Maharashtra State Board
Class X Science and Technology
Board Paper - 2013

Time: 2 1/2 hrs **Max. Marks: 60**

Note:

(i) Use the same answer book for Section A and Section B.
(ii) Draw well-labelled diagrams wherever necessary.
(iii) All questions are compulsory.
(iv) Students should write the answers of questions in sequence.

SECTION A

1. (A) Fill in the blanks: **[2]**

(1) The chemical formula for rust is..... .
(2) The law used by Newlands to arrange elements is known as..... .

(B) State whether the following statements are true *or* false: **[2]**

(1) The pH of rainwater is 7.
(2) The SI unit of charge is volt.

(C) Rewrite the following table so as to match the second and third columns with the first column: **[3]**

Column I	Column II	Column III
1. Dispersion	Long-sightedness	Twinkling of stars
2. Refraction	Splitting of white light into component colours	Convex lens
3. Hypermetropia	Change in the direction of the ray of light due to change in medium	Spectrum of seven colours

2. Answer the following questions: **[3 × 2 = 6]**

(1) Distinguish between Conductors and Insulators.
(2) Why should the wires carrying electricity not be touched barefooted?
(3) Calculate the focal length of a corrective lens having power +2.5 D.

3. Answer the following questions (any *four*): [4 × 3 = 12]

(1) The atomic masses of three elements A, B and C having similar chemical properties are 7, 23 and 39, respectively.

(a) Calculate the average atomic mass of elements A and C.

(b) Compare the average atomic mass with atomic mass of B.

(c) What could the elements A, B and C be?

(2) When the substance 'A' is added to a solution of $BaSO_4$, a yellow precipitate is formed.

(a) What do you think substance A is likely to be?

(b) Name the precipitate.

(c) Which type of reaction is this?

(3) A person has sour taste in the mouth and a burning sensation of the stomach.

(a) What is he suffering from?

(b) Why does it happen?

(c) What substance is used as a remedy?

(4) Write any *three* properties of magnetic lines of force.

(5) Explain how the formation of a rainbow occurs.

4. Answer the following (any *one*): [5]

(1) What is myopia? Explain *two* possible reasons of myopia. How can it be corrected? Explain with a suitable diagram.

(2) Find the expression for resistors connected in series. Write any *two* characteristics of a series combination of resistors.

SECTION B

5. (A) Fill in the blanks: **[2]**

(1) Dominant character masks the ..... character.

(2) ..... artery takes the blood to the lungs for oxygenation.

(B) State whether the following statements are true *or* false: **[3]**

(1) Roots of plants grow towards light.

(2) Hormones secreted by endocrine glands are directly released into the bloodstream.

(3) If the X chromosome is inherited from the mother and the Y chromosome from the father, then the offspring will be a male.

(C) Write the structural formula of Methane. **[1]**

(D) Name the following: **[1]**

Metal which forms an amphoteric oxide.

6. Answer the following sub-questions: **[3 × 2= 6]**

(1) 'A' is an element having four electrons in its outermost orbit. An allotrope 'B' of this element is used as a dry lubricant in machinery and in pencil leads. So

(i) Write the name of element 'A' and its allotropes.

(ii) State whether 'B' is a good conductor or non-conductor of electricity.

(2) 'E' is an element which reacts with oxygen to form an oxide E_2O. An aqueous solution of E_2O turns red litmus blue, so

(i) What is the nature of oxide E_2O?

(ii) Write the name of element 'E'.

(3) Write two points of differences between arteries and veins.

7. Answer the following questions (any *four*): [4 × 3 = 12]

(1) Write any *three* differences between metals and non-metals with respect to their physical properties.

(2) Define:

(i) Saturated hydrocarbon

(ii) Unsaturated hydrocarbon

(iii) Catenation

(3) Write the names and functions of *three* parts of the human nervous system in which it is divided.

(4) What is meant by sexual reproduction? Name its two main processes.

(5) Name any *three* parts of the female reproductive system in human beings. Write *one* function of each.

