Grade 10 Science Maharashtra 2014

Time: 3 hrs Max. **Marks: 80**

Note:

1. Use the same answer-sheet for Section A and Section B.
2. Draw well-labelled diagrams wherever necessary.
3. All questions are compulsory.
4. Students should write the answers of questions in sequence.

SECTION A

Q1. (A)(a) Rewrite the following statements with suitable words in the blanks:

i. Very fine particles mainly scatter _____ coloured light.

ii. The element eka-silicon in Mendeleev's periodic table is known as _____ in the modern periodic table.

iii. Sodium or Potassium salt of higher fatty acid is termed as _____

(b) State whether the following statements are True or False:

i. $CuSO_{4(aq)} + Zn_{(s)} \rightarrow ZnSO_{4(aq)} + Cu_{(s)}$ is an example of decomposition reaction.

ii. True, magnetic lines of force are closed continuous curves.

Solution:

(a)

i. Very fine particles mainly scatter **blue** coloured light.

ii. The element eka-silicon in Mendeleev's periodic table is known as **Germanium** in the modern periodic table.

iii. Sodium or Potassium salt of higher fatty acid is termed as **soap**.

(b)

i. False. $CuSO_{4(aq)} + Zn_{(s)} \rightarrow ZnSO_{4(aq)} + Cu_{(s)}$ is an example of displacement reaction (also called a single replacement reaction).

ii. True. Magnetic lines of force are closed continuous curves.

(B) Rewrite the following statements by selecting the correct options:

i. The reddish brown deposit formed on iron nails kept in a solution of copper sulphate is:

(a) Cu_2O (b) Cu

(c) CuO (d) CuS

Correct answer: (b)

Solution:

When iron nails are placed in copper sulfate solution, iron displaces copper from the solution due to its higher reactivity.

ii. What will be the change in the current, if the potential difference is kept constant and the resistance of the circuit is made four times?

(a) It will remain unchanged (b) It will become four times

(c) It will become one-fourth (d) It will become half

Correct answer: (c)

Solution:

It will become one-fourth. If the resistance becomes four times and the voltage remains the same, the current will become one-fourth of its original value. This follows from Ohm's Law (V=IR): when resistance increases, current decreases.

iii. A ray of light strikes the glass slab at an angle of 50°. What is the angle of incidence?

(a) 50° (b) 25°

(c) 40° (d) 100°

Correct answer: (a)

Solution:

The angle of incidence is the angle between the incident ray and the normal to the surface at the point of incidence.

iv. From which plant is litmus paper or litmus solution obtained?

(a) Moss (b) Rose

(c) Hibiscus (d) Lichen

Correct answer: (d)

Solution:

Litmus paper or litmus solution is obtained from Lichen.

v. If the equivalent resistance is to be increased, then the number of resistances should be connected in:

(a) series (b) parallel

(c) mixed arrangement (d) none of the above

Correct answer: (a)

Solution:

If the equivalent resistance is to be increased, the resistances should be connected in series. In a series connection, the total resistance increases because resistances add up:

Q2. Answer any five of the following:

i. Elements in the same group show same valency. Give scientific reasons.

ii. Find the resistance of a conductor if 0.24 A current is passing through it and potential difference of 24 V is applied across it.

iii. Differentiate between Primary pollutants and Secondary pollutants.

iv. Write the electronic configuration of K and Ne.

v. State Fleming's right-hand rule.

vi. Write a short note on dispersion of light.

Solution:

i. Elements in the same group show same valency. This is because elements in the same group have the same number of electrons in their outermost shell, which determines their valency.

ii. Resistance (R) can be calculated using Ohm's law: R = V/I.

Therefore, R = 24V/0.24A = 100 ohms.

iii. Primary pollutants are directly emitted from a source (e.g., smoke), while secondary pollutants are formed when primary pollutants react in the atmosphere (e.g., smog).

iv. The electronic configuration of K (Potassium) is [Ar] $4s^1$ and for Ne (Neon) is [He] $2s^2$ $2p^6$.

