Class IX Session 2024-25
Subject - Science
Sample Question Paper - 13

Time: 3 hours. **Total Marks: 80**

General Instructions:

i. *All questions would be compulsory. However, an internal choice of approximately 33% would be provided. 50% marks are to be allotted to competency-based questions.*

ii. *Section A would have 16 simple/complex MCQs and 04 Assertion-Reasoning type questions carrying 1 mark each.*

iii. *Section B would have 6 Short Answer (SA) type questions carrying 02 marks each.*

iv. *Section C would have 7 Short Answer (SA) type questions carrying 03 marks each.*

v. *Section D would have 3 Long Answer (LA) type questions carrying 05 marks each.*

vi. *Section E would have 3 source based/case based/passage based/integrated units of assessment (04 marks each) with sub-parts of the values of 1/2/3 marks.*

SECTION - A

Select and write the most appropriate option out of the four options given for each of the questions 1-20. There is no negative mark for incorrect response.

1. Manjiri is designing a new irrigation system and needs to understand the behaviour of liquids. During a discussion, her supervisor asks, "Why are liquids referred to as fluids?" [1]

a) Liquids can flow.

b) Particles of a liquid have spaces between them.

c) Liquids do not fill the whole container in which they are placed.

d) Particles of liquid have no force of attraction between them.

2. The components of a solution are: [1]

a) Solute and dispersed medium

b) Dispersed particles and solvent

c) Dispersed phase and dispersion medium

d) Solute and solvent

3. The number of hydrogen atoms present in one mole of hydrogen molecule is: [1]

a) 6.022×10^{23}

b) 12.044×10^{23}

c) 3.011×10^{23}

d) 6.022×10^{22}

4. When we put some crystals of potassium permanganate in a beaker containing water, we observe that after some time, the whole water turns pink. This is due to: [1]

a) Brownian motion
b) Melting
c) Sublimation
d) Diffusion

5. Most of the alpha particles passed through the gold foil without deflection because:[1]

a) Atoms are stable.
b) Most of the space inside the atom is empty.
c) Atoms are unstable.
d) All the space inside the atom is covered by nucleus.

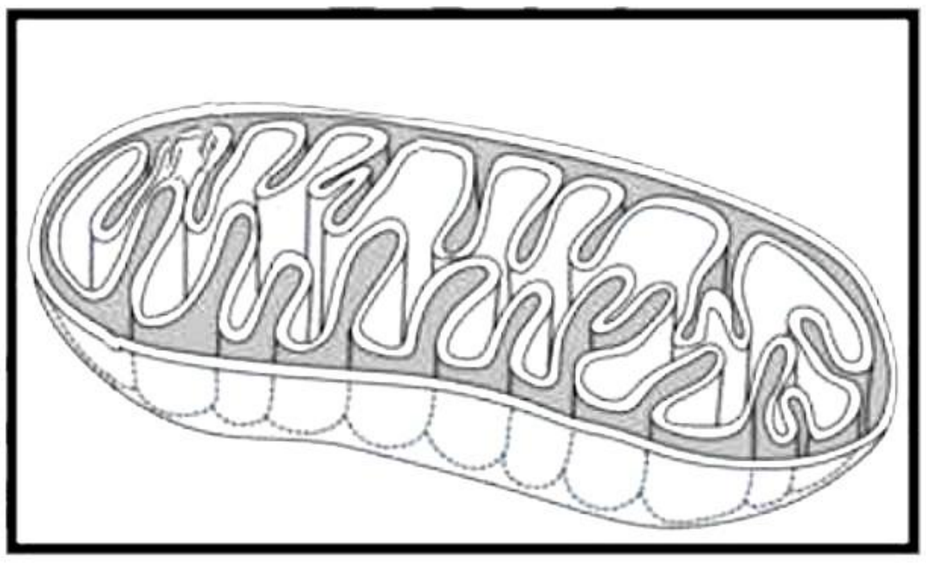
6. Which of the following will show Tyndall effect? [1]

a) Clouds
b) Fog
c) Sugar solution
d) Both Clouds and Fog

7. The theory which visualizes that solid, liquid or gas is made up of tiny particles which are in constant motion is called: [1]

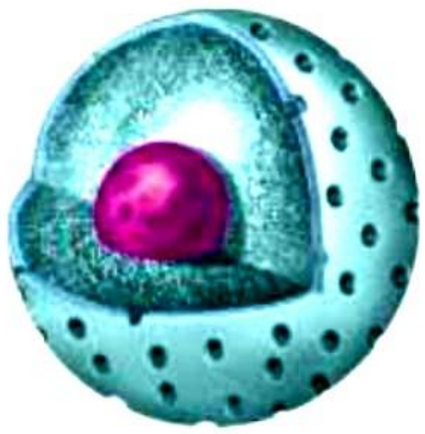
a) Kinetic theory of matter.
b) Latent heat of fusion.
c) Latent heat of vaporization.
d) Interconversion of states of matter.

8. The given figure shows an important cell organelle. This organelle is regarded as the ..... of the cell. [1]



a) Suicidal bag
b) Powerhouse
c) Food factory
d) Storage bag

9. The given figure shows a certain cell organelle. Which of the following cells lacks this organelle? [1]



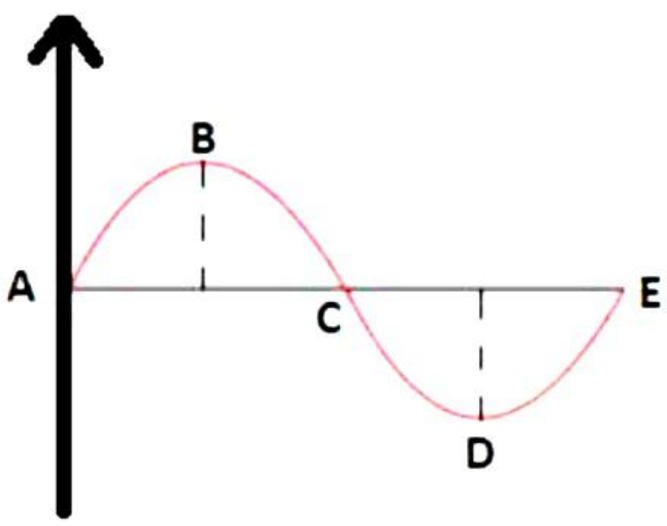
a) Human RBCs
b) Muscle cells
c) Liver cells
d) Bone cells

10. Which of the following is a likely advantage of composite fish culture? [1]
a) Fish grow better when different species live together.
b) All areas of the pond are utilised for better fish production.
c) Fish eat less food when grown in composite culture ponds.
d) Dissolved oxygen level is higher in composite culture ponds.

11. Why are athletes in high jump competition made to fall on a cushioned bed? [1]
a) To stop him quickly.
b) To increase the time to stop.
c) To make him sleep comfortably.
d) To decrease his momentum fast.

