

**Maharashtra State Board**  
**Class IX Science and Technology**  
**Sample Paper – 2**  
**Solution**

**SECTION A**

**1.**

**(A)**

(a)

- i. orbits
- ii. compound
- iii. negative

(b)

- i. True.
- ii. False. The density of water is  $1000 \text{ kg/m}^3$  or  $1 \text{ g/cm}^3$ .

**(B)**

i. (c) Carbon

Atomic mass number = 14

Protons + Neutrons = 14

Protons + 8 = 14

Protons = 6

The number of protons is equal to the number of electrons in an atom.

Protons = Electrons = 6

Carbon has 6 electrons in its atom.

Hence, this element is an isotope of carbon as both carbon and the element have the same number of electrons/protons in their atoms.

ii. (d) Is doubled

Force is a product of mass and acceleration. So, force is directly proportional to acceleration. Hence, if force is doubled, acceleration also has to double.

iii. (a) Is equal to the weight of the liquid displaced

According to Archimedes' principle, when a body is fully immersed in a liquid, the apparent loss in its weight is equal to the weight of liquid displaced.

iv. (c) Can be positive, negative or zero

Work done is positive when the displacement is in the direction of the force, negative when the displacement is in the opposite direction of the applied force and zero when the displacement is perpendicular to the direction of the applied force.

v. (b) 60 grams

Atomic mass of carbon = 12

∴ Weight of 1 mole of carbon = 12 grams

∴ Weight of 5 moles of carbon =  $12 \times 5$   
= 60 grams

***[Please note that the explanation provided is to help you in learning. You may not be required to write an explanation in your answer to this question.]***

2.

i.

(a) Iodine: Isotopes of iodine are used in the treatment of goitre.

(b) Uranium: Isotopes of uranium are used for the production of energy.

ii.

Data :  $s = 72 \text{ km} = 72000 \text{ m}$

$t = 4 \text{ hours} = 4 \times 60 \times 60 \text{ s} = 14400 \text{ s}$

To find: average speed,  $v = ?$

$$\begin{aligned}\text{Solution: } v &= \frac{s}{t} = \frac{72000 \text{ m}}{14400 \text{ s}} = \frac{720}{144} \text{ m/s} \\ &= \frac{60}{12} \\ &= 5 \text{ m/s}\end{aligned}$$

The average speed of the person is 5 m/s.

iii.

Grass	→	Grasshopper	→	Frog	→	Snake
(First trophic level)		(Second trophic level)		(Third trophic level)		(Fourth trophic level)

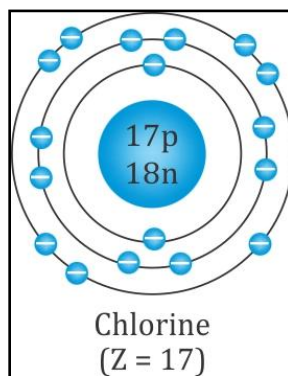
iv.

(a) When on the Moon, one will not be able to hear any sound produced by an accompanying friend.

(b) Sound requires a material medium for its propagation.

(c) There is no atmosphere which can act as a material medium on the Moon.

v. Electronic configuration of chlorine atom:



vi. The units horsepower and kilowatt are used in industry and for commercial purpose.

1 horsepower (hp) = 746 watts (W)

1 kilowatt = 1000 watts

3.

i. Newton's first law of motion: Every inanimate body continues to be in its state of rest or of uniform motion in a straight line unless an external unbalanced force acts on it. Newton's first law of motion explains the inertia of a body. All examples of inertia are examples of Newton's first law of motion. Hence, this law is called the law of inertia.

ii. Buoyant force

(a) When a body is partially or fully immersed in a liquid, the liquid exerts forces on the body. This force is perpendicular to the surface of the body and is equal to the product of pressure and area at that point. The resultant of these contact forces is called buoyant force.

(b) The buoyant force acting on an object depends on the volume of the object and the density of the fluid.

(c) The buoyant force increases with an increase in the volume of the object and the density of the liquid.

