SOLUTIONS

SAMPLE PAPER - 3

SECTION - A

1. (c) Oxygen < Water < Sugar

Explanation: The correct order of increasing 'force of attraction' between their particles is: Oxygen < Water < Sugar

It is because the force of attraction increases in the order: Gas < Liquid < Solid.

Related Theory

→ Intermolecular forces are attractive or repulsive forces that act between adjacent particles (atoms, molecules or ions). A molecule is held together by these forces.

→ A particle in a solid can vibrate but not move. Sugar is a solid substance.

→ The force of attraction in a liquid is weaker than in a solid. Water is a type of liquid.

→ There is no force of attraction in gas since the particles move swiftly in a random direction. Oxygen is a substance that exists in the form of a gas.

2. (a) Secretion of substances

Explanation: In some instances, cells of columnar and cuboidal epithelium folds inward and forms a multicellular gland whose main function is secretion of useful substances like enzymes, hormones, etc.

3. (d) 700 kg

Explanation: We know that,

$$Force = mass \times acceleration$$

As the force remains same

So,

$$a = \frac{F}{m}$$

Acceleration is inversely proportional to mass. Truck whose mass is less has higher acceleration.

4. (c) 0.5 N

Explanation: The buoyant force acts in the opposite direction of the object's weight. As a result, if an object weighs 4.5 N in liquid, it will experience a 0.5 N buoyant force.

5. (c) remain at the same position

Explanation: Apical meristems help the plant grow longer. Apical meristem is present on the root and shoot tips. When a nail is inserted in the trunk, it will remain in the same position since its permanent tissue does not divide.

6. (b) (I) and (III)

Explanation: A crest and trough make up a transverse wave. The largest upward displacement is at the crest, whereas the maximum downward displacement is at the trough.

The crests and troughs are also formed in electromagnetic waves comparable to those of ocean waves.

Related Theory

→ **Longitudinal waves:** The particles in the wave, on the other hand, do not move with the wave; instead, they oscillate back and forth around their own equilibrium.

→ Some examples of longitudinal waves:
(1) Sound waves in air
(2) An earthquake's primary waves
(3) Ultrasound
(4) The sound of a spring vibrating
(5) Variations in the composition of a gas
(6) The waves of the tsunami

→ Some examples of transverse waves:
(1) The ripples on the surface of the water
(2) The secondary waves of an earthquake
(3) Electromagnetic waves
(4) The waves on a string
(5) The ocean waves

7. (c) there is a force on the ball opposing the motion.

Explanation: When the ball rolls on the ground, the frictional force exerted by the ground is in the opposite direction of the ball's motion. Because of the frictional force, the ball slows down and eventually stops after travelling a short distance.

8. (a) Plasma

Explanation: Red Blood Corpuscles (RBCs), White Blood Cells (WBCs) and platelets are suspended in a fluid (liquid) matrix called plasma. When these are removed from the blood, plasma is found which is a pale yellow-coloured fluid. Plasma aids in the transport of salts and enzymes as-well-as the intake of nutrients, proteins and hormones and the delivery of these to the parts of the body that require them.

9. (a) electrons and protons have the same number; neutrons have a different number.

Explanation: In Isotopic elements, electrons and protons have the same number but different numbers of neutrons.

10. (a) Acceleration

Explanation: Both spheres have the same acceleration, that is, equals to acceleration due to gravity. Momenta, potential energy, and kinetic energy are all affected by mass, which differs between the two spheres and hence, the quantities will differ.

11. (a) Isobars

Explanation: Isobars of different elements have same mass number and different atomic number. So, calcium and argon are Isobars.

12. (b) (I) and (V)

Explanation: The external force of air resistance and friction has forced the bicycle to change its state of motion to state of rest in this situation. If there was no air resistance or friction to resist the bicycle's motion, the bicycle would continue to move continuously, according to the first law of motion.

☠ **Related Theory**

➡ Newton's first law of motion states that if any body is in rest it continues to be in rest or if its moving it will keep on moving in a straight path until and unless no external force is applied. This force is an unbalanced force.

