, its power (P) and a constant Voltage (V) applied across it? (1)

5. What is the general name of the substances having infinitely high electrical resistance? (1)

6. What kind of mirror can have a focal length of, -10 cm? (1)

OR

Refractive indices of carbon disulphide and ethyl alcohol are 1.63 and 1.36 respectively. Which is optically denser?

7. How is an ammeter connected in a circuit to measure the current flowing through it? (1)

8. What is the other name of Maxwells right-hand thumb rule? (1)

9. By how much time the day would have been shorter if the earth had no atmosphere? (1)

OR

What colour does the sky appear to an astronaut?

10. What is the mode of nutrition in fungi and plasmodium? (1)

11. Which of the following makes a 3-chambered heart less efficient as compared to a 4-chambered heart? (1)

OR

What regulates the opening and closing of stomata?

12. List any one eco-friendly practice. (1)

OR

Name the process which is a direct outcome of excessive burning of fossil fuels.

13. What is parturition? (1)

For question numbers 13 and 14, two statements are given—one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (i), (ii), (iii) and (iv) as given below:

i) Both A and R are true, and R is the correct explanation of the assertion.
ii) Both A and R are true, but R is not the correct explanation of the assertion.
iii) A is true, but R is false.
iv) A is false, but R is true.

14. **Assertion**: When carbon dioxide gas is passed through lime water, a white precipitate is initially formed. (1)

Reason: The white precipitate is of calcium carbonate which is formed during the reaction.

15. **Assertion**: Food chain is responsible for the entry of harmful chemicals in our bodies. (1)
Reason: The length and complexity of food chains vary greatly.

OR

Assertion: Greater number of individuals are present in lower trophic levels.
Reason: The flow of energy is unidirectional.

16. **Assertion:** Sexual reproduction generates recombination. (1)
Reason: Sexual reproduction involves crossing over.

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) (1×4)

The human respiratory system consists of a group of organs and tissues that help us to breathe. Lungs are the primary organs of the respiratory system which help in the exchange of gases. The other main parts of this system include a series of airways for air passages, blood vessels and the muscles that facilitate breathing.

i) Which are the primary organs of respiration in humans?
   a) Lungs
   b) Bronchi
   c) Trachea
   d) Pharynx

ii) Nostrils are divided by a framework of cartilaginous structure termed as
   a) Flaps
   b) Cartilage
   c) Septum
   d) Rings

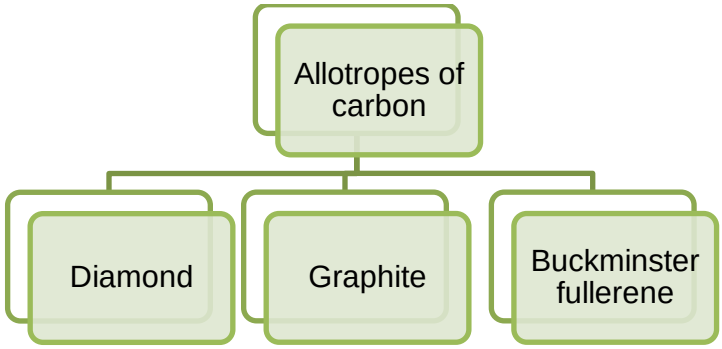
iii) Respiration in humans is primarily
   a) Aerobic
   b) Anaerobic
   c) Partially anaerobic
   d) Partially aerobic

iv) Exchange of gases takes place in the
   a) Bronchi
   b) Alveoli
   c) Trachea
   d) Bronchioles

v) The percentage of nitrogen in exhaled air is
   a) 78%
   b) 0.3%
   c) 21%
   d) 0.03%