8. Write the answer of any *one* question given below: [5]

(1) Write the names of different parts of the human digestive system and explain the functions of any *three* parts.

(2) Answer the following:

(a) Draw a diagram of DNA showing genes.

(b) What are the peculiarities of its structure?

Experiment - based MCQs

Max. Marks: 20

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1. ..... is a combination reaction.

(a) $Cu + H_2SO_4 \longrightarrow CuSO_4 + H_2$

(b) $H_2 + Cl_2 \longrightarrow 2HCl$

(c) $2HgO \xrightarrow{\Delta} 2Hg + O_2$

(d) $CaCO_3 \xrightarrow{\Delta} CaO + CO_2$

2. Reddish brown deposit of ..... is formed on iron nails kept in a solution of copper sulphate.

(a) Cu_2O

(b) Cu

(c) CuO

(d) CuS

3. The litmus paper or the litmus solution is obtained from ..... plants.

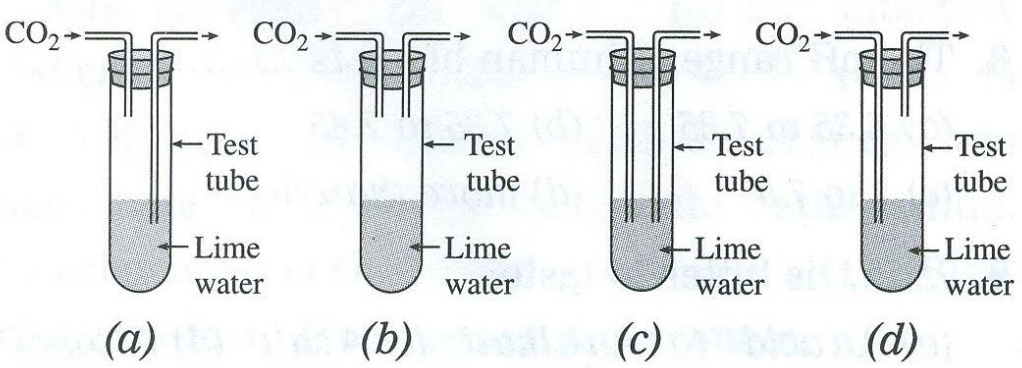
(a) Moss

(b) Rose

(c) *Hibiscus*

(d) Lichen

4. ..... is the correct set up to pass CO_2 through limewater.



5. If there are 8 divisions between the 0 A mark and 0.4 A mark of an ammeter, then its least count is ……..

(a) 0.050 A
(b) 0.025 A
(c) 0.040 A
(d) 0.020 A

6. The equivalent resistance of the parallel combination of two resistors of 5 Ω and 10 Ω is ……

(a) 15 Ω

(b) $\frac{10}{3}$ Ω

(c) $\frac{3}{10}$ Ω

(d) 5 Ω

7. When a resistor of 2 Ω is connected to a cell of negligible internal resistance, the current through a 2 Ω resistor is 1 A. If another resistor of 8 Ω is connected in series with the first one, then the current through the 2 Ω resistor will be about ……

(a) 1 A
(b) 0.25 A
(c) 0.20 A
(d) 10 A

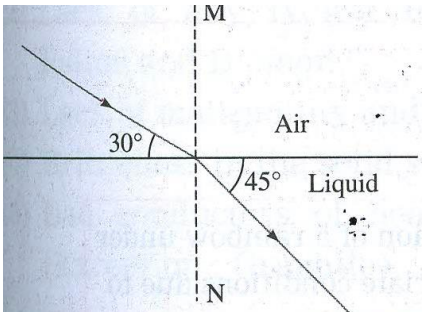
8. The image formed by a concave lens is always ……

(a) Real, inverted and diminished
(b) Real, inverted and magnified
(c) Virtual, erect and magnified
(d) Virtual, erect and diminished