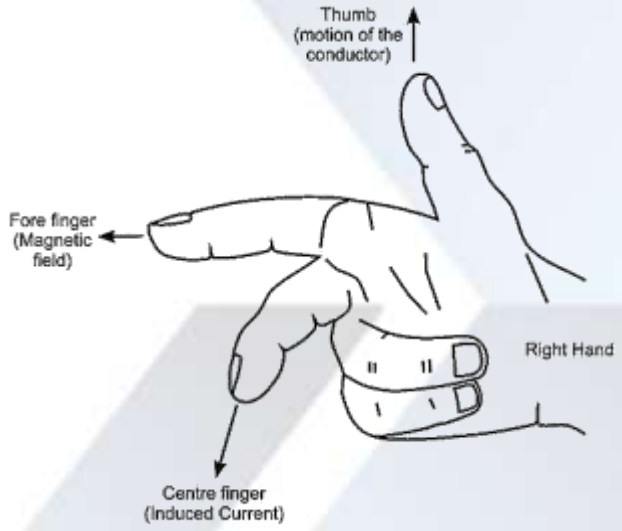
v. Fleming's Right-Hand Rule states that when the thumb, forefinger, and middle finger of the right hand are extended perpendicular to each other:

The thumb indicates the direction of the force (motion).

The forefinger represents the direction of the magnetic field.

The middle finger shows the direction of the current.

This rule helps determine the direction of induced current in a conductor moving within a magnetic field.



vi. Dispersion of light refers to the phenomenon where white light is separated into its component colors (spectrum) when it passes through a prism due to different wavelengths.

Q3. Answer any five of the following:

i. State three differences between Direct current and Alternating current.

ii. After you have dinner tonight, wash your own plate with soap/detergent.

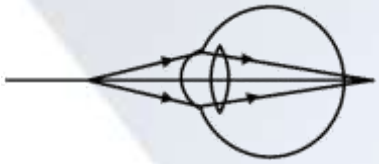
(1) What colour change is observed when soap/detergent is applied?

(2) Name the type of reaction and explain it.

iii. Methyl orange is used as an indicator. It shows colour changes in acid, base, and neutral substance. Tabulate your results are follows:

Indicator	Colour Change	Inference
Methyl Orange	No change	-
		Acid
	Yellow	-

iv. Given below is a diagram showing a defect of human eye. Study it and answer the following questions:



Study it and answer the following questions:

(a) Name the defect shown in the figure.

(b) Give two possible reasons for this defect of eye in human being.

(c) Name the type of lens used to correct the eye defect.

v. State three effects of Radioactive pollution.

vi. Define refraction and state the laws of refraction.

Solution:

i. Direct current vs Alternating current.

S.NO	Direct current	Alternating current
1.	DC flows in a constant direction	AC changes direction periodically.
2.	DC has a constant voltage	AC voltage varies over time
3.	DC is produced by sources like batteries,	AC is produced by generators.

ii. (1) The colour change often depends on the type of detergent used. However, some detergents may not produce a noticeable colour change but can still generate foam and effectively remove grease.

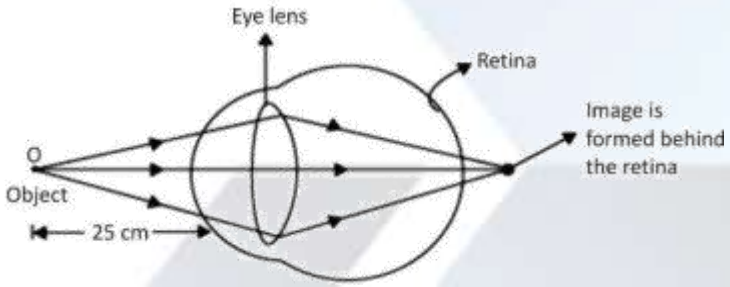
(2) Saponification is a type of hydrolysis in which fats or oils react with an alkali to produce soap, which is a salt of fatty acids. When detergent interacts with grease

on dishes, it assists in breaking down and dispersing the grease, making it easier to rinse off with water.

