Q1) It is observed that water boils at lower temperature at higher altitudes. Why?

Solution:

Atmospheric pressure is much less at higher altitudes. So, less thermal energy is required to get the vapour pressure equal to the atmospheric pressure. Hence, water boils at lower temperature at higher altitudes.

Q2) What is the speciality of the cellular structure of viruses?

Solution:

Viruses do not have plasma membrane, cytoplasm, or other cell organelles. They just have their genetic material surrounded by a protein coat. Due to the lack of cellular apparatus, they require the host's cell to reproduce.

Q3) A scientist developed a hybrid crop variety resistant to abiotic stress. List the abiotic factors the plant would be resistant to.

Solution:

The abiotic stress-resistant crop will have the following characteristics:

- Drought resistance
- Salinity resistance
- Flood (water-logging) resistance
- Heat/cold/frost resistance

Q4) The use of manure is preferable over the use of fertilisers. Give reasons.

Solution:

The use of manure is preferable over the use of fertilisers because of the following reasons:

- Manure increases the water-holding capacity of soil.
- Manure is rich in organic nutrients. It increases the amount of organic nutrients in the soil.
- Fertilisers get washed away because of irrigation. Hence, they are a cause of water pollution. There is no such risk associated with the use of manures.
- Continuous use of fertilisers causes harm to useful or symbiotic microorganisms living in soil. Manures do not pose this threat.
- Fertilisers lead to loss in soil fertility whereas manures do not.

Q5) Give examples of for the following range of motions:

i.) Acceleration in the direction of motion

ii) Acceleration against the direction of motion

Solution:

i.) A car moving forward with a uniform acceleration is an example of acceleration in the direction of motion.

ii.) A ball when thrown up moves upward but its acceleration (or more appropriately, retardation) is directed downwards. This is an example of acceleration against the direction of motion.

Q6) State the functions of epithelial tissues.

Solution:

Functions of epithelial tissues:

(i) To protect the animal body − It protects the underlying cells from injury, water loss, bacterial infections, etc.

(ii) To form barriers to keep different body systems separated from each other.

(iii) To regulate the exchange of materials between different parts of the body, and between the body and the external environment.

Q7) Is inter-conversion between the three states of matter possible? How?

Solution:

Yes, the three states of matter, i.e., solid, liquid and gas, can be inter-converted.

Temperature and pressure determine the state of a substance. On heating, the molecules of matter vibrate faster. When heated, the solid state changes into the liquid state, which on further heating, changes into the gaseous state. When cooled, the gaseous state condenses into the liquid state, which on further cooling, condenses into the solid state.

Q8) Write down the properties of a colloidal solution.

Solution:

Following are the properties of colloidal solutions:

i. A colloid is a heterogeneous mixture.

ii. The size of the solute particles in a colloid is bigger than that of the particles in a true solution but smaller than that of the particles in a suspension. They are between 1 nm and 100 nm in diameter.

iii. The solute particles present in a colloidal solution cannot be seen even with a microscope.

iv. Since the size of the particles present in colloids is quite large, they scatter the beam of light passing through them.

v. The solute particles of a colloid cannot be filtered using a filter paper.

vi. Colloids are quite stable. Their particles do not settle down when left undisturbed.

Q9) a. Why is molality preferred over molarity while expressing the concentration of a solution?

b. Why does the boiling point of water increase when sodium chloride is added to it?

c. Why is phenol partially soluble in water?

Solution:

a. While molarity decreases with an increase in temperature, molality is independent of temperature. This happens because molality involves mass, which does not change with a change in temperature, while molarity involves volume, which is temperature dependent. Hence, molality is preferred over molarity while expressing the concentration of a solution.

b. When a non-volatile solute such as sodium chloride is dissolved in water, the vapour pressure of water decreases. This happens because on addition of NaCl, some of the solvent molecules on the surface are replaced by the non-volatile solute molecules. Hence, the solution has to be heated at a higher temperature to make the vapour pressure equal to the external pressure. Hence, the boiling point of the solution increases.

c. As a general rule, like dissolves like. Phenol has a polar −OH group but an aromatic phenyl C_6H_5 group. Hence, it is partially soluble in water.

Q10) Write down the differences between a mixture and a compound.

Solution:

Following are the differences between a mixture and a compound.