12. It is due to which one of the following reasons that a body floats in a liquid? [1]
a) When the weight of the body is exactly half of the weight of the liquid displaced.
b) When the weight of the body is greater than the weight of the liquid displaced.
c) When the weight of the body is equal to the weight of the liquid displaced.
d) When the weight of the body is less than the weight of the liquid displaced.

13. The sound wave is produced by a vibrating tuning fork shown in the diagram below. Half the wavelength is represented by: [1]

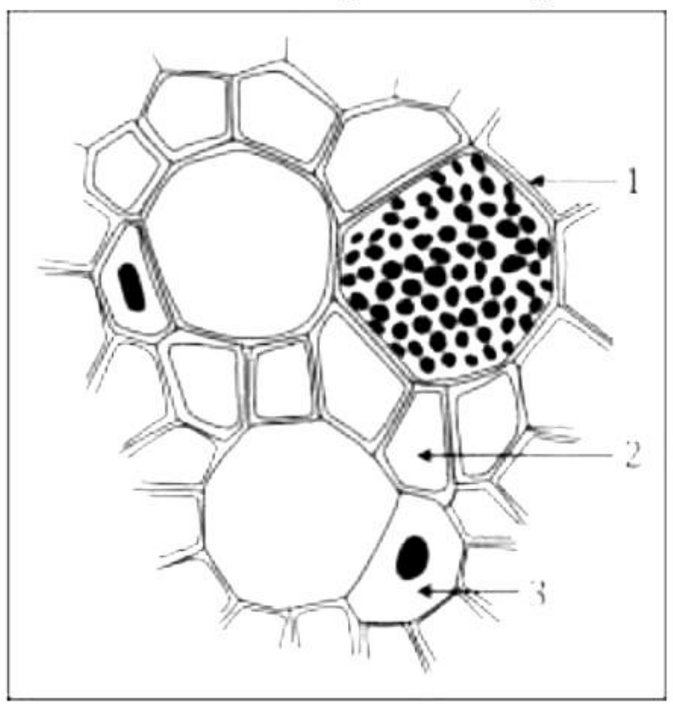


a) AE
b) CD
c) BD
d) BC

14. On the distance-time graph, the Y-axis should be labeled as [1]

a) Speed
b) Displacement
c) Distance
d) Time

15. The correct labelling for the given structure is [1]



a) 1 – Sieve tube, 2 – Xylem parenchyma, 3 – Companion cell
b) 1 – Sieve tube, 2 – Phloem parenchyma, 3 – Companion cell
c) 1 – Companion cell, 2 – Xylem parenchyma, 3 – Sieve tube
d) 1 – Companion cell, 2 – Phloem parenchyma, 3 – Sieve tube

16. A and B are plant tissues. Cells of tissue A have small inter-cellular spaces and walls are thickened at the corners. Cells of tissue B do not have inter-cellular spaces and the cell walls are thickened. Identify tissues A and B. [1]

a) A: Chlorenchyma, B: Sclerenchyma
b) A: Sclerenchyma, B: Collenchyma
c) A: Collenchyma, B: Chlorenchyma
d) A: Collenchyma, B: Sclerenchyma

Question No. 17 to 20 consist of two statements – Assertion (A) and Reason (R). Answer these questions selecting the appropriate option given below:

(a) Both A and R are true, and R is the correct explanation of A
(b) Both A and R are true, and R is not the correct explanation of A
(c) A is true but R is false
(d) A is false but R is true

17. **Assertion (A):** In sublimation a substance changes directly from solid to vapour without passing through liquid state and vice-versa. [1]
Reason (R): Distillation involves two processes i.e., vapourisation and condensation.

18. **Assertion (A)**: Cell is the fundamental structural and functional unit of all living organisms. [1]
Reason (R): Anything less than a complete structure of a cell does not ensure independent living.

19. **Assertion**: Work is done in lifting a book through a height of 10 cm. [1]
Reason: Work is equal to ratio of force and displacement.

20. **Assertion (A):** The movement of alimentary canal, iris of the eye and bronchi of lungs are not under our will. [1]
Reason (R): These are voluntary muscles.

SECTION - B

Question No. 21 to 26 are very short answer questions.

21. In chemistry class, Radhika learns that CO_2 is a gas. Can you write two properties of CO_2 to justify this? Also, how can Radhika liquefy CO_2 gas? Finally, why is solid CO_2 called dry ice? [2]

22. What will happen if the apical meristem is damaged or cut? [2]

23. During a quiz competition, some flashcards were shown to the students. They were asked to identify the cell organelle basis the clues provided. [2]

(a) Transporting channel of the cell

(b) Brain of the cell

OR

Why are cells generally of a smaller size?

24. If a cyclist has travelled a distance of 12,250 meters in one hour along the southwest direction, what would the velocity of the cyclist be? [2]

25. The gravitational force between two objects is F. How will this force change when: [2]

(i) The distance between them is reduced to half?

(ii) The mass of one of the objects becomes four times?

OR

How will you separate a mixture of mercury, oil, and water?

26. If there is low rainfall in a village throughout the year, what measures will you suggest to the farmers for better cropping? List any two such measures. [2]

SECTION - C

Question No. 27 to 33 are short answer questions.

27. Deduce the formulae for below compounds. [3]

(a) Ammonium sulphate

(b) Sodium phosphate

(c) Carbon dioxide

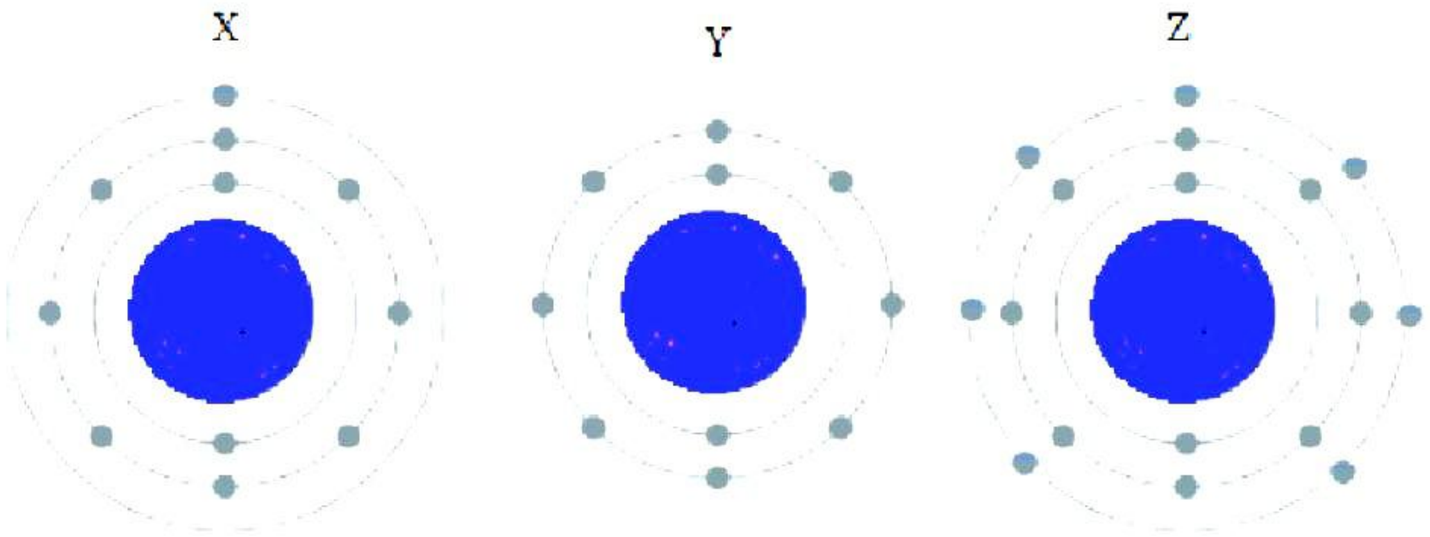
28. The percentage of three elements calcium, carbon, and oxygen in a sample of calcium carbonate is:

Calcium = 40%; Carbon = 12.0%; Oxygen = 48%

If the law of constant proportions is true, what weights of these elements will be present in 1.5 g of another sample of calcium carbonate? [3]

OR

Identify the valency, atomic number and name of element depicted by below given atomic orbitals X, Y and Z. [3]



29. What will happen to the red blood cells if they are placed in – [3]

(a) Hypotonic solution

(b) Isotonic solution

(c) Hypertonic solution

30. [3]

(a) How can we obtain the maximum benefit from a crop field?

(b) Which of the following crops would require a minimum quantity of fertilisers for their proper growth? Why?
Paddy, Pea, Wheat, Sugarcane

31. Two forces F_1 and F_2 are acting on an object as shown. [3]

(a) What must be the force added to F_2 or F_1 so as to make the net force the balanced force?

(b) How much force is required to be exceeded on F_1 so that the net force will act along the direction of F_1?

(c) After exceeding the force F_1 as per the condition mentioned in question (b) and if the mass of the object is 10 kg, what will be the acceleration produced in it?

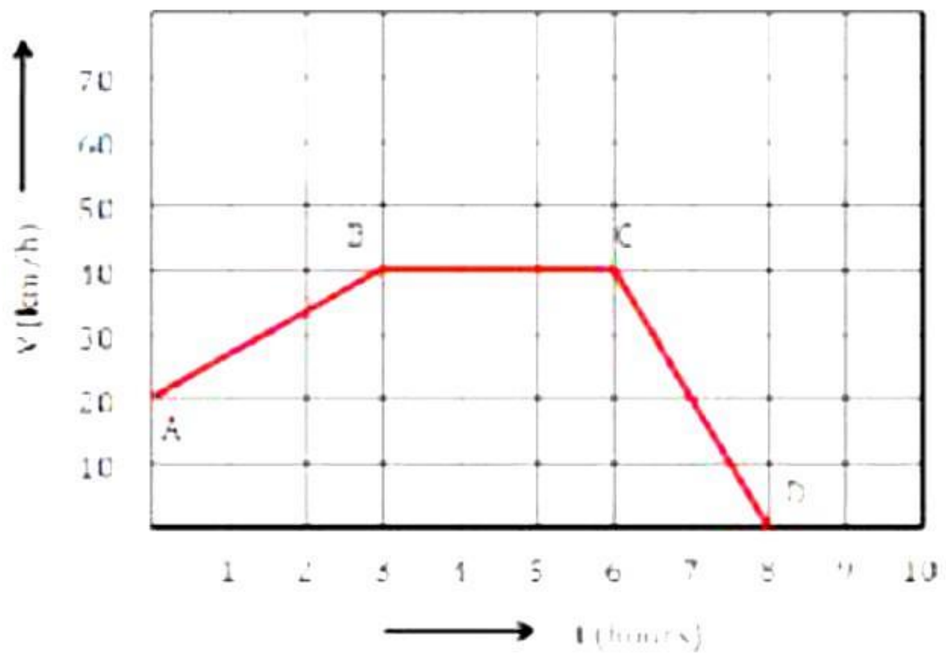
32. A trumpet produces 1500 sound waves in 3 seconds. The distance covered by a compression and an adjacent rarefaction is 66 cm. Find the [3]

(a) Frequency

(b) Wavelength and

(c) Velocity of the sound wave

33. The velocity–time graph for a moving body is given alongside. Find [3]



a) Acceleration between points A and B

b) Acceleration between points B and C

c) Acceleration between points C and D

SECTION - D

Question No. 34 to 36 are long answer questions.

34. [5]

(a)

(i) Reena stood there watching her mother roll papads large enough to last a year. Reena questioned her mother about why she only produces ready-to-fry raw crispy papad in the summer and not in the monsoon or winter seasons. Could you please explain?

(ii) Meenal wanted to enjoy her mother's hot Manchurian soup before leaving the house. The soup was too hot to swallow, but Meenal was in a hurry.
So, her mother told her to pour the hot soup into a saucer and sip it gently. What do you suppose the rationale is?

(b) Write the chemical formulae of the following compounds:

(i) Magnesium sulphate

(ii) Ammonium bicarbonate

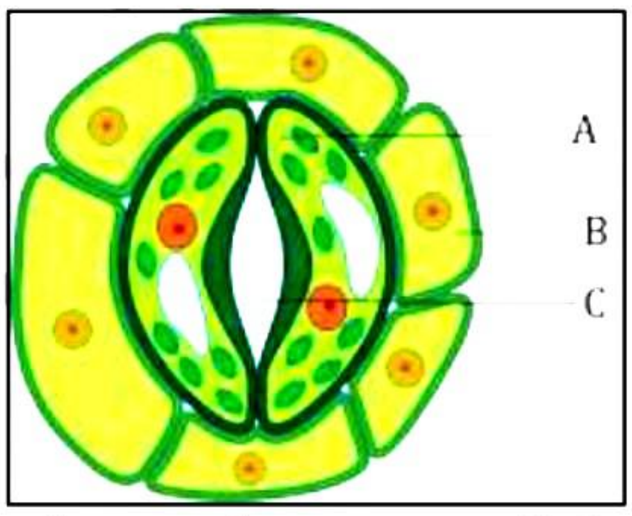
OR

Answer the following questions:

(a) What happens when a liquid is left exposed to air?

(b) List the factors which affect the rate of evaporation and explain their effect on it.

