SAMPLE PAPER - 10

Class 09 - Science

Time Allowed: 3 hours **Maximum Marks: 80**

General Instructions:

1. This question paper consists of 39 questions in 5 sections.
2. All questions are compulsory. However, an internal choice is provided in some questions. A student is expected to attempt only one of these questions.
3. Section A consists of 20 objective type questions carrying 1 mark each.
4. Section B consists of 6 Very Short questions carrying 02 marks each. Answers to these questions should in the range of 30 to 50 words.
5. Section C consists of 7 Short Answer type questions carrying 03 marks each. Answers to these questions should in the range of 50 to 80 words.
6. Section D consists of 3 Long Answer type questions carrying 05 marks each. Answer to these questions should be in the range of 80 to 120 words.
7. Section E consists of 3 source-based/case-based units of assessment of 04 marks each with sub-parts.

Section A

1. Which of the following set of apparatus is required to determine the boiling point of water? **[1]**

   a) Round bottom flask, burner, thermometer, wire gauze, stand with clamp, cork with two holes, glass tube

   b) Boiling tube, beaker, thermometer, burner, cork with one hole, stand with clamp, wire gauze

   c) Tripod stand, conical flask, thermometer, wire gauze, stand with clamp, pair of tongs

   d) Funnel, burner, clamp and stand, test tube, thermometer, wire gauze

2. The cell sap in plant cells consists of: **[1]**

   a) water + organic substances

   b) both (water only) and (water + inorganic substances)

   c) water only

   d) water + inorganic substances

3. A car accelerates uniformly from 18 km/h to 36 km/h in 5 minutes. The acceleration is **[1]**

   a) $5\ ms^{-1}$

   b) $1\ ms^{-2}$

   c) $1\ km/s^2$

   d) $216\ ms^{-2}$

4. Pulses crops are rich in **[1]**

   a) Fats

   b) Vitamins

c) Proteins
d) Carbohydrates

5. Intestine absorb the digested food materials. What type of epithelial cells are responsible for that? **[1]**

a) Spindle fibres
b) Stratified squamous epithelium
c) Columnar epithelium
d) Cuboidal epithelium

6. The number of lenses in a compound microscope is: **[1]**

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

7. Which of the following two statement(s) is/are true? **[1]**

Statement A: Mole is quite often known as chemist's dozen.

Statement B: The mass of one-twelfth ($\frac{1}{12}$) of the mass of one atom of Carbon is taken as 1 u.

a) Statement A
b) Statement B
c) Neither Statement A nor Statement B.
d) Both the statements - A and B

8. The common characteristic of xylem tracheids and sieve tubes is that both are: **[1]**

a) thick-walled cells
b) dead cells
c) living cells
d) meant for conduction

9. If the volume of a body is V and half of it is immersed in the liquid, the upthrust will be proportional to: **[1]**

a) Difference in density of the body and half the density of the liquid.
b) Half the volume
c) Volume
d) Double the volume

10. Two cars A and B race each other. The Car A ran for 2 min at a speed of 7.5 km/h, slept for 56 min and again ran for 2 min at a speed of 7.5 km/h. The average speed of the car A in the race is: **[1]**

a) 10 km/hr
b) 5 km/hr
c) 0.5 km/hr
d) 50 km/hr

11. Which of the following would weigh the highest? **[1]**

a) 2 moles of $CaCO_3$
b) 10 moles of H_2O
c) 0.2 mole of sucrose (C_{12} H_{22} O_{11})
d) 2 moles of CO_2

12. The conducting cells of xylem are **[1]**

a) tracheids and xylem fibres
b) tracheids and vessels
c) vessels and sieve tubes
d) vessels and xylem fibres

13. Find the incorrect statement: **[1]**

A. Root tips are permanent tissue.
B. Mycoplasma gallisepticum is the smallest cell among the unicellular organisms.
C. Acetabularia measures nearly 10 cm in height.
D. Tonoplast is the membrane surrounding the vacuole.

a) (B)
b) (D)
c) (A)
d) (C)

14. Match the following with the correct response: **[1]**

(1) Nitrate	(A) P^{3-}
(2) Phosphide	(B) $PO_4{}^{3-}$
(3) Nitrite	(C) $NO_2{}^{-}$
(4) Phosphate	(D) $NO_3{}^{-}$

a) 1-B, 2-D, 3-A, 4-C
b) 1-C, 2-B, 3-D, 4-A
c) 1-D, 2-A, 3-C, 4-B
d) 1-A, 2-C, 3-B, 4-D

15. Which of the following are physical changes? **[1]**

i. Melting of iron metal
ii. Rusting of iron
iii. Bending of an iron rod
iv. Drawing a wire of iron metal

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

16. _____ are related to the duration of sunlight. **[1]**

a) Geotropism
b) Photoperiods
c) Pollination
d) Phototropism

17. **Assertion (A):** The speed of a body can be negative. **[1]**
Reason (R): If the body is moving in the opposite direction of positive motion, then its speed is negative.

