Class IX Session 2024-25
Subject - Science
Sample Question Paper - 15

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. Valency of hydrogen is 1 and that of sulphur is 2. What should be the formula of hydrogen sulphide? [1]

a) HS

b) HS_2

c) H_2S

d) H_2S_2

2. Which of the following statements is true for colloids? [1]

a) A colloid is a homogeneous mixture.

b) Particles of a colloid can be seen by the naked eye.

c) Particles of a colloid scatter a beam of light passing through it.

d) All the above.

3. Rita is working as a chemistry lab assistant. Her HOD asks her to prepare a solution containing calcium chloride ($CaCl_2$). To ensure the right quantity of $CaCl_2$, she needs to know its formula unit mass. The formula unit mass of $CaCl_2$ would be: [1]

a) 111 u

b) 75. 5 u

c) 40 u

d) 35.5 u

4. Which of the following equations are true for an Element? [1]

(i) Mass number = number of protons + number of neutrons

(ii) Atomic number = number of protons + number of electrons

(iii) Atomic mass = number of protons = number of neutrons

(iv) Atomic number = number of protons = number of electrons

a) (i)and(ii)

b) (ii)and(iv)

c) (ii)and(iii)

d) (i) and (iv)

5. The condition from the following given options which will increase the evaporation of water is: [1]

a) Less exposed surface area of water

b) Decrease in temperature of water

c) More exposed surface area of water

d) Adding common salt to water

6. There are three isotopes of carbon which are named as C-12, C-13, and C-14. Which one of the following options is true for the composition of nucleus of these three isotopes? [1]

a) C-12 : 6p+6n, C-13 : 7p+6n, C-14 : 8p+6n

b) C-12 : 6p+6n, C-13 : 6p+7n, C-14 : 6p+8n

c) C-12 : 6p+6n, C-13 : 5p+8n, C-14 : 5p+9n

d) C-12 : 6p+6n, C-13 : 12p+1n, C-14 : 7p+7n

7. According to the law of conservation of mass, mass of reactants will be equal to the mass of: [1]

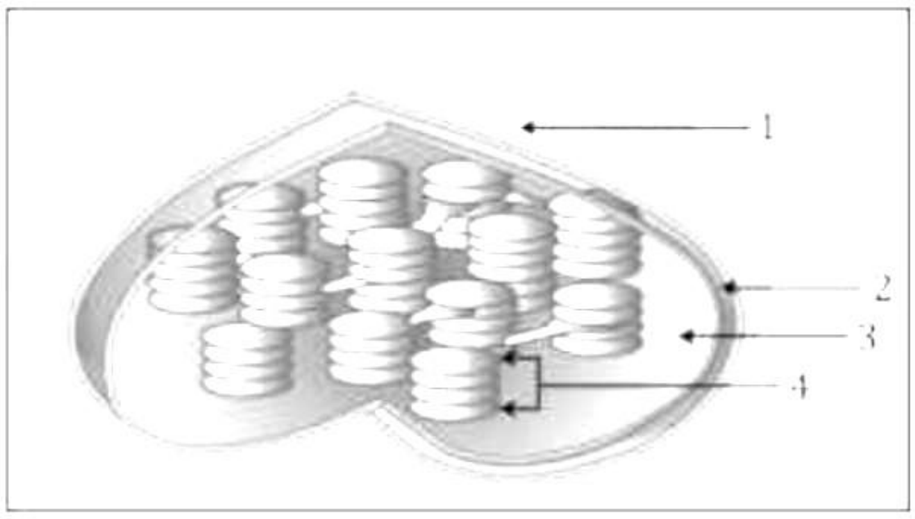
a) Products

b) Catalysts

c) Gases evolved

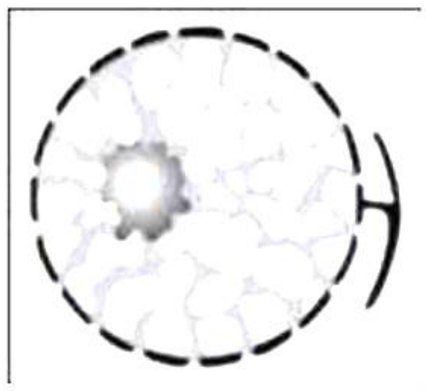
d) Apparatus used for reaction

8. The given figure shows a cell organelle. Which part is associated with the light reactions of photosynthesis? [1]



a) 1
b) 2
c) 3
d) 4

9. The given figure shows a certain structure of the cell. How is this structure important for the cell? [1]



a) Regulates cell division
b) Synthesises proteins
c) Provides energy
d) Removes waste products

10. Given below are few statements about hybridisation. Identify the correct statements. [1]

(i) Hybridisation means crossing between genetically dissimilar plants.
(ii) Cross between two varieties is called interspecific hybridisation.
(iii) Introducing genes of desired characters into a plant gives a genetically modified crop.
(iv) Cross between plants of two species is called intervarietal hybridisation.

a) (ii) and (iv)
b) (ii) and (iii)
c) (iii) and (iv)
d) (i) and (iii)

11. An archer shoots an arrow. Consider the action force to be the bowstring against the arrow. What will be the reaction force? [1]

a) Arrow pushing against the bowstring.
b) Weight of the arrow
c) Air resistance against the bow
d) Grip of the archer's hand on the bow

12. A student lowers a body in a container filled with some liquid. He finds that there is a maximum apparent loss in weight of the body when [1]

a) It just touches the surface of the liquid.
b) It is completely immersed in the liquid.
c) It is partially immersed in the liquid.
d) It is partially immersed and touches the sides of the container.

13. If the velocity of a body changes uniformly from u to v in time t, then what will be the sum of average velocity and acceleration? [1]

a) $\frac{2u}{t}$

b) $\frac{2v}{t}$

c) $\frac{u+v}{t}$

d) $\frac{u-v}{t}$

14. In which one of the following cases is work scientifically said to be done? [1]

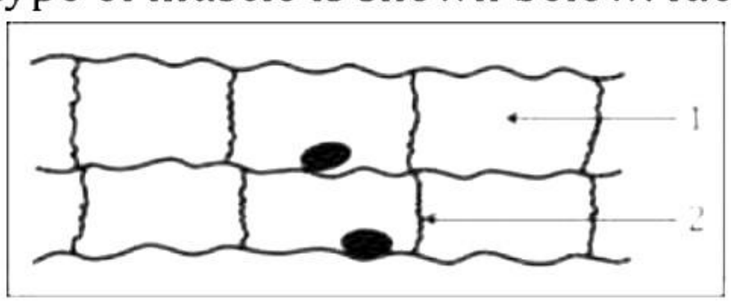
a) Mira is studying for her exam.

b) Manish pulls the trolley up to a certain distance.

c) Manoj pushes the wall with no change in the position of the wall.

d) Aruna standing at a bus stop holding a bag in her hand.

