

- ii. Calculate the retarding force provided by the brakes. (1)
- iii. How much time did it take to stop after the brakes were applied? (2)

OR

What is the work done by the braking force? (2)

39. i. A cube of side 5 cm is immersed in water and then in saturated salt solution. In which case, will it experience a greater buoyant force? If each side of the cube is reduced to 4 cm and then immersed in water, what will be the effect on the buoyant force experienced by the cube as compared to the first case for water. Give the reason for each case. [5]
- ii. A ball weight 4 kg of density 4000 kg m^{-3} is completely immersed in water of density 10^3 kg m^{-3} . Find the force of buoyancy on it. (Given $g = 10 \text{ ms}^{-2}$.)

OR

A stone is dropped from a 100 m high tower. How long does it take to fall?

- a. the first 50 m and
- b. the second 50 m.

Solution

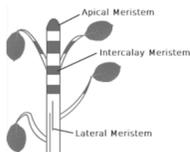
Section A

1.

(d) Z

Explanation:

X is apical meristem, Y is intercalary meristem, and Z is lateral meristem. The girth of stems or roots increases due to lateral meristems. Thus Z is the correct option.



2.

(b) Virchow

Explanation:

Rudolf Virchow presented the idea in 1855 that every cell arises from another (pre-existing) cell. This was an addition to the cell theory that was proposed earlier by **Matthias Jakob Schleiden** and **Theodor Schwann**.

3.

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

Explanation:

- Lysosomes are popularly known as 'suicidal bags'. They contain enzymes for the hydrolysis of all cell components in case of damage. They play a role in cell death.
- Centrioles are a very important part of centrosomes or spindle pole bodies that act as the microtubule-organizing centers in animal cells.
- Golgi apparatus consists of a system of membrane-bound vesicles. The proteins manufactured by the ribosomes are packed inside the vesicles.
- Smooth endoplasmic reticulum (SER) helps in the manufacture of fat molecules or lipids. Some of these lipids help in building the cell membrane (known as membrane biogenesis).

4.

(d) Tendons are non-fibrous tissue and fragile

Explanation:

Tendons are white fibrous connective tissues having great strength and join skeletal muscles with bones.

5.

(c) Rice

Explanation:

Rice is one of the chief grains of India. India has the largest area under rice cultivation, as it is one of the principal food crops.

6.

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

Explanation:

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

7.

(d) A is false and R is true.

Explanation:

The cell wall is found only in plant cells, outer to the cell membranes.

8.

(d) Competing for various resources of crops (plants)

Explanation:

The growth of weeds in the fields is harmful because they compete with other crops for nutrients, water, space, light. A **weed** is a plant considered undesirable in a particular situation, "a plant in the wrong place". A plant that is a weed in one context is not a weed when growing in a situation where it is in fact wanted, and where one species of plant is a valuable crop plant, another species in the same genus might be a serious weed. They compete with the desired plants for the resources that a plant typically needs, namely, direct sunlight, soil nutrients, water, and space for growth, providing hosts and vectors for plant pathogens giving them greater opportunity to infect and degrade the quality of the desired plants.

9.

(d) Catla

Explanation:

Catla is the fastest growing Indian major carp species and widely distributed throughout India, Nepal, Pakistan, Burma, and Bangladesh.

10. **(a) The main functions of ribosomes are :**

- (i) They assemble amino acids to form specific proteins, proteins are essential to carry out cellular activities.
- (ii) The process of production of proteins, the deoxyribonucleic acid produces mRNA by the process of DNA transcription.
- (iii) The genetic message from the mRNA is translated into proteins during DNA translation.
- (iv) The sequences of protein assembly during protein synthesis are specified in the mRNA.

If plasmolysed cell is kept in a hypertonic solution then, there will be no movement because they both have same concentration of water.

(v) The proteins that are synthesized by the ribosomes present in the cytoplasm are used in the cytoplasm itself. The proteins produced by the bound ribosomes are transported outside the cell.