(d) The buoyant force determines whether an object will float or sink in a liquid.

(e) If the weight of the object exceeds the buoyant force, the object sinks.

(f) If the buoyant force exceeds the weight of the object, the object floats.

(g) If the buoyant force is equal to the weight of the object, the object floats inside the liquid.

- iii. On the basis of the alpha particle experiment, the following conclusions were drawn by Rutherford:
  - (a) Most of the alpha particles passed through the thin foil of gold without any deviation. This shows that an atom must be hollow with a lot of space.
  - (b) An atom has a tiny, dense, positively charged core in which most of the mass of the atom is concentrated. This core is called the nucleus.
  - (c) The light, negatively charged electrons revolved around the nucleus in paths called orbits.
  
- iv.
  - (a) Law of conservation of energy: Energy can neither be created nor destroyed. It can be converted from one form to another. The total amount of energy in the Universe remains constant.
  - (b) Uses of solar energy: Plants use solar energy to manufacture food by the process of photosynthesis. Solar energy can be used in solar cookers and solar water heaters for domestic purposes.
  
- v. Measures to be taken to maintain a balance in nature:
  - (a) Plants should not be destroyed beyond a certain limit as their destruction causes a reduction in the number of producers.
  - (b) Animals should not be hunted, killed or poached. It disturbs the balance in the food chain.
  - (c) Apex carnivores should not be killed as this may cause their extinction and may also affect the population control of herbivores.
  - (d) Activities such as pollution, deforestation, over construction and exploitation of natural resources should be curbed immediately. Such activities disturb the balance in nature.
  - (e) Natural resources should be used in a sustainable manner to protect and maintain the ecological balance.
  - (f) Family and friends must be encouraged to be ecologically aware and contribute to maintaining the natural balance.

vi.

(a) The sum of the atomic masses of all the atoms in a given molecule is called molecular mass.

(b)

Element	Atomic mass (u)	Number of atoms in a molecule	Atomic mass (u) × Number of atoms	Total molecular mass (u)
Potassium	39	1	$39 \times 1$	39
Nitrogen	14	1	$14 \times 1$	14
Oxygen	16	3	$16 \times 3$	48

Molecular mass of potassium nitrate = Sum of atomic masses of potassium, nitrogen and oxygen ( $\text{KNO}_3$ )

$$\begin{aligned} &= (\text{Atomic mass of K}) \times 1 + (\text{Atomic mass of N}) \times 1 \\ &\quad + (\text{Atomic mass of O}) \times 3 \\ &= (1 \times 39) + (14 \times 1) + (16 \times 3) \\ &= 39 + 14 + 48 \\ &= 101 \text{ u} \end{aligned}$$

Molecular mass of potassium nitrate ( $\text{KNO}_3$ ) is 101 u.