15. A type of muscle is shown below. Identify the characteristic feature of this muscle. [1]



a) Long, cylindrical, branched, uninucleate

b) Isodiametrical, spherical, unbranched, uninucleate

c) Long, cylindrical, unbranched, multinucleate

d) Isodiametrical, spherical, unbranched, multinucleate

16. The cells of the ciliated epithelium have cilia at their free ends which constantly keep lashing and move the materials which enter these regions. The ciliated epithelium is most likely to be found in the [1]

a) Walls of the heart

b) Lining of the trachea

c) Sweat glands

d) Around the muscles, blood vessels and nerves

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: An atom is the smallest particle in the element that has the properties of element.

Reason: Molecules are formed by the combination of two or more atoms. [1]

18. **Assertion**: The inner mitochondrial membrane is highly folded.
Reason: This increases the surface area for ATP synthesis. [1]

19. **Assertion**: The sensation of sound persists in our brain for about 0.1 s.
Reason: The sound returning towards the source after getting reflected from a distant obstacle is called an echo. [1]

20. **Assertion:** Epithelial tissues are covering or protective tissues.
Reason: Materials are exchanged at the surface across the epithelial tissues. [1]

SECTION - B

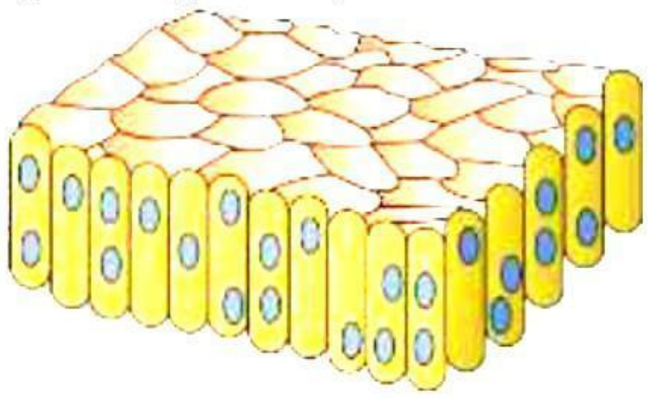
Question No. 21 to 26 are very short answer questions.

21. Define: [2]

(a) Law of constant proportion

(b) Law of conservation of mass

22. The given figure represents a tissue found in the human body. [2]



(a) Identify the tissue and state its function.

(b) Mention any two locations where this tissue is found in the body.

23. What would happen if all the cells of our body were of the same shape and size? [2]

OR

Do you think the cells of an elephant would be larger than the cells of a rat? Explain briefly.

24. An object starting from rest undergoes an acceleration of 10 m/s^2. Find the distance travelled in 5 seconds. [2]

25. An egg sinks in fresh water but floats in highly salty water. Give reason. [2]

OR

(a) What is the force between the Earth and a body called?

(b) What will happen to the force of gravitation between two objects if the distance between them is reduced to half?

26. Raghur observed that the growth of weeds in his field reduced the crop yield. What can the farmer do to prevent the growth of weeds without investing money on weedicides?[2]

SECTION - C

Question No. 27 to 33 are short answer questions.

27. During chemistry class, Suyash learnt about Rutherford's α-particle scattering experiment. Can you explain the observations which led Rutherford to make the following conclusions: [3]

(a) Most of the space in an atom is empty.

(b) Entire mass of an atom is concentrated in its centre.

(c) Centre is positively charged.

28. [3]

(a) Why is large part of the atom neglected when calculating the mass of the atom?

(b) Give reason why atoms combine with each other.

(c) In the notation of an atom, how are the atomic number, mass number and symbol of the element written?

OR

(a) Calculate formula unit mass of K_2SO_4.

(b) Write the formula of oxide for an element with valency 3?

29. We eat food composed of nutrients like carbohydrates, proteins, fats, vitamins, minerals, and water. After digestion, these are absorbed in the form of glucose, amino acids, fatty acids, and glycerol. What mechanisms are involved in the absorption of digested food and water? [3]

30. What would happen if poultry birds were larger in size and have no summer adaptation capacity? To get small-sized poultry birds, having summer adaptability, which method can be employed? [3]

31. [3]

(a) A wooden block has volume 30 cm^3 and mass 75 g. Calculate the density of water and state whether the object will float or sink? (Density of water = 1 g/cm^3)

(b) The volume of 50 g of a substance is 20 cm^3. If the density of water is 1 g cm^3, will the substance float or sink in water? Justify your answer.

32. [3]

(a) Two identical pointed objects made from iron and wood are allowed to fall on a heap of sand from the same height. The iron object penetrates more into the sand as compared to the wooden object. Which of these objects has more potential energy?

(b) Define 1 joule of work done?

(c) In a tug of war, team A wins, and team B loses. Which team does positive work and which team does negative work? Justify your answer.

33. A ball thrown vertically upwards returns to the thrower after 6 s. Find [3]

(a) The velocity with which it was thrown up.

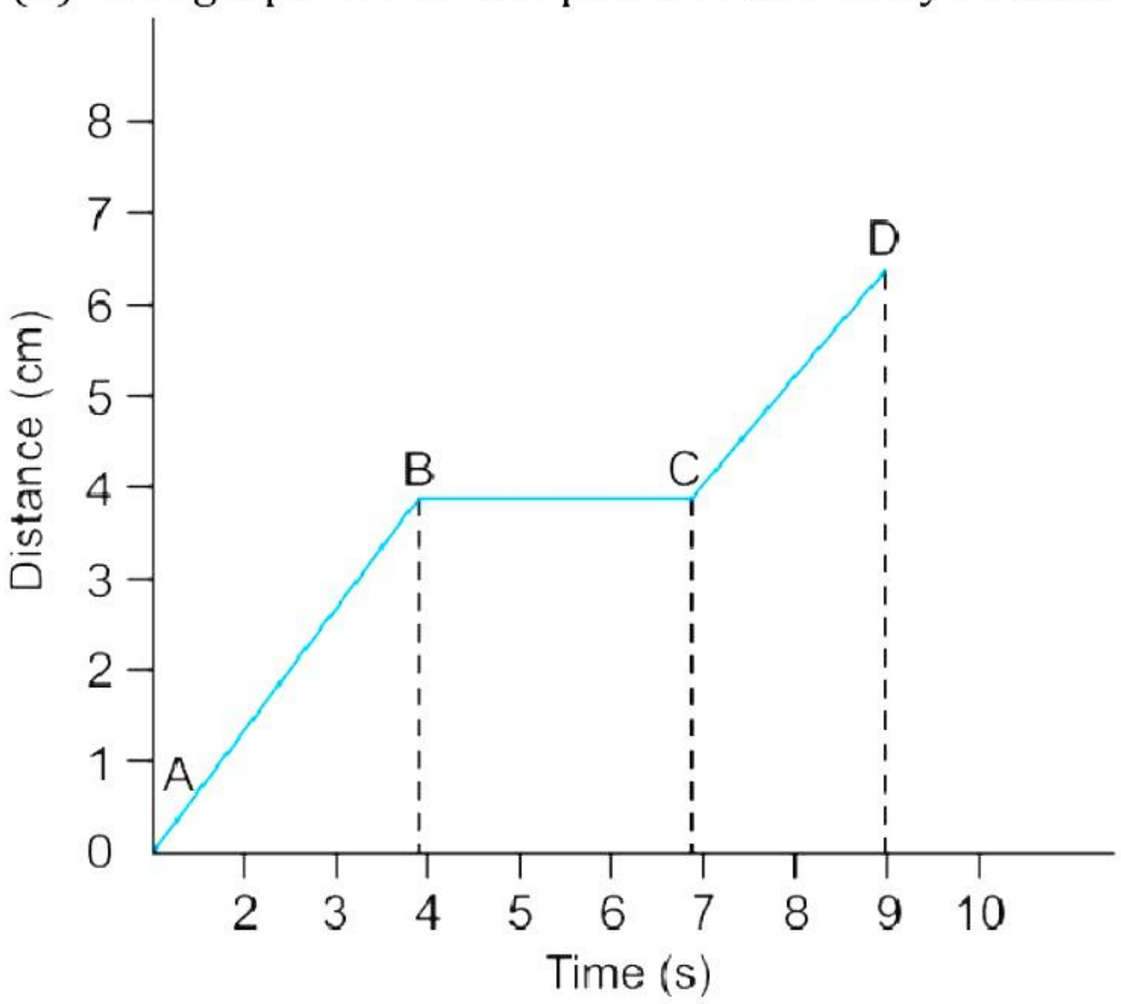
(b) The maximum height it reaches.