iii. Colour changes in different substances by Methyl Orange:

Indicator	Colour Change	Inference
Methyl Orange	No change	*Neutral*
	Red	Acid
	Yellow	*Base*

iv. (a) The given diagram illustrates hypermetropia, also known as farsightedness. This vision defect enables a person to see distant objects clearly while nearby objects appear blurry. To read comfortably, they must hold objects at a greater distance from their eyes.

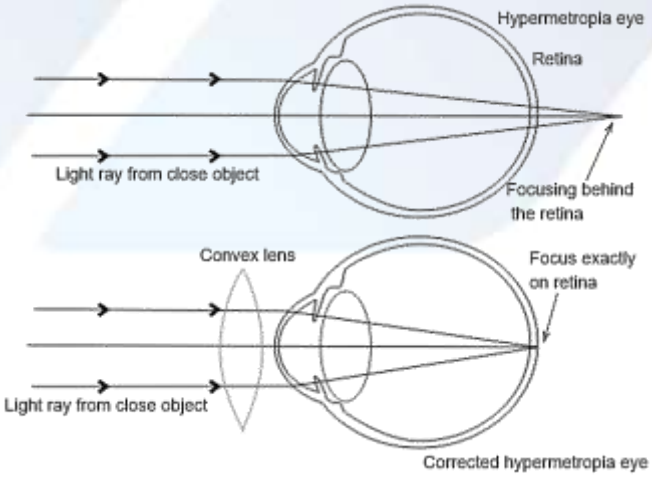


(b) Hypermetropia may possibly occur due to:

(i) The eye lens has a focal length that is too large.

(ii) The size of the eyeball is smaller than normal.

(c) Hyperopia is corrected with convex lenses.



v. Effects of Radioactive pollution are:

(a) Health Effects: Coming into contact with radioactive substances can cause severe health problems, such as cancer, genetic disorders, and various other diseases.

(b) Environmental Impact: Radiation pollution can pollute water and soil, harming plant and animal life and causing lasting damage to ecosystems.

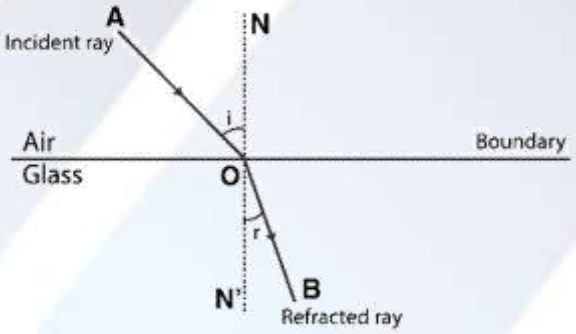
(c) Economic Losses: Regions contaminated by radiation may become unsafe for living and working, negatively affecting industries like farming, tourism, and property markets.

vi. Refraction**:**

Definition: Refraction is the phenomenon where the direction of light changes as it passes from one transparent medium to another.

Laws of Refraction: The incident ray, refracted ray, and the normal at the point of incidence all lie in the same plane.

The ratio of the sine of the angle of incidence to the sine of the angle of refraction remains constant for a given pair of media and a specific wavelength of light. This principle is known as Snell's Law of Refraction.



Mathematically, if i is the angle of incidence and r is the angle of refraction, then:

$$\mu = \frac{\sin i}{\sin r}$$

This constant is known as the refractive index of the second medium relative to the first.