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

18. **Assertion (A):** Naphthalene, camphor, iodine, ammonium chloride are some common examples of the substances which undergo sublimation. **[1]**
Reason (R): All solids are first converted to liquids and then gases on heating.

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

19. **Assertion (A):** The cells of sclerenchyma tissue are living. **[1]**
Reason (R): They are long and narrow as the walls are thickened due to the deposition of lignin.

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

20. **Assertion (A):** Rutherford postulated that the atom must contain large empty spaces. **[1]**
Reason (R): He concluded that the positively charged particles in an atom must be concentrated in a very small space.

a) Both A and R are true and R is the correct explanation of A.

b) Both A and R are true but R is not the correct explanation of A.

c) A is true but R is false.

d) A is false but R is true.

Section B

21. A person holds a bundle of hay over his head for 30 minutes and gets tired. Has he done some work or not? Justify your answer. **[2]**

OR

Why is the bottom part of the foundation of a building made wider?

22. Why do we see water droplets on the outer surface of a glass containing ice cold water? **[2]**

23. Explain how defects in a metal block can be detected using ultrasound. **[2]**

24. The mass per unit volume of a substance is known as density (density = mass/volume). Arrange the following in order of increasing density:Air, exhaust from chimneys, honey, water, chalk, cotton and iron. **[2]**

25. Why can a small mass such as a bullet kill a person when fired from a gun? **[2]**

OR

A bullet of mass 5 g travelling at a speed of 120 ms^{-1} penetrates deeply into the fixed target and is brought to rest in 0.01 s. Calculate: (a) the distance of penetration in the target, (b) the average force exerted on the bullet.

26. Draw a sketch of Bohr's model of an atom with three shells. **[2]**

Section C

27. Study the given below diagram and answer the following questions: **[3]**

i. Identify the application of ultrasound in the above diagram.

ii. Explain the working principle of this medical procedure.

iii. What is the range of frequencies associated with ultrasound?

28. Compare the properties of electrons, protons and neutrons. **[3]**

29. Draw the graph for uniform retardation - **[3]**

a. position - time graph

b. velocity - time graph

c. Acceleration- time graph

OR

The position of a body at different times is recorded in the table given below:-

Time (s)	0	1	2	3	4	5	6	7	8
Displacement (m)	0	6	12	18	24	30	36	42	48

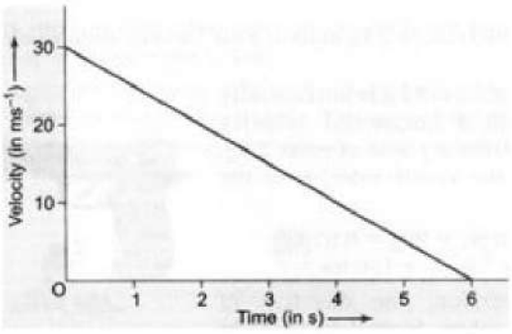
i. Draw the displacement time graph for the above data.

ii. What is the slope of graph?

iii. What is the velocity of the motion?

30. Give reason : An iron nail sinks in water, but a ship made of iron floats. **[3]**

31. The velocity-time graph of a ball moving on the surface of a floor is shown in the figure. Find the force acting on the ball if the mass of the ball is 50 g. **[3]**

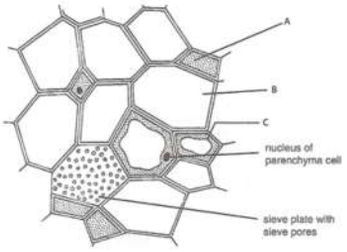


32. Differentiate between hypertonic and hypotonic solution. **[3]**

OR

What is the difference between plasma membrane and cell wall ? Give the functions of each one.

33. Study the following diagram of phloem and answer the following questions: **[3]**



i. Identify A, B and C in the given diagram.

ii. What term is used for the end walls of the B?

iii. What are the two functions performed by C?

Section D

34. Derive an expression for the force of attraction between two bodies and then define gravitational constant. **[5]**

OR

i. At some moment, two giant planets Jupiter and Saturn of the solar system are in the same line as seen from the earth. Find the total gravitational force due to them on a person of mass 50 kg on the earth. Could the force due to the planets be important?