(c) Its position after 4 s.

OR

(a) Draw a distance-time graph for an object in non-uniform motion with increasing and decreasing slope.

(b) The graph shows the position of a body at different times.



Calculate the speed of the body as it moves from

(i) A to B

(ii) B to C

(iii) C to D

SECTION - D

Question No. 34 to 36 are long answer questions.

34. Sejal is a graduate student presenting at a science conference, and her topic is the historical development of atomic models. During her presentation, she focuses on Niels Bohr and his contributions to atomic theory. The audience is particularly interested in understanding how Bohr's model improved upon earlier models of the atom. [5]

- What were Bohr's key contributions to the understanding of atomic structure?
- Describe Bohr's model of the atom in detail, including a neat and labelled diagram.

OR

Answer the following questions:

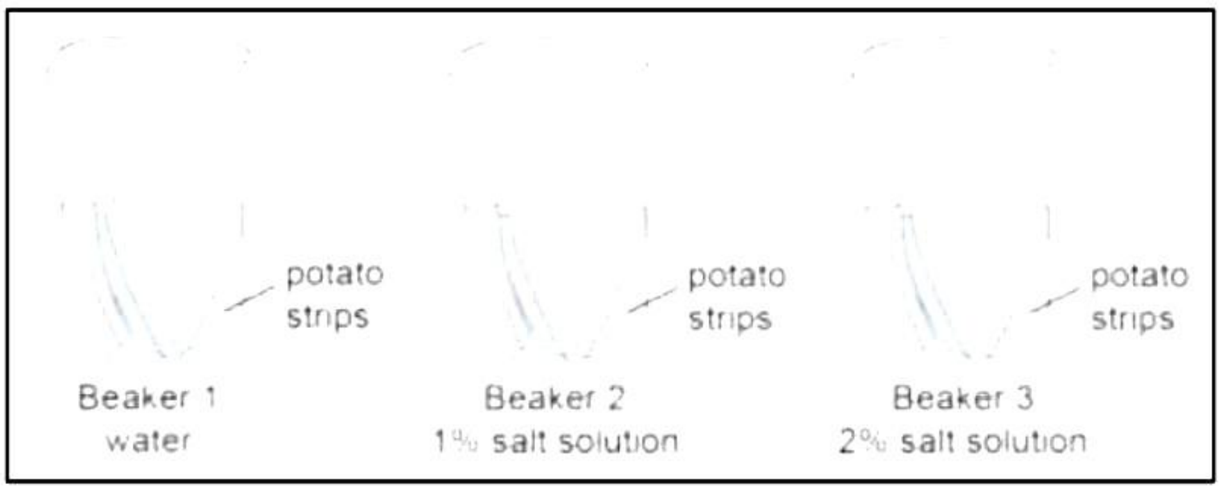
(a) Describe Rutherford's model of an atom.

(b) Give reasons:

i. After a hot sunny day, people sprinkle water on the roof or open ground.

ii. A wooden table should be called a solid.

35. Radhika conducted an experiment to know how plant cells lose or gain water through osmosis. She cut out 5 cm long potato strips and placed three potato strips in each of the following beakers:



Radhika left the potato strips in the beaker for 5 hours. She recorded the length of the potato strips in each beaker after 5 hours.

	Length of the potato strip before placing in the beaker (cm)	**Length of the potato strip after 5 hours in the beaker (cm)**
Beaker 1 (water)	5.0	5.3
	5.0	5.2
	5.0	5.2
Beaker 2 (1% salt solution)	5.0	5.0
	5.0	5.0
	5.0	4.9
Beaker 3 (2% salt solution)	5.0	4.8
	5.0	4.9
	5.0	4.7

(a) How will you explain the movement of water during osmosis from the above experiment?

(b) In which beaker was the concentration of water molecules inside and outside the potato cells likely to be the same? Explain your answer.

(c) Why did Radhika place three potato strips in each beaker?

OR

(a) Draw a neat diagram of a plant cell and label the following parts:

i. Mitochondria

ii. Nucleus

iii. Vacuole

iv. Golgi apparatus

(b) Name the energy currency of the cell. Which cell organelle releases this currency?

(c) What is the role of cell wall in a plant cell?

36. [5]

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

(b) A body whose volume is 100 cm^3 weighs 10 N in air. Find its weight in water. (Take g = 10 ms^{-2}, density of water = 1000 kg m^{-3})

(c) A body is weighed first in air, then in liquid A and then in liquid B. The observations are 100 N, 50 N and 60 N, respectively.

i. Which liquid is denser?

ii. What is the density ratio of liquid A to liquid B?

OR

(a) On what factors does the gravitational force between the two bodies depend? How does the gravitational force between the two bodies change if the distance between them is tripled?

(b) What is meant by free fall? A man weighs 600 N on earth. What is his mass? ($g=10ms^{-2}$). On moon, his weight would be 100N. What is the acceleration due to gravity on the moon?

(c) Distinguish between mass and weight of an object.

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. Pragya tested the solubility of three different substances at different temperatures and collected the data as given below (results are given in the following table, as grams of substance dissolved in 100 grams of water to form a saturated solution). [4]

Substance dissolved	Temperature (in K)				
	283	293	313	333	353
Potassium nitrate	21	32	62	106	167
Sodium chloride	36	36	36	37	37
Potassium chloride	35	35	40	46	54
Ammonium chloride	24	37	41	55	66

(a)

(i) What mass of potassium nitrate would be needed to produce a saturated solution of potassium nitrate in 50 grams of water at 313 K?