13. (c) half potential and half kinetic energy

Explanation: When a body falls from a height $h/2$ its potential energy is reduced to half because potential energy is equal to the remaining half of the energy which changed into kinetic energy.

14. (a) when comparing the mass of one molecule of any material to the mass of one atom of C-12.

Explanation: Mass of one molecule of any substance compared with the mass of one atom of C-12.

The mass of a molecule equals the total of the masses of all the atoms in the molecule. It is used for those substances whose constituent particles are atoms.

15. (c) the weight of water displaced is the equal to the ship's weight.

Explanation: According to Archimedes' principle, when a body is submerged totally or partially in a liquid, it receives an upward force equal to the weight of the fluid displaced by it, hence the mass of water displaced is equal to the mass of the submerged ship.

16. (c) Epithelial tissues have intercellular spaces between them.

Explanation: Intercellular spaces are absent in epithelial tissue. They form a sheet or layer of cells, that is in continuous form.

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

Explanation: Diffusion occurs when a drop of dettol is placed into water and the dettol particles mix with the water particles due to particle mobility. Diffusion is the process through which substances move into and out of living beings' cells.

18. (d) A is false but R is true.

Explanation: Chloroplast is a green coloured plastid which helps in the photosynthesis and manufacture of food for plants. The coloured plastids are called chromoplasts. The unique colour of flowers and fruits is due to chromoplasts. They contain yellow, orange, or red pigments except green. They play a role in attracting insects, and various pollinating agents and also in fruit dissemination.

19. (c) A is true but R is false.

Explanation: The use of pesticides, which include herbicides, insecticides, and fungicides, is one of the most popular techniques. These substances are applied to crop plants through spraying or are used to treat soil and seeds. With the aid of pesticides, farmers can produce more on less land. Pesticides have enabled farmers to grow larger crops on small plots of land, increasing crop output by 20 to 50 percent.

Manure enriches the soil's nutrients without reducing its fertility. It creates healthy plants without harming the crops. Chemical fertilizers can reduce soil fertility when used often.

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

Explanation: Protons are present in the nucleus with neutrons. And the energy required to remove a proton is five or ten million electron volts which is not possible in our environment. This energy is generally called Proton Separation Energy.

SECTION - B

21. (A) The process of 'crystallisation' allows salt to be extracted from its solution. Crystallisation is a superior approach than evaporation since it removes soluble contaminants as well which evaporation does not.

(B) Given:

Solute = 5.5 g

Solvent = 55 g

Solution = 55 + 5.5 g = 60.5 g

Percentage of concentration

$$= \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$$

$$= \frac{5.5}{60.5} \times 100 = 9.1\%$$

22. (A) Exosmosis is caused by concentrated salt solution, which is a hypertonic solution (water concentration lower than the cell). Irritation and dehydration come from the outward flow of water from the cell. This causes reversible movements and, as a result, vomiting.

(B) The chromosomes are made up of chromatin, which is a thread-like structure. Chromatid refers to a copy of a duplicated chromosome that is connected to the other copy by a centromere.

23.

S.No.	Roughage	Concentrates
(1)	It is high in fiber. Other nutrients are low.	It is low in fiber. Proteins and other nutrients are relatively high.
(2)	Eg., Legumes, hay, green fodder	Eg., Oats, barley and gram.

OR

Genetically modified crop or GM crop is the one which has been developed through introduction of some specific genes from other sources.

GM crops: Golden rice (Vitamin-A rich), Bt cotton (insect resistant).　　　(Any one)

24. When the bus is moving, luggage kept on the bus roof tends to remain in a condition of inertia of motion. When the bus comes to a stop, the luggage resists the change and due to inertia, slides forward, possibly falling off. As a result, it is recommended to use a rope to tie any luggage placed on a bus's roof.

OR

Initially, the pram was at rest, ball tends to remain at rest due to inertia of rest. When the pram suddenly moves, the state of rest of the pram changes but the ball will resist the motion. Hence, the ball will move towards the right.