(b) Cell Wall Functions:

- (i) The plant cell wall provides definite shape, strength, rigidity, and protection against mechanical stress.
- (ii) Helps in controlling cell expansion.
- (iii) It helps in preventing water loss from the cell.
- (iv) Involved in transporting of substances between and across the cell.
- (v) It acts as a barrier between the cell interior and the outer environment.

11. Xylem is a complex permanent tissue. It is a conducting tissue of the plants. It consists of tracheids, vessels, xylem parenchyma and xylem fibres. The cells have thick walls. Many of the cells are dead. Tracheids and vessels are tubular structures. They transport water and mineral vertically. The xylem parenchyma stores food. The xylem parenchyma helps in the sideways conduction of water. Fibres are mainly supportive in function. Xylem moves materials in one direction – from the roots to the aerial parts.

OR

The outermost protective covering of the plants is called the epidermis. It is important for the plants due to its functions.

- a. The main function of epidermis is protection against water loss. In desert plants, epidermal cells secrete a waxy, water-resistant layer of cutin on the outer surface of the plants which reduces loss of water.
- b. It also consists of small pores called stomata which help in the exchange of gases with the atmosphere.
- c. The function of the epidermal cells of the roots is absorption of water from the soil.
- d. It also aids against mechanical injury and invasion by parasitic fungi.

12. **Hybridization** - Hybridization refers to crossing between genetically dissimilar organisms to produce offsprings with a desirable combination of characters.

Photoperiod - Duration of sunlight available to the plant is called as photoperiod. It affects the growth, flowering, and maturation of crops.

13. 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.
14.
 - i. These two crops are selected in such a way that they have different nutrient requirements so they can grow simultaneously in the same field.
 - ii. It reduces the risk and gives some insurance against failure of one of the crops.
 - iii. Various methods for removal of weed, insect, and disease include pesticides, insecticides, fungicides, and mechanical removal.
 15.
 - i. Cellulose is a complex substance which provides structural strength to the plants.
 - ii. Chromosomes are present as thread like structures packed inside the nucleus of a plant cell or animal cell. Each chromosome is made up of protein and a single molecule of DNA (deoxyribonucleic acid).
Therefore, chromosomes are made of DNA and protein
 - iii. Plasmolysis in a plant cell is defined as the process of shrinkage of the cytoplasm as a result of loss of water from the cell. It occurs when plant cells are placed in a solution that has a higher concentration of solutes than the cell does.

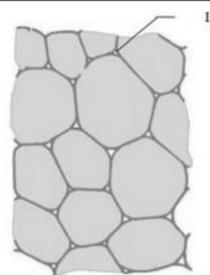
OR

Hypertonic solution.

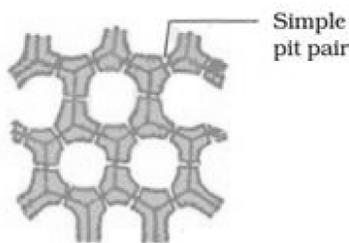
16.
 - i. When human red blood cells are placed in hypotonic salt/sugar solution they swell due to endosmosis.
 - ii. Plant cell shrinks when kept in hypertonic solution because the concentration of the solvent is more inside the cell. It shrinks due to exosmosis.
 - iii. Lysosomes are known as suicidal bags because, during the breakdown of cell structure, lysosome bursts and enzymes eat up their own cells.

OR

Parenchyma	Sclerenchyma
Cells are live.	Cells are dead.
Cells have thin cell walls.	The cell wall is thick due to the deposition of lignin.
Intercellular spaces are present between cells.	No intercellular spaces are found between the cells.
Cells are oval in shape.	Cells are long in shape.
Some cells contain chloroplast.	The chloroplast is absent.
Storage of food is a major function.	Structural rigidity is the main function.
Found in soft parts.	Found in hard parts.



T.S. Parenchyma



T.S. Sclerenchyma

Section B

17.