9. The power of a concave lens of focal length 25 cm is ……

(a) +4.0 D
(b) +5.0 D
(c) −4.0 D
(d) −5.0 D

10. The figure shows the path of a ray of light from air into liquid. What is the refractive index of the liquid?



(a) $\frac{\sin 45^\circ}{\sin 60^\circ}$ **(b)** $\frac{\sin 60^\circ}{\sin 45^\circ}$ **(c)** $\frac{\sin 45^\circ}{\sin 30^\circ}$ **(d)** $\frac{\sin 30^\circ}{\sin 45^\circ}$

11. The speed of light in a transparent medium having absolute refractive index 1.25 is ……

(a) 1.25×10^8 m/s
(b) 2.4×10^8 m/s
(c) 3.0×10^8 m/s
(d) 1.5×10^8 m/s

12. A solution of $Al_2(SO_4)_3$ in water is ……

(a) Blue
(b) Pink
(c) Green
(d) Colourless

13. 2 ml of ethanoic acid was taken in each of the test tubes A, B and C, and 2 ml, 4 ml and 6 ml of water was added respectively to them. A clear solution is obtained in ……

(a) Test tube A
(b) Test tube B
(c) Test tube C
(d) All the test tubes

14. To observe stomata in a dicot leaf, we must prepare a slide by taking ……

(a) The crushed leaf
(b) The upper epidermis of the leaf
(c) The lower epidermis of the leaf
(d) The central part of the leaf

15. A student soaked 5 g of raisins in beaker A containing 25 ml of ice cold water and another 5 g of raisins in beaker B containing 25 ml of tap water at room temperature. After one hour, the student observed that ……

(a) The water absorbed by raisins in beaker A is more than the water absorbed by raisins in beaker B.

(b) The water absorbed by raisins in beaker B is more than the water absorbed by raisins in beaker A.

(c) The amount of water absorbed by raisins in both the beakers is the same.

(d) No water was observed by raisins in any of the beakers.

16. ……. stain will clearly show *Amoeba* and *Paramoecium* in a drop of water taken on a slide and observed under a microscope.

(a) Methylene blue

(b) Iodine

(c) Safranin

(d) Eosin

17. Suresh observed a slide of *Amoeba* with elongated nuclei. It would represent …….

(a) Budding

(b) Fragmentation

(c) Binary fission

(d) Regeneration

18. Riya prepared limewater and used it the next month to show that CO_2 is produced during respiration. Which of the following is true?

(i) White precipitate will be formed.

(ii) White precipitate will not be formed.

(iii) Limewater should be fresh.

(iv) Limewater can be used any time.

(a) (ii) is correct.

(b) (ii) and (iv) are correct.

(c) (i) and (iv) are correct.

(d) (ii) and (iii) are correct.

19. In the experiment to test the presence of starch, the leaf is boiled in alcohol using a water bath because …….

(a) Alcohol softens the leaf

(b) Alcohol prevents iodine from entering the leaf

(c) Alcohol allows iodine to enter the leaf

(d) Alcohol dissolves the chlorophyll

20. The reaction of iron nails with copper sulphate solution is a ……. reaction.

(a) Combination

(b) Decomposition

(c) Displacement

(d) Double displacement

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SECTION A

1. (A)

(1) $Fe_2O_3 . x H_2O$
(2) Newlands' octaves

(B)

(1) False. The pH of rainwater is less than 7.
(2) False. The SI unit of charge is coulomb.

(C)

Column I	Column II	Column III
1. Dispersion	Splitting of white light into component colours	Spectrum of seven colours
2. Refraction	Change in the direction of the ray of light due to change in medium	Twinkling of stars
3. Hypermetropia	Long-sightedness	Convex lens

2.

(1) Conductors and Insulators

Conductors	Insulators
1. A substance which has very low electrical resistance is called a conductor.	1. A substance which has infinitely high electrical resistance is called an insulator.
2. Conductors contain charge carriers which can be easily accelerated by a potential difference.	2. Insulators do not contain charge carriers which can be easily accelerated by a potential difference.
3. Silver and copper are conductors.	3. Wood and glass are insulators.

(2)

(i) When wires carrying electricity are touched barefooted, a large current may pass through our body.