25. As a light metal cannot be used because on being hit by a fast moving particle, the atom of light metal will be simply pushed forward and no scattering will occur.

Whereas, gold is a heavy metal with a high mass number and has a high malleable property. So, a very thin foil (=1000 atoms thick) can be made from gold to get clear observations.

26. Given:　Side of square field = 10 m

The perimeter of the square = 4 × side

$$= 4 \times 10$$

$$= 40 \text{ m}$$

Farmer cover boundary in 40 seconds i.e.,

Distance traveled by the farmer in 40 seconds is 40 m.

Therefore, the distance covered by a farmer in 1 second is 1 m,

So,　　　2 min 20 s = 140 s

So, distance covered by a farmer in 140 s

$$= 1 \times 140$$

$$= 140 \text{ meter}$$

⚠ **Caution**

↪ Students usually get confused between distance and displacement in such type of questions. They calculate displacement for 0.5 round using AD + DC = 10 m + 10 m = 20 m. While it is the distance not displacement, since displacement is the shortest path followed by any object that is AC.

SECTION - C

27. Calcium carbonate decomposes into calcium oxide and carbon dioxide when heated. This procedure is used to make quick lime, which is a critical ingredient in a variety of industries.

$$CaCO_3 \rightarrow CaO + CO_2$$
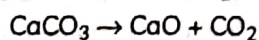
(A) Chemical change is demonstrated in the given process.

(B) By dissolving the products into water, acidic and basic solutions can be made.

A basic solution will be formed by calcium oxide.

$CaO + H_2O \rightarrow Ca(OH)_2$ (Basic solution)

Carbon dioxide will react with water to generate an acidic solution.

$CO_2 + H_2O \rightarrow H_2CO_3$ (Acidic solution)
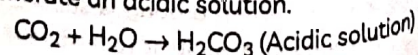
28.

S. No.	Meristematic Tissue	Permanent Tissue
(1)	These tissues in general are small in size and can be oval, rectangular or polygon in shape.	Permanent tissues are large and different in shapes.
(2)	Vacuole is absent.	Vacuole is present.
(3)	The cells are arranged in a compact manner due to which there is no intercellular space between them.	Intercellular spaces are present in between the cells.
(4)	Cell walls of the meristematic tissue are thin and flexible.	Cell walls of permanent tissue are either thin or thick.
(5)	It is a simple tissue.	It can be simple, complex or specialised.
(6)	Meristematic tissues are living cells.	Permanent tissues may be living or dead.

29. (A) Since they are not poisonous in nature.

(B) Organic farming

(C) Manure helps in enriching soil with nutrients and organic matter present in manure helps in improving the soil structure. This involves increasing the water holding capacity in sandy soils. In clayey soils, the larger quantities of organic matter help in drainage and to avoid water logging.

30. (A) Total distance traveled by the object,

$$s = 12\,m + 6\,m + 4\,m + 14\,m$$
$$= 36\,m$$

Total time taken,

$$t = (6 + 4 + 4 + 6)\ \text{seconds}$$
$$= 20\ \text{seconds}$$

$$\text{Average Speed} = \frac{\text{Total Distance travelled}}{\text{Total Time taken}}$$

$$v_{av} = \frac{36}{20}$$
$$= 1.8\ m/s$$

Therefore, the average speed of the object is $1.8\ ms^{-1}$.

(B) (i) Distance $= h + h = 2h$

(ii) Displacement $= h - h = 0$

31. (A) The pores present on the nuclear membrane allow transport of water-soluble molecules across the nuclear envelope. RNA and ribosomes move out of the nucleus, whereas carbohydrates, lipids and proteins move into the nucleus.

(B) Water will move inside the cell when the surrounding medium is hypotonic. As a result, cells of onion peel and RBC get enlarged and swell. Since RBCs lack a plasma membrane, they quickly inflate and explode. Plant cells have a protective cell wall that prevents them from exploding. Hence, the onion peel is swelled and RBC will burst when kept in hypotonic solution.