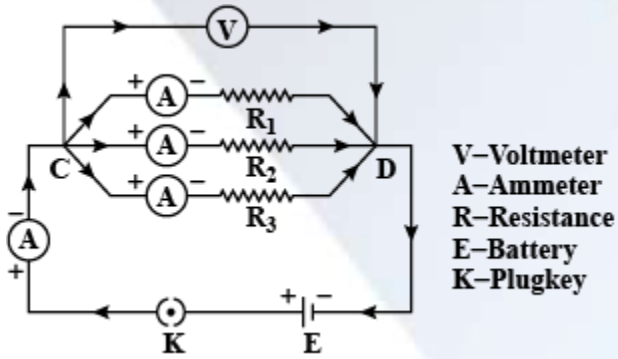
Q4. Attempt any one of the following:

i. With a neat labelled diagram derive the equation for three resistances connected in parallel.

ii. With the help of appropriate ray diagram, state the sign convention for reflection by spherical mirror.

Solution:

(i)



The above figure shows the circuit diagram for a parallel combination of three resistors with resistance R_1, R_2, R_3 connected between the points C and D. The Voltmeter measures the potential difference V between C and D and the ammeter measure the current in a given branch.

$$I = I_1 + I_2 + I_3$$

If R_p be resultant resistance of parallel combination, we have by Ohm's Law.

$$I = \frac{V}{R_p} \text{ and } I_1 = \frac{V}{R_1}, I_2 = \frac{V}{R_2} \text{ and } I_3 = \frac{V}{R_3}$$

from equation (i)

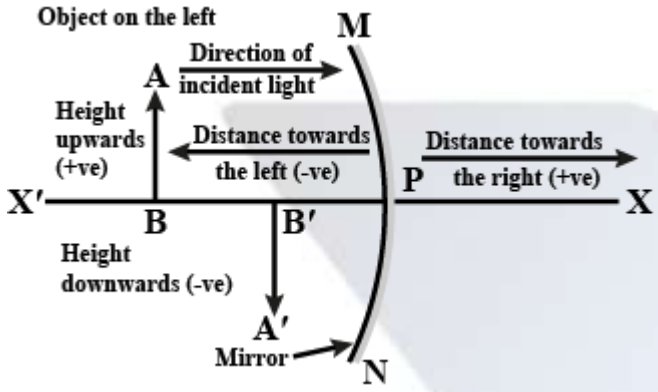
$$I = I_1 + I_2 + I_3 = \frac{V}{R_1} + \frac{V}{R_2} + \frac{V}{R_3}$$

$$\therefore I = V\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right)$$

$$\therefore \frac{V}{R_p} = V\left(\frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}\right)$$

$$\therefore \frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}$$

(ii)



In the new Cartesian sign convention, the pole (P) of the mirror serves as the origin, and the principal axis is considered the X-axis of the coordinate system. The sign conventions are as follows:

(a) The object is always positioned to the left of the mirror.

(b) All distances along the principal axis are measured from the pole of the mirror.

(c) Distances measured to the right of the origin are positive, while those to the left are negative.

(d) Distances measured perpendicular to and below the principal axis are negative.

(e) Distances measured perpendicular to and above the principal axis are positive.

(f) The focal length of a convex mirror is positive, whereas for a concave mirror, it is negative.

SECTION B

Q5. (A)(a) Find the odd one out:

i. Pancreas, Gall bladder, Glomerulus, Liver.

ii. $C_2H_4, C_4H_{10}, C_3H_8, CH_4$.

(b) Match the following:

Column 'A'	Column 'B'
i. Stigma	a. Neuron
ii. Pepsin	b. Carpel
iii. Dendrites	c. Protein
	d. Stamen

Solution:

(a) i. Glomerulus

The pancreas, gallbladder, and liver are essential organs that play a role in digestion and metabolism, whereas the glomerulus, a structure within the kidney, is responsible for blood filtration.

ii. C_2H_4

(Ethene) is an alkene (contains a double bond), while C_4H_{10}, C_3H_8, CH_4 all are alkanes (saturated hydrocarbons with single bonds).