35. Plants give out water through the pores present under their leaves. These pores allow carbon dioxide, oxygen, and water vapour to diffuse in and out of a plant's internal tissues. [5]



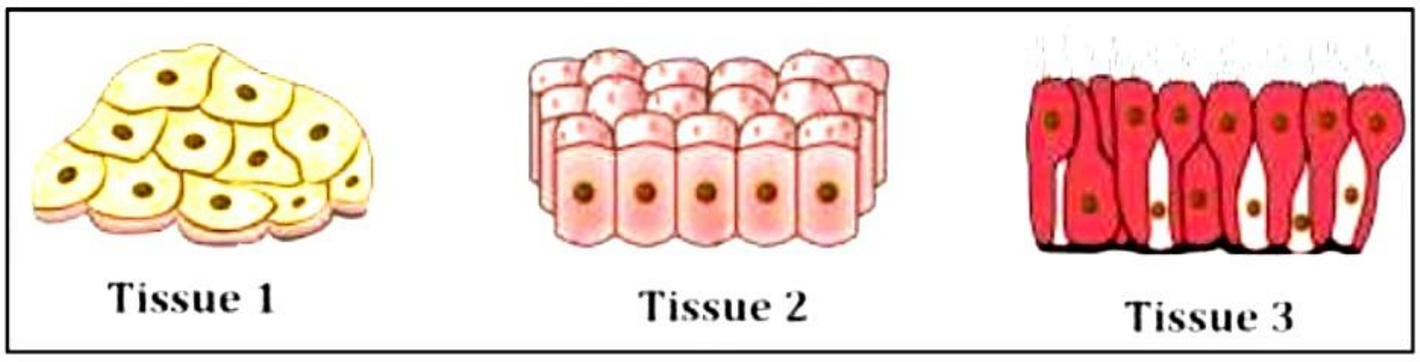
(a) What are these pores called?

(b) In the above diagram, which label correctly denotes these pores?

(c) Why do desert plants have smaller and fewer pores as compared to rainforest plants? Explain your answer.

OR

The picture shows three types of tissues found in the human body.



(a) Where are tissues 2 and 3 most likely to be found in the human body? Give two locations each.

(b) State two points of differences between tissue 1 and tissue 2.

(c) The inner lining of alveoli of lungs is very thin and delicate. Which type of tissue forms the inner lining of alveoli? Explain your answer.

36. [5]

(a) State the Universal Law of Gravitation.

(b) Calculate the force of gravitation between the earth and the sun. [Given that the mass of the earth = 6×10^{24} kg, mass of the sun = 2×10^{30} kg, average distance between the two is 1.5×10^{-11} m and G = 6.67×10^{-11} Nm^2kg^{-2}].

(c) A planet's weight is twice that of earth and the radius is 3 times that of earth. Find the acceleration due to gravity of that planet.

OR

(a) Explain why swimmers are provided with an inflated rubber jacket/tube?

(b) It is easier to swim in seawater than in river water. Why?

(c) The density of turpentine at 293 K is given as 870 kg/m^3.
Identify and write the names of substances that sink in turpentine at the same temperature.

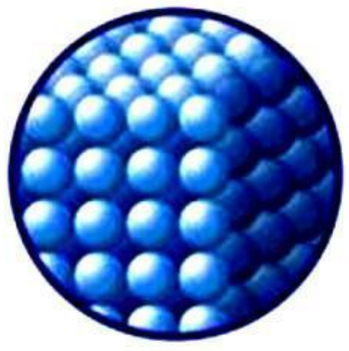
Sr. No	Substance	Density (kg/m^3)
1	Wood	690
2	Ice	920
3	Rubber	970
4	Paraffin Wax	900
5	Cork	240
6	Bone	1850

(d) State the conditions under which the object will float? Ships are made of iron and steel, yet they float on water. Why?

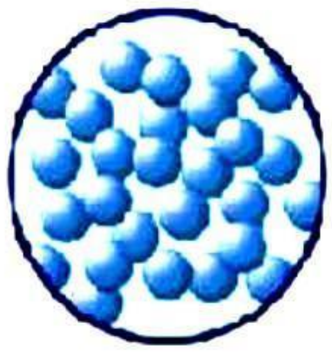
SECTION - E

Question No. 37 to 39 are case-based/data -based questions with 2 to 3 short sub-parts. Internal choice is provided in one of these sub-parts.

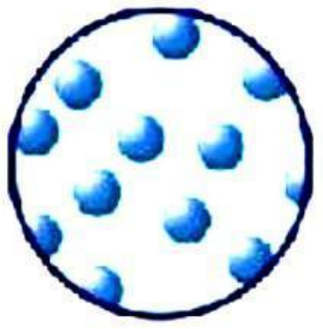
37. We know that the gases are highly compressible as compared to solids and liquids. The liquefied petroleum gas (LPG) cylinder that we get in our home for cooking, or the oxygen supplied to hospitals in cylinders is compressed gas. Now-a-days compressed natural gas (CNG) is used as fuel in vehicles. The liquid takes up the shape of the container in which they are kept. Liquids flow and change shape, so they are not rigid but can be called fluids. Solids and liquids can diffuse into liquids. The aquatic animals can breathe underwater. The rate of diffusion of liquids is greater than solid.



Solid



Liquid



Gas

(a) [2]

(i) How aquatic plants and animals can breathe underwater?

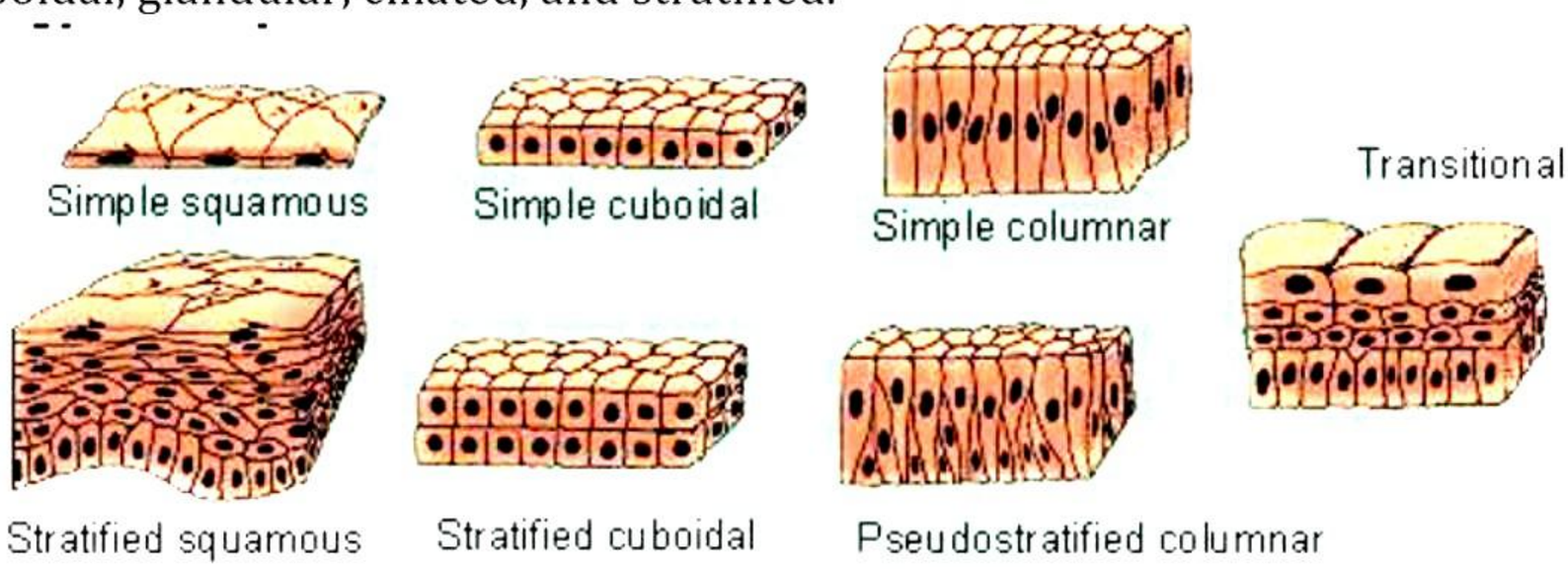
(ii) Among solids, liquids and gases which can be termed as fluids and why?