Mass of the Jupiter = 2×10^{27} kg

Mass of the Saturn = 6×10^{26} kg

The distance of Jupiter from the earth = 6.3×10^{11} m

The distance of Saturn from the earth = 1.28×10^{12} m

ii. A bag of sugar weighs 'w' at a certain place on the equator. If this bag is taken to Antarctica, then will it weigh the same or more or less. Give a reason for your answer.

35. Write the main functions of atleast ten cell components. **[5]**

OR

What are cell organelles? Write the names of different cell organelles.

36. i. Draw a neat and labelled diagram of the apparatus used to separate components of blue-black ink. Name the process and state the principle involved. **[5]**

ii. Identify, the physical and chemical changes from the following.

a. Burning of magnesium in air.

b. Tarnishing of silver spoon.

c. Sublimation of iodine.

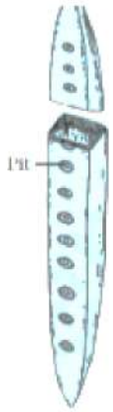
d. Electrolysis of water.

Section E

37. **Read the text carefully and answer the questions:** **[4]**

The process of taking up a permanent shape, size, and a function is called differentiation. Differentiation leads to the development of various types of permanent tissues. A few layers of cells beneath the epidermis are generally simple permanent tissue. another type of permanent tissue is complex tissue. Complex tissues are made of more than one type of cells. All these cells coordinate to perform a common function. Xylem and phloem are examples of such complex tissues. Xylem consists of tracheids, vessels, xylem parenchyma and xylem fibres. Phloem is made up of five types of cells: sieve cells, sieve tubes, companion cells, phloem fibres and the phloem parenchyma.

(i) Identify the type of cell in the given figure



(ii) Which part of desert plants reduces the loss of water?

OR

What is the dead element present in the phloem?

38. **Read the text carefully and answer the questions:** **[4]**

Culture fishery is rearing and harvesting of fish in small water bodies. The best method of culture fishery is composite fish culture, Here, fishes are selected on the basis of their growth rate, palatability, area of feeding and tolerance towards others. All of them have their exclusive zone and type of feeding. There are three zones- surface, middle zone and bottom. Each zone can have 2 or even 3 feeding options.

You have studied the various fishes that can be accomodated in different zones of pond culture.

(i) How many fishes can be accommodated at the bottom zone?

(ii) What types of fish can occur on the surface zone of fresh water fish ponds?

(iii) Where is fish Catla found in a fresh water culture pond?

OR

Which fish feeds on filamentous algae and decaying vegetation?

39. **Read the text carefully and answer the questions:** **[4]**

Sulphur dioxide is a colorless gas with a pungent odor. It is a liquid when under pressure, and it dissolves in water very easily. Sulphur dioxide in the air comes mainly from activities such as the burning of coal and oil at power plants or from copper smelting. In nature, sulphur dioxide can be released into the air from volcanic eruptions.

'SO_2 is an air pollutant released during the burning of fossil fuels and from automobile exhaust'.

(i)

What are the valencies of sulphur in SO_2 and SO_3?

(ii) Find out the number of molecules in 5 moles of SO_2.

(iii) Calculate the number of moles in 320 g of SO_2 gas.

OR

Calculate the molar mass of 10 moles of sodium sulphite.

[Given, atomic masses of S = 32 u, O = 16 u, Na = 23 u and $N_A = 6.022 \times 10^{23}$ per mol]

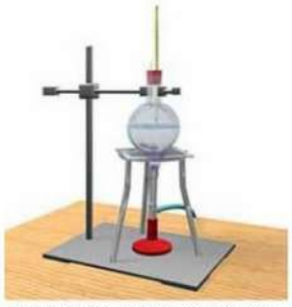
Solution

SAMPLE PAPER - 10

Class 09 - Science

Section A

1. **(a)** Round bottom flask, burner, thermometer, wire gauze, stand with clamp, cork with two holes, glass tube
   Explanation: Round bottom flask, burner, thermometer, wire gauze, stand with clam, cork with two holes, glass tube are needed.



Determination of Boiling point of water

2. **(b)** both (water only) and (water + inorganic substances)
   Explanation: The liquid found inside the plant cell vacuole is referred to as the cell sap and it is a dilute fluid consisting of water, amino acids, glucose i.e. (water + inorganic substances), water may also be inhabited with a negligible amount of salts because it somehow depends on the mineral excess inside the body of plants. The excess material is temporarily stored inside the cell sap. Thus, vacuoles act as storehouses in plants.