18. Read the following and answer any **four** questions from 18 (i) to 18 (v) (1×4)

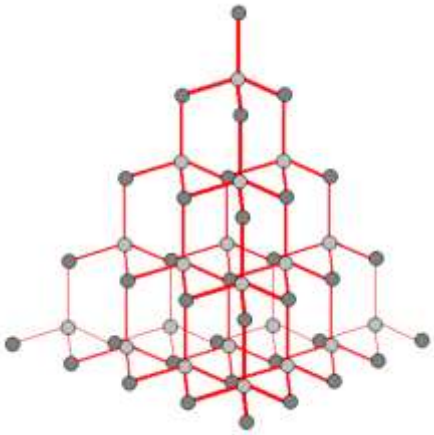
The various physical forms in which an element can exist are called the allotropes of the element. Three allotropes of carbon are:



In diamond, each carbon atom is bonded to four other carbon atoms, forming a three dimensional. It is a non-conductor of electricity since there are no free electrons in a diamond crystal. In graphite, each carbon atom is bonded to three other carbon atoms in the same plane, giving a hexagonal array. It is a very good conductor of electricity due to the presence of free electrons. Fullerene is an allotrope of carbon containing clusters of 60 carbon atoms joined together to form spherical molecules. There are 60 carbon atoms in a molecule of buckminsterfullerene, so its formula is C_{60}. The allotrope was named buckminsterfullerene after the American architect Buckminster Fuller.

i) Which has a 2D hexagonal layered structure?
   a) Graphite
   b) Diamond
   c) Fullerene
   d) all of these

ii) What structure is shown in the diagram?



   a) Graphite
   b) Diamond
   c) Fullerene
   d) all of these

iii) Which is a semiconductor?
   a) Graphite
   b) Diamond
   c) Fullerene
   d) all of these

iv) Which answer shows the correct number of C-C covalent bonds in its allotropes?
   a) Diamond 3, Graphite 3, fullerene 3
   b) Diamond 4, Graphite 3, fullerene 3
   c) Diamond 4, Graphite 3, fullerene 4
   d) Diamond 4, Graphite 4, fullerene 3

v) Three of the following applications of graphite follow from structure-related properties. Which application in the list is not associated with graphite?
   a) Use as a semiconductor.
   b) Use as a lubricant.
   c) Use in pencil leads.
   d) Use in electrodes.

19. Read the following and answer any **four** questions from 19 (i) to 19 (v) (1×4)

The magnetic field at any point is the combined effect of the magnetic field due to the current in the wire and the magnetic field of the Earth. Iron filings when placed near the wire carrying current are arranged in circles due to the magnetic field produced by the current flowing through the wire. However, at the point far away from the wire, the magnetic field due to the earth is predominant as compared to the magnetic field due to current due to which the iron filings are arranged in straight lines. The point where the two fields are equal and opposite is called the neutral point. At the neutral point, the net magnetic field is zero and the compass needle at this point rests in any direction.

(i) How are the magnetic field lines at the point near the straight current-carrying conductor?
   a) Concentric circles pattern whose centre lies on wire
   b) Uniform and parallel line pattern
   c) Spiral pattern
   d) Zig – zag pattern

(ii) To what parameter is the magnitude of the magnetic field produced by the straight conductor directly proportional?
   a) Distance from the conductor
   b) Strength of current in wire
   c) External forces acting on wire
   d) Nature of material

(iii) Which rule is used to find the direction of the magnetic field produced by the straight current-carrying conductor?

a) Maxwell's left-hand thumb rule
b) Maxwell's right-hand thumb rule
c) Fleming's left-hand rule
d) Fleming's right hand rule

(iv) What according to the rule will be the direction of the current when lines of the magnetic field are in the anti-clockwise direction?

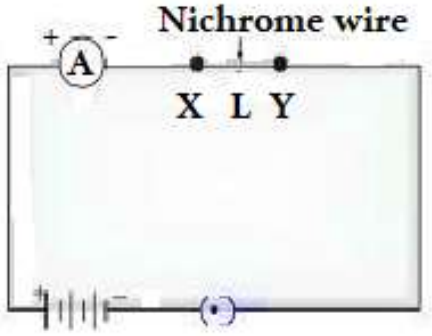
a) Downward direction
b) Left direction
c) upward direction
d) right direction