(b)

Column 'A'	Column 'B'
i. Stigma	b. Carpel - Stigma is part of the carpel in a flower
ii. Pepsin	c. Protein - Pepsin is an enzyme that breaks down proteins
iii. Dendrites	a. Neuron - Dendrites are part of a neuron

(B) Rewrite the following statements by selecting the correct options:

i. Iron is

(a) more reactive than Zinc

(b) more reactive than Aluminium

(c) less reactive than Copper

(d) less reactive than Aluminium

Correct answer: (c)

Solution:

Iron is generally less reactive compared to copper, as evidenced by the reactivity series.

ii. _____ is a mode of asexual reproduction.

(a) Cloning (b) Budding

(c) Pollinating (d) Germination

Correct answer: (a)

Solution:

Cloning is a type of asexual reproduction because it results in the production of genetically identical copies of an organism, a key feature of asexual reproduction.

iii. The percentage of water absorbed by raisins is calculated on dividing _____ by initial weight.

(a) final weight (b) increased weight

(c) decreased weight (d) none of the above

Correct answer: (b)

Solution:

The weight gain indicates the amount of water absorbed, which is essential for calculating the percentage of water uptake.

iv. Cellular respiration takes place in

(a) lysosome (b) chlorophyll

(c) mitochondria (d) ribosome

Correct answer: (c)

Solution:

Cellular respiration primarily occurs in the mitochondria, often referred to as the "powerhouse of the cell." It is the process by which cells generate energy in the form of ATP. This process

v. _____ is not essential for photosynthesis.

(a) Oxygen (b) Carbon dioxide

(c) Light (d) Chlorophyll

Correct answer: (c)

Solution:

Photosynthesis requires carbon dioxide, water, light, and chlorophyll, but oxygen is only a byproduct, not essential for the process.

Q6. Answer any five of the following:

i. Give any two differences between Alkane and Alkene.

ii. Write two methods of preventing the rusting of iron.

iii. Write the functions of the following organs of reproduction

(a) Ovaries

(b) Seminal vesicle and prostate glands.

iv. Neat labelled diagram of vertical section of the human heart:

v. Write a short note on 'Pressure Cooker'.

vi. Explain the term 'Haemodialysis'.

Solution:

i. Alkane vs Alkene

Alkane	Alkene
• Alkanes contain only single C-C bonds (saturated),	• Alkenes contain at least one double bond (unsaturated).
• The general formula for alkanes is $C_nH_{2n}+2$	• The general formula for alkenes is C_nH_{2n}

ii. The following are the two methods of preventing the rusting of iron:

(1) Galvanization – Iron is coated with a layer of zinc, which acts as a protective shield against moisture and oxygen, preventing rust formation.

(2) Paint Coating – A layer of paint is applied to iron surfaces, forming a barrier that blocks contact with air and moisture, thereby reducing the risk of rusting.

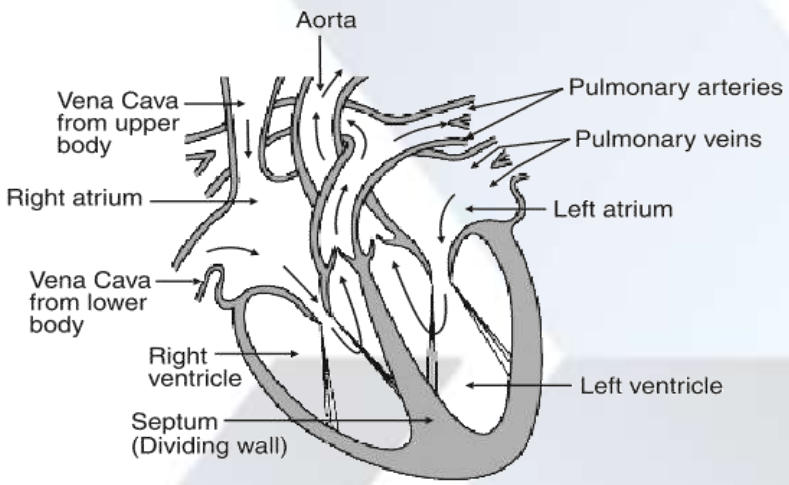
iii. Organs of reproduction

(a) Function of ovaries: The ovaries are the primary female reproductive organs responsible for producing ova (eggs). In addition to their reproductive function, they also secrete essential hormones such as estrogen and progesterone, which