3. **(b)** 1 ms^{-2}
   Explanation: Given,
   u = 18km/h = 18×1000 / 60×60 = 5m/s
   v = 36km/h = 36×1000 / 60×60 = 10m/s
   t = 5 sec
   acceleration, a = ?
   1st equation of motion,
   v = u + at
   10 = 5 + 5a
   5a = 5
   a = 5/5 = 1m/s

4. **(c)** Proteins
   Explanation: Pulses are a low-fat source of protein with high levels of protein and fiber. Pulses also contain important vitamins and minerals like iron, potassium, and folate. The amount of protein in beans, lentils, chickpeas, and peas is 2-3 times the levels found in cereal grains like wheat, rice, quinoa, oats, barley, and corn. Pulses, seeds, and nuts are all valuable sources of protein as well as being low in saturated fat, sodium, and also cholesterol-free. They are also good sources of fiber, complex carbohydrates, vitamins and minerals including thiamine (B1), riboflavin (B2), niacin (B3), folate, calcium, potassium, iron, and phosphorus.

5. **(c)** Columnar epithelium
   Explanation: Columnar epithelium consist of pillar-like cells with their nuclei towards the base. They form the lining of stomach, small intestine and colon, forming the mucous membrane. Their main function is absorption (e.g., stomach, intestine) and secretion (e.g., mucous by goblet cells).Stratified squamous epithelium, also known as pavement epithelium is covered by fibrous protein, (keratin) that covers the skin. This epithelium is waterproof and resistant to mechanical injury. Cuboidal epithelium is found in kidney tubules, thyroid vesicles and in glands.

6. **(d)** 2
   Explanation: The compound microscope contains two lenses that magnify the object. It uses a lens (called the objective lens) close to the object being viewed to collect light which focuses on a real image of the object inside the microscope. The image is then magnified by a second lens (called the eyepiece) that gives the observer an enlarged inverted virtual image of the object.

7. **(d)** Both the statements - A and B

Explanation: A mole is also known as a chemist's dozen. A mole, just like a dozen, is a common counting unit. A counting unit is a convenient number that makes it easier to count objects. The mass of one-twelfth of the mass of one atom of Carbon is taken as 1u.

Both statements are correct.

8. **(d)** meant for conduction

Explanation: Xylem is composed of tracheids, vessels, xylem parenchyma, and xylem fibres. Tracheids and vessels are tubular structures and thus they provide a channel for conduction of water and minerals. Phloem is composed of sieve tubes, companion cells, phloem fibre and phloem parenchyma. Sieve tubes are tubular cells with perforated walls. Sieve tubes are the conducting elements of phloem.

9. **(a)** Difference in density of the body and half the density of the liquid.

Explanation: Weight = W - U

$V\rho g - \frac{V}{2}\sigma g = Vg\left(\rho - \frac{\sigma}{2}\right)$

10. **(c)** 0.5 km/hr

Explanation: Distance = speed $\times$ time

Distance travelled in first 2 min = $7.5 \times \frac{2}{60}$ = 0.25 km

Distance travelled in last 2 min = $7.5 \times \frac{2}{60}$ = 0.25 km

Total distance = 0.25 + 0.25 = 0.5 km

Total time = 2 + 2 + 56 = 60 min = 1 hr

Average speed = $\frac{0.5}{1}$

= 0.5 km/hr

11. **(a)** 2 moles of $CaCO_3$

Explanation: Weight = Number pf moles $\times$ molar mass.

- 0.2 moles of source ($c_{12}H_{22}O_{11}$) = 0.2 $\times$ 342 = 68.4 g
- 2 moles of CO_2 = 2 $\times$ 44 = 88 g
- 2 moles of $CaCo_3$ = 2 $\times$ 100 = 200 g
- 10 moles of H_20 = 10 $\times$ 8 = 180 g

12. **(b)** tracheids and vessels

Explanation: There are two types of conducting cells in xylem, tracheids and vessel elements. Both have thick lignified secondary walls and are dead at maturity. These cells create hollow cylinders that have high tensile strength. Materials moving within the xylem are under tension.

13. **(c)** (A)

Explanation:

A. Root tips are replaced; they are meristematic tissue; and not permanent tissue.

B. Mycoplasma gallisepticum is the smallest cell amongst the unicellular organisms.

C. Acetabularia measures nearly 10 cm in height.

D. Tonoplast is the membrane that bounds the chief vacuole of a plant cell. It is also known as the 'vacuolar membrane'. It separates the vacuolar contents from the cytoplasm of the cell.