(v) SI unit of magnetic field is

a) Gauss
b) Coulomb
c) Weber
d) Tesla

20. Read the following and answer any 4 questions from 20 (i) to 20 (v) (1× 4)

In the below circuit, a nichrome wire of length 'L' is connected between points X and Y and note the ammeter reading. The experiment is performed and repeated by inserting another nichrome wire of same thickness but twice the length i.e. '2L'.



i) What are the changes observed in the ammeter readings?

a) Ammeter readings decreases, becomes half
b) Ammeter readings increases, becomes two times
c) Ammeter readings increases becomes quadrupled
d) Ammeter reading decreases becomes one – fourth

ii) What change is occurred in ammeter reading if instead of changing the length the area of cross – section is doubled?

a) Ammeter readings decreases, becomes half
b) Ammeter readings increases, becomes two times
c) Ammeter readings increases becomes quadrupled
d) Ammeter reading decreases becomes one – fourth

iii) If the resistors of 5 ohms and 10 ohms are connected in series in the above circuit. What is the ratio of the current passing through the two resistors?
   a) 2:1
   b) 3:1
   c) 1:2
   d) 1:1

iv) If the resistors are connected in parallel
   a) Current across each resistor is same and voltage changes
   b) Current and voltage across each resistor is same
   c) Current across each resistor varies and voltage remains same
   d) Current changes, voltage changes

v) SI unit of current is denoted as
   a) A
   b) C
   c) I
   d) J

SECTION B

21. Why is there a need to ban the use of polythene bags? (2)

OR

Why a vegetarian food habit help us in getting more energy?

22. Differentiate between single and double circulation found in vertebrates. (2)

23. From amongst the metals sodium, calcium, aluminium, copper and magnesium, name the metal: (2)
(i)Which reacts with water only on boiling, and
(ii)Another which does not react even with steam.

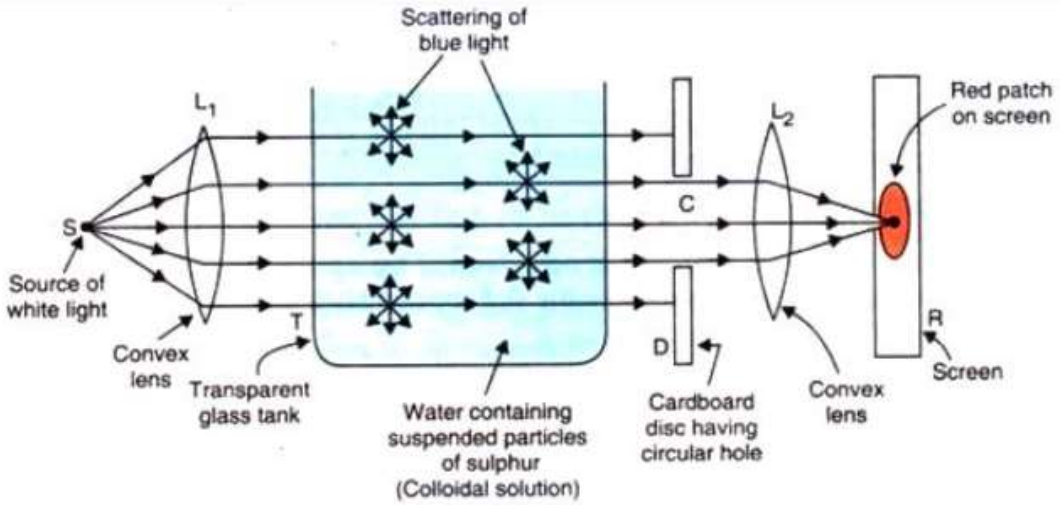
OR

A copper plate was dipped in $AgNO_3$ solution. After certain time, silver from the solution was deposited on the copper plate. State the reason why it happened.

24. Write the chemical formula of washing soda and baking soda. Which of these two is an ingredient of antacids? How do antacids provide relief in stomach ache? (2)

25. Draw a circuit diagram to show how 3 bulbs can be lit from a battery so that 2 bulbs are controlled by the same switch while the third bulb has its own switch. (2)

26. Observe the experimental setup given below and answer the following questions: -



An arrangement for observing the scattering of light in a colloidal solution to show how the sky appears blue, and the sun appears red at sunrise and sunset.