regulate the menstrual cycle, support pregnancy, and influence secondary sexual characteristics in females.

(b) Function of seminal vesicle and prostate glands: The seminal vesicles and prostate gland play a crucial role in the male reproductive system. They produce and secrete fluid that provides nourishment and mobility to sperm. This fluid forms a major component of semen, helping sperm survive and function effectively within the female reproductive tract.

iv. Vertical section of the human heart:



v. A pressure cooker is an airtight vessel designed to cook food by utilizing steam or water under high pressure. The elevated pressure increases the boiling point of water, enabling food to cook more quickly than traditional methods. This not only reduces cooking time but also helps preserve nutrients effectively.

vi. Haemodialysis is a medical treatment that helps eliminate waste materials and excess fluids from the blood when the kidneys can no longer function properly. During the process, blood is circulated through a dialyzer (artificial kidney), where it undergoes filtration before being returned to the body.

The process of haemodialysis:

- Blood Collection: Extracting blood from the patient's body.
- Filtration Process: The extracted blood flows through a dialyzer (artificial kidney), which eliminates waste, excess salts, and fluids.

- Blood Reinfusion: The cleaned blood is then circulated back into the patient's body.

Q7. Answer any five of the following:

i. Give the IUPAC name of the following compounds:

(a) $CH_3CH_2CH_2OH$

(b) HCOOH

(c) $CH_3 - CH = CH - CH_3$

ii. Classify the following as voluntary and involuntary actions:

(a) Coughing

(b) Food getting digested

(c) Moving a table

(d) Kicking a ball

(e) Beating of heart

(f) Flying a kite

iii. What is the three ' R mantra'? Write its significance.

iv. What do you mean by DNA? What is the peculiarity of its structure? Name the scientist who put forward the most popular model of DNA.

v. Complete the following table to get the difference between asexual and sexual reproduction:

Characteristics	Asexual Reproduction	Sexual Reproduction
Number of Parents involved	-	-
Type of cells Involved	Somatic cells	Germ cells
Type of Cell Division	-	Meiosis and Mitosis

vi. Classify the types of neurons and state their functions:

Solution:

i. (a) $CH_3CH_2CH_2OH$ - Propan-1-ol

(b) HCOOH - Methanoic acid (Formic acid)

(c) $CH_3 - CH = CH - CH_3$ - But-2-ene

ii. Voluntary Actions: Coughing, moving a table, Kicking a ball

Involuntary Actions: Food getting digested, beating of the heart, Flying a kite

iii. The Three 'R' Mantra includes:

- Reduce – Use fewer resources to create less waste.
- Reuse – Use items multiple times instead of throwing them away.
- Recycle – Convert waste into new products to save resources.

The significance of three “R” mantra:

(1) Protects the environment by reducing pollution.

(2) Conserves natural Resources like water, trees, and minerals.

(3) Saves energy by recycling materials instead of producing new ones.

(4) Reduces waste in landfills, keeping surroundings clean.