32. (A) Power consumed by 6 bulbs $= 6 \times 100$

$$= 600\ W$$

Power consumed by 2 fans $= 2 \times 60$

$$= 120\ W$$

Power consumed by 2 ACs $= 2 \times 2$

$$= 4\ kW$$
$$= 4000\ W$$

Total power consumed in house

$$= 600 + 120 + 4000$$
$$= 4720\ W$$

(B) Total Power consumed in 30 days

$$= 4720 \times 30 = 141600\ W$$
$$= 141.6\ kW$$

(C) Electrical energy consumed in 30 days

$$= \text{Power} \times \text{time} = 141.6 \times 4$$
$$= 566.4\ kW$$

33. (A) It happens because of the strong nuclear force, which is also the fundamental force. The nuclear force is stronger than the electromagnetic force. Hence, protons stay in the nucleus.

(B) Atoms are electrically neutral as the number of protons is equal to the number of electrons. Therefore, if an atom loses or gains an electron, it becomes charged and called an ion.

If it loses one or more electrons, it becomes positively charged called a cation and if it gains one or more electrons, it becomes negatively charged called an anion.

(C) Average atomic mass

$$= \frac{16 \times 15 + 17 \times 50 + 18 \times 35}{100}$$
$$= \frac{240 + 850 + 630}{100}$$
$$= \frac{1720}{100}$$
$$= 17.2u$$

OR

(A) The atomic number of Magnesium is 12. Its electronic configuration is 2, 8, 2.

Therefore, to achieve a stable configuration it's easy for magnesium to lose 2 electrons from the M shell rather than gaining 6 electrons.

So, magnesium can lose 2 electrons, hence its valency is +2.

(B) According to Thomson's model of the atom, an atom consists of both positively and negatively charged particles. An atom contains a positively charged sphere in which the negatively charged electrons are implanted. These negative and positive charges are equal in magnitude. Thus, an atom is neutral.

(C) Rutherford selected alpha particles which are helium ions. Helium ion (He^{2+}) is formed by removing 2 electrons from the helium (He) atom.

SECTION - D

34. (A) (i) In case of Carbon:

Molecular mass = Atomic mass × Atomicity

$$y = 12 \times 1 = 12$$

In case of Chlorine:

$$\text{Atomic Mass} = \frac{\text{Molecular mass}}{\text{Atomicity}}$$

$$z = \frac{71}{2} = 35.5$$

(ii) Electrons, protons, and neutrons form an atom. When atoms of the same or different elements come together, they form a molecule. For example, hydrochloric acid is formed when hydrogen and chlorine atoms combine.
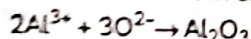
(iii) Molecular mass

$$= \text{Atomic mass} \times \text{Atomicity}$$

$$\therefore \qquad x = 32 \times 8 = 256$$

Molecular mass of sulphur is 256.

(B) The formula for aluminium oxide is Al_2O_3.

$$2Al^{3+} + 3O^{2-} \rightarrow Al_2O_3$$

(C) Since nitrogen has five electrons in its valence shell, its valency is three. As a result, it can take three electrons to complete its octet. Hence, the valency of nitrogen in NH_3 is 3.

OR

(A) Mass of the given sample compound

$$= 0.36 \text{ g}$$

Mass of boron in compound = 0.056 g

Mass of oxygen in compound = 0.169 g

% composition of compound

$$= \% \text{ of boron} + \% \text{ of oxygen}$$

Therefore, % of boron

$$= \frac{\text{Mass of boron}}{\text{Mass of the sample compound}} \times 100$$

$$= \frac{0.056}{0.36} \times 100 = 15.56\%$$

Therefore, % of oxygen

$$= \frac{\text{Mass of oxygen}}{\text{Mass of the sample compound}} \times 100$$

$$= \frac{0.169g}{0.36} \times 100 = 46.94\%$$

(B) Molecular mass of carbon = 12

Molecular mass of oxygen = 16

Molecular mass of CO_2 = Molecular mass of carbon + 2(Molecular mass of oxygen)

$$= 12 + (16 \times 2)$$

$$= 12 + 32$$

$$= 44 \text{ g}$$

(C) The total of the average atomic masses of each atom represented in the chemical formula is the formula mass, which is expressed in atomic mass units. A covalent compound's formula mass is also known as its molecular mass.