(i) Out of blue light and red light, which one is scattered more easily?
(ii) What causes the scattering of blue component of sunlight in the atmosphere? (2)

SECTION C

27. How will an organism be benefited if it reproduces through spores? (3)

OR

Write the full form of AIDS. Name the causative agent of AIDS. How is this disease transmitted?

28. A few tapioca plants remained in the farmland after harvest. Harvesting was done in summer. Then there was a summer rain. When these plants were harvested and the tubers eaten raw, they tasted sweet. Can you explain the reason for the sweet taste of the tubers? (3)

29. Explain that it is a matter of chance whether a couple will give birth to a boy or a girl. (3)

30. An element reacts with oxygen to form an oxide which dissolves in dilute hydrochloric acid. The oxide formed also turns a solution of red litmus blue. Is the element a metal or non-metal? Explain with the help of a suitable example. (3)

31. An element P belongs to Group 17 and the third period of the periodic table. (3)
(a) Write the electronic configuration of the element. What is its valency?
(b) Predict its nature, whether it is a metal or a non-metal.
(c) Give the formula of the compound formed when it combines with an element Q having a valency three.

32. Write one equation each for the decomposition reactions where energy is supplied in the form of (a) heat, (b) light and (c) electricity. (3)

33. A concave mirror produces a three times larger real image of an object placed at a distance of 20 cm in front of it. Find the position of the image and the nature of the image. Also, find the focal length of the mirror. (3)

SECTION D

34. A water-insoluble substance 'X' on reacting with dilute H_2SO_4 released a colourless and odourless gas accompanied by brisk effervescence. When the gas was passed through water, the solution obtained turned blue litmus red. On bubbling the gas through lime water, it initially became milky and the milkiness disappeared when the gas was passed in excess.

Identify the substance 'X' and write the chemical equations of the reactions involved.

OR

Five solutions A, B, C, D and E when tested with universal indicator showed pH as 4, 1, 11, 7 and 9, respectively. Which solution is (5)

(a) Neutral
(b) Strongly alkaline
(c) Strongly acidic
(d) Weakly acidic
(e) Weakly alkaline

35. Define the terms pollination and fertilisation. Draw a diagram of a pistil showing pollen tube growth into the ovule and label the following: Pollen grain, male gamete, female gamete and ovary. (5)

OR

(a) Explain how the lungs are designed in human beings to maximise the area for the exchange of gases. Why does the air passage not collapse when there is no air in it?
(b) Why is it necessary to separate oxygenated and deoxygenated blood in birds and mammals?

36. Draw the ray diagram and state the nature and position of the image formed when the object is placed at

a) 2F in front of a convex lens
b) Anywhere between the optical centre and infinity of the concave lens

OR

a) What is the mirror formula? Give an expression for the mirror formula.
b) Define the following terms related to spherical mirrors:
   i) Pole
   ii) Centre of curvature
   iii) Principal axis

CBSE
Class X Science
Sample Paper 13 – Solution

SECTION A

1. Exothermic reaction: Reactions involving the release of heat energy.
Endothermic reaction: Reactions involving the absorption of heat energy.

OR

Oxygen should be in molecular form, O_2

$2Mg + O_2 \longrightarrow 2MgO$

2. Egg shell contains calcium carbonate which reacts with acid forming calcium chloride salt, carbon dioxide and water. The bubbles evolved are of carbon dioxide.

$CaCO_{3(aq)} + 2\ HCl_{(aq)} \rightarrow CaCl_{2(aq)} + CO_{2(g)} + H_2O$

3. (A) The balanced chemical reaction is

$Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$

4. $P = \frac{V^2}{R}$

5. Insulators

6. Concave mirror (since focal length is negative).

OR

Carbon disulphide is denser than the ethyl alcohol.