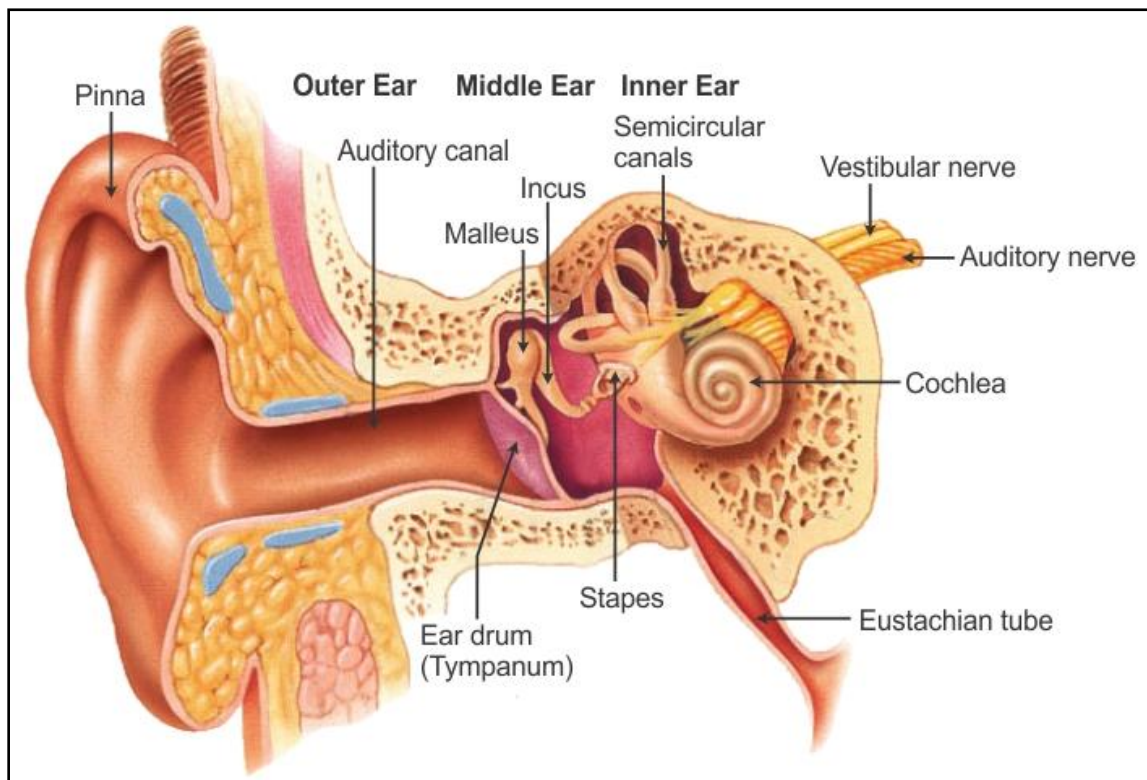
4.

i.

- (a) According to Bohr, electrons associated with a certain amount of energy move in the stationary orbits of the atom.
- (b) The electrons are confined to well-defined orbits.
- (c) They can jump between these orbits but cannot follow an intermediate path such as a spiral path towards the nucleus or away from the nucleus.
- (d) If a specific amount of energy is absorbed, the electron jumps from the inner orbit to the outer orbit. On the other hand, when an electron jumps from the outer orbit to the inner orbit, it emits the same specific amount of energy.
- (e) The energy emitted or absorbed during these transitions is equal to the energy difference between the initial state and the final state of the electron.

ii.

- (a) The human ear has three major parts—external ear or pinna, middle ear and inner ear. The pinna collects the sound from the surroundings.
- (b) The collected sound is carried by the auditory canal to the ear drum.
- (c) When the compression of the medium reaches the ear drum, the pressure outside the membrane increases and forces the ear drum inwards. Similarly, the ear drum moves outward when a rarefaction reaches it.



- (d) The vibrations are amplified in the middle ear and carried to the inner part of the ear.
- (e) In the inner ear, the pressure vibrations are converted into electrical signals by the spiral chamber called cochlea.
- (f) The electrical signals are then sent to the brain via the auditory nerve and the brain interprets them as sound.

## SECTION B

5.

(A)

(a)

i. Copper

Copper cannot sublime while the rest of the substances can sublime at room temperature.

ii. Guard cells

Guard cells are cells of the epidermis, while the rest are cells in the phloem.

(b)

Column A	Column B
i. Bajra	(b) Ergot
ii. Wheat	(c) Rust
iii. Rice	(a) Leaf spot

(B)

i. (c) Degree of hotness of the substance

Temperature is the degree of hotness or coldness of a substance which can be measured using a thermometer. It is a measure of how fast the atoms and molecules of a substance are moving.

ii. (b) Are clearly visible

Staining is done in microscopy to enhance contrast in the microscopic image. Stains are used to highlight structures in biological tissues for viewing, often with the aid of different microscopes.

iii. (d) Providing strength to plant parts

Collenchyma tissue provides strength and flexibility to plant parts.

iv. (c) Pteridophyta

Vascular tissues composed of xylem and phloem which helps in the transport of water and dissolved substances is present only in Pteridophytes. Thallophytes, Bryophytes and Fungi lack vascular tissues.

v. (b) Law of conservation of mass

Because the sum of masses of reactants is equal to the sum of masses of the product, it follows the law of conservation of mass.