(ii) Find the solubility of each salt at 293 K. Which salt has the highest solubility at this temperature?

(b)

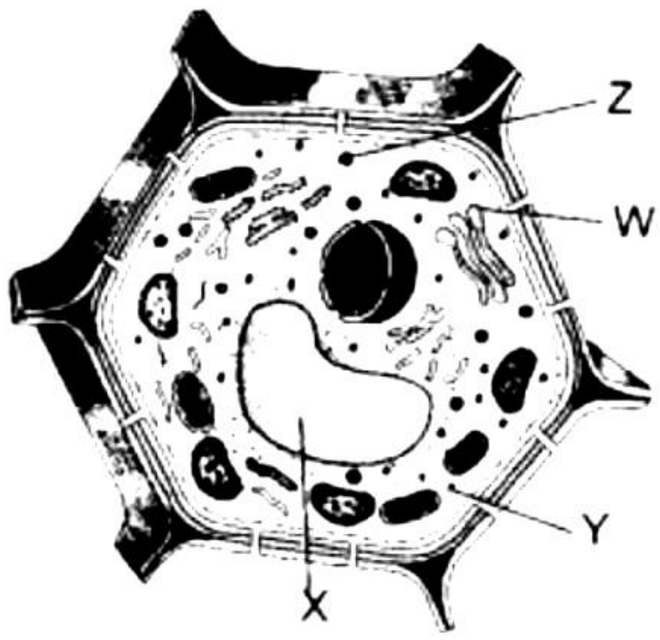
(i) Pragya makes a saturated solution of potassium chloride in water at 353 K and leaves the solution to cool at room temperature. What would she observe as the solution cools? Explain.

(ii) What is the effect of change of temperature on the solubility of a salt?

OR

(b) Define solubility. Give effects of temperature and pressure on the solution of gas in liquid.

38. Cell is the basic structural and functional unit of life. The activities of the cell are carried out by membrane-bound cell organelles like mitochondria, Golgi bodies, ribosomes, plastids, etc. Each cell organelle performs a designated function. A particular cell organelle is responsible for the synthesis of substances like lipid, protein, starch, etc. while the other generates energy. One secretes hormones, enzymes, etc. while the other participates in the digestion of substances taken up by the cell.



(a) Identify W, X, Y and Z in the given figure.

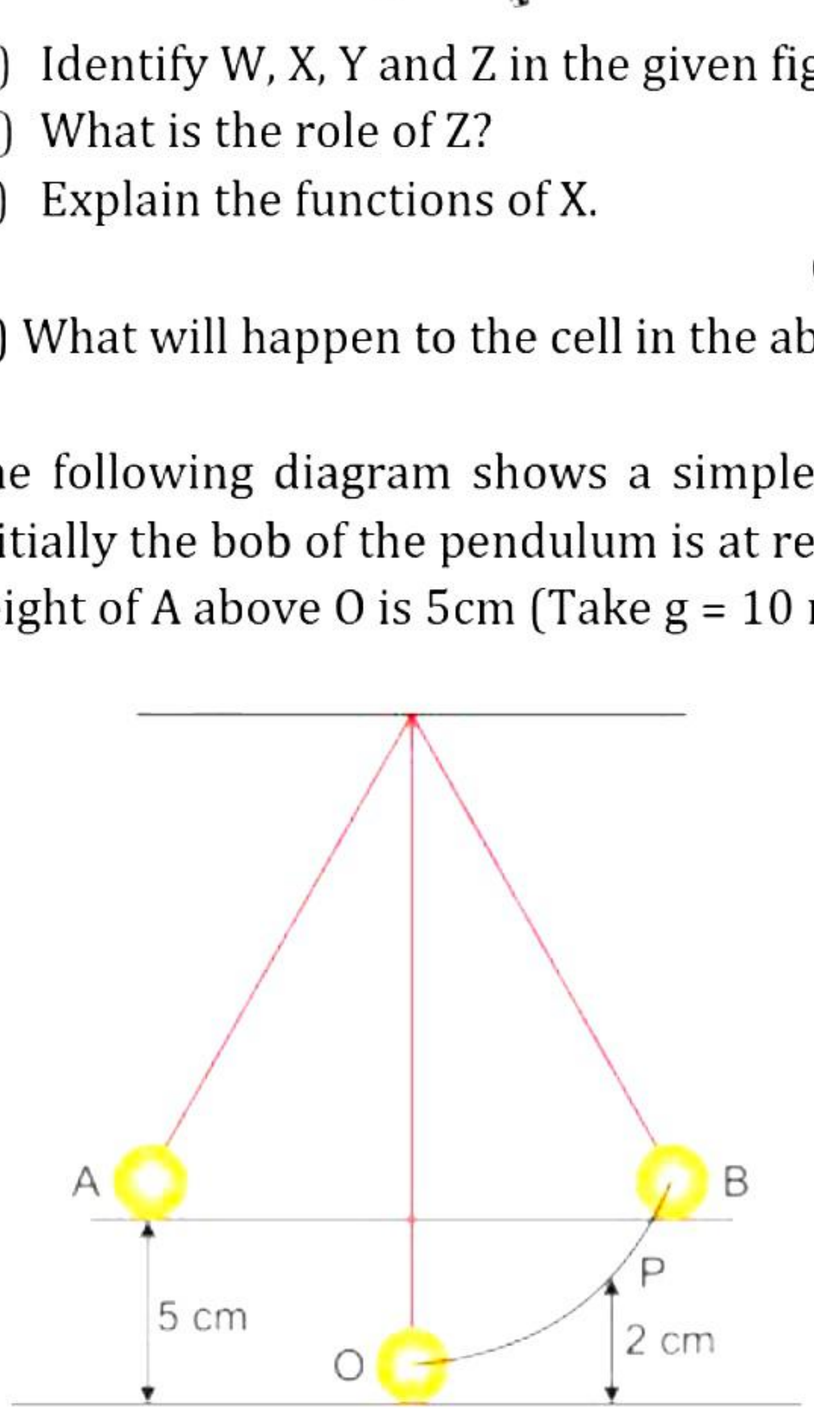
(b) What is the role of Z?

(c) Explain the functions of X.

OR

(c) What will happen to the cell in the absence of W?

39. The following diagram shows a simple pendulum consisting of a bob of mass 100g. Initially the bob of the pendulum is at rest at O. It is then displaced to one side at A. The height of A above O is 5cm (Take g = 10 m/s2) [4]



(a) What is the value of potential energy of bob at A and where does it come from?
(b) What is the value of total energy of the bob at position A?
(c) What is the value of kinetic energy of the bob at mean position O?
(d) What is the value of kinetic energy and potential energy of the bob at position P whose height above O is 2 cm?

