

Maharashtra Board Class 10 Science 2017

Paper I

Note:

- i. Draw well-labelled diagrams wherever necessary.
- ii. All questions are compulsory.

Q1. (A) (a) Find the odd man out:

- i. Camphor, Ammonium Chloride, Naphthalene balls, Sugar
- ii. Turmeric, Methyl Orange, Rose petals, Beetroot.

Solution:

i. Sugar

Sugar is the odd one out because camphor, ammonium chloride, and naphthalene balls undergo sublimation, while sugar does not.

ii. Methyl orange

Methyl Orange is the odd one out because turmeric, rose petals, and beetroot are natural indicators, whereas methyl orange is a synthetic indicator.

(b) Match the following:

Column I	Column II
i. Myopia	(A) Converging power of eye lens becomes low
ii. Hypermetropia	(B) Converging power of eye lens remains the same
	(C) Converging power of eye lens becomes high

Solution:

Column I	Column II
i. Myopia	(A) Converging power of eye lens becomes high
ii. Hypermetropia	(B) Converging power of eye lens becomes low

(c) Fill in the blank:

To increase the effective resistance in a circuit, the resistors are connected in _____.

Solution:

Series

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

i. $\text{CaCO}_3 \Delta \text{CaO} + \text{CO}_2$ is a _____ reaction.

- (A) combination
- (B) displacement
- (C) double displacement
- (D) decomposition

Solution:

$\text{CaCO}_3 \Delta \text{CaO} + \text{CO}_2$ is a decomposition reaction.

In this reaction, calcium carbonate (CaCO_3) breaks down into calcium oxide (CaO) and carbon dioxide (CO_2) upon heating.

ii. The colour of the universal indicator solution is _____.

- (A) red
- (B) blue
- (C) green
- (D) greenish yellow

Solution:

The colour of the universal indicator solution is greenish yellow.

iii. The height of the image formed by an object of height 10 cm placed in front of a plane mirror is _____ .

- (A) 5 cm
- (B) 10 cm
- (C) 15 cm
- (D) 20 cm

Solution:

- (B) 10cm

iv. When the resistance of a conductor increases, the current will _____

- (A) increase
- (B) decrease
- (C) remain the same
- (D) become double

Solution:

- (B) decrease

According to Ohm's law, a conductor's resistance is inversely proportional to the current flowing through it.

v. Lime water turns milky when _____ gas is passed through it.

- (A) H₂
- (B) CO
- (C) CO₂
- (D) SO₂

Solution:

- (C) CO₂

Carbon dioxide (CO₂) reacts with lime water, causing it to turn milky due to the formation of calcium carbonate.

Q2. Answer any five of the following:

i. State any two applications of baking soda.

Solution:

- In Baking: Baking soda (sodium bicarbonate) is used as a leavening agent in cakes and bread, helping them rise by releasing carbon dioxide gas.
- As an Antacid: It helps neutralize stomach acid and provides relief from acidity and indigestion.

ii. Define magnetic lines of force and state its two properties.

Solution:

Magnetic lines of force are imaginary lines used to represent the strength and direction of a magnetic field. These lines indicate the path that a north pole would follow if placed in the field.

Properties:

1. They never intersect – If they did, it would mean two different magnetic field directions at a single point, which is impossible.
2. They emerge from the north pole and enter the south pole of a magnet externally, forming closed loops.

iii. Differentiate between Normal elements and Transition elements.

Solution:

Feature	Normal Elements	Transition Elements
Position in Periodic Table	Found in s-block and p-block	Found in d-block and f-block
Electronic Configuration	Do not have partially filled d-orbitals	Have partially filled d-orbitals (except Zn, Cd, and Hg)

Oxidation States	Usually show a fixed oxidation state	Show variable oxidation states
Magnetic Properties	Mostly diamagnetic	Many are paramagnetic due to unpaired electrons
Color of Compounds	Usually colorless	Many compounds are colored due to d-d transitions
Catalytic Activity	Generally not used as catalysts	Many act as catalysts due to variable oxidation states

iv. Classify the given sources of water pollution as natural and man-made:

- a. domestic waste
- b. dead animals
- c. oil spills
- d. ashes released due to forest fires

Solution:

- Natural Sources:
 - (b) Dead animals
 - (d) Ashes released due to forest fires
- Man-Made Sources:
 - (a) Domestic waste
 - (c) Oil spills

v. An object is held 20 cm away from a converging lens of focal length 10 cm . Find the position of the image formed.