(ii) As a result, we may get a severe electric shock. It may even cause death. Hence, wires carrying electricity should not be touched barefooted.

(3) Solution: Data: Convex lens, P = +2.5 D, f = ?

$$P = \frac{1}{f}$$

$$\therefore 2.5\ \text{D} = \frac{1}{f}$$

$$\therefore f = \frac{1}{2.5\ \text{D}} = 0.4\ \text{m} = 40\ \text{cm}$$

The focal length of the lens is 40 cm.

3.

(1)

(a) The average atomic mass of elements A and C = $\frac{7+39}{2} = \frac{46}{2} = 23$

(b) The average atomic mass of elements A and C is equal to the atomic mass of element B.

(c) A is lithium, B is sodium and C is potassium.

(2)

(a) The substance 'A' is potassium chromate (K_2Cr0_7)·

(b) The name of the yellow precipitate is barium chromate ($BaCr0_4$).

(c) The type of chemical reaction is double displacement.

(3)

(a) The person is suffering from acidity.

(b) The stomach of the person produces dilute acid which helps in the digestion of the food which he eats. When the production of acid is more than the required amount, the person suffers from acidity which causes a burning sensation of the stomach.

(c) The following substances can be used as a remedy:

(1) Sodium bicarbonate ($NaHCO_3$)
(2) Limewater mixed with butter
(3) Jaggery
(4) Cold milk

(4) Properties of magnetic lines of force:

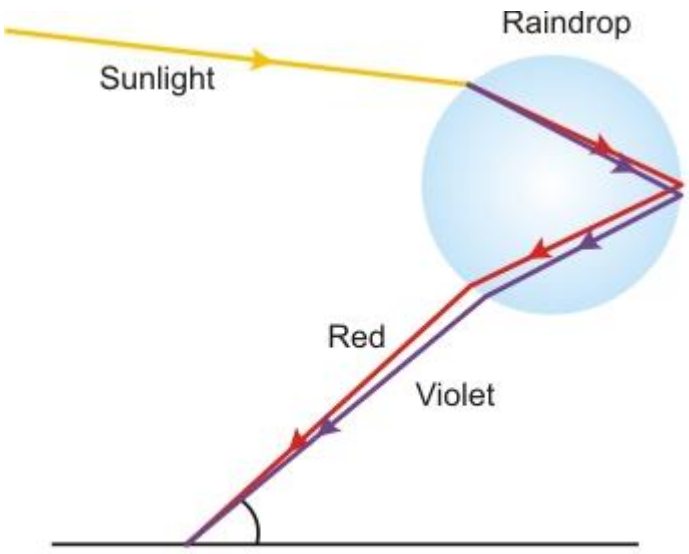
(1) Magnetic lines of force (or magnetic field lines) are closed continuous curves. They start from the North Pole and end at the South Pole.

(2) The tangent at any point on a magnetic line of force gives the direction of the magnetic field at that point.

(3) No two magnetic lines of force can intersect each other.

(4) Magnetic lines of force are crowded where the magnetic field is strong, and they are far from each other where the field is weak.

(i) The formation of a rainbow in the sky is a combined result of refraction, dispersion and reflection of sunlight by water droplets present in the atmosphere after it has rained.



Formation of rainbow

(ii) Sunlight is a mixture of seven colours: Violet, indigo, blue, green, yellow, orange and red. After it has stopped raining, the atmosphere contains a large number of water droplets. When sunlight is incident on a water droplet, there is
   (a) Refraction and dispersion of light as it passes from air to water
   (b) Internal reflection of light inside the droplet
   (c) Refraction of light as it passes from water to air

(iii) The refractive index of water is different for different colours, being maximum for violet and minimum for red. Hence, there is dispersion of light (separation into different colours) as it passes from air to water.

(iv) The combined action of different water droplets (acting like tiny prisms) produces a rainbow with red colour on the outer side and violet colour on the inner side. The remaining five colours lie between these two colours. The rainbow is seen when the Sun is behind the observer and the water droplets are in the front.

4.