Mixture	Compound
1. It is obtained by the physical combination of either elements or compounds or both.	1. It is obtained by the chemical combination of more than one element.
2. The composition of the elements present in a mixture is not fixed.	2. The composition of elements present in a compound is fixed.
3. It shows the properties of all its constituents.	3. It may or may not show the properties of its constituent elements.

|	
4. Its constituents can be separated by using physical methods.	4. Its constituents can be separated by using only chemical and electrochemical methods.

Q11) How can different components of a dye be separated?

Solution:

A dye is a mixture of two or more colours and these colours can be separated by the process of chromatography. This technique is used for the separation of those solutes that are soluble in the same solvent.

Dye is generally soluble in water. A thin strip of filter paper containing a spot of dye is dipped in water in such a way that the drop of dye on the paper is just above water level (as shown in figure **A**).
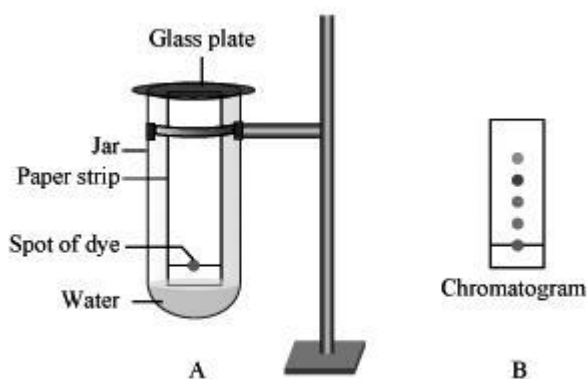
As water rises on the filter paper, it takes along with it the dye particles of different colours (as shown in figure **B**). Thus, colours can be separated from a dye by the process of chromatography.

Q12) What is mixed cropping? List some advantages associated with mixed cropping.

Solution:

Mixed cropping is the process of growing two or more crops simultaneously on the same land in a random fashion. Wheat and gram, wheat and mustard, groundnut and sunflower, etc. are some common examples of mixed cropping.

In mixed cropping, crops are chosen in such a way that their nutritional requirements are different. This ensures proper and maximum utilisation of nutrients by both the crops.

Q13) Write a brief account on the biotic factors that affect the storage of crop plants.

Solution:

Some of the biotic factors that affect the storage of crop plants are listed as follows:

- Weeds − They are the plants that grow in cultivated fields along with the crop plant. They compete with the crop plant for nutrients, light, and space. As a result, the crop plant gets lesser of these essential requirements, thereby showing a decline in their productivity. *Xanthium, Parthenium*, etc. are some examples of weeds.
- Pests − They are generally insects. They destroy crops by sucking the cellular sap from various plant parts, cutting the roots, stem, and leaves of plants, and boring into stems and fruits.
- Microorganisms or pathogens − They are the diseases-causing agents in crop plants. Pathogens can be bacteria, fungi, or virus. These pathogens are generally transmitted through soil, water, and air.

Q14) What is a composite fish culture system?

Solution:

Aquaculture is the practice of farming or culture of fishes. Modern fish culturing techniques involve the composite fish culture system.

In this method, a combination of various fish species (generally five to six species) is cultured in a same pond. The selection of fishes is made in a way so that they do not compete with each other for food and other resources. Generally a combination of *Catla*, *Rohu*, and *Mrigal* representing indigenous species and some exported species of carp like common grass and silver carps are cultured in the same tank. *Catla* is a surface feeder; *Rohu* feeds in the middle zone while the common carp and *Mrigal* feed at the bottom of the pond. Grass carp feeds on the weeds. The composite fish culture technique helps in the utilization of food present in various parts of the pond and thus, helps to increase the yield.

Q15) In the given figure, the organelle labelled as **X** has two variants. Name them and write their functions.
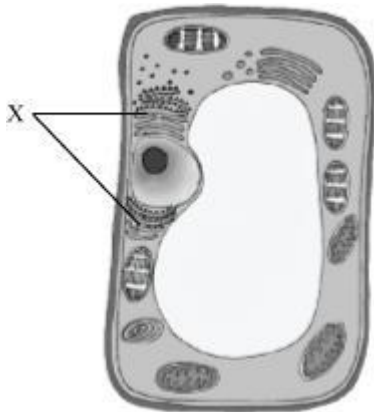
Solution:

The organelle **X** marked in the figure is endoplasmic reticulum.

There are two types of endoplasmic reticulum, namely, smooth endoplasmic reticulum (SER) and rough endoplasmic reticulum (RER). When ribosomes get attached to the surface of smooth endoplasmic reticulum, it becomes rough endoplasmic reticulum.