OR

Define potential energy. At what height, an object of mass 1 kg has a potential energy of one joule relative to the ground?

Solution

SECTION - A

1. Correct option- c: H_2S

While writing the chemical formula for hydrogen sulphide, first write the constituent elements and their valencies; then, cross over the valencies of the combining atoms.

	Hydrogen	Sulphur
Symbols	H	S
Valency	1^+	2^-
Interchanging Valency	2	1
Formula	H_2S	

2. Correct option – c: Particles of a colloid scatter a beam of light passing through it.
Colloids are big enough to scatter a beam of light passing through it.

3. Correct option – a: 111 u
Formula unit mass of $CaCal_2$:
Atomic mass of Ca + 2(atomic mass of Cl)
$= 40 + 2(35.5) = 40 + 71 = 111$ u

4. Correct option – d: (i) and (iv)
Mass number = number of protons + number of neutrons
Atomic number = number of protons = number of electrons

5. Correct option – c: More exposed surface area of water
Evaporation is surface phenomenon. More the exposed area of water, more is the rate of evaporation.

6. Correct option – b: C-12 : 6p+6n, C-13 : 6p+7n, C-14 : 6p+8n
Atoms of the same elements differing in the number of neutrons in their nuclei are known as isotopes.

7. Correct option - a: Products
According to the law of conservation of mass, in a chemical reaction, mass can neither be created nor destroyed. The total mass of the reactants equals the total mass of the products.

8. Correct option – d: 4
The given cell organelle is chloroplast.
1 - Outer membrane, 2 – Inner membrane, 3 - Stroma, 4 - Granum
Grana is the site of the light reactions of photosynthesis.

9. Correct option – a: Regulates cell division
The given structure is nucleus. The nucleus is the controlling centre of the cell. It controls the metabolic activities of the cell and regulates cell division.

10. Correct option – d: (i) and (iii)
The process of crossing two genetically dissimilar plants to produce a hybrid having desirable traits of both is called hybridisation. The crossing may be intervarietal (between different varieties), intergeneric (between different genera) or interspecific (between different species of the same genus). Genetically modified crops are produced by the insertion of genes of desired traits.

11. Correct option – a: Arrow pushing against bow string.
Action and reaction force acts in opposite direction. Action force: Bowstring against the arrow; Reaction force: Arrow pushing against the bow string.

12. Correct option – b: It is completely immersed in the liquid.
When a solid is completely immersed in a liquid, there is a maximum apparent loss in its weight due to the maximum volume of liquid displaced.

13. Correct option – b: $\frac{2v}{t}$

$$\text{Average velocity} = \frac{(u + v)}{t} \text{ and Acceleration} = \frac{(v - u)}{t}$$

$$\text{Thus, the sum of average velocity and acceleration} = \frac{(u + v)}{t} + \frac{(v - u)}{t}$$

$$= \frac{2v}{t}$$

14. Correct option – b: Manish pulls the trolley up to a certain distance.
Work is done when a force is applied, and that force brings about some change in the position of the body. And for the given case, displacement will be made only by pulling the trolley up to a certain distance.

15. Correct option – c : Long, cylindrical, unbranched, multinucleate
The given figure shows striated muscle fibre. Striated muscle fibres are multi-nucleated, long, cylindrical, and unbranched. The cells are enclosed in connective tissue sheaths in the form of bundles.

16. Correct option – b: Lining of the trachea
Ciliated epithelium in the lining of the trachea helps in mobilising the mucus and keeping the respiratory tract clear, unobstructed, and free from infections.

17. Both A and R are true, and the R is not the correct explanation of A.
According to postulates of Dalton's Theory, Matter is made up of small particles called atoms. According to these postulates, it is also true that atoms of different element exhibit different properties of element and atoms of same element have the similar properties. So, from these two postulates, we can say that assertion is true. Molecules are formed by combination of two or more atoms for example- CO_2, NH_3. So, the reason is also true. But reason is not the correct explanation for assertion. Thus, both statements are true, and reason is not the correct explanation of assertion.

18. Both A and R are true, and the R is the correct explanation of A.
To increase the capacity of the mitochondrion to synthesize ATP, the inner membrane is folded to form cristae. These folds allow a much greater amount of electron transport chain enzymes and ATP synthase to be packed into the mitochondrion.

19. Both A and R are true, and R is not the correct explanation of A
The sensation of sound persists in our brain for about 0.1 seconds. This is called persistence of hearing. An echo is a sound that is heard after it has been reflected off a surface such as a wall or a cliff.
However, the reason for the sensation of sound persisting in our brain for about 0.1 seconds is not related to the definition of an echo.

20. Both A and R are true, but R is not the correct explanation of A.
Epithelial tissue forms a continuous layer over the free surfaces of many other tissues. Consequently, it covers the external surface of the animal body and the internal surfaces of visceral organs, body cavities and blood vessels. The epithelial tissue protects the underlying and overlying tissues. It also helps in the exchange of materials.

SECTION – B

21.

(a) Law of constant proportion:
According to the law of constant proportion, in a chemical substance the elements are always present in a definite proportion by mass.

(b) Law of conservation of mass:
According to the law of conservation of mass, the mass can neither be created nor destroyed in a chemical reaction.
Total Mass of the Reactant = Total Mass of the Product

22.

(a) The figure shows simple columnar epithelial tissue. Its main functions include absorption and secretion.

(b) Simple columnar epithelial tissue forms the lining of the stomach, small intestine, colon, gall bladder and oviducts.

23. Different cells of our body assume varied sizes and shapes to perform distinct functions in our body. The human body is complex and requires a vast range of functions to be carried out. If all the cells in our body were of the same size, shape, and volume, they would all perform the same function and a multitude of other essential functions cannot be carried out, making life impossible.

OR

The cells of an elephant would be of the same size as the cells of a rat. The size of cells does not vary within the organisms; however, the number of cells vary from one organism to another. A larger animal like an elephant will have a greater number of cells as compared to a smaller animal like a rat. However, the size of the cell will be the same.

24. Given that,

Given:

$u = 0$,

$t = 5$ s,

$a = 10$ m/s^2

We know that.

$$s = ut + \frac{1}{2}at^2$$

$$= 0 + \frac{1}{2} \times 10 \times 5^2$$

$$s = 125 \text{ m}$$

25. Egg is less dense than high salty water, but it is denser than fresh water. Thus, it sinks in fresh water and floats in salty water.

OR

(a) The force between the Earth and the body is known as the force of gravity or gravitational force. It is also called the weight of the body.

(b) Let the two objects be X and Y of mass M and m respectively,

Then, according to the law of gravitation,

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

If the distance is reduced to half, we get the force F_1 as,

$$F_1 = G\frac{Mm}{\left(\frac{d}{2}\right)^2}$$

$$F_1 = G\frac{Mm \times 4}{d^2}$$

$F_1 = 4$ F

Hence, the force increases by a factor of 4 if the distance is reduced to half.