(5) Promotes sustainability for a better future.

iv. DNA (Deoxyribonucleic Acid) serves as the genetic material in the majority of living organisms, storing instructions for their growth, development, functioning, and reproduction. It has a distinctive double-helix structure, consisting of two intertwined nucleotide strands. The most well-known model of DNA was introduced by James Watson and Francis Crick.

v. asexual vs sexual reproduction:

Characteristics	Asexual Reproduction	Sexual Reproduction
Number of Parents involved	One (single parent)	Two (male and female parent)
Type of cells Involved	Somatic cells	Germ cells
Type of Cell Division	Mitosis	Meiosis and Mitosis

vi. Neurons are classified into three types based on their functions:

- Sensory Neurons: These neurons carry signals from sense organs (like skin, eyes, and ears) to the brain and spinal cord.
- Motor Neurons: They transmit signals from the brain and spinal cord to muscles and glands, enabling movement and responses.

- Interneurons: Found in the brain and spinal cord, these neurons connect sensory & motor neurons to process information and coordinate responses.

Q8. Answer any one of the following:

(A) In the extraction of aluminium:

i. Name the process of concentration of Bauxite.

ii. Write the cathode reaction in the electrolytic reduction of alumina.

iii. Write the function and formula of cryolite in the extraction of aluminium.

iv. Draw the diagram of extraction of aluminium.

Solution:

i. The concentration of bauxite is carried out using the Bayer's process. In this method, the ore is first crushed and then treated with sodium hydroxide (NaOH). This treatment allows aluminium oxide (Al_2O_3) to dissolve selectively, while the impurities remain undissolved.

ii. During the electrolytic reduction of alumina (Al_2O_3) in the Hall-Héroult process, the cathode reaction is:

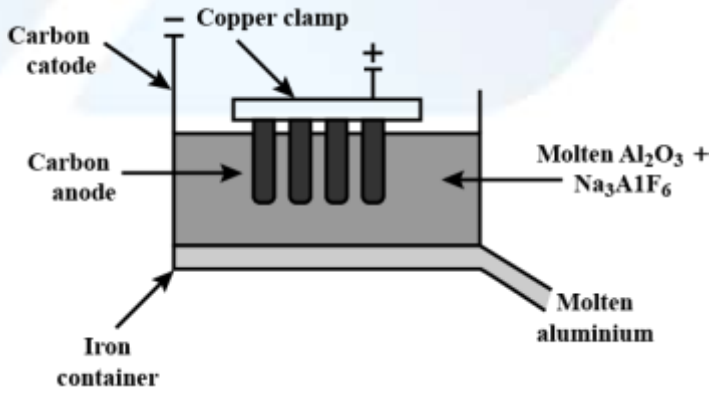
$$Al^{3+} + 3e^- \rightarrow Al$$

At the cathode, aluminium ions (Al^{3+}) gain electrons (e^-) and get reduced to form molten aluminium metal.

iii. Cryolite: chemical formula – Na_3AlF_6

Function: Cryolite is used in aluminium extraction to lower the melting point of alumina (Al_2O_3), reducing energy consumption. It is also used to increase conductivity of the molten mixture, improving the efficiency of electrolysis.

iv.



(B) Answer the following questions related to sex determination in human beings:

i. What is a sex chromosome?

ii. How many pairs of chromosomes are there in human beings?

iii. How is the sex of the human offspring determined?

iv. Draw a diagram depicting sex determination in man.

Solution:

i. Sex chromosomes are a specific pair of chromosomes responsible for determining an individual's sexual traits. In humans, there are two types of sex chromosomes: X and Y. Typically, females possess two X chromosomes (XX), while males have one X and one Y chromosome (XY).

ii. Humans possess 23 pairs of chromosomes, amounting to a total of 46 chromosomes. Among these, 22 pairs are autosomes (non-sex chromosomes), while one pair consists of sex chromosomes.

iii. The sex of a human baby is determined by the combination of sex chromosomes inherited from both parents. The mother always provides an X chromosome, while the father can pass on either an X or a Y chromosome. If the father contributes an X chromosome, the child will have an XX combination, resulting in a female. On the other hand, if the father provides a Y chromosome, the combination becomes XY, leading to a male offspring.

iv. Sex determination in man