(d) Iodine

Explanation:
The process of changing solid directly into gases without changing into a liquid is called sublimation. sugar, urea, and ice are not sublime substances, Iodine, ammonium chloride, naphthalene balls, camphor is a sublime substance.

18.

(d) a = multiply by 22.4 L, b = divide by 22.4 L

Explanation:

Volume of gas at STP = No. of moles $\times 22.4 \text{ L}$

$\underbrace{\hspace{10em}}_a$

No. of moles = Volume of gas at STP $\div 22.4 \text{ L}$

$\underbrace{\hspace{10em}}_b$

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

Explanation:

Light is scattered by colloidal particles, making the path of the beam visible.

20.

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

Explanation:

Atomic number (Z) of a chemical element is the number of protons in the nucleus of that atom. It is a characteristic of the element and determines its place in the periodic table. The mass of an atom of a chemical element is equivalent to the number of protons and neutrons in the atom (the mass number) or to the average number allowing for the relative abundance of the different isotopes. Isotopes are atoms with the same number of protons but different number of neutrons. It can also be said that isotopes are atoms of the same element with the same atomic number but different mass number. Isobars are atoms (nuclides) of different chemical elements that have the same number of nucleons.

21.

- (c) BiPO_4

Explanation:

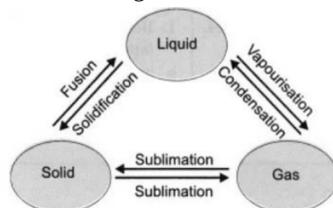
BiPO_4 is the correct formula, its name is Bismuth phosphate.

22.

- (c) (A) Vapourisation (B) Condensation

Explanation:

The correct figure is:



23. (a) Starch + Water

Explanation:

Starch forms a colloid in water (hot water).

24.

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

Explanation:

Number of atoms present in a molecule of a gaseous element is called atomicity. e.g., O_2 has two atoms and hence, its atomicity is 2.

25. When salt is heated, it does not get charred but sugar gets charred on heating. When salt is dissolved in water, the solution conducts electricity. This does not happen with aqueous solution of sugar.

26. They do not come closer because of the presence of either positive or negative charge on them. Due to mutual repulsion, these particles remain scattered in a colloidal solution.

OR

Elements	Compounds
Elements are pure substances that cannot be broken down	Compounds are those pure substances that can be broken down

into simpler substances by any known physical or chemical means..	into their constituent elements by chemical or electrochemical reactions.
Elements are made up of only one kind of atoms.	Compounds are made up of more than one kind of atoms.
Examples of elements are copper, oxygen, iron.	Examples of compounds are water, methane, sugar.

27. i.	Particles	Discoverer
	Electrons	J.J. Thomson
	Protons	Rutherford
	Neutrons	Chadwick

ii. View point in support of scientist as he discourages superstition.

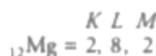
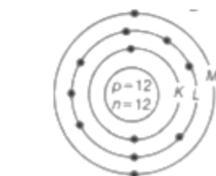
28. i. The process by which a substance changes from a solid state to a liquid state is called fusion. Fusion is also called melting.
 ii. The temperature at which the solid changes into liquid at the atmospheric pressure is called melting point. For example, ice melts at 0°C to form water.
 iii. The amount of heat energy released or absorbed when a solid changing to liquid at atmospheric pressure at its melting point is known as the latent heat of fusion.

OR

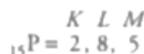
latent heat, energy absorbed or released by a substance during a change in its physical state (phase) that occurs without changing its temperature.

29. i. An outermost shell, which has eight electrons is said to possess an octet. Elements attain their octet by sharing, gaining or losing electrons.

ii. Atomic structure of Mg



Atomic structure of P



OR

When atomic number $Z = 3$, the element will have 3 protons in its nucleus.

Since the atom is electrically neutral, the number of electrons in its shells will be equal to the number of protons .

The element will have 3 electrons in its different shells.

The maximum number of electrons that can be accommodated in the first orbit ($n = 1$) or K-shell will be $= 2n^2 = 2$

So, the 3 electrons in the element would be distributed as 2, 1.