7. Ammeter is connected in series in electric circuit.

8. Maxwell's corkscrew rule.

9. 4 minutes

OR

Sky appears dark to astronauts.

10. <u>Modes of nutrition:</u>

- Fungi- Saprophytic
- Plasmodium- Parasitic

11. In a 3-chambered heart, due to mixing of blood in a single ventricle, the parts of the body do not get blood saturated with oxygen. Therefore, a 3-chambered heart is less efficient as compared to a 4-chambered heart.

OR

The opening and closing of stomata is regulated by kidney-shaped cells called guard cells.

12. Carrying cloth bag while shopping is an eco-friendly practice.

OR

Global warming is a direct outcome of excessive burning of fossil fuels.

13. The birth of a fully developed foetus in completion of gestation is called parturition.

14. Both A and R are true, and the reason is the correct explanation of the assertion. Lime water contains traces of calcium hydroxide dissolved in it. It reacts with carbon dioxide gas to form a white precipitate of calcium carbonate.

15. Both A and R are true, but reason is not correct explanation of assertion.

If any harmful chemical enters the food chain, it gets magnified as it moves along the food chain to higher trophic levels. The length and complexity of food chains vary greatly. Some food chains are shorter with three trophic levels while some are longer with more than three trophic levels.

OR

Both A and R are correct, but reason is not correct explanation of assertion.

Lower trophic levels contain more number of individuals. The flow of energy in a food chain is unidirectional.

16. Both A and R are true, and reason is the correct explanation of the assertion. Sexual reproduction involves fusion of two different gametes and crossing over which results in variation and recombination.

17.

i) a) Lungs are the primary organs of respiration in humans.
ii) c) Nostrils are divided by a framework of cartilaginous structure termed as septum.
iii) a) Respiration in humans is primarily aerobic in the presence of oxygen.
iv) b) Exchange of gases takes place in the alveoli.
v) a) The percentage of nitrogen in exhaled air is 78%.

18.

i) (a) Graphite has a 2D hexagonal layered structure.
ii) (b) Diamond has each carbon atom is bonded to four other carbon atoms, forming a three dimensional structure.
iii) (c) Fullerene acts as a semiconductor.

iv) (b) The number of C-C covalent bonds in Diamond are 4, Graphite are 3 and fullerene are 3.

v) (a) Graphite is not used as a semiconductor.

19.

(i) a) Concentric circles pattern whose centre lies on wire

The magnetic field lines around the straight conductor carrying current are concentric circles whose centre lies on the wire.

(ii) b) Strength of current in wire

The magnitude of the magnetic field is directly proportional to the current passing in the wire.

(iii) b) Maxwell's right – hand thumb rule

Maxwell's right-hand thumb rule is used to find the direction of magnetic field produced by the straight current-carrying conductor.

(iv) c) upward direction

According to Maxwell's right-hand rule, the current will be flowing in the upward direction when the direction of the magnetic field is in the anti-clockwise direction.

(v) d) Tesla

SI unit of magnetic field is Tesla (T).

20.

i) a) ammeter reading decreases, becomes half

The increase in length of wire increases the resistance in the circuit and thus, the current decreases. Hence the ammeter readings are reduced and becomes half the initial readings.

ii) b) ammeter reading increases and becomes two times

When the area of wire increases, the resistance decreases thus the current in the circuit will increase. Thus, the ammeter readings will increase and becomes twice the initial readings.

iii) d) 1:1

When resistors are connected in series the current flowing through all resistors is same. Thus, the ratio of the currents for these two resistors is 1:1

iv) c) current across each resistor varies and voltage remains same

When the resistors are connected in parallel to each other the voltage across each resistor is same while the current changes.

v) a) A

SI unit of current is denoted as A (Ampere).

SECTION B

21. Polythene bags need to be banned because they are non-biodegradable; microorganisms are unable to decompose them. So, they keep on accumulating in the environment and cause land pollution.

OR

A person having a vegetarian food habit is close to the producer level and gets maximum amount of energy as compared to the organisms at a higher trophic level as only 10% of energy is passed on from one trophic level to another.