Hence, statement A is incorrect.

14. **(c)** 1-D, 2-A, 3-C, 4-B

Explanation:

(1) Nitrate	(D) NO_3^-
(2) Phosphide	(A) P^{3-}
(3) Nitrite	(C) NO_2^-
(4) Phosphate	(B) PO_4^{3-}

15. **(d)** (i), (iii) and (iv)

Explanation: Melting of iron metal, bending of an iron rod and drawing wire of iron metal are all physical changes whereas

rusting of iron is a chemical change.

16. **(b)** Photoperiods
Explanation: Photoperiod is the period of direct exposure to sunlight by a plant. The movement of a plant part in response to light is called photoperiod.

17. **(d)** A is false but R is true.
Explanation: Speed can never be negative because it is a scalar quantity.

18. **(d)** A is false but R is true.
Explanation: Certain solids directly change to the gaseous state upon heating without passing through the liquid state. The process is called sublimation.

19. **(d)** A is false but R is true.
Explanation: The cells of sclerenchyma tissue are dead. They are long and narrow as the walls are thickened due to the deposition of lignin. The walls of cells are so thick that there is no internal space inside the cell.

20. **(a)** Both A and R are true and R is the correct explanation of A.
Explanation: Rutherford postulated that the atom must contain large empty spaces as most of the α-particles passed through it without getting deflected. Some α-particles were deflected by the foil through small angles, while some were deflected through very large angles. Thus, Rutherford concluded that the positively charged particles in an atom must be concentrated in a very small space.

Section B

21. When a person holds a bundle of hay over his head for 30 minutes and gets tired he applies force in upward direction and displacement of bundle of hay is in forward direction which is perpendicular to the direction of force applied therefore displacement is zero
$W = F \times sCos\theta$
$= F \times sCos90^0$
$= F \times 0 = 0$
No work done.

OR

Foundation of a building is made wider so that it may not sink under the extremely high pressure of building. The broad foundation distributes the weight of the building to the ground.

22. The water vapour present in the air comes in contact with cold surface of the glass, loses its energy and gets converted into droplets of water.

23. The ultrasound waves are allowed to pass through metal block to which detectors are fitted. If there is a small defect in the metal block like an air bubble or a crack, then the ultrasound waves are reflected from such spots. Metal block if defective is indicated by the reflected ultrasonic waves.

24. The increasing order of density for the given substances is:
Air, exhaust from chimneys, cotton, water, honey, chalk, iron. Actually, the density of a substance depends upon the number of particles per unit volume as well as upon their mass. The number of the particles is related to their size as well as the attractive forces among them.

25. When a small mass such as a bullet is fired from a gun, it moves out of the gun with a very high velocity. Thus, the momentum produced by a bullet is very high (p = mv). This high momentum of the bullet can kill a person.

OR

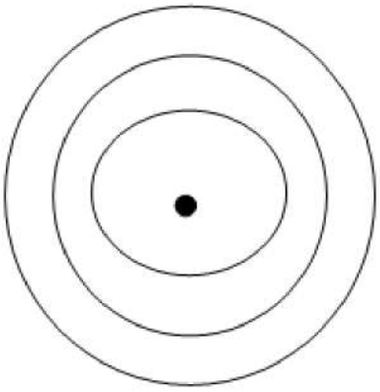
m = 5 g = 5 $\times$ 10^{-3} kg u = 120 ms^{-1}, v = 0, t = 0.01s

a. From the relation v = u + at
We have 0 = 120 + a $\times$ 0.01
or a $= -\frac{120}{0.01}$ = -12000 ms^{-2} (the negative sign here shows retardation)
Distance of penetration in the target
S = ut + $\frac{1}{2}$ at^2 we have
S = 120 $\times$ 0.01 + $\frac{1}{2}$ $\times$ (-12000) $\times$ $(0.01)^2$ = 0.6 m

b. Average retarding force F = ma = (5 $\times 10^{-3}$) $\times$ (12000) = 60N

26. Bohr's model of an atom with three shells:
The three stationary orbits are designated as K-shell (nearest to the nucleus), M-shell and N-shell.

The atom with three shells can accommodate a maximum of 2, 8 and 18 electrons respectively.