***[Please note that the explanation provided is to help you in learning. You may not be required to write an explanation in your answer to this question.]***

6.

i.

Solution	Lemonade
Suspension	Sand in water
Colloid	Milk, smoke

ii.

Data :  $m = 35 \text{ g}$

$v = 7 \text{ cm}^3$

To find: density,  $d = ?$

$$\begin{aligned}\text{Solution: } d &= \frac{m}{v} = \frac{35}{7} \text{ g/cm}^3 \\ &= 5 \text{ g/cm}^3\end{aligned}$$

The density of the material of the body is  $5 \text{ g/cm}^3$ .

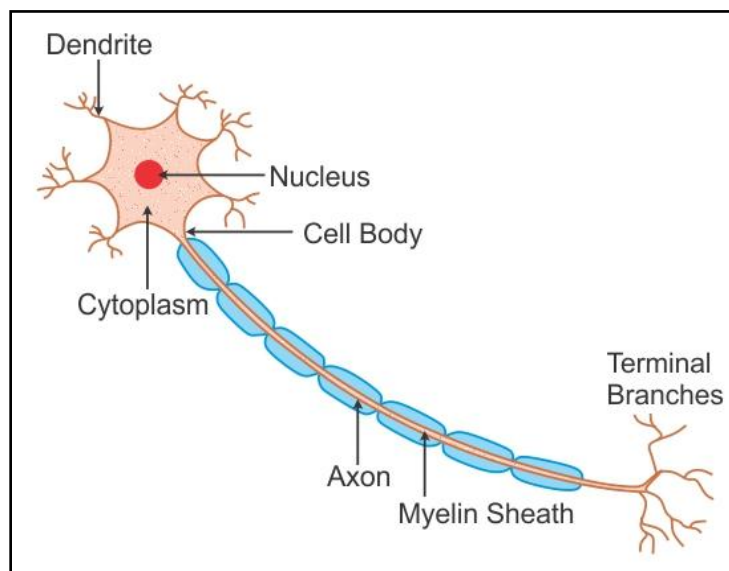
iii.

(a) Lysosomes contain digestive enzymes.

(b) When a cell becomes old and worn out or if it is damaged, the lysosomal bags burst and digest the cell.

(c) Lysosomes undergo autolysis and destroy the cell. Therefore, lysosomes are called suicidal bags.

iv. Neuron or nerve cell:





v. Differences between manures and fertilisers:

<b>Manures</b>	<b>Fertilisers</b>
1. Manures are obtained from decaying and decomposing organic matter.	1. Fertilisers are prepared by chemical process.
2. They add humus to the soil.	2. They do not add humus to the soil.
3. They do not decrease the fertility of the soil after repeated applications.	3. They decrease the fertility of the soil after repeated applications.
4. They do not cause soil pollution.	4. They cause soil pollution.
5. Examples: Cow dung, human and plant wastes	5. Examples: Nitrogenous and phosphate compounds

vi. Waste separation or segregation, composting, vermicomposting, secured landfill and pyrolysis are the scientific or eco-friendly methods of waste disposal.

7.

- i. The scattering of light by colloidal particles in a solution is called Tyndall effect. The path of light when passed through a solution becomes visible due to the Tyndall effect.
- (a) The Tyndall effect is often observed by the dust in the air when sunlight comes in through the window, holes in the roof or passes through gaps in the clouds.
- (b) The Tyndall effect is also observed when headlight beams are visible on foggy nights.

ii. Basic principles of prevention of a disease:

- (a) Private and personal hygiene should be maintained so that infectious pathogenic agents are kept away from healthy persons.
- (b) Everyone should get proper, clean and sufficient food and water.
- (c) Every child and susceptible individual should be immunised.

iii.