22. Differences between single and double circulation found in vertebrates:

Single circulation	Double circulation
• Blood passes through the heart only once in one complete cycle.	• Blood passes through the heart twice in one complete cycle.
• Heart has only deoxygenated blood.	• Heart has both oxygenated and deoxygenated blood.
• It is less efficient.	• It is more efficient.

23.

(i) Aluminium reacts with water only on boiling.

(ii) Copper does not react even with steam.

OR

Silver gets deposited on the copper plate because copper is more reactive than silver and hence displaces silver from silver nitrate solution.

24.

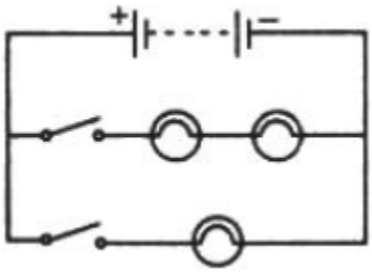
(a) Washing soda: $Na_2CO_3.10H_2O$

(b) Baking soda: $NaHCO_3$

Baking soda is an ingredient of antacids. It neutralizes HCl released in stomach and eases stomach-ache.

$NaHCO_3 + HCl \rightarrow NaCl + CO_2 + H_2O$

25.



26.

(i) Blue light scatters more easily due to its smaller wavelength.

(ii) Gas molecules present in the air.

SECTION C

27. There are several advantages if the organism reproduces by spores:

- There are large numbers of spores formed from one sporangium.
- The spores can remain in dormant state till the favourable conditions are available.
- The spores have thick covering called cyst which helps them to survive in unfavourable conditions.
- The spores are very light and can spread easily through water, air or through the animals.

OR

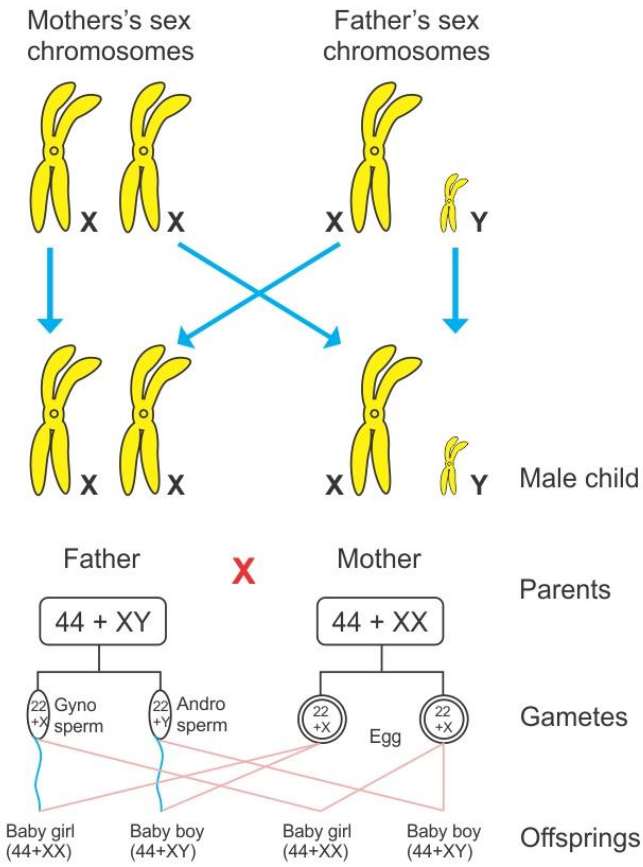
'AIDS' stands for Acquired Immuno Deficiency Syndrome. Its causative agent is Human Immunodeficiency Virus (HIV). It is transmitted from an infected person to a healthy person in the following ways.

- Through sexual intercourse, if one of the partner is infected
- Through contaminated blood transfusion
- The virus from infected mother may cross through the placenta and reach the embryo in the womb

28. Before the rains, the tubers contained starch. When it rained, the plants started growing again producing new foliage. So, the plant converted the starch in the tuber to sugar, a water-soluble form, in order to be transported. This sugar made the tuber sweet.