(1) Myopia or near-sightedness is the defect of vision in which a human eye can see nearby objects distinctly but is unable to see distant objects clearly. In this case, the image of a distant object is formed in front of the retina instead of on the retina.

Possible reasons of myopia:

(i) Ciliary muscles do not relax sufficiently. Therefore, the converging power of the eye lens becomes high.

(ii) The distance between the eye lens and the retina increases (relative to the normal eye) as the eyeball is lengthened (elongated) or the eye lens is curved.

Correcting myopia:

(i) Myopia is corrected using a suitable concave lens. Light rays are diverged by the concave lens before they strike the eye lens.

(ii) A concave lens of appropriate power is chosen to produce the required divergence. Hence, after the converging action of the eye lens, the image is formed on the retina.

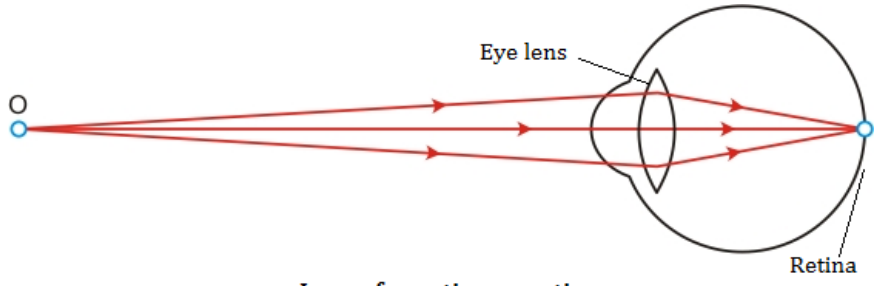


Image formation on retina

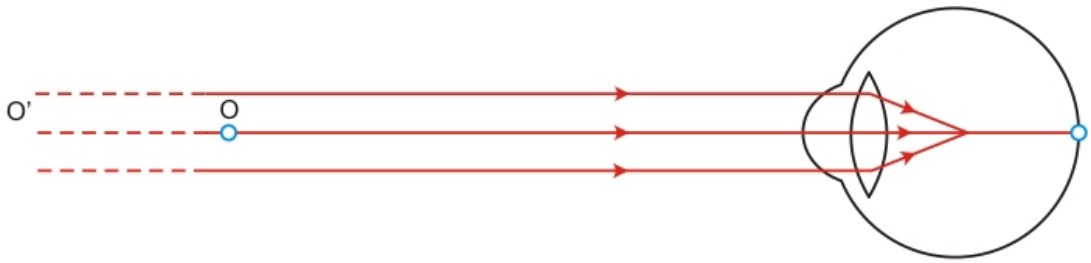
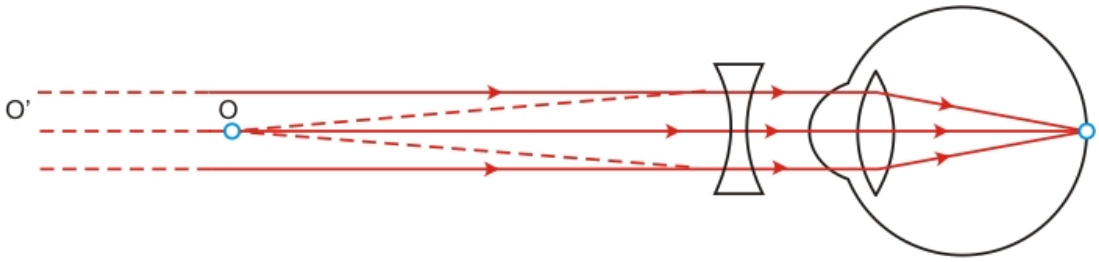
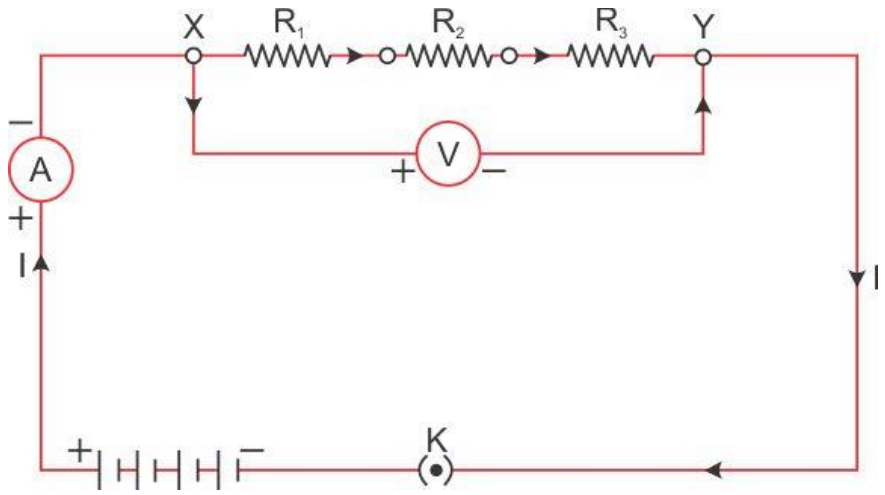