(b) Why compressed natural gas is used as fuel in vehicles these days? [2]

OR

(c) Why two different carats gold jewelry cannot be kept together? [2]

38. Epithelial tissues are widespread throughout the body. They form the covering of all body surfaces, line body cavities and hollow organs. Depending upon the shape and function of the constituent cells, epithelial tissues can be squamous, columnar, cuboidal, glandular, ciliated, and stratified. [4]



a) What is the role of ciliated epithelium?
b) Where is stratified epithelium located in the body?
c) Give two points of differences between cuboidal and columnar epithelium.

OR

c) Describe the structure, location and one function of squamous epithelium.

39. Ramesh conducts an experiment where he simultaneously drops a sheet of paper and a stone from the first floor of his school building. He observes that the paper reaches the ground later than the stone due to air resistance. Now, he imagines conducting this experiment on the moon, where there is no air.

(a) Predict what would happen if Ramesh repeated his experiment on the moon, where there is no air. Would the paper and stone reach the lunar surface at the same time? Why or why not?

(b) How does this experiment help in understanding the concept of gravity?

(c) What would gravity affect the paper and stone on Earth versus on the moon?

OR

(c) If Ramesh conducts the same experiment in the vacuum chamber. Will there be any difference in observation?

Solution

SECTION - A

1. Correct option – a: Liquid can flow
Liquids flow and change shape, so they are not rigid and can be called fluids. Liquids show a property called viscosity. More viscous liquids flow more slowly, while less viscous liquids flow easily.

2. Correct option – d: Solute and solvent
A solution consists of two components: solute and solvent.

3. Correct option – b: 12.044×10^{23}
One mole of hydrogen atom contains 6.022×10^{23} atoms. Since there are two hydrogen atoms in a hydrogen molecule hence, one mole of H_2 molecule contains = $2 \times 6.022 \times 10^{23}$ atoms.

4. Correct option – d: Diffusion
Intermixing of particles of two different types of matter on their own is called diffusion. The rate of diffusion increases on increasing the temperature of the diffusing substance (by heating).

5. Correct option – b: Most of the space inside the atom is empty.
Most of the alpha particles passed through the gold foil undeflected because most of the space inside the atom is empty.

6. Correct option – d: Both Clouds and Fog
Tyndall effect is shown by colloids. Clouds and fog can scatter light, and the path of light is illuminated. This effect is known as Tyndall effect.

7. Correct option – a: Kinetic theory of matter
The theory which visualizes that solid, liquid or gas is made up of tiny particles which are in constant motion is called kinetic theory of matter.

8. Correct option – b: Powerhouse
The given picture is of mitochondria. Mitochondria are called powerhouses of the cell as all the energy required by the body is synthesised in the mitochondria.

9. Correct option – a: Human RBCs
The given cell organelle is nucleus. Human RBCs do not contain a nucleus to accommodate more haemoglobin molecules and enable the transport of more oxygen.

10. Correct option – b: All areas of the pond are utilised for better fish production.
In composite fish culture, all areas of the pond are utilised. This avoids competition for the available resources and enhances fish production.

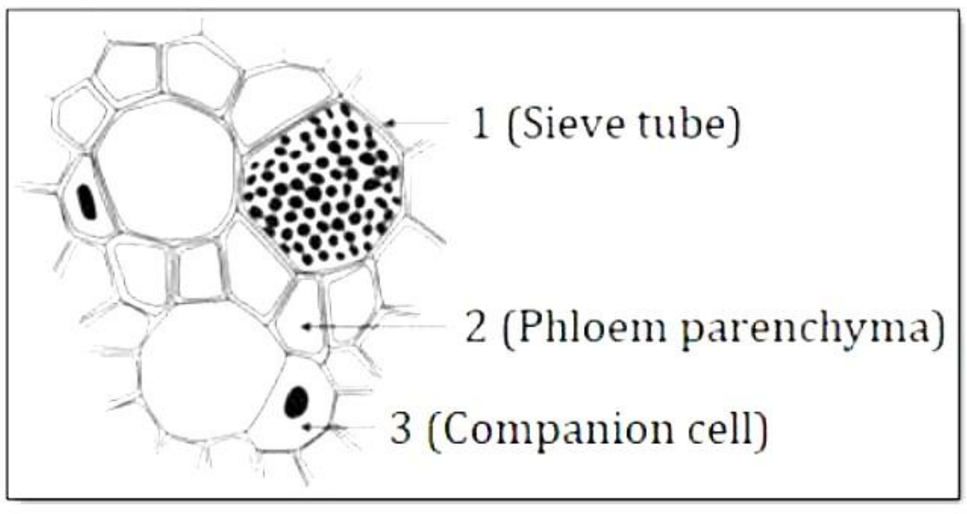
11. Correct option – b: To increase the time to stop.
The cushioned bed sinks under the weight, due to which the momentum of the athlete takes longer to reach zero. This results in a lesser force being exerted on the athlete, thereby reducing any chances of injury.

12. Correct option – c: When the weight of the body is equal to the weight of the liquid displaced.
An object will float in a liquid if the weight of the body is equal to the weight of the liquid displaced by it.

13. Correct option – c: BD
The minimum distance in which a sound wave repeats itself is called its wavelength. In a sound wave, the combined length of a compression and an adjacent rarefaction is called its wavelength. The distance between the centres of a compression and an adjacent rarefaction is equal to half the wavelength.
Thus, half the wavelength will be represented by BD.

