

Solution

Section A

1.

(b) R

Explanation: Changes of state are examples of phase changes or phase transitions. All phase changes are accompanied by changes in the energy of a system. The energy change in the phase transitions can be explained as follows:

Phase Change Name	Phase	Energy Change	Example
Freezing	Liquid to solid	Exothermic	Freezing water
Melting (P)	Solid to liquid	Endothermic	Ice melting
Condensation (R)	Gas to liquid	Exothermic	Water vapour burns
Evaporation (Q)	Liquid to gas	Endothermic	Boiling water
Sublimation (S)	Solid to gas	Endothermic	Dry ice
Deposition	Gas to solid	Exothermic	Formation of frost

2.

(b) The part labelled 'a' is the site of dark reaction.

Explanation: The given figure is of chloroplast. The part labelled 'a' is stroma. The part labelled 'b' is called grana where light reaction of photosynthesis takes place. The part labelled 'c' is intergranal thylakoid. Photosynthetic pigments such as chlorophyll are present only in thylakoid membranes (grana + intergranal thylakoids) and not in stroma or nongranal thylakoids.

3.

(d) distance travelled

Explanation: The area under a velocity-time graph represents the distance covered and the gradient of a velocity-time graph represents the acceleration.

4.

(d) fish

Explanation: Induced breeding is an optimal effort to produce fish fry without considering the season. This technique is used to produce fry of fish species that have or potentially have great economic significance for aquaculture, which do not reproduces spontaneously in captivity.

5.

(b) Companion cells

Explanation: Companion cells are present along the sieve tube, connected to them via plasmodesmata. These cells are metabolically active and sieve tube elements are dependent on these cells they do not lose nucleus at maturity. RBC vessels and sieve tube cells lose their nucleus at maturity.

6.

(b) vacuole

Explanation: Vacuoles occupy a very large part of the cell volume in plants. Upton 95% of cellular volume can be occupied by them.

7.

(c) N₂

Explanation:

- Nitrogen exists as nitrogen gas. It is a diatomic molecule. Therefore, it exists as N₂. The chemical symbol for the element nitrogen is N.
- Ni is the chemical symbol for a nickel.

- N^+ is for nitrogen ion.

8. (a) plasma and three types of cells

Explanation: Blood is classified as connective tissue and consists of two main components:

- Plasma, which is a clear extracellular fluid.
- Formed elements, which are made up of the blood cells and platelets.

Formed elements are:

- Erythrocytes, also known as red blood cells (RBCs)
- Leukocytes, also known as white blood cells (WBCs)
- Platelets

9. (a) 5 gwt

Explanation: The reading on the spring balance when suspended freely in the air.

10. (a) 25.5 ms^{-1}

Explanation: Let the acceleration of the car is = a

And the distance between A and B is = d

$$v^2 - u^2 = 2ad$$

$$v = 30 \text{ m/s and } u = 20 \text{ m/s}$$

$$2ad = 30^2 - 20^2$$

$$Ad = \frac{(900 - 400)}{2} = 250$$

When the car is at the mid point of AB then let the speed of the car is v_1

$$v_1^2 - 20^2 = 2a \left(\frac{d}{2}\right)$$

$$v_1^2 = ad + 400 = 250 + 400 = 650$$

therefore v_1 is = 25.4950 m/s.

11.

(b) Na^+ , O^{2-} , Ne

Explanation: An Isoelectronic series is a group of atoms/ions that have the same number of electrons.

Examples: N^{3-} , O^{2-} , F^- , Ne, Na^+ , Mg^{2+} , Al^{3+}

This series each have 10 electrons.

P^{3-} , S^{2-} , Cl^- , Ar, K^+ , Ca^{2+} , Sc^{3+}

This series each have 18 electrons.

12.

(c) Suberin

Explanation: The cork is impervious to water due to suberin deposition in the cell wall of its cells. The walls of cork cells are heavily thickened with an organic substance, suberin. Suberin makes these cells impervious to water and gases.

13. (a) increase in its volume

Explanation: The cell is said to be turgid when the plant cell wall becomes rigid and stretched by an increase in the volume of vacuoles due to the absorption of water when placed in a hypotonic solution.

14.

(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.

15.

(c) Chemical change

Explanation:

- The new substance is formed
- It is not reversible
- It is permanent

- iv. After fermentation, you are not able to obtain grapes again.
So, Fermentation of grapes is an example of chemical change.

16.

(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.

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

Explanation: Since velocity is a vector quantity, hence as its direction changes keeping magnitude constant, velocity is said to be changed. But for constant speed in equal time interval distance travelled should be equal.