Image formation in Myopia



Correction of Myopia

(2) When two or more resistors are joined from end to end, the resistances are connected in series.



The current in series remains the same across all the resistors.

The potential difference is the sum of potential differences across all the individual resistors.

$$V = V_1 + V_2 + V_3 \quad \text{... (1)}$$

Let I be the current in the circuit.

On applying Ohm's law to the entire circuit, we get

$$V = IR_s \quad \text{... (2)}$$

Here, R_s is the combined resistance of the circuit.

Now, applying Ohm's law to individual resistances, we get

$$V_1 = IR_1$$
$$V_2 = IR_2 \quad \text{... (3)}$$
$$V_3 = IR_3$$

From equations (1), (2) and (3), we get

$$IR_s = IR_1 + IR_2 + IR_3$$
$$\therefore R_s = R_1 + R_2 + R_3$$

Here, $\mathbf{R_s}$ is the resultant resistance. Thus, the resultant resistance of a series combination of resistors is the sum of individual resistances.

The resultant resistance is greater than all the resistances.

Characteristics of series combination of resistors:

(i) The same current flows through each resistor.

(ii) The voltage (potential difference) across the combination is equal to the sum of the voltage drops across the individual resistors.

(iii) The effective resistance of the combination is equal to the sum of the individual resistances.

(iv) The effective resistance of the combination is greater than any of the individual resistances.

(v) The voltage across each resistor is directly proportional to the resistance of the resistor.

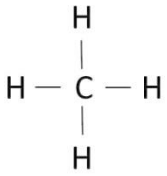
(vi) The series combination can be used to increase the resistance in a circuit.

SECTION B

5. **(A)**
   (1) Recessive
   (2) Pulmonary

   (B)
   (1) False. Roots of plants grow towards water and gravity.
   (2) True
   (3) True

   (C) Structural formula of methane:



   (D) Aluminium

6.

(1)

(i) The name of the element 'A' is carbon. The name of its allotrope is graphite.

(ii) The allotrope 'B', i.e. graphite, is a good conductor of electricity.

(2)

(i) The nature of oxide E_2O is basic.

(ii) The name of the element 'E' is sodium.

(3) Arteries and Veins

Arteries	**Veins**
1. Arteries are blood vessels which carry blood away from the heart.	1. Veins are blood vessels which carry blood towards the heart.
2. Arteries are thick-walled blood vessels.	2. Veins are thin-walled blood vessels.
3. The blood flow in arteries is rapid and under higher blood pressure.	3. The blood flow in veins is slower and under lower blood pressure.
4. Arteries are situated deep inside the body.	4. Veins are situated superficially in the body.
5. Arteries do not have valves.	5. Veins have valves to prevent the backflow of blood.
6. Except for the pulmonary artery, all arteries carry oxygenated blood.	6. Except for the pulmonary vein, all veins carry deoxygenated blood.

7.