35. (A)

Rough Endoplasmic Reticulum (RER)	Smooth Endoplasmic Reticulum (SER)
Ribosomes are connected to its membrane.	Ribosomes are not found on its membrane.
Cisternae and a few tubules make up this structure.	Vesicles and tubules make up this structure.
It is involved in the production of enzymes and proteins.	Glycogen, lipids, and steroids are all synthesised by this enzyme.
Lysosome production is aided by this substance.	Spherosomes/Oleosomes are produced as a result.

The endoplasmic reticulum is responsible for the formation of the membrane by synthesising lipids (smooth endoplasmic reticulum) and proteins (rough endoplasmic reticulum). As a result, they aid in membrane biogenesis.

(B) If plasma membrane breaks down,
  (1) Cell will not be able to exchange materials with its surroundings.
  (2) Semi permeability of the cell will be lost.
  (3) Results in cell lysis.

(C) The cells in the plasma membrane are killed by boiling Rheo leaves in water. Plasmolysis will not occur if a drop of sugar syrup is applied to it, because only living cells can absorb water by osmosis, while dead cells cannot.

OR

(A) (i) On sprinkling of some salt on the salad, the salad will release water.
  (ii) The salt outside the salad acts as hypertonic solution as it has less water concentration and therefore, the cell loses water by osmosis.
  (iii) Sachin showed the value of being very helpful, caring and responsible.

(B) (i) We can separate the rotten eggs by dipping them in water. The eggs that will float in water are rotten eggs and the one that sinks are good one.
  (ii) Egg shell is made up of calcium carbonate.
  (iii) Gaurav showed the value of being helpful and responsible.

36. Final velocity, $v = 0$ m/s — (i)
Acceleration due to gravity, $a = g$

$$v = u + gt$$
$$0 = u + gt$$
$$u = -gt \quad \text{— (ii)}$$

Also,

$$v^2 = u^2 + 2gh$$

Here, $v = 0$, $u = -gt$ from eqs (i) and (ii)
Distance, $s = h$ and taken time $t = t_1$
Substitutes the value in equation — (ii)

$$g^2 t_1^2 = 2gh_1$$
$$h_1 = \frac{1}{2} gt_1^2 \quad \text{— (iii)}$$

Similarly for $s = h_2$ and $t = t_2$,

$$h_2 = \frac{1}{2} gt_2^2 \quad \text{— (iv)}$$

$$\frac{h_1}{h_2} = \frac{t_1^2}{t_2^2}$$

$$\frac{t_1}{t_2} = \sqrt{\frac{h_1}{h_2}}$$

Since the acceleration is constant in both cases, the ratio will not change. In the situation of free-fall, acceleration is independent of the body's mass and size.

OR

(A) When Rahul immerses the egg in water, the density of the water is less than that of the egg, and the egg sinks. However, when you add salt to it, the density of the water increases due to its much higher density, and the salt solution exerts a greater upward buoyant force on the egg, causing it to rise and then float.

(B) When a child stands on a cushion, only his two feet (which have a modest surface area) come into contact with it. As a result, the child's weight is concentrated in a tiny region of the cushion, exerting a significant amount of pressure and a considerable depression in the cushion. When the man lies down on the cushion, however, his entire body (which has a big surface area) is in contact with the cushion. His weight is distributed over a significantly broader area of the cushion, resulting in less pressure and little cushion depression.

SECTION - E

37. (A) (i) Plants have meristematic tissues present in specific regions whose main role is division of cell leading to growth. Animals on the other hand, do not have specialised growing cells rather all the cells undergo cell division for overall growth of the body.
  (ii) Continuous cell division in meristematic cells help in the growth of the plant.