Solution:

For a converging lens if $f = 10$ cm and $u = -20$ cm, then apply the given equation

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

Hence,

$$\frac{1}{v} = \frac{1}{f} + \frac{1}{u} = \frac{1}{10} + \frac{1}{-20} = \frac{1}{10} - \frac{1}{20}$$

Therefore, $\frac{1}{v} = \frac{1}{20}$ cm

So, $v = 20$ cm.

vi. Define scattering of light

Solution:

Scattering of light is the phenomenon in which light particles (photons) are deflected in different directions when they interact with tiny particles, molecules, or impurities in a medium, such as air or water.

Q3. Solve any five of the following questions:

i. Define corrosion. What is meant by rust? Write the chemical formula of rust.

Solution:

Corrosion is the slow deterioration of metals due to their reaction with moisture, air, or other environmental factors. It weakens the metal and reduces its strength over time. One common example of corrosion is rusting, which occurs when iron reacts with oxygen and water in the presence of air. This leads to the formation of a reddish-brown, flaky substance called rust, scientifically known as hydrated iron(III) oxide with the chemical formula $\text{Fe}_2\text{O}_3 \cdot x\text{H}_2\text{O}$. Rusting weakens iron structures, making them brittle and less durable. To prevent corrosion, methods like painting, galvanization, and using rust-resistant alloys are commonly used.

ii. Complete the following table:

Instruments	Number of Convex Lenses	Uses
Simple Microscope	_____	_____
Compound Microscope	_____	_____
Telescope	_____	_____

Solution:

Instruments	Number of Convex Lenses	Uses
Simple Microscope	1	Used by watch repairers to see tiny watch parts
Compound Microscope	2	Used by watch repairers to see tiny watch parts
Telescope	2	Used to view faraway objects in outer space

iii. What do you do in the following situations?

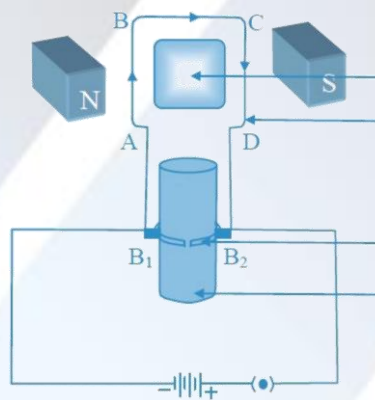
a. Exposed to exhaust fumes in traffic

- b. Exposed to a series of firecrackers with high sound level
- c. Get turbid drinking water during monsoon

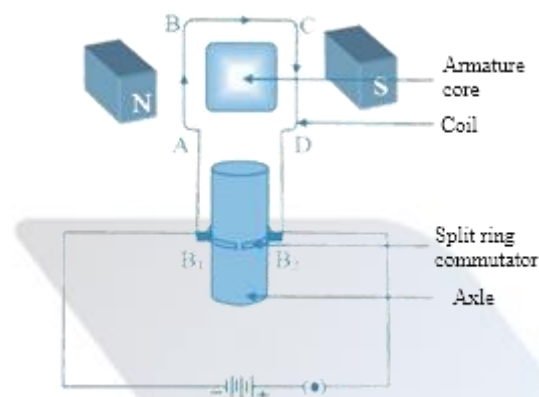
Solution:

- a. To avoid the harmful effects of exhaust fumes, move to a well-ventilated area, like a car with the windows closed or indoors. Use a mask to reduce inhaling toxic gases, and if possible, use air purifiers or air conditioning with proper filtration to improve air quality.
- b. Protect your ears by using earplugs or earmuffs, and move to a quieter area if possible. Prolonged exposure to loud sounds can cause hearing damage, so it's important to take preventive measures. If you experience ear discomfort, seek medical attention.
- c. Avoid drinking untreated turbid water. Boil the water to kill bacteria, or use water filters to remove impurities. Contaminated water can cause waterborne diseases, so ensure it's safe before consumption.

- iv. Label the four parts of the electric motor and write two uses of DC motor.



Solution:



In Electric Vehicles (EVs): DC motors are commonly used in electric vehicles to drive the wheels due to their ability to provide high torque at low speeds.