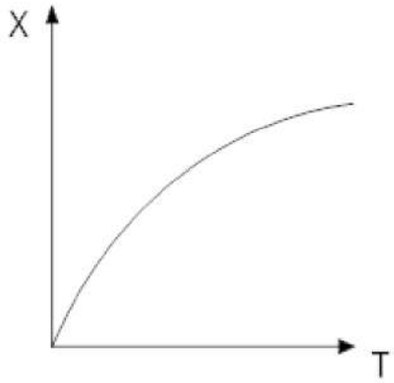
Section C

27. i. Ultrasound is used to monitor the development of the foetus inside the mother's womb.
    ii. The ultrasound scanner transmits ultrasound into the mother's body and receives echoes formed by the reflection of ultrasound from inside. The ultrasound echoes form a picture of a developing baby on a monitor which helps the doctor to keep a track of the developing baby. Thus ultrasonography is used for the examination of the foetus during pregnancy to detect any growth and abnormalities.
    iii. The sound above 20,000Hz is regarded as ultrasound

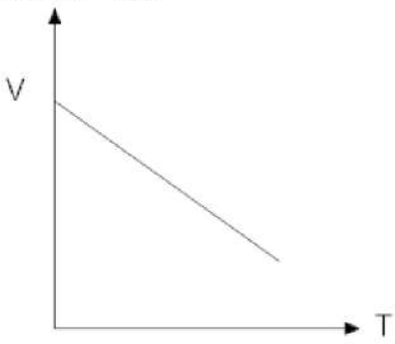
28.

Proton	Neutron	Electron
(i) It is positively-charged sub-atomic particle.	(i) It is neutral sub-atomic particle.	(i) It is negatively-charged sub-atomic particle.
(ii) Its mass is equivalent to a hydrogen atom i.e. 1 a.m.u	(ii) It mass is equal to the mass of a proton.	(ii) Its mass is 1/1838 of the mass of a proton.
(iii) It is present inside the nucleus of an atom.	(iii) It is also found inside the atomic nucleus.	(iii) It is found outside the nucleus of an atom.

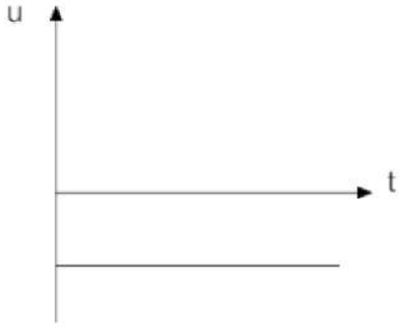
29. i. Position – time



ii. Velocity – time

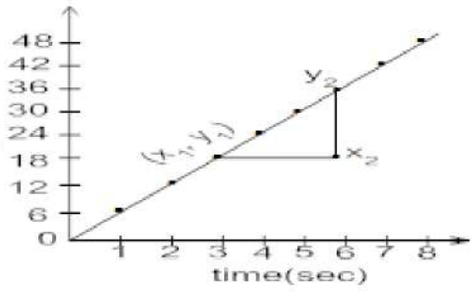


iii. Acceleration- time



OR

a.



b. Slope of the displacement - time graph = velocity

c. velocity = $\frac{48-0}{8-0}$ = 6m/s

30. If we place an iron nail on the surface of water, it sinks. This is because the density of iron is greater than that of water, so the weight of the nail is more than the upthrust of water on it. On the other hand a ship made of iron does not sink. This is because the ship is hollow and the empty space contains air which makes the average density of the ship less than that of water. Therefore, even with a small part of it submerged into water, the weight of the water displaced becomes equal to the total weight of the ship and hence the ship floats.

31. The velocity-time graph shows that velocity of the ball at t = 0 is 30 ms^{-1}

Initial velocity of the ball, u = 30 ms^{-1}

The velocity of the ball at t = 6 s is zero.

Final velocity of the ball, v = 0

Time, t = 6s

∴ Acceleration of the ball,

$a = \frac{v-u}{t} = \frac{0-30\ ms^{-1}}{6\ s}$

= -5 ms^{-2}

Negative sign shows that the ball is retarded or decelerated.

Also, mass of ball, $M = 50\ g = \frac{50}{1000} = \frac{1}{20}\ kg$

Therefore, Force acting on the ball, F = ma

$= \left(\frac{1}{20} kg\right)(-5\ ms^{-2})$

= - 0.25 kg ms^{-2}

= 0.25 N [1 kg ms^{-2}= 1 N]

Here -ve sign indicates that the force is retarding or stopping force.

32. Hypertonic solution – If the medium surrounding the cell has higher solute concentration than the cell, then the solution in called hypertonic solution.

Hypotonic solution – If the medium surrounding the cell has lower solute concentration than the cell, then the solution in called hypotonic solution.