- **Functions of smooth endoplasmic reticulum −** Smooth ER synthesises fats and lipids. It also takes part in the metabolism of carbohydrates.
- **Functions of rough endoplasmic reticulum −** It takes part in the synthesis and transport of proteins to various destinations such as the plasma membrane.

Q16) If 20 g of sugar is dissolved in 300 g of water, then what is the concentration of the solution in terms of mass percentage?

Solution:

Mass of the solute (sugar) = 20 g

Mass of the solvent (water) = 300 g

Mass of the solution = Mass of the solute + Mass of the solvent

= 20 g + 300 g

= 320 g

$$\text{Mass percentage of the solution} = \frac{\text{Mass of the solute}}{\text{Mass of the solution}} \times 100$$
$$= \frac{20}{320} \times 100$$
$$= 6.25\%$$

Q17) (a) How can a mixture of two immiscible liquids be separated?

(b) What are the properties of a solution?

Solution:

(a) A mixture of two immiscible liquids can be separated using a separating funnel. A separating funnel can be used to separate kerosene oil and water in which the heavier part (water) forms a lower layer and the lighter part (kerosene) forms an upper layer.

(b) The properties of a solution are:

(i) A solution is a homogeneous mixture.

(ii) The particles of a solution are so small that they cannot scatter a beam of light passing through it.

(iii) The particles of a solution are so small (smaller than 1nm) that they are not visible to the naked eye.

(iv) The solute particles cannot be separated from the solution by the process of filtration.

Q18) A car moving with a uniform velocity of 72 km/h is brought to rest in 5 s. Calculate the distance travelled by the car in this interval of time.

Solution:

Initial velocity of the car, u = 72 km/h = 20 m/s

Find velocity of the car, $v = 0$

Time, $t = 5$ s

From the first equation of motion, the acceleration produced in the car in the opposite direction can be calculated as:

$v = u + at$

$$\therefore a = \frac{v - u}{t} = \frac{0 - 20}{5} = -4 \text{ m/s}^2$$

The negative value of acceleration indicates that the velocity of the car is decreasing with time.

Using the third equation of motion to calculate distance (s):

$v^2 - u^2 = 2as$

$0 - (20)^2 = 2 \times (-4) \times s$

$$\therefore s = \frac{-400}{-8} = 50 \text{ m}$$

Hence, before stopping, the car travels 50 metres in 5 seconds.

Q19) Find the initial velocity of a car which is stopped in 5 seconds by applying brakes. The retardation because of the brakes is 2.5 m/s^2.

Solution:

According to the 1st equation of motion,

$v = u + at$

Here,

$v = 0$

$t = 5$ s

$a = -2.5 \text{ m/s}^2$

Therefore,

$0 = u - 2.5 \times 5$

Or

$u = 12.5 \text{ m/s}$

Thus, the initial velocity of the car is 12.5 m/s^2.

Q20) (a). What is gravitational force?

(b). What will be the value of *g* if the earth were to become three times as heavy and twice as large as it is now?

(c). What is the gravitational force of attraction between Hari and his friend, of masses 50 kg and 55 kg respectively, if they are sitting 1 m away from each other? (G = 6.673 × 10^{-11} Nm^{2}kg^{-2})

Solution:

(a). The force of attraction between two objects by virtue of their masses is called gravitational force.

(b). Gravitational acceleration on earth surface, $g = \dfrac{GM}{R^2}$

Where,

G = Universal gravitational constant

M = Mass of the earth

R = Radius of the earth

Given that:

New mass of the earth, $M_1 = 3M$

New radius, $R_1 = 2R$

New value of gravitational acceleration on earth surface, $g_1 = \dfrac{GM_1}{R_1^2}$

$= \dfrac{G3M}{(2R)^2}$

$$= \frac{GM}{R^2} \times \frac{3}{4}$$

$$= \frac{3}{4}g$$

Therefore, the new value, g_1, will be 0.75 g.

(c). Given that:

Mass of Hari, M_1 = 50 kg

Mass of Hari's friend, M_2 = 55 kg

Distance between Hari and his friend, R = 1 m

$G = 6.673 \times 10^{-11}$ Nm²kg⁻²

Therefore, gravitational force of attraction between Hari and his friend, $F = G\dfrac{M_1 M_2}{R_2}$

$$= \frac{6.673 \times 50 \times 55 \times 10^{-11}}{1^2}$$

$= 1.84 \times 10^{-7}$ N

Therefore, the force of attraction is only 1.84×10^{-7} N.