14. Correct option – c: Distance
Independent variables are plotted along the X-axis, and dependent variables are plotted along the Y-axis. In the distance-time graph, time is independent, and distance is a dependent variable; hence, it is plotted along the Y-axis.

15. Correct option – b: 1 - Sieve tube, 2 – Phloem parenchyma, 3 – Companion cell
The given figure shows the cross section of the phloem tissue.



16. Correct option – d: A: Collenchyma, B: Sclerenchyma
Collenchyma tissue has small inter-cellular spaces with cell walls thickened at the corners whereas sclerenchyma tissue lacks inter-cellular spaces and has thickened cell walls.

17. Both A and R are true, but R is not the correct explanation of the assertion.
Both are definitions of sublimation and distillation, respectively. So, both assertion and reason are true, but reason is not the correct explanation of the assertion.

18. Both A and R are true, and the R is the correct explanation of the A.
To survive, an organism should be capable of independent existence and be able to perform essential life functions. Anything less than a complete structure of a cell does not ensure independent living. Hence, cell is the fundamental structural and functional unit of all living organisms.
So, both assertion and reason are true, and the reason correctly justifies the assertion statement.

19. A is true, R is false.
Work is equal to the product of force and displacement.
i.e., Work = Force × Displacement
Hence, the given reason is incorrect.

20. A is true but R is false.
Voluntary muscles are under our own will or volition, e.g., working and movement of our limbs. Involuntary muscles are controlled by hypothalamus, i.e., they are regulated rhythmically, e.g., alimentary canal, iris of the eye and bronchi of lungs. They are not under the control of our will or volition.
So, the assertion is true, but the reason is false.

SECTION - B

21. Gaseous properties of CO_2:

(i) It has neither fixed volume nor a fixed shape and is hence a gas.

(ii) It exerts pressure due to collision of the molecules.

CO_2 may be liquefied by reducing temperature or by increasing pressure.

Solid CO_2 gets converted directly into gaseous state without coming into liquid state and is hence called dry ice.

22. Apical meristems are present at the tips of roots, shoots, branches, and leaves. They form the growing parts of the roots and stems. If the apical meristems are damaged or cut, the growth in length of that plant part will gradually stop.

23.

(a) Endoplasmic reticulum

(b) Nucleus

OR

Cells generally remain smaller in size because of the following reasons:

- To enable different regions of the cell to communicate with each other rapidly for the cell to function effectively.
- To have a large surface area is to volume ratio for greater diffusion of substances, in and out of the cell.

24.

$$\text{we know that speed} = \frac{\text{Distance}}{\text{Time}}$$

Distance travelled =12,250 m

Time taken = 1 hour = 60 x 60 s = 3600 s

$$\rightarrow \text{Speed} = \frac{12{,}250\text{m}}{3600\,\text{s}}$$

= 3.4 m/s southwest

Thus, the cyclist travels at a speed of 3.4 m/s in the southwest direction.

25.

(i)

$$F \propto \frac{1}{r^2}$$

$$\therefore F_{new} \propto \frac{1}{r_{new}^2}$$

$$\Rightarrow \frac{F_{new}}{F} = \frac{r^2}{r_{new}^2} = \frac{r^2}{\left(r/2\right)^2} = 4$$

$$\therefore F_{new} = 4F$$

That is, the force increases 4 times when the distance between two objects is reduced to half.

(ii)

$$F \propto m_1 m_2$$

$$\therefore F_{new} \propto m_{1,new} m_2$$

$$\Rightarrow \frac{F_{new}}{F} = \frac{m_{1,new} m_2}{m_1 m_2} = \frac{4m_1 m_2}{m_1 m_2} = 4$$

$$\therefore F_{new} = 4F$$

That is, the force increases 4 times when the mass of one object is increased to 4 times.

OR

Mercury, oil, and water are immiscible liquids and have different densities. The mercury, oil and water mixture will be put in a separating funnel and allowed to stand for some time. The mixture separates into three layers according to the mercury, oil, and water densities. On opening the stop cock of the separating funnel, the lower layer formed by mercury comes out first and is collected in a beaker leaving behind the other two layers. Similarly, again on opening the stop cock of the separating funnel, the lower layer of water comes out first and is collected in the beaker leaving behind the oil in the funnel.

26. <u>If case of low rainfall in a village throughout the year, the following measures can be taken by the farmers for better cropping:</u>

- Practice farming with drought-resistant and early maturing varieties of crops.
- Enrich soil with more humus content as it increases the water-holding capacity and retains water for a longer duration.

SECTION - C

27.

(a) Ammonium sulphate:

	Ammonia	Sulphate
Symbols	NH_4	SO_4
Valency	1+	2-
Interchanging Valency	2	1
Chemical formula	$(NH_4)_2SO_4$	

Therefore, the molecular formula of ammonium sulphate is $(NH_4)2SO_4$.

(b) Sodium phosphate:

	Sodium	Phosphate
Symbols	Na	PO_4
Valency	1+	3-
Interchanging Valency	3	1
Chemical formula	Na_3PO_4	

Therefore, the molecular formula of sodium phosphate is Na_3PO_4.

(c) Carbon dioxide:

	Carbon	Oxygen
Symbols	C	O
Valency	4+	2-
Interchanging Valency	2	4
Chemical formula	C_2O_4 = **CO_2**	

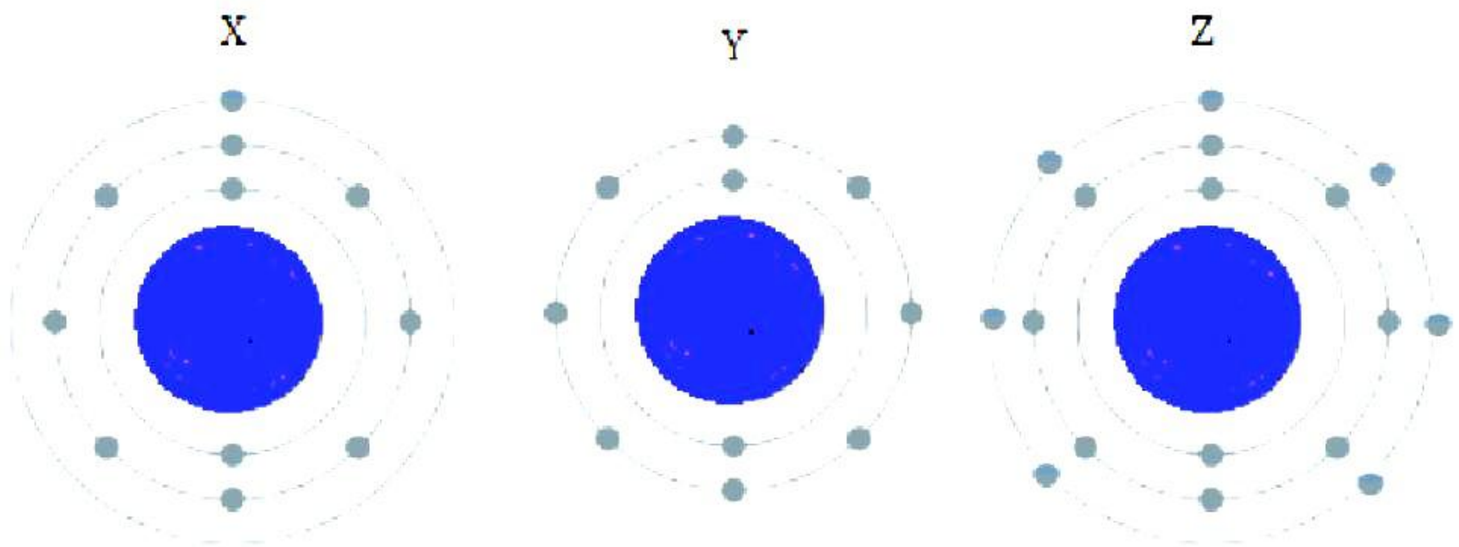
Therefore, the molecular formula of carbon dioxide is CO_2.