26. Instead of investing money on weedicides, Raghu can do tilling of the soil to prevent the growth of weeds in the soil. Tilling before sowing of crops helps in uprooting and killing of weeds, which may then dry up and get mixed with the soil.

SECTION - C

27.

(a) Most of the rays passed through thin gold foil without deviation.

(b) Very few rays returned in the same path.

(c) Some rays deflected through larger angles.

28.

(a) The large or extra nuclear part of the atoms contains electrons which have negligible mass. Heavier particles like protons and neutrons are contained in the nucleus. So, only nucleus is considered when calculating the mass of an atom.

(b) The atoms combine with other atoms to achieve the electronic configuration of nearest noble gas and thus to become more stable.

(c) In the notation of an atom, the atomic number, mass number, and symbol of the element are to be written as:

$^{\text{Mass number}}_{\text{Atomic number}}$ Symbol of Element

OR

(a) Formula unit mass of K_2SO_4 = (2 × Atomic mass of potassium) + Atomic mass of Sulphur + (4 × Atomic mass of oxygen)

= (2 ×39 u) + 32 u + (4 × 16 u)

= 78 u + 32 u + 64 u

= 174 g/mole

(b) An element with valency 3 is aluminium.

The formula of aluminium oxide = Al_2O_3

29. The mechanisms involved in the absorption of digested food and water are diffusion and osmosis, respectively.

- Absorption of digested food occurs through diffusion. Diffusion is a process in which molecules move from their region of higher concentration to their region of lower concentration till they are uniformly distributed throughout the available space.
- Absorption of water occurs through osmosis. Osmosis involves the passage of water from a region of higher water concentration through a semi-permeable membrane to a region of lower water concentration. In this case, from small intestine (high concentration) to blood (low concentration).

30. If poultry birds are larger in size, it becomes very difficult to manage summer adaptability with them.

The programme of crossbreeding between Indian (indigenous) and foreign (exotic) breeds for variety improvement is focused to develop new varieties for desirable traits.

Some of these traits include -

- Quantity and quality of chicks
- Dwarf broiler parent for commercial chick production for summer adaptation
- Capacity/tolerance to high temperature
- Low maintenance requirement
- Improvement in hen housed for egg production
- Reduction in the size of the layer with the ability to utilise more fibrous, cheap diet formulations using agricultural byproducts.

31.

(a) We know that,

$$\text{Density} = \frac{\text{Mass of the object}}{\text{Volume of the object}}$$

Substituting the values, we get :

$$\text{Density} = \frac{75\ \text{g}}{30\ \text{cm}^3} = 2.5\text{g cm}^{-3}$$

Since the density of the object is lesser than the density of water (1 g/cm3), the wooden block will sink into the water.

(b)

$$\text{Density of body} = \frac{\text{Mass}}{\text{Volume}} = \frac{50}{20} = 2.5\text{g}/\text{cm}^3$$

Since, density of the body is greater than that of water, the body will sink.

32.

(a) Since the iron object penetrates more in the sand as compared to the wooden object, more work is done by the iron object. Also, the potential energy of an object is equal to the work done by the object. Hence, the potential energy of the iron object is more than the potential energy of the wooden object.

(b) 1 joule of work is done when a force of 1 newton moves a body through a distance of 1 metre in its own direction. That is,

1 joule = 1 newton × 1 metre

(c) Team A does positive work. The displacement is in the direction of the force.

(d) Team B does negative work. The displacement is in the direction opposite to the force.

33.

Time of ascent = Time of descent = 6/2 = 3 s

(a) $v = 0, a = -g = -9.8\ m/s^2$

According to the first equation of motion, we have

$v = u + at$

$0 = u - 9.8 \times 3$

$u = 29.4\ m/s$

Hence, the ball was thrown up with a speed of 29.4 m/s.

(b) According to the second equation of motion, we have

$v^2 = u^2 + 2as$

$0 = 29.4^2 - 2 \times 9.8 \times h$

$h = \frac{29.4^2}{19.6} = 44.1\ m$

Hence, the ball reaches a maximum height of 44.1 m.

(c) After the first three seconds, the ball is moving downwards.

Hence, 4 s after launch means 1 s after reaching the maximum height.

Thus, according to the third equation of motion, we have

$s = ut + \frac{1}{2}at^2$

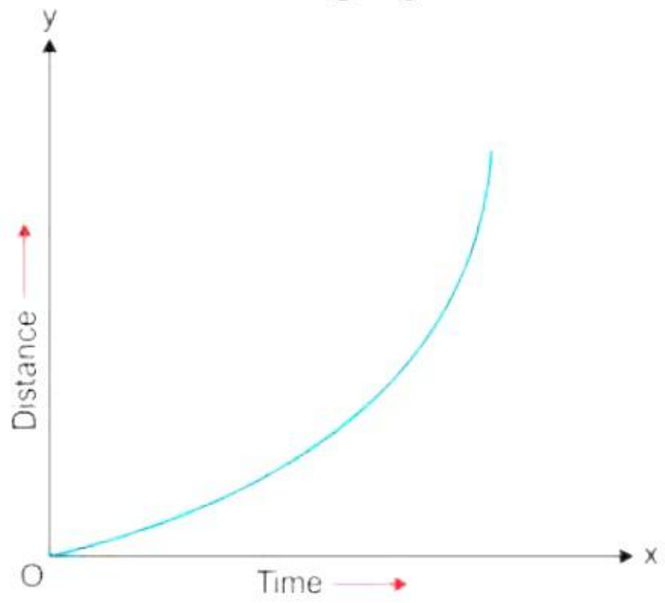
$h = 0 + \frac{1}{2} \times 9.8 \times 1^2$

$h = 4.9\ m$

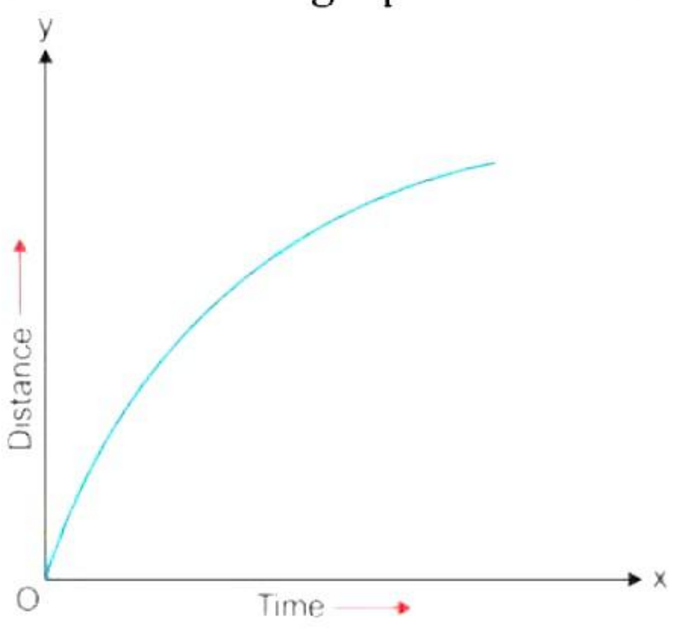
Hence, its position after 4 s is 44.1 – 4.9 = 39.2 m from the ground.