OR

1. Plasma Membrane is the phospholipid layer, found in all types of cells; it helps in protecting the protoplasm and checks the passage of molecules inside the cell, Though cell wall is found in the plant cell, fungi, bacteria only and protects the cell from external shocks, and provide rigidity and shape to the cell.
2. The cell wall is the outermost boundary of the cell (if present), and plasma membrane is present in the inner lining of the cell. The plasma membrane is delicate thin layer while cell wall is the thick and rigid layer. Plasma Membrane is selectively

permeable membrane allowing small molecules entry only; their layer is made up of lipids and proteins and few carbohydrates, while Cell wall constituents may vary from chitin, peptidoglycon, and cellulose.

3. Plasma membrane is the living membrane made up of lipids and proteins, whereas cell wall is non-living made up of cellulose.

Function of Plasma membrane: It acts as semi permeable membrane which allows only selective substances to pass through it.

Function of Cell Wall: It provides rigidity and protection to cell.

33. i. A represents companion cells, B represents sieve tubes, and C represents phloem parenchyma. which are small thin-walled cell containing dense and very active cytoplasm and large elongated nucleus.

ii. The sieve tubes end walls are perforated by numerous pores and are called sieve plates.

iii. The phloem parenchymatous cell performs the following functions:

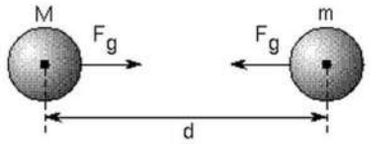
a. Storage of food.

b. Slow lateral conduction of food.

Section D

34. **Newton's Law of universal gravitation:** Everybody in the universe attracts every other body with a force which is directly proportional to the product of their masses and inversely proportional to the square of the distance between them.

Let us consider two bodies A and B of masses m_1 and m_2 which are separated by a distance d.



Then the force of gravitation (F) acting on the two bodies is given by

$F \propto m_1 \times m_2$ .....(1)

and $F \propto \frac{1}{d^2}$ .....(2)

Combining equations (1) and (2), we get

$F \propto \frac{m_1 \times m_2}{d^2}$

$F = k \frac{m_1 \times m_2}{d^2}$

Where, k= proportionality constant, known as universal gravitational constant, G having value = 6.67×10^{-11} $Nm^2 kg^{-2}$.

Therefore, $F = G \times \frac{m_1 m_2}{d^2}$, Which is required expression for force of attraction between two bodies.

Here, if the masses m_1 and m_2 of the two bodies are of 1 kg and the distance (d) between them is 1 m, then putting m_1 = 1 kg, m_2 = 1 kg and d = 1m in the above formula, we get

$F = G \times \frac{1}{1^2}$,

G = F

Definition of the gravitational constant G: Gravitational constant, G is numerically equal to the force of gravitation which exists between two bodies of unit masses kept at a unit distance from each other.

OR

i. a. Gravitational force acting on the 50 kg,

$F = mg = 50 \times 9.8 = 490$ N

b. Gravitational force acting on the 50 kg mass due to jupiter,

$$F_{Jupiter} = \frac{G \times M_{jupiter} \times M_{person}}{(\text{distance of jupiter from the earth})^2}$$

$$F_{Jupiter} = \frac{6.67 \times 10^{-11} \times 2 \times 10^{27} \times 50}{6.3 \times 10^{11} \times 6.3 \times 10^{11}}$$

$F_{Jupiter} = 1.68 \times 10^{-5}$ N

c. Gravitational force acting on the 50 kg mass due to saturn

$$F_{saturn} = \frac{G \times M_{saturn} \times M_{person}}{(\text{distance of saturn from the earth})^2}$$

$$F_{saturn} = \frac{6.67 \times 10^{-11} \times 6 \times 10^{26} \times 50}{1.28 \times 10^{12} \times 1.28 \times 10^{12}}$$

$F_{saturn} = 1.12 \times 10^{-6}$ N

∴ Total gravitational force due to the Jupiter and the Saturn = $(1.68 \times 10^{-5} + 1.12 \times 10^{-6}) = 1.8 \times 10^{-5}$ N

Thus, the combined force due to the planets Jupiter and Saturn (1.8×10^{-5}) N is negligible as compared to the gravitational force i.e. 490 N due to the earth.

ii. We know that g at the equator is less than g at poles (Antarctica). Thus, weight at the equator is less than weight at the pole (Antarctica). A bag of sugar weighs 'w' at a certain place on the equator. If this bag is taken to Antarctica, then it will weigh more due to the greater value of g.