In Fans and Blowers: DC motors are used in ceiling fans, exhaust fans, and air blowers for their efficient speed control and smooth operation.

V. State any three demerits of Mendeleev's periodic table.

Solution:

Irregular Hydrogen Position: Hydrogen shares characteristics with alkali metals and halogens, leading to confusion in its placement.

Isotope Arrangement Issues: The reliance on atomic masses hindered the proper arrangement of isotopes.

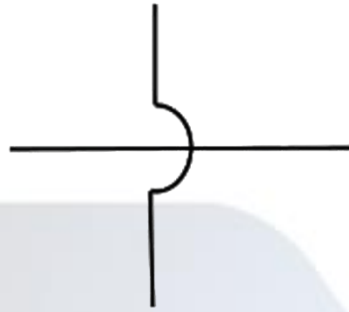
Order Anomalies: To preserve chemical properties, atomic mass positions some elements incorrectly, resulting in inconsistencies.

vi. Draw the electrical symbols of the following components and state its use:

- a. Wire crossing
- b. Rheostat (variable resistance)
- c. Ammeter.

Solution:

- a. **Wire crossing:** Represents two wires crossing without connection.



- b. **Rheostat (variable resistance):** Used to control current by varying resistance.

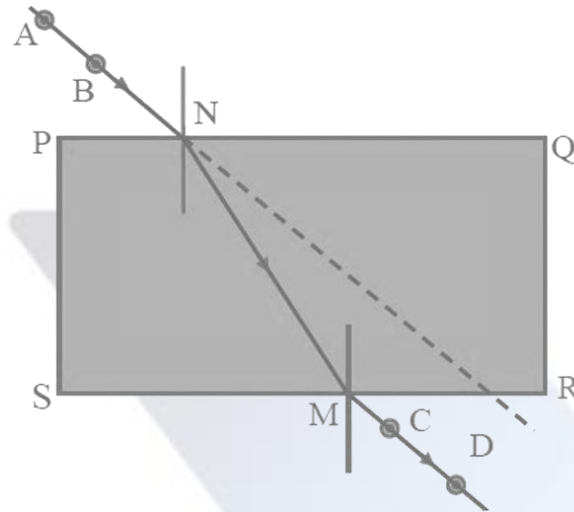


- c. **Ammeter:** Used to measure current in a circuit.



4. Answer any one of the following questions:

- i. Observe the following figure and answer the questions given under it:



- How many times does refraction take place in the above figure?
- What happens to the ray of light when it passes from air to glass?
- What happens to the ray of light when it passes from glass to air?
- What are the rays AB and CD in the figure called?
- Define refraction

Solution:

- Refraction occurs twice in the figure above: once at point N and again at point M .
- Since air is less dense than glass, the light ray bends towards the normal as it moves from the rarer medium (air) to the denser medium (glass).
- When the light ray travels from a denser medium to a rarer one, it bends away from the normal.
- The ray AB is referred to as the incident ray, while ray CD is the emergent ray.
- Refraction is the phenomenon in which light changes its direction as it passes obliquely from one transparent medium to another.

- Find the expression for resistivity of a material and state the SI unit of resistivity.
 - Observe the following figure:



If the current in the coil *A* is changed, will some current be induced in the coil *B* ?
Explain.

Solution:

a. The resistance of a conductor is directly proportional to its length (*l*) and inversely proportional to its cross-sectional area (*A*).

Thus, $R \propto l$ and $R \propto 1/A$, which gives $R \propto l/A$.

Additionally, $R \propto \rho \times (l/A)$, where ρ is the resistivity of the material.

Rearranging this equation, we get $\rho = R \times A / l$.

This is the expression for resistivity, and its SI unit is ohm-meter.

b. When the current in Coil *A* changes, it induces a current in Coil *B*. This change in the magnetic field creates a potential difference between the two coils.

Consequently, the galvanometer shows a deflection, which reflects the potential difference and leads to the generation of current in Coil *B*.

Part II

Q1. (A) Answer the following sub-questions:

(a) Fill in the blanks and rewrite the completed statements:

i. Nervous system is absent in _____

ii. Both the parents contribute equal amounts of _____ material to the offspring.