18.

(c) A is true but R is false.

Explanation: The diffusion rate of oxygen is smaller than nitrogen as the molecular mass of oxygen is greater than nitrogen, as the diffusion rate $\propto \frac{1}{\sqrt{M}}$.

The molecular size of oxygen is smaller than nitrogen.

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

Explanation: The plant will die within few days of replanting. This is because since the root tips are cut, the roots won't grow because of the absence of meristematic tissue. And if the roots will not grow, proper absorption of water and minerals will not occur.

20.

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

Explanation: According to Bohr's model, electrons occupy certain stable orbits or shells which are represented by the letters K, L, M, N... or the numbers 1, 2, 3, 4... Each shell has a definite energy.

Section B

21. Given : Vertical height climbed = Height of step \times No. of steps = 20 cm \times 30 = 600 cm = 6 m

Acceleration due to gravity (g) = 10 ms⁻²

Mass of the boy (m) = 50 kg

Since work done is equal to gain in potential energy, therefore, we have = 50 \times 10 \times 6 = 3000 J

Hence power developed by the boy

$$P = \frac{W}{t} = \frac{3000}{30} = 100 \text{ W}$$

OR

Height of each step = 20 cm = 0.20 m

Height of 30 steps, H = 30 \times 0.20 m = 6.0 m

Time, t = 15 seconds

Force exerted by man against gravity

F = Weight of man = mg

work done by man = Force \times Height = mg \times H

Power

$$= \frac{mgH}{t} \\ = \frac{60 \times 10 \times 6.0}{15} \\ = 240 \text{ joule.}$$

22. When temperature of the solid is increased, kinetic energy of the particles increases as results particles vibrates more freely with greater speed. They overcome the force of attraction between the particles and start moving more freely.

23. Given: $V_a = 340 \text{ ms}^{-1}$ and $V_{\text{iron}} = 5130 \text{ ms}^{-1}$

We know that $V = \frac{\text{distance travelled}}{\text{time}}$

$$\Rightarrow t = \frac{\text{distance travelled}}{\text{velocity}}$$

Let length of the pipe = L

Now time taken by sound to travel through air

$$t_a = \frac{L}{340} \dots\dots (1)$$

Also, time taken by the sound to travel through iron

$$t_{\text{iron}} = \frac{L}{5130} \dots\dots (2)$$

Therefore the ratio of time taken in air to that taken in iron is obtained by dividing equation 1 by equation 2, thus

$$\frac{t_a}{t_{\text{iron}}} = \frac{L}{340} \times \frac{5130}{L} = 15.08 \text{ which is approximately 15 times.}$$

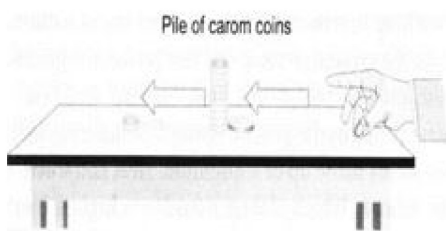
24. The decrease in temperature brings the particles of a substance closer while the same can be achieved by increasing the pressure.

Thus, at low temperature and under high pressure, a gas can be liquefied easily. In case, temperature is high and pressure is low, it may not be possible to liquefy the gas. It is interesting to note that the effect of temperature is more important as compared to that of pressure. For every gas, there is a certain temperature above which the gas cannot be changed to the liquid state howsoever large may be the pressure exerted on its surface.

25. The bus and the persons in it are in the state of motion and at rest with respect to each other before the application of the brakes.

When the brakes are suddenly applied, the bus comes to the state of rest, but the passengers tend to continue in the state of motion because of inertia of motion. Therefore, they fall in forward direction. Conversely, when the bus is in the state of rest, the passengers in it have inertia of rest. When the bus accelerates suddenly, the passengers tend to continue in their state of rest and hence are left behind, relative to the position of bus. Therefore, they fall in the backward direction.