29.

- Humans have 22 pairs of autosomes and 1 pair of sex chromosomes.
- The male parent produces X-bearing and Y-bearing gametes or sperms.
- The female parent produces only X-bearing gametes or eggs.
- During reproduction, the combination of an X-bearing gamete from the male with an X-bearing gamete from the female results in an offspring with the genetic constitution XX. The child produced is a female or a daughter.
- The combination of a Y chromosome from the male with an X chromosome from the female results in an offspring with the genetic constitution XY. The child produced is a male or a son.
- Thus, the birth of a boy or a girl is purely a matter of chance and entirely depends on the type of sperm which fertilises the egg.



30. It is a metal.

$$4Na(s) + O_2 \longrightarrow 2Na_2O(s)$$

$$Na_2O(S) + H_2O(l) \longrightarrow 2NaOH(aq)$$

$$Na_2O(s) + 2HCl(dil) \longrightarrow 2NaCl(aq) + H_2O(l)$$

31.

(a) Electronic configuration of the element is 2, 8, 7 and its valency is 1.

(b) Non-metal

(c) The formula of the compound formed when element X combines with an element Y is PQ_3.

32.

(a) Decomposition reaction where heat is supplied for energy:

$$2Pb(NO_3)_2 \xrightarrow{\Delta} 2PbO + 4NO_2 + O_2$$

(b) Decomposition reaction where light is supplied for energy:

$$2AgCl \xrightarrow{hv} 2Ag + Cl_2$$

(c) Decomposition reaction where electricity is supplied for energy:

$$2NaCl \xrightarrow{\text{electricity}} 2Na + Cl_2$$

33. m = −3

u = −20 cm

m = −v/u

−3 = −v/ (−20)

v = −60 cm

The image is located at a distance of 60 cm, and the nature of the image is enlarged, real and inverted.

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

$$\frac{1}{f}=\frac{1}{-60}+\frac{1}{-20}$$

$$\frac{1}{f}=\frac{-80}{1200}$$

$$f=-15 \text{ cm}$$

Thus, the focal length of a concave mirror is 15 cm.

SECTION D

34. The water-insoluble substance 'X' is metal carbonate $CaCO_3$. On reacting with dilute H_2SO_4, it releases a colourless and odourless gas accompanied by brisk effervescence of carbon dioxide.

$$CaCO_{3\,s} + H_2SO_{4(aq)} \longrightarrow CaSO_{4(s)} + H_2O_{(l)} + CO_{2(g)}$$

When the carbon dioxide gas was passed through water, the solution obtained turned blue litmus red.

$$CO_{2(g)} + H_2O_{(l)} \longrightarrow H_2CO_{3(aq)}$$

carbonic acid

On bubbling the carbon dioxide gas through lime water, it initially became milky.

$$Ca(OH)_{2\,aq} + CO_{2(g)} \longrightarrow CaCO_{3(s)} + H_2O_{(l)}$$

(milkiness)

The milkiness disappeared when carbon dioxide gas was passed in excess.