(1) Metals and Non-metals

Metals	Non-metals
1. Metals have lustre.	1. Non-metals have no lustre. Exceptions: Iodine and diamond
2. They are generally good conductors of heat and electricity.	2. They are bad conductors of heat and electricity. Exception: Graphite
3. They are generally solids at room temperature. Exceptions: Mercury and gallium are liquids.	3. They are generally gases and solids at room temperature. Exception: Bromine is a liquid.
4. Metals form basic oxides.	4. Non-metals form acidic or neutral oxides.

(2)

(i) Saturated hydrocarbon: Hydrocarbons in which the carbon atoms are linked to each other only by single bonds are known as saturated hydrocarbons. Example: Methane (CH_4) is a saturated hydrocarbon.

(ii) Unsaturated hydrocarbon: Hydrocarbons in which carbon atoms are linked to each other by double or triple bonds are known as unsaturated hydrocarbons. Examples: Ethene ($CH_2=CH_2$) and propyne ($CH_3-C=CH_2$) are unsaturated hydrocarbons.

(iii) Catenation: The remarkable property of carbon atoms to form bonds with each other and give rise to a single large structure or chain is called catenation.

(3)

The human nervous system has three components—central nervous system, peripheral nervous system and autonomic nervous system.

(i) Central nervous system (CNS): CNS consists of the brain and spinal cord. It controls and regulates all the activities of the body.

(ii) Peripheral nervous system (PNS): PNS consists of all the nerves and the nerve network which is present in the body. It is formed by the cranial and spinal nerves which connect the body parts to CNS.

(iii) Autonomic nervous system (ANS): ANS is an involuntary nervous system. It controls involuntary actions and coordinates the organs such as the heart, stomach and lungs, which do not function according to our will.

(4) Sexual reproduction: The process of reproduction which involves the fusion of two gametes for the production of a young one is called sexual reproduction.

Two main processes of sexual reproduction:

(1) Meiosis: It is a process of cell division in which the chromosome number is reduced to half to form haploid gametes ($2n \rightarrow n$).

(2) Fertilisation: The union of the haploid male gamete with the haploid female gamete to form the diploid zygote is called fertilisation. By fertilisation, the chromosome number again becomes diploid ($2n$).

(5) Parts of the female reproductive system in human beings:

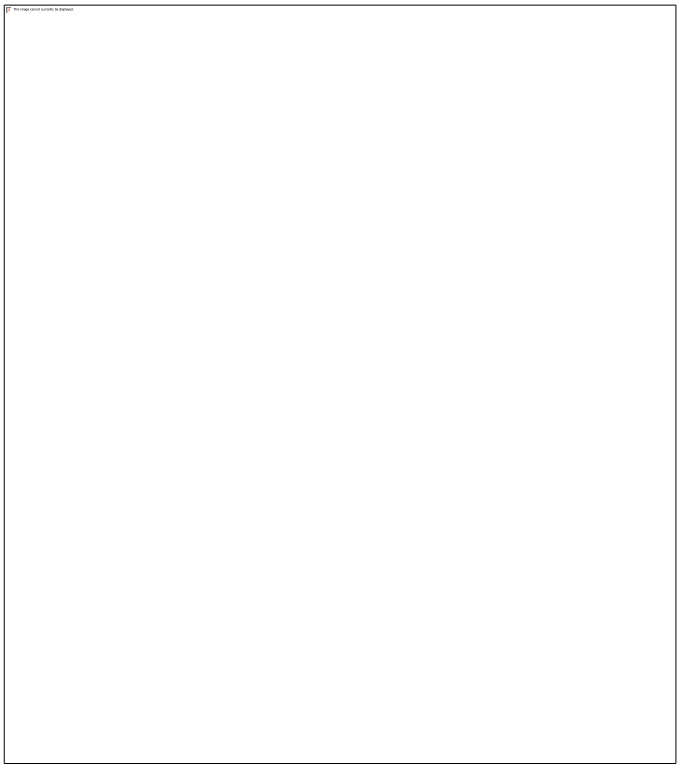
(1) Ovary: The ovary produces the female gamete or egg and the female hormone oestrogen.