(B) (i) Intercalary meristem is responsible for the growth of new branches in a plant especially in the nodal regions.
  (ii) A - Xylem
  B - Phloem
  C - Vascular bundles

OR

(B) (i) The epidermis is the layer of skin that protects the plant's body from parasites. It possesses a thick cuticle and dermal tissue, which helps to keep parasites away.

(ii) Water hyacinth has a specific type of parenchyma termed aerenchyma. This tissue contains air-filled pockets, especially in the stem part, causing it to float. Due to this, water hyacinth floats on the water surface.

🔆 Related Theory

- Hydrophytes have floating leaves larger in size having stomata and waxy coating on the upper surface. The waxy layer prevents stomata from being clogged.

38. (A) Shaving cream seems to have an unusual state because it is a liquid soap with a lot of gas bubbles mixed in it. The gas makes it so thick and frothy that it maintains its shape.

(B) Iodine crystals < Shaving foam < Orange juice < Water vapours

(C) Sand is a solid that has the ability to be poured like a liquid and takes the shape of its container. It is still a solid, as each individual grain of sand has a shape of its own and keeps that shape. In the case of things such as sand, salt and sugar, when you pour them from a container they will create a pile on the floor or bench top due to each individual grain having its own shape. When liquids are poured onto the same surface they are not able to create a pile, as they have no shape.

OR

(C) When the temperature drops to 0°C, the water turns into ice. When heat is applied to water, it turns into steam at 100°C. Water as a vapour has a lot of latent heat, but water as a liquid does not. In the case of ice, the energy of water molecules is low. When they come into contact with the skin, water molecules absorb energy from the body. Therefore, it provides a cooling effect. On the other hand, in the case of steam, water molecules have higher energy. The high energy of water molecules in steam is converted into heat, which can cause burns.

39. (A) Sound absorbent materials such as curtains, drapes, and cushions decrease reverberation.

(B) Sound boards and curved cutting focus the sound so that it reaches all four corners of the auditorium and is uniformly distributed across the width.

The hall's walls and ceiling are also curved to reduce reverberation and increase sound quality by preventing numerous reflections of sound waves.

🔆 Related Theory

Curved ceiling of a conference hall

Source of sound

Sound board
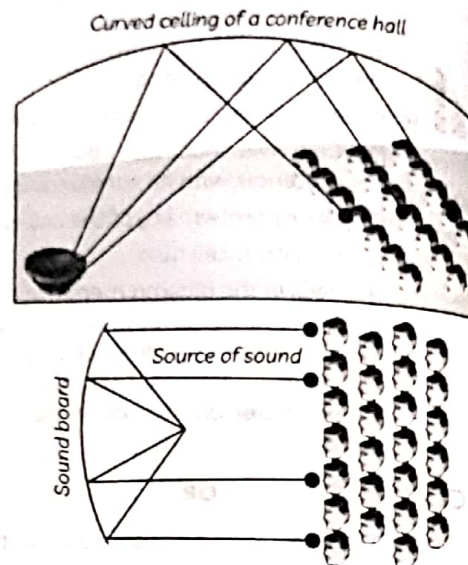
(C)

Echo	Reverberation
A single reflection of a sound wave off a surface is called an echo.	The sound or pattern formed by the superposition of such echoes is known as reverberation.
When the distance between the source of sound and the reflecting body is at least 17 metres, an echo can be heard.	When a sound wave is reflected by a nearby wall, reverberation can occur.
An echo is audible and easily distinguishable.	The reverberation effect isn't a perfect match for the original sound sample.
If the ambient temperature is known, echo can be used to measure the distance of a reflecting object such as a tall structure or a mountain.	For the distance measurement application, reverberation is not a solution.

OR

(C) (i) Given:

Velocity of sound, $v = 346$ m/s
Time taken for hearing the echo, $t = 4$ s

Distance travelled = Velocity × Time
= 346 × 4
= 1384 m

(ii) An echo is a sound produced when sound waves are reflected off a surface and returned to the listener. It is a sound that is reflected and arrives at the listener after the direct sound has passed.