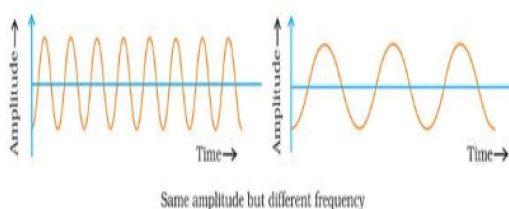
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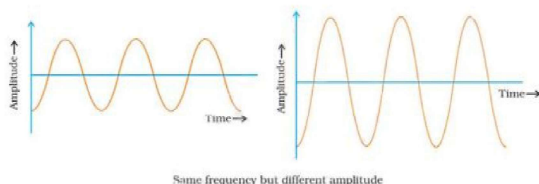
- Make a pile of similar carrom coins on a table, as shown in the figure.
 - Attempt a sharp horizontal hit at the bottom of the pile using another carrom coin or the striker. If the hit is strong enough, the bottom coin moves out quickly. Once the lowest coin is removed, the inertia of the other coins makes them 'fall' vertically on the table.
 - The remaining coins due to the inertia of rest try to remain at rest but fall down due to gravity.
26. The main limitation of the atomic model proposed by J.J Thomson was that it didn't explain the arrangement of electrons inside an atom. The model failed to explain how protons and electrons were arranged inside an atom so close to each other when they carried opposite charges.

Section C

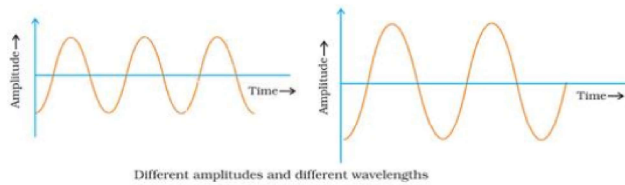
27. i.



- ii.



iii.



28. i. Valency = 0 [\because number of valence electrons = 8]
 ii. Valency = 5 [\because number of valence electrons = 3]
 iii. Valency = 2 [\because number of valence electrons = 6]

29. a. We know that area under v-t graph gives displacement.

So, Area = distance (S) = area of triangle + area of rectangle

$$\text{Area of triangle} = \frac{1}{2} \times \text{base} \times \text{height}$$

$$= \frac{1}{2} \times 6 \times 10$$

$$= 30 \text{ m}$$

Area of rectangle = length \times breadth

$$= (16-6) \times 10$$

$$= 10 \times 10$$

$$= 100 \text{ m}$$

$$\text{Total area} = 100 + 30 = 130 \text{ m}$$

Therefore distance covered by the runner in 16s = 130 m

- b. Since, at $t = 11$ sec, runner is travelling with uniform velocity so, there is no change in velocity hence acceleration is zero.

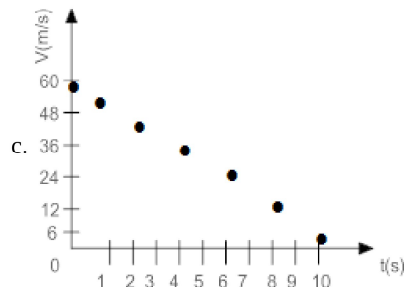
OR

- a. (a) Acceleration = slope of the velocity time graph

$$a = \frac{V_2 - V_1}{t_2 - t_1}$$

$$a = \frac{54 - 24}{1 - 6} = \frac{30}{-5} = -6 \text{ m/s}^2$$

- b. Distance = $S = ut + \frac{1}{2}at^2$
 $= 60 \times 10 + \frac{1}{2}(-6) \times (10)^2$
 $= 600 - 300 = 300 \text{ m}$



30. Weight of an object = mg

where 'm' is mass of the object at the equator than at the poles as the magnitude of 'g' is less at the equator than at the poles.

So, his friend will not agree with weight of the gold at the poles when measured at equator.

31. i. Acceleration = Slope of the line of the velocity-time graph,

$$a = \frac{v_2 - v_1}{t - t_1} = \frac{5 - 0}{2 - 0} = \frac{5}{2} = \frac{10}{4} = \frac{15}{6} = 2.5 \text{ m/s}^2$$

- ii. The force acting on the body is given by

$$F = ma = 5 \times 2.5 = 12.5 \text{ N}$$

- iii. \therefore Change in momentum = $mv - mu$ [$\because u = 0$ and $v = 5 \text{ m/s}$]

$$= 5 \times 5 - 5 \times 0$$

$$= 25 \text{ kg-m/s}$$

32. Plant Cell	Animal Cell
Cells comparatively larger in size	Cells usually small in size
Cell wall present	Cell wall absent
Plastids present	Plastids absent

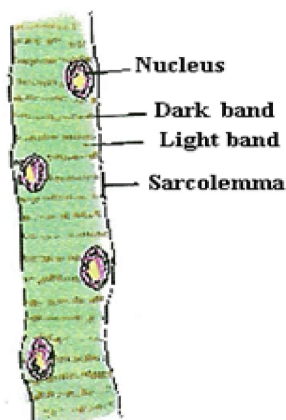
Vacuole are large and generally one	Vacuoles are absent, if present small in size and large in number
Dictyosomes (Golgi apparatus) are present	Prominent Golgi apparatus are present

OR

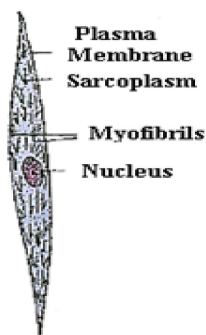
An organism is made up of various organ systems like digestive system, nervous system, etc. These organ systems in turn are made up of various organs which are made up of tissues. Also tissues are a group of cells performing the same function. Hence, a cell is the building unit of an organism.