OR

(a) Distance-time graph with increasing slope:



Distance-time graph with decreasing slope:



(b)

i. In the motion from A to B:

Distance covered = (4-0) = 4 cm

And time take = (4-0) = 4 seconds

$$\Rightarrow \text{Speed} = \frac{\text{Distance}}{\text{time}}$$

$$v = \frac{4cm}{4s} = 1cm/s$$

ii. In the motion from B to C:

Distance Covered = (4-4) = 0 cm

And time taken = (7-4) = 3s

$$\Rightarrow \text{Speed} = \frac{0cm}{2s} = 0cm/s$$

Speed is zero means object is at rest.

iii. In the motion from C to D:

Distance moved = (7-4) =3cm

And time taken= (9-7) = 2s

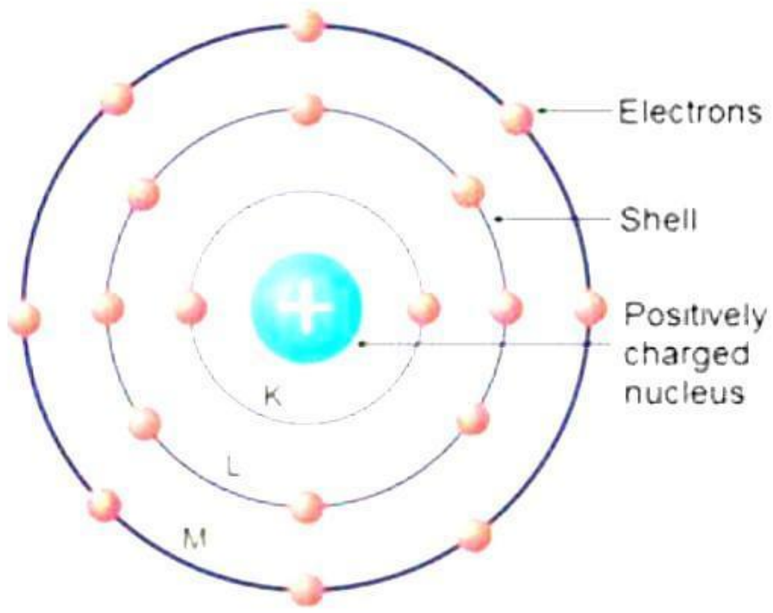
$$\Rightarrow \text{Speed} = \frac{3cm}{2s} = 1.5cm/s$$

SECTION - D

34. Bohr developed the Bohr model of the atom, in which he proposed that energy levels of electrons are discrete and that the electrons revolve in stable orbits around the atomic nucleus but can jump from one energy level (or orbit) to another.

Bohr's Model of an Atom

- Niels Bohr revised Rutherford's atomic model and put forth the following suggestions:
- Niels Bohr proposed that the electrons possess a specific amount of energy which allows them to revolve around the nucleus.
- An atom contains discrete orbits which correspond to specific amount of energy. Hence, these orbits are also known as energy levels.
- The energy levels of an atom are represented as K, L, M, N and so on or the numbers n = 1, 2, 3, 4 and so on.



Niels Bohr's Atomic Model

- Electrons are confined to these energy levels. While revolving in these discrete orbits, the electrons do not radiate energy. Hence, these orbits are also known as stationary orbits or stationary shells. Smaller the size of the orbit, smaller is its energy.
- As we move away from nucleus, the energy of the orbit increases progressively.
- The transfer of an electron from one orbit to another is always accompanied with absorption or emission of energy.
- When an electron jumps from a lower energy level to a higher energy level, it absorbs energy.

- When an electron returns from a higher energy level to a lower energy level, it emits energy.

<u>Distribution of electrons in orbits</u>

- According to Bohr's model, electrons occupy certain stable orbits or shells. Each shell has a definite energy.
- These orbits or shells are represented by the letters K, L, M, N... or the numbers 1, 2, 3, 4....
- The maximum number of electrons present in the shell is given by the formula ($2n^2$), where n is the orbit number or shell number.
- The maximum number of electrons in different shells is as follows:
  - The first orbit or K shell will have $2 \times 12 = 2$ electrons.
  - The second shell will have $2 \times 22 = 8$ electrons.
  - The third shell will have $2 \times 32 = 18$ electrons.
  - The fourth shell will have $2 \times 42 = 32$ electrons and so on.
  - The maximum number of electrons which can be accommodated in the outermost orbit is 8.
  - The orbits or shells are filled in a stepwise manner.
  - Electrons are not accommodated in a given shell unless the inner shells are filled.

<u>Octet Rule:</u> The maximum number of electrons that the outermost shell of an electrically neutral and chemically stable atom can have is 8.

<u>Exception:</u> If the atom has only one shell, it can hold only 2 electrons. For example, hydrogen and helium can have only 2 electrons (duplet).

OR

(a) Rutherford's Atomic Model

- Based on the results of the α-particle scattering experiments, Rutherford put forth his atomic model.
- An atom contains a positively charged centre called the nucleus of the atom. Almost all the mass of the atom is concentrated in the nucleus.
- The electrons of the atom revolve around the nucleus in fixed, circular orbits.
- The size of the nucleus is many times smaller than the size of the atom. The nucleus of an atom is 10,000 times smaller than the atom.

Rutherford's Atomic Model

(b)

i. After a hot sunny day, people sprinkle water on the roof or open ground because the large latent heat of vaporisation of water helps to cool the hot surface.
ii. Particles of a wooden table are rigid and have a fixed location. They also possess a definite shape and volume. Because of these properties, we should call a wooden table a solid substance.

35.

(a) Osmosis is the diffusion of water across a semi-permeable membrane from an area of high concentration of water, to an area of low concentration. In the above experiment, water molecules move out of the cell based on the amount of salt in the solution. Water will move from an area of less salt to more salt (more water to less water), and so when the potato is placed in the saltwater, all the water that is inside the potato moves out by osmosis.