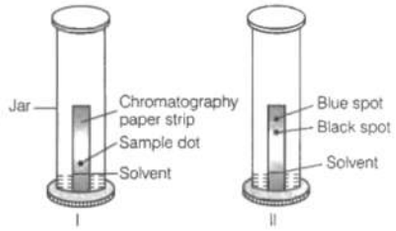
35. The ten cell components are:

i. **Plasma membrane:** It acts as a semipermeable membrane and allows only selective substances to pass through it.
ii. **Chromosomes:** To carry hereditary characters of an organism from one generation to another.
iii. **Lysosomes:** Breakdown of unwanted macromolecules is the main function of these organelles.
iv. **Ribosomes:** These help in protein synthesis.
v. **Nucleus:** Control centre of the cell. It contains cellular DNA (genetic information) in the form of genes.
vi. **Mitochondria:** The main function of mitochondria in aerobic cells is the production of energy by the synthesis of ATP.
vii. **Nucleolus:** Biosynthesis of ribosomal RNA (rRNA) and acts as a platform for protein synthesis.
viii. **Cell wall:** It provides protection and rigidity to the plant cell.
ix. **Chloroplasts:** These are the sites of photosynthesis within plant cells.
x. **Endoplasmic reticulum:** Serves as channels for transport of materials.

OR

Cell organelles are the intracellular structures present in the cytoplasm. Various cell organelles are –

1. Mitochondrion – It produces energy
2. Endoplasmic reticular – synthesize lipids and proteins
3. Golgi apparatus - Storage, packaging and dispatch various substances.
4. Lysosomes – Digest intracellular substances
5. Ribosomes – Synthesize proteins
6. Vacuoles – Provide turgidity and store house of various organic substances

36. i. 

The labelled diagram of the apparatus used to separate components of blue-black ink is shown above.

Name of the process: Paper chromatography.

Principle of paper chromatography: Different components of a mixture move with different speeds in a solvent, so they separate at different heights. Here blue ink and black ink rise with the help of solvent at different speeds to form two spots at different heights.

ii. The physical and chemical changes are as follows:

- Burning of magnesium in the air: Chemical change
- Tarnishing of silver spoon: Chemical change
- Sublimation of iodine: Physical change
- Electrolysis of water: Chemical change

Section E

37. **Read the text carefully and answer the questions:**

The process of taking up a permanent shape, size, and a function is called differentiation. Differentiation leads to the development of various types of permanent tissues. A few layers of cells beneath the epidermis are generally simple permanent tissue. another type of permanent tissue is complex tissue. Complex tissues are made of more than one type of cells. All these cells coordinate to perform a common function. Xylem and phloem are examples of such complex tissues. Xylem consists of tracheids, vessels, xylem parenchyma and xylem fibres. Phloem is made up of five types of cells: sieve cells, sieve tubes, companion cells, phloem fibres and the phloem parenchyma.

(i) Tracheids

(ii) Cuticles reduce the loss of water.

OR

Phloem fibres

38. **Read the text carefully and answer the questions:**

Culture fishery is rearing and harvesting of fish in small water bodies. The best method of culture fishery is composite fish culture, Here, fishes are selected on the basis of their growth rate, palatability, area of feeding and tolerance towards others. All of

them have their exclusive zone and type of feeding. There are three zones-surface, middle zone and bottom. Each zone can have 2 or even 3 feeding options.

You have studied the various fishes that can be accomodated in different zones of pond culture.

(i) Three on detritus, vegetation and other organisms.

(ii) Two, one herbivore and one carnivore

(iii) Only in surface zone

OR

Rohu feeds on filamentous algae and decaying vegetation.

39. **Read the text carefully and answer the questions:**

Sulphur dioxide is a colorless gas with a pungent odor. It is a liquid when under pressure, and it dissolves in water very easily. Sulphur dioxide in the air comes mainly from activities such as the burning of coal and oil at power plants or from copper smelting. In nature, sulphur dioxide can be released into the air from volcanic eruptions.

'SO_2 is an air pollutant released during the burning of fossil fuels and from automobile exhaust'.

(i) Valency of sulphur in SO_2 = 4

Valency of sulphur in SO_3 = 6

(ii) 5 $\times$ Avogadros number = $5 \times 6.022 \times 10^{23}$

5 mole of $SO_2 = 3.011 \times 10^{23}$ molecules

(iii) Mass = 320 g, Molar mass (m) of

$SO_2 = 32 + 2 \times 16 = 64$ g/mol

$\Rightarrow n = \frac{m}{M} = \frac{320}{64}$ = 5 moles

OR

Molar mass of 10 moles of Na_2SO_3

$= 10\ [23 \times 2 + 32 + 16 \times 3] = 1260$ g