28.

$$\text{Mass of calcium in 1.2 g sample of } CaCO_3 = \frac{40 \times 1.5}{100}$$
$$= 0.6\,g$$
$$\text{Mass of carbon in 1.5 g sample of } CaCO_3 = \frac{12 \times 1.5}{100}$$
$$= 0.18\,g$$
$$\text{Mass of oxygen in 1.5 g sample of } CaCO_3 = \frac{48 \times 1.5}{100}$$
$$= 0.72\,g$$

OR

Valency of X is 1 since it has only 1 electron in its outermost shell so it can easily give away that electron in order to achieve stable electronic configuration.
Atomic number of X is 11 and the name of element is sodium.
Valency of Y is zero since it has achieved octet.
Atomic number of Y is 10 and the name of element is Neon.
Valency of Z is again 1 since it receive one electron in its valence shell in order to achieve stable octet.



Atomic number of Z is 17 and the name of element is Chlorine.

29.

a) Hypotonic solution: RBCs will swell if they are placed in a hypotonic solution. The cells will gain water by osmosis (endosmosis). The cells might burst and rupture if they are placed in the hypotonic solution for a longer time.
b) Isotonic solution: RBCs will be of the same size if they are placed in an isotonic solution. No change will occur in the shape and size of the cells.
c) Hypertonic solution: RBCs will shrink if they are placed in a hypertonic solution. The cells will lose water by osmosis (exosmosis).

30.

a) <u>To obtain the maximum benefit from a crop field, we should adopt the following practices:</u>

i. Maintain soil fertility through judicious use of manures and fertilisers.
ii. Practise crop rotation.
iii. Employ cropping patterns such as mixed cropping and intercropping.
iv. Keep a check on the weed and insect pest population.

b) The pea crop would require a minimum quantity of fertilisers for its proper growth because pea is a dicot leguminous plant. The root nodules of leguminous plants contain nitrogen fixing bacteria which supply essential nutrients required for plant growth.

31.

a) To make the net force a balanced force, 10 N must be added to F1.
90+ 10 N = 100 N

b) To move the object along the direction of F1, it must be exceeded by 20 N so that it becomes greater than F2. So now F1 becomes 110 N.

c) After carrying out the condition given in question (b),
F = 110 N
So, net force = F = F1 − F2 = 110 N − 100 N = 10 N.
Acceleration F = ma
i.e., F= 10 N
$\therefore a = \frac{F}{m} = \frac{10}{10} = 1\ m/s^2$

32.

(a) No. of waves produced in 3 seconds = 1500
No. of waves produced in 1 second = 1500/3 = 500
Thus, the frequency of the sound is 500 Hz.

(b) The distance covered by compression an adjacent rarefaction is equal to its wavelength. This distance is 66 cm. Thus, the wavelength of a sound wave is 66 cm = 0.66 m.

(c) Velocity
$v = f\lambda$
$v = 500 \times 0.66 = 330$ m/s

33.

(a) Acceleration between points A and B will be given by the slope of line AB
$Slope = a_{AB} = \frac{v_B - v_A}{t_B - t_A}$
$\therefore a_{AB} = \frac{40-20}{3-0} = \frac{20}{3} = 6.67\ m/s^2$

(b) The velocity of the body is constant between points B and C. Hence, the acceleration will be zero. So, $a_{BC} = 0$

(c) Acceleration between points C and D will be given by the slope of line CD.

$$Slope = a_{CD} = \frac{v_D - v_C}{t_D - t_C}$$

$$\therefore a_{AB} = \frac{0-40}{8-6} = \frac{-40}{2} = -20\ m/s^2$$

SECTION – D

34.

(a)

(i) Food products such as papad need appropriate drying to be kept for the entire year. Any residual water in the papads might cause them to go rancid or spoil quickly.

The rate of evaporation of water increases on a hot, dry day due to the increase in temperature. Furthermore, air dryness, or a reduction in air humidity, increases the rate of evaporation.

The humidity in the atmosphere is higher during the monsoon season, while the temperature is very low during the winter season. The weather is sunny and dry during the summer. So, papad making is preferred to be done in the summer season by most of the households.

(ii) When soup is poured in a saucer, it cools faster. Evaporation is a surface phenomenon. Particles of soup on the surface absorb heat of vaporisation from the remaining particles of soup and evaporate. Soup thus loses heat and cools faster.

(b)

(i) Formula of Magnesium sulphate

	Magnesium	Sulphate
Symbols/Formula	Mg	SO_4
Valency	2+	2-
Formula	$Mg_2(SO_4)_2 = \mathbf{MgSO_4}$	

Therefore, the molecular formula of Magnesium sulphate is $MgSO_4$.

(ii) Formula of Ammonium bicarbonate

	Ammonium	bicarbonate
Symbols/Formula	NH_4	HCO_3
Valency	1+	1-
Formula	$\mathbf{NH_4HCO_3}$	

Therefore, the molecular formula of Ammonium bicarbonate is NH_4HCO_3.

OR

(a) When a liquid is left exposed to air, its volume decreases gradually because of evaporation of some of the water from its surface.

(b) The four factors affecting the rate of evaporation are:

1. Surface area: Evaporation is a surface phenomenon. If the surface area is increased, then the rate of evaporation increases.

2. Temperature: With the increase of temperature, more particles get enough kinetic energy to go into the vapour state, and hence, the rate of evaporation increases.

3. Humidity: If the humidity of air is high, then the rate of evaporation decreases.

4. Wind speed: With the increase in wind speed, the particles of water vapour move away with the wind, decreasing the amount of water vapour in the surroundings; hence, the rate of evaporation increases.