Solution:

- i. plants
- ii. genetic material

(b) State whether the following statements are true or false:

- i. The general formula of alkanes is C_nH_{2n+2}
- ii. Carbohydrates are body building nutrients.

Solution:

- i. True
- ii. False

(c) Considering the relationship in the first pair, complete the second pair:

Root: Vegetative propagation:: Flower : _____

Solution:

c. Sexual reproduction

Root: Vegetative propagation:: Flower : _____

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

i. The exchange of respiratory gases in the cells of plants occurs by the process of

- (A) osmosis
- (B) diffusion
- (C) glycolysis
- (D) exhalation

Solution: (B) diffusion

The exchange of respiratory gases in the cells of plants occurs by the process of diffusion.

ii. A solution of _____ in water is green in colour.

- (A) $CuSO_4$
- (B) $FeSO_4$

(C) ZnSO_4

(D) $\text{Al}_2(\text{SO}_4)_3$

Solution: (B) FeSO_4

The aqueous solution of FeSO_4 is in green colour.

iii. _____ type of reproduction takes place in Hydra.

(A) Budding

(B) Binary fission

(C) Multiple fission

(D) None of the above

Solution: (A) Budding

Budding type of reproduction takes place in Hydra.

iv. The process of absorption of water into raisins occurs through its membranes. This process is known as _____

(A) Absorption

(B) Osmosis

(C) Adsorption

(D) Diffusion

Solution: (B) Osmosis

The process of absorption of water into raisins occurs through its membranes.

This process is known as osmosis.

v. When zinc powder is added to acetic acid

(A) the mixture becomes warm

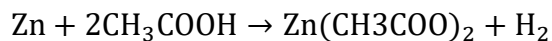
(B) a gas is evolved

(C) the colour of the mixture becomes yellow

(D) a solid settles at the bottom

Solution: (B) a gas is evolved

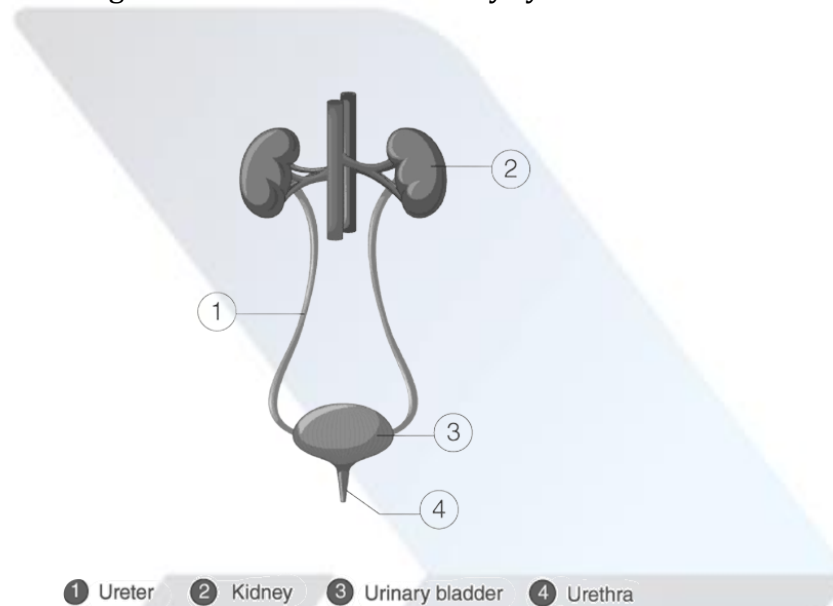
When zinc powder is added to acetic acid a gas is evolved.



Q2. Attempt any five of the following:

i. Draw a neat labelled diagram of the human excretory system.

Solution:



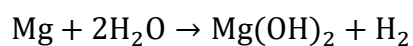
ii. Differentiate between Mendel's monohybrid cross and dihybrid cross

Solution: Mendel's Monohybrid Cross involves the inheritance of a single trait (e.g., flower color), while Mendel's Dihybrid Cross involves the inheritance of two different traits (e.g., flower color and seed shape) simultaneously.

iii. Explain the following reaction with the help of a balanced chemical equation:
Magnesium reacts with hot water.

Solution:

Magnesium reacts with hot water to form magnesium hydroxide and hydrogen gas.



iv. What is recycling? Give one example.