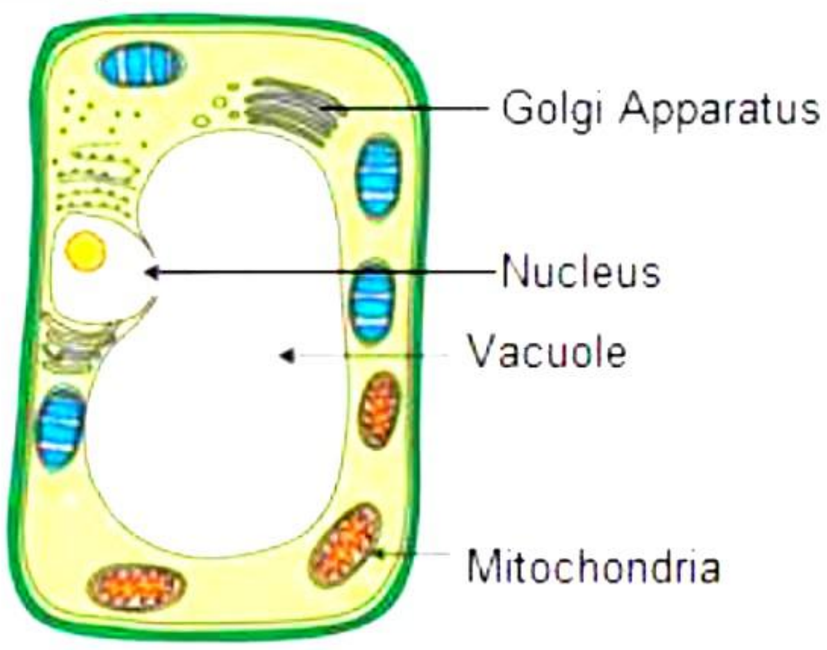
(b) In Beaker 2 with 1% salt solution, the concentration of water molecules inside and outside the potato cells is likely to be the same. This is because the lengths of the potato strips placed in beaker 2 are almost the same before and after the experiment. There is hardly any change in the length of the strips. This implies that there is hardly any osmosis and hence, no noticeable swelling or shrinking of the potato cells.

(c) <u>Radhika placed three potato strips in each beaker for the following reasons-</u>

- Reduce errors in measurement
- Confirm the results of the experiment
- Be sure about the readings

OR

(a) <u>Plant cell</u>



(b) Adenosine Triphosphate (ATP) molecule is called the energy currency of the cell. Mitochondria releases ATP.

(c) <u>Role of cell wall in a plant cell:</u>

- Provides definite shape, strength, and rigidity to the cell.
- Provides protection against mechanical stress and physical shocks.
- Helps to control cell expansion due to the intake of water.
- Helps in preventing water loss from the cell.

36.

(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) Given that,

$V = 100\ cm^3 = 100 \times 10^{-6}\ m^3 = 10^{-4}\ m^3$

$\rho = 1000\ kg\ m^{-3}$

$g = 10\ m/s^2$

Now,

Upthrust = Weight of liquid displaced

Weight of the object = Volume × Density × g

Upthrust = $v\rho g = 10^{-4} \times 10^3 \times 10 = 10^{-1} \times 10 = 1\ N$

$\therefore$ weight in water = 10 N – 1 N = 9 N

(c)

i. Since, the body weighs least in liquid A, liquid A is denser.

ii. Ratio of density of liquid A to liquid B

$$= \frac{\text{loss of wt. in liquid A}}{\text{loss of wt. in liquid B}}$$

$$= \frac{100 - 50}{100 - 60} = \frac{50}{40} = \frac{5}{4}$$

$\therefore$ ratio = 5 : 4

OR

(a) Gravitational force between two bodies depends on:

1. Masses of the two bodies. The greater an object's mass, the greater its gravitational force.
2. Distance of separation between them. The smaller the distance greater is the gravitational force.

Now,

$$F = \frac{Gm_1m_2}{r^2}$$

When distance is tripled, $r' = 3r$

$$\rightarrow F' = \frac{Gm_1m_2}{(r')^2}$$

$$= \frac{Gm_1m_2}{(3r)^2}$$

$$= \frac{1}{9} \times F$$

(b) Whenever objects fall towards the earth under the influence of gravitational force alone, it is called free fall. Both bodies will hit the ground at the same time as acceleration due to gravity is independent of mass of the falling object.

$$W_e = 600\ N,\ m = \frac{W_e}{g_e} = \frac{600}{10} = 60\ kg$$

$$g_m = \frac{W_m}{m} = \frac{100}{60} = 1.67\ ms^{-2}$$

(c)

Mass	Weight
The quantity of matter contained in a body is called mass of the body	The force with which the earth attracts a body towards its centre is called the weight
Mass is a scalar quantity	Weight is a vector quantity.

SECTION – E

37.

(a)

(i) 62 g of potassium nitrate is dissolved in 100 g of water to prepare a saturated solution at 313 K. So, 31 g of potassium nitrate should be dissolved in 50 g of water to prepare a saturated solution at 313 K.

(ii) Solubility of the salts at 293 K:
Potassium nitrate: 32 g
Sodium chloride: 36 g
Potassium chloride: 35 g
Ammonium chloride: 37 g
Ammonium chloride has the highest solubility at 293 K.

(b)

(i) Amount of potassium chloride which should be dissolved in water to make a saturated solution increases with temperature. Thus, as the solution cools, some of the crystals of potassium chloride will precipitate out of the solution.

(ii) The rate of solubility of a salt increases with increase in temperature.

OR

(c) Solubility: The maximum amount of a solute which can be dissolved in 100 grams of a solvent at a specified temperature is known as the solubility of that solute in that solvent at that temperature.

Effect of temperature and pressure on solubility of gas in liquid:

- The solubility of gases in liquids usually decreases on increasing the temperature and increases on decreasing the temperature.
- The solubility of gases in liquids increases on increasing the pressure and decreases on decreasing the pressure.

38.

(a) W - Golgi apparatus, X - Vacuole, Y - Ribosomes, Z - Lysosome

(b) Z (lysosomes) destroy any foreign material such as bacteria and virus which enter the cell. They remove worn out and poorly working cellular organelles by digesting them to make way for their new replacements. Lysosomes are called suicide bags of cell as they digest the cellular contents in case a cell gets damaged.

(c) <u>Functions of X (vacuole):</u>

- It acts as a store house for water-soluble pigments and waste products.
- It also stores useful minerals and salts.

OR

(c) In the absence of Golgi apparatus (W), the modification and packaging process of proteins and lipids will not occur properly. Also, there will be no production of lysosomes which leads to the accumulation of dead and damaged organelles. This can lead to dysfunction of the cell and can result in cell death.

39.

(a) PE = mgh = 0.1 x 10 x 5 x 10^{-2} = 0.05 J

The work done in raising the bob through a height of 5 cm (against the gravitational attraction) gets stored in the bob in the form of its potential energy.

(b) At position A, PE = 0.05 J, KE = 0

So, Total energy = 0.05 J

(c) At mean position, potential energy is zero, hence KE at O = 0.05 J

(d) PE at P = mgh = 0.1 x 10 x 2 x 10^{-2} = 0.02 J

K.E = Total energy - PE = 0.05-0.02 = 0.03 J

OR

Potential Energy: The energy possessed by an object due to its position or change in shape or configuration is known as potential energy.

m =1 kg

U = 1J

g = 9.8 ms^{-2}

h = ?

We know, U = mgh

$$\Rightarrow h = \frac{u}{mg} = \frac{1}{1 \times 9.8} = 0.102m$$