35.

(a) Stomata are minute openings or pores found in the epidermis of plant leaves.

(b) A – Guard cells, B – Epidermal cell, C - Stomatal pore
So, in the above diagram, label C correctly denotes the stomatal pores.

(c) Water vapor diffuses through the stomata into the atmosphere in a process called transpiration. In deserts, due to heavy sunlight and high temperatures, rate of evaporation of water is very high. Therefore, to minimise the loss of water through transpiration, desert plants have smaller and fewer stomata. Rainforests have abundant water and hence, plants in these regions do not need to conserve water. Therefore, they have larger and a greater number of stomata.

OR

Tissue 1 – Simple squamous epithelium
Tissue 2 – Cuboidal epithelium
Tissue 3 – Ciliated epithelium

(a) Tissue 2 – Salivary glands and pancreatic duct.
Tissue 3 – Lining of the trachea, fallopian tubes

(b) Differences between simple squamous (tissue 1) and cuboidal (tissue 2) epithelium:

Simple squamous epithelium	Cuboidal epithelium
1. Composed of flat, tile-like polygonal cells.	1. Consists of short, cube-shaped cells.
2. Main function is protection, excretion, gas exchange, and secretion of coelomic fluid.	2. Main function is protection secretion, absorption, excretion, and gamete formation.
3. Found in terminal bronchioles and alveoli of lungs.	3. Found in PCT and DCT of nephrons of kidney.

(c) The inner lining of the alveoli is very thin and delicate. This means that the tissue which lines the alveoli is extremely thin and delicate. Such a lining is possible only through the simple squamous epithelium which comprises of a single layer of thin, flat, and closely packed cells.

Thus, the inner lining of alveoli is lined by tissue 1, that is, simple squamous epithelium. This epithelium is extremely thin and delicate which facilitates easy diffusion of oxygen and carbon dioxide.

36.

(a) Every object in the universe attracts every other object with a force which is proportional to the product of their masses and inversely proportional to the square of the distance between them.

$\therefore F\alpha \frac{Mm}{d^2}$ $F = G\frac{Mm}{d^2}$

Here, G is the constant of proportionality and is known as universal constant of gravitation.

(b)

Given $m_1 = 6\times10^{24}\,kg,\ m_2 = 2\times10^{30}\,kg,\ d = 1.5\times10^{11}\,m$

$$F = G\frac{m_1 m_2}{a^2} = \frac{6.67\times10^{-11}\times6\times10^{24}\times2\times10^{30}}{(1.5\times10^{11})^2}$$

$F = 35.573 \times 10^{21} N$

(c) Let the mass of earth be M Then the mass of planet is $M_p = 2M$

Let the radius of earth be R Then the radius of planet is $R_p = 3R$

$$g_e = \frac{GM}{R^2} = 9.8\ m/s^2$$

Thus, the acceleration due to gravity of planet is

$$g_p = \frac{GM_p}{R_p^{\ 2}}$$

$$g_p = \frac{G(2M)}{(3R)^2}$$

$$g_p = \frac{2}{9}\frac{GM}{R^2}$$

$$g_p = \frac{2}{9}g_e$$

$$g_p = \frac{2}{9}\times 9.8\ m/s^2$$

$$g_p = 2\times10.8\ m/s^2$$

$$g_p = 2.17\ m/s^2$$

OR

(a) Swimmers are provided with an inflated rubber jacket or rubber tube. The jacket tube has low weight and large volume. Hence, it displaces large volume of water. As a result, up thrust due to water increases and the person remains afloat, i.e., there is no chance of drowning of the swimmer in such case.

(b) It is easier to swim in sea water because density of sea water is more due to added salts. Hence, up thrust acting on the swimmer in sea water is more than in fresh water. So, it is easier to swim in sea water.

(c) Ice, rubber, paraffin wax and bone will sink in turpentine as their densities are larger than turpentine.

(d) An object will float in a liquid:

- If its density is less than that of liquid
- If its density is equal to the density of the liquid

  A ship is made up of iron but is not a solid block of iron, it is filled with air spaces. Air has density lower than that of water. Hence, due to presence of air, the density of ship becomes less than that of water and hence floats on water. Also, a ship is able to displace volume of water equal to its own volume. Hence, a ship is able to float on water.

SECTION - E

37.

(a)

(i) Aquatic plants and animals can breathe underwater because atmospheric oxygen gas dissolves in water due to diffusion.

(ii) Only liquids and gases can be termed fluids because they both have the unique property of being fluids, which is that they can flow.

(b) Compressed natural gas (CNG) is used as fuel in vehicles these days because,

(i) CNG has high compressibility,

(ii) Large volumes of a gas can be compressed into a small cylinder,

(iii) It can be transported easily.

OR

(c) Two different carats of gold jewellery cannot be kept together because the gold from higher-carat jewellery would get diffused into the jewellery made up of lower-carat gold. This results in the loss of gold from higher-carat jewellery. Hence, it is advisable to keep different-carat gold jewellery separately.

38.

(a) Ciliated epithelium helps in the movement of mucus, urine, eggs, sperms, and cerebrospinal fluid in a particular direction.

(b) Stratified epithelium is found in places where there is much wear and tear, such as the epidermis of skin and lining of the mouth cavity.

(c) Differences between cuboidal and columnar epithelium:

Cuboidal epithelium	Columnar epithelium
1. Cells are cube shaped.	1. Cells are tall and column-like.
2. Provides mechanical support.	2. Helps in absorption and secretion and facilitates movement across the epithelial barrier.
3. Forms the lining of kidney tubules and ducts of salivary glands.	3. Forms the inner lining of the intestine, stomach and colon and lining of gall bladder.

OR

c) **Squamous epithelium**

Structure:

- The cells in the squamous epithelium are extremely thin and flat and are arranged edge to edge forming a delicate lining or covering.

Location:

- Squamous epithelium forms the lining of cavities of ducts and blood vessels, lines the chambers of the heart, covers the skin, and lining of the mouth.
- It also lines pharynx, oesophagus, anal canal, vagina, and lower part of urethra.

Function:

- Squamous epithelium provides protection to the underlying parts against abrasion (mechanical injury) and entry of germs or chemicals.
- It also helps in excretion, gas exchange and secretion of coelomic fluid.

39.

(a) The paper and stone would reach the surface simultaneously on the moon due to a lack of air resistance.

(b) This experiment helps us understand that gravity acts on all objects equally, but air resistance can affect their fall.

(c) On Earth, gravity pulls both objects down, but air resistance affects them differently. On the moon, without air resistance, gravity affects them equally. As a result, irrespective of mass, both objects will hit the ground simultaneously.

OR

(c) In a vacuum chamber, both the paper and stone would fall at the same rate.