Solution:

Recycling is the process of converting waste materials into new products to reduce the consumption of raw materials and minimize waste.

Example: Recycling paper involves processing used paper to create new paper products.

v. What are vestigial organs? Give one example.

Solution:

Vestigial organs are body parts or structures that have lost their original function through evolution.

Example: The human appendix is a vestigial organ since it no longer serves a significant function in digestion.

vi. Write a short note on Catenation.

Solution: **Catenation** is the ability of atoms, particularly carbon, to form long chains or rings by bonding with other atoms of the same element. This property is crucial in the formation of organic compounds, such as hydrocarbons, where carbon atoms bond together to create structures ranging from simple chains to complex rings. Catenation is a key feature in organic chemistry, enabling the vast variety of carbon-based compounds.

Q3. Attempt any five of the following questions:

i. Write the names of the indicated parts 1 to 6 in the following diagram:



Human Brain

Solution: The following are the names indicated by the labels in the diagram above:

1. Medulla oblongata
2. Pons varolii
3. Corpus callosum
4. Cerebrum
5. Pineal body
6. Cerebellum

ii. What is the need to use eco-friendly technology?

Solution: The need to use eco-friendly technology arises to reduce environmental impact, conserve natural resources, minimize pollution, and promote sustainability for a healthier planet and future generations.

iii. State the IUPAC names of the following compounds:

- a. $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{OH}$
- b. HCOOH
- c. $\text{CH}_3 - \text{CH}_2 - \text{CH} = \text{CH}_2$.

Solution:

- a. 1- Propanol
- b. Methanoic acid
- c. 1-Butene

iv. What is embryology? How does its study lead us to understand evolution?

Solution: **Embryology** is the branch of biology that studies the development of embryos from fertilization to birth.

Its study helps us understand evolution by showing how early developmental stages of different species are similar, indicating common ancestry. By comparing embryonic development across species, scientists can trace evolutionary relationships and identify evolutionary changes that occur over time.

v. What are the two types of nerves? Write their functions.

Solution: The two types of nerves are:

1. **Sensory nerves:** These convey sensory information from the sense organs (such as the skin, eyes, and ears) to the brain or spinal cord, enabling us to perceive stimuli like touch, temperature, and pain.
2. **Motor nerves:** These transmit signals from the brain or spinal cord to muscles and glands, enabling movement and bodily functions.

vi. What would be the consequences of the deficiency of haemoglobin in the human body?

Solution:

A lack of hemoglobin in the body can result in anemia, leading to symptoms like fatigue, weakness, pale skin, shortness of breath, and dizziness. This condition arises when tissues and organs do not get enough oxygen because the blood's capability to carry oxygen is diminished.

Q4. Attempt any one of the following:

i. Answer the following questions with respect to the sexual reproduction in plants:

- State the name of the functional unit concerned with sexual reproduction.
- Name the part made up of the stigma, style and ovary.
- Name the swollen lower part of the carpel.
- Name the male part of the flower.
- Where are the pollen grains produced?

Solution:

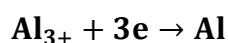
- The flower is a functional unit involved in sexual reproduction in plants.
- The pistil is the part that comprises the stigma, ovary, and style.
- The ovary is the swollen portion of the carpel.
- The stamen is the male reproductive part of the flower
- The anther produces the pollen grains.

ii. In the extraction of aluminium:

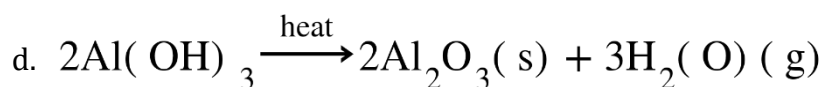
- Name the process of concentration of bauxite.
- Write the cathode reaction in electrolytic reduction of alumina.
- Write the function and chemical formula of cryolite.
- Write a chemical equation for the action of heat on aluminium hydroxide.
- Why is it necessary to replace anodes from time to time?

Solution:

- Bayer's process is known as the process of concentration of bauxite
- The cathode reaction in the electrolytic reduction of ammonia is given below:



- Cryolite is mixed with the molten ammonia mixture, thereby lowering the melting point. Chemical formula of cryolite is Na_3AlF_6 .



- e. It is necessary to replace anodes periodically, as they become easily oxidised due to the oxygen that is generated at their surface.