The number of valence electrons (i.e. electrons in the outermost shell) is 1.

Valency = number of valence electrons (for 4 or lesser valence electrons)

The element can easily give away its outermost single electron for achieving a duplet (Helium) configuration.

The valency of the element is 1. The given element is Lithium (Li).

Section C

30.

(b) third law of motion

Explanation:

As the sailor jumps forward out of a rowing boat, the force on the boat moves it backwards. Thus, when one object exerts a force on another object, the second object instantaneously exerts a force back on the first. Hence, this is an example of the third law of motion.

31.

(d) In the direction of A

Explanation:

The momentum after the collision is in the direction of A because of less momentum.

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

Explanation:

Sound needs a material medium like solid, liquid, or a gas to travel and be heard. Sound waves are mechanical waves because they require a material medium for their propagation.

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

a. From the relation $v = u + at$

We have $0 = 120 + a \times 0.01$

or $a = -\frac{120}{0.01} = -12000 \text{ ms}^{-2}$ (the negative sign here shows retardation)

Distance of penetration in the target

$S = ut + \frac{1}{2} at^2$ we have

$S = 120 \times 0.01 + \frac{1}{2} \times (-12000) \times (0.01)^2 = 0.6 \text{ m}$

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

34. Mass of substance $m = 50 \text{ g}$

Volume of substance $V = 20 \text{ cm}^3$

Therefore density of substance is

$$D = \frac{M}{V} = \frac{50}{20} = 2.5 \text{ g cm}^{-3}$$

The substance will sink in water, because its density is more than that of water.

OR

Mass of object (m) = 40 kg

Height (h) = 5 m

Acc. due to gravity (g) = 10 ms^{-2}

\therefore P.E. at a height of 5 m (PE) = mgh

$$= 40 \times 10 \times 5 = 2000 \text{ J}$$

P.E. at a half way height, i.e. : 2.5 m (PE)

= mgh

$$= 40 \times 10 \times 2.5$$

$$= 1000 \text{ J}$$

Decrease in P.E. = Increase in K.E.

$$= 2000 - 1000$$

$$= 1000 \text{ J}$$

35. The shape of the path followed by the ball is parabolic.

Vertically downward motion is due to gravitational acceleration. Horizontal motion is due to zero acceleration.

36. Since speed of sound in air = 344 m/s

and speed of sound in aluminium = 6420 m/s

we know that $v = \text{distance}/\text{time}$ therefore $\text{time} = d/v$

time taken by sound wave in air/time taken by sound wave in aluminium

$$= \frac{d}{344} : \frac{d}{6420} = \frac{6420}{344} = \frac{18.66}{1}$$

the sound will take 18.66 times more time through air than in aluminium in reaching other boy.

37. Initial velocity, $u = 360 \text{ m/s}$

Final Velocity, $v = 0$

Distance Travelled, $S = 10 \text{ cm} = 0.1 \text{ m}$

Acceleration, $a = ?$

From third equation of motion, $v^2 = u^2 + 2as$

$$\Rightarrow 0 = (360)^2 + 2a(0.1)$$

$$\Rightarrow a = \frac{-129600}{2} = -648000 \text{ m/s}^2$$

Now,

mass of the bullet, $m = 2.0 \text{ g} = 0.002 \text{ kg}$

Force, $F = ma$

$$= 0.002 \times (-648000)$$

$$= -1296 \text{ N}$$

\therefore The average de-accelerating force exerted by the wood = -1296 N

(b)

From first equation of motion, $v = u + at$

$$\Rightarrow 0 = 360 + (-648000)t$$

$$\Rightarrow t = 5.56 \times 10^{-4} \text{ s}$$

Therefore, time taken by the bullet to come to rest = $5.56 \times 10^{-4} \text{ s}$

38. i. Given, mass of the vehicle, $m = 1 \text{ tonne} = 1000 \text{ kg}$

Initial speed, $u = 60 \text{ ms}^{-1}$

Distance between vehicle and the cow, $s = 9 \text{ m}$

Final velocity, $v = 0$

Kinetic Energy is the energy possessed by a body due to its motion. The kinetic energy of an object increases with its speed.