- (a) Golgi apparatus: Modification, sorting and packing of substances such as enzymes, lipids, pigments etc. take place in the Golgi apparatus.
- (b) Nucleus: The nucleus consists of DNA which transfers hereditary information from one generation to another.
- (c) Endoplasmic reticulum: The endoplasmic reticulum acts as a supporting framework and an intracellular transport system for the cell.

iv. Characteristics of epithelial tissue:

- (a) The cells of the epithelial tissue are tightly packed and form a continuous sheet.
- (b) The cells do not have intercellular spaces between them. So, the permeability of the cells plays an important role in regulating the exchange of materials between the body and the external environment.
- (c) The epithelial cells are separated from the underlying tissues by an extracellular fibrous basement membrane.

Different types of epithelial tissue:

- (a) Simple squamous epithelium
- (b) Stratified squamous epithelium
- (c) Columnar epithelium
- (d) Ciliated columnar epithelium
- (e) Cuboidal epithelium
- (f) Glandular epithelium

v. High-yielding variety of crops:

- (a) High-yielding varieties of crops are also called HYV.
- (b) They are produced through the technique of hybridisation in which two different varieties of crop plants with desirable characteristics are crossed.
- (c) HYV crops have higher yields, better quality, higher resistance to diseases and pests and a short period of maturation.
- (d) Farmers are benefitted commercially by using HYV crops because of their high yield.
- (e) Jaya and T141 are HYV rice, and Sonalika, Arjun and Sonara 64 are HYV wheat.

vi. Effects of improper management of solid waste:

- (a) Loss of aesthetic beauty: Litter and discarded solid waste spoil the aesthetic beauty of an area. The place appears dirty and the people tend to add to the already existing waste.
- (b) Emission of bad odours: Stored or accumulated solid wastes decompose and emit obnoxious odours which spread in the nearby vicinity.
- (c) Emission of toxic gases: Municipal solid waste disposal sites or landfill sites produce toxic gases such as  $\text{H}_2\text{S}$ ,  $\text{CH}_4$  and  $\text{CO}_2$  which are released into the surroundings.
- (d) Spread of diseases: Open dumping of solid waste creates unhygienic environmental conditions and directly affects public health. Diseases such as typhoid, cholera, diarrhoea and amoebic dysentery are commonly observed in such areas.
- (e) Environmental pollution: Air, water and soil get polluted due to burning and dumping of solid waste.
- (f) Effect on bird diversity: Many migratory and resident bird species move from one place to another in order to avoid polluted sites and escape from the bad odour of dumped wastes.

8.

(A)

- i. Substances A and B react chemically with one another in a fixed proportion to form substance C. The properties of C are different from those of A and B. Hence, substance C is a compound as it shows the characteristics of a compound.
- ii. Substances A and B have electronic configurations (2,8,1) and (2,8,7), respectively. Hence, A and B are the elements sodium (Na) and chlorine (Cl), respectively. Sodium and chlorine react together chemically to form sodium chloride (NaCl), commonly known as table salt or common salt. Hence, substance C is the compound sodium chloride.
- iii. Substance C or table salt is a compound of substance A (sodium) and B (chlorine). The constituents of a compound do not retain their individual properties when they form a compound. Hence, although sodium and chlorine are poisonous, their compound sodium chloride or common salt is non-poisonous and can be consumed in our day to day life.

**(B)**

- i. The cottony growth found on the surface of bread is the growth of a fungus.
- ii. A - Sporangium  
B - Columella  
C - Stolon  
D - Rhizoid
- iii. The given organism (*Rhizopus*) belongs to Kingdom Fungi.

Characteristics of Kingdom Fungi:

- (a) Fungi include non-green eukaryotic organisms.
  - (b) They are mostly saprophytes as they obtain their food from dead and decaying organic matter.
  - (c) They have cell wall made of a tough and complex sugar called chitin.
  - (d) The body of a fungus is made of thread-like structures called hyphae. These hyphae have continuous cytoplasm with several nuclei embedded in them.
- iv. Mushroom, yeast, rust and smut belong to Kingdom Fungi.