(2) Uterus: The uterus accommodates the growing foetus till it completes growth.

(3) Fallopian tube or oviduct: The fallopian tubes carry the egg from the ovary to the uterus.

8.

(1) The digestive system of human beings consists of an alimentary canal and the associated digestive glands.



Alimentary canal: The human alimentary canal begins with the mouth and ends in the anus. It is a long muscular tube of varying diameter consisting of oesophagus, stomach, small intestine and large intestine.

Associated digestive glands: The digestive glands associated with the alimentary canal are salivary glands and gastric glands.

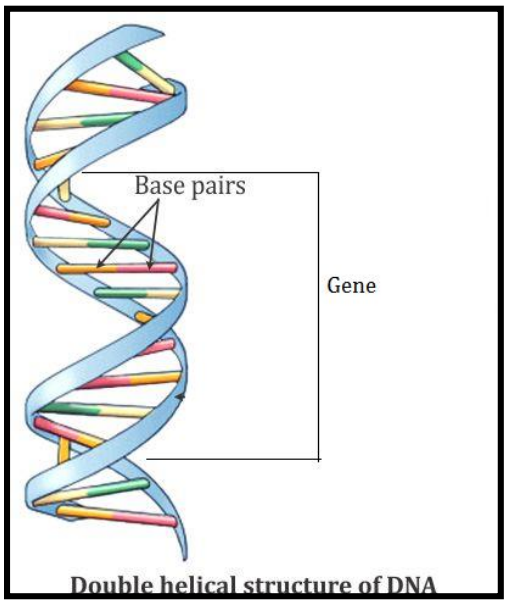
(1) Mouth: In the mouth, there are teeth which masticate the food and convert the larger particles of food into smaller ones. The tongue helps in tasting the food and rolling it into a soft ball. There are salivary glands in the mouth which secrete saliva.

(2) Oesophagus: The oesophagus is a narrow tube carrying food to the stomach. Due to peristalsis, the food is pushed forward in the alimentary canal.

(3) Stomach: The stomach is a J-shaped muscular organ situated on the left side of the abdomen. Muscles of the stomach also undergo peristalsis and push the food forward. In the stomach, the food is mixed thoroughly with the gastric juice secreted by the gastric glands present in the stomach wall. There is a sphincter muscle at the lower end of the stomach. This sphincter muscle releases the partially digested food into the small intestine.

(2)

(a)



Double helical structure of DNA

(b) Peculiarities of DNA:

(1) DNA is a double helical structure having nucleotides.

(2) These nucleotides are made of deoxyribose sugar, phosphoric acid and nitrogenous bases such as adenine, thymine, cytosine and guanine.

(3) The nucleotide sequence of the DNA molecule is called a gene.

(4) Genes are present on DNA.

(5) A type of gene is responsible for the synthesis of a particular protein.

(6) Changes in the gene can alter the characteristics of the organisms.

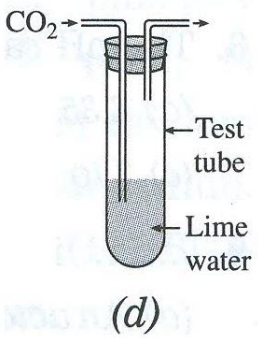
Experiment-based MCQs

1. $H_2 + Cl_2 \rightarrow 2HCl$

2. Cu

3. Lichen

4. Fig. D



(d)

5. 0.050 A

6. $\Omega \frac{10}{3}$

7. 0.20 A

8. Virtual, erect and diminished

9. –4.0 D

10. $\frac{\sin 60°}{\sin 45°}$

11. 2.4×10^8 m/s

12. Colourless

13. All the test tubes

14. The lower epidermis of the leaf

15. The water absorbed by raisins in beaker B is more than the water absorbed by raisins in beaker A.

16. Methylene blue

17. Binary fission

18. (ii) and (iii) are correct.

19. Alcohol dissolves the chlorophyll

20. Displacement