KE of vehicle before applying brakes is given by = $\frac{1}{2} mu^2 = \frac{1}{2} \times 1000 \times 60 \times 60 = 1800000 \text{ J} = 1800 \text{ kJ}$

- ii. Given, mass of the vehicle, $m = 1 \text{ tonne} = 1000 \text{ kg}$

Initial speed, $u = 60 \text{ ms}^{-1}$

Distance between vehicle and the cow, $s = 9 \text{ m}$

Final velocity, $v = 0$

From the third equation of motion,

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

$$(0)^2 - (60)^2 = 2 \times a \times 9$$

$$\Rightarrow a = -200 \text{ ms}^{-2}$$

So, retarding force provided by the brakes = $ma = 1000 \times (-200) = -200000 \text{ N}$

- iii. Given, mass of the vehicle, $m = 1 \text{ tonne} = 1000 \text{ kg}$

Initial speed, $u = 60 \text{ ms}^{-1}$

Distance between vehicle and the cow, $s = 9 \text{ m}$

Final velocity, $v = 0$

Now, again from the second equation of motion,

$$s = ut + \frac{1}{2} at^2 \Rightarrow 9 = 60t + \frac{1}{2} \times (-200) t^2$$

$$\text{or } 9 = 60t - 100t^2$$

$$\text{or } 100t^2 - 60t + 9 = 0 \Rightarrow (10t - 3)^2 = 0$$

$$\text{or } 10t - 3 = 0 \Rightarrow t = \frac{3}{10} = 0.3 \text{ s}$$

OR

Given, mass of the vehicle, $m = 1 \text{ tonne} = 1000 \text{ kg}$

Initial speed, $u = 60 \text{ ms}^{-1}$

Distance between vehicle and the cow, $s = 9 \text{ m}$

Final velocity, $v = 0$

So, work done by the braking force is given by = $Fs = -200000 \times 9 = -1800000 \text{ J} = -1800 \text{ kJ}$

39. i. The cube will experience a greater buoyant force in saturated salt solution than in water because density of saturated salt solution is more than the density of water. If each side of the cube is reduced to 4 cm, it will result in reduction in volume of the cube. Hence, the buoyant force experienced by it will reduce in water.

ii. Buoyant force = weight of displaced water
 = density of water \times volume of displaced water \times g
 = $1000 \times \frac{4}{4000} \times 10$ [∵ volume = $\frac{\text{weight}}{\text{density}}$]
 = 10 N

OR

Initial velocity, $u=0$

Total height, $h = 100$ m

a. Let, for the first 50 m the time taken by the stone be 't' sec.

$S=-50$ m (- ve sign shows the stone falls in downward direction)

$$g = -10 \text{ m/s}^2$$

$$h = s = ut + \frac{1}{2}gt_1^2$$

$$\Rightarrow -50 = 0 + \frac{1}{2}(-10)t_1^2$$

$$\Rightarrow -50 = -5t_1^2$$

$$\Rightarrow \frac{50}{5} = t_1^2$$

$$\Rightarrow t_1^2 = 10$$

$$\Rightarrow t_1 = \sqrt{10}$$

$$\therefore t_1 = 3.16 \text{ sec}$$

b. For the entire journey, let the time taken be T

$$u = 0$$

$$S = -100 \text{ m}$$

$$a = -10 \text{ m/s}^2$$

$$S = ut + \frac{1}{2}aT^2$$

$$\Rightarrow -100 = 0 + \frac{1}{2} \times (-10)T^2$$

$$\Rightarrow T_2 = 20$$

$$\Rightarrow T = \sqrt{20}$$

$$\Rightarrow T = 4.47 \text{ sec}$$

$$\therefore \text{Time taken to fall through the next 50 m} = T - t_1 = 4.47 - 3.16 = 1.31 \text{ sec}$$