$$CaCO_{3\,aq} + CO_{2(g)} \longrightarrow H_2O_{(l)} + Ca(OH)_2$$

Excess milkiness disappeared

OR

(a) Neutral: Solution D with pH 7

(b) Strongly alkaline: Solution C with pH 11

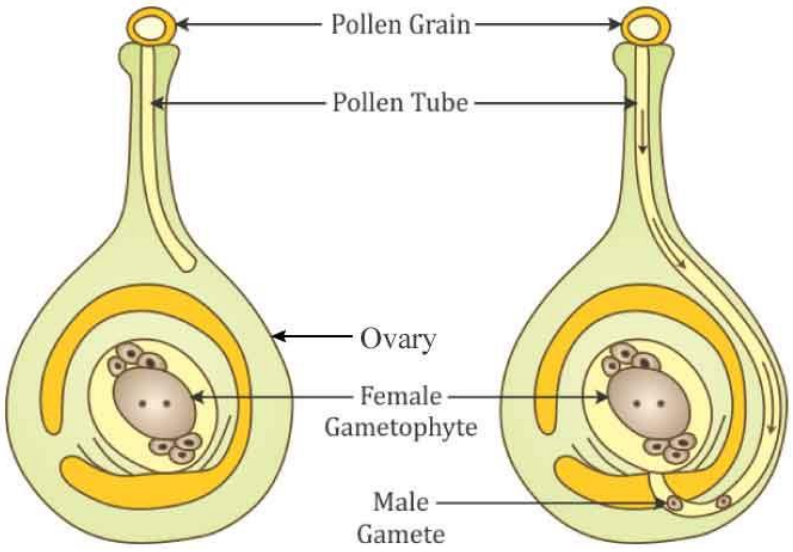
(c) Strongly acidic: Solution B with pH 1

(d) Weakly acidic: Solution A with pH 4

(e) Weakly alkaline: Solution E with pH 9

pH is inversely proportional to hydrogen ion concentration. Hence, the pH can be arranged in the increasing order of the concentration of hydrogen ions as 11 < 9 < 7 < 4 < 1.

35. Pollination: Transfer of pollen grains from the anther to the stigma is called pollination.
Fertilisation: The process of fusion of male and female gametes to form a zygote which eventually develops into an embryo is called fertilisation.



OR

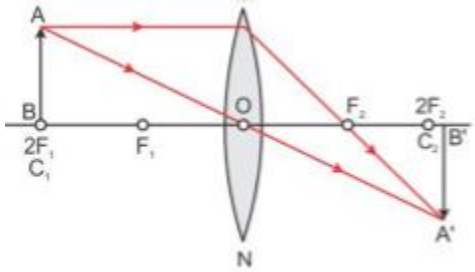
(a) The lungs contain millions of alveoli which provide a surface for the exchange of gases. An extensive network of blood vessels is present in the wall of the alveoli. By lifting our ribs and flattening the diaphragm, the chest cavity becomes spacious. Air is sucked into the lungs and alveoli. Oxygen from the breath diffuses into the blood and carbon dioxide from the blood (brought from all over the body) diffuses out to the air.

The trachea has rings of cartilage around it. These rings of cartilage prevent the trachea from collapsing when we breathe out.

(b) Warm-blooded animals such as birds and mammals maintain a constant body temperature by cooling themselves when they are in a hotter environment and by warming their bodies when they are in a cooler environment. Hence, these animals require more oxygen (O2) for more cellular respiration so that they can produce more energy to maintain their body temperature. Thus, it is necessary for them to separate oxygenated and de-oxygenated blood, so that their circulatory system is more efficient and can maintain their constant body temperature.

36.

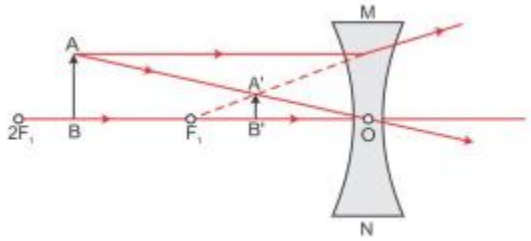
a) When an object is placed at 2F in front of the convex lens:



Object at $2F_1$

Nature of the image is real, inverted and is of the same size as that of the object.
Position of the image formed is at a distance of 2f on the other side of the image.

b) When an object is placed anywhere between the optical centre and infinity of the concave lens:



Object between infinity and optical centre

Nature of the image is virtual, erect and diminished.
Position of the image is between the optical centre and the focus.

OR

a) The relation between the object distance (u), image distance (v) and focal length (f) of a spherical mirror is given by the mirror formula.
The object distance (u), image distance (v) and focal length (f) of a spherical mirror are related as

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

b)

i) The pole (P) of a spherical mirror is the centre of the mirror.
ii) The centre of curvature (C) of a spherical mirror is the centre of the hollow sphere of glass, of which the spherical mirror is a part.
iii) The principal axis of a spherical mirror is a straight line passing through the centre of curvature C and pole P of the spherical mirror.