Cell → tissue → organ → organ system → organism

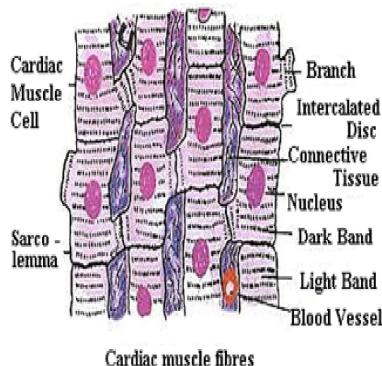
33.



Striated muscle fibre



Smooth muscle fibre



Cardiac muscle fibres

Section D

34. The value of g on the earth is 9.8 m/s^2

i. a. g on the moon is given by

$$g' = \frac{g}{6} = \frac{9.8}{6} = 1.63 \text{ m/s}^2$$

b. Mass of the person on the moon = $\frac{110.84}{1.63} = 68 \text{ kg}$

c. Mass will be constant and does not change from place to place. Hence the mass of the person on the earth is the same that on the moon.

$$\text{Weight of person on the earth} = mg = 68 \times 9.8 = 666.4 \text{ N}$$

ii. According to the Newton's law of gravitation, the force of attraction between earth and the body is given by

$$F = \frac{GMm}{R^2} \dots (i)$$

where, M = mass of the earth, R = radius of the earth, m = mass of person and $G = 6.67 \times 10^{-11} \text{ N-m}^2/\text{kg}^2$

Force produces an acceleration 'g'. So from Newton's second law, $F = mg$ (ii)

Equating (i) and (ii) we get,

$$mg = \frac{GMm}{R^2}$$

$$\therefore g = \frac{GM}{R^2}$$

OR

$$F_{\text{gravitation}} = \frac{G \times M_e \times m_o}{r^2}$$

$$= \frac{6.67 \times 10^{-11} \times 6 \times 10^{24} \times 1}{(6.4 \times 10^6)^2}$$

$$= \frac{6.67 \times 6 \times 10^{-11+24}}{6.4 \times 6.4 \times 10^{12}}$$

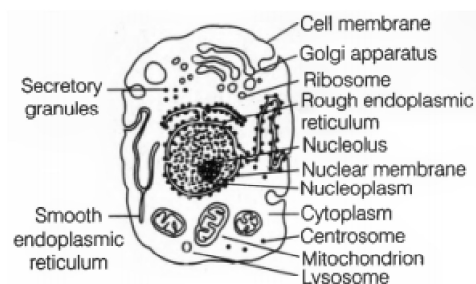
$$= \frac{6.67 \times 6}{6.4 \times 6.4} \times 10^{-11+24-12}$$

$$= 0.9770 \times 10N = 9.770N$$

35. The plasma membrane, cytoplasm, and nucleus are three main functional regions of a cell.

- i. Plasma membrane: It is a thin, selectively permeable membrane, covering the cell and is made up of lipids and proteins.
- ii. Cytoplasm: It is aqueous material containing a variety of cell organelles along with non-living inclusions.
- iii. Nucleus: It is the control centre of a cell. It contains the cells hereditary information (DNA).

The diagram of the eukaryotic cell is:-



OR

Plant cell	Animal cell
1. cell wall is present.	1. cell wall is absent.
2. Plastids are present.	2. Plastids are absent.
3. They have dictyosomes instead of Golgi body.	3. They have Golgi apparatus.
4. centrosomes and centrioles are absent.	4. centrosomes and centrioles are present.
5. Vacuoles are large in size.	5. vacuoles are smaller in size.
6. Daughter cells separate from each other due to formation of cell plate.	6. Daughter cells separate from each other due to contrition or furrow formation.

36. i. Sublimation
- ii. Diffusion
- iii. Diffusion/dissolution
- iv. Evaporation/diffusion
- v. Centrifugation
- vi. Sedimentation
- vii. Tyndall effect

Section E

37. Read the text carefully and answer the questions:

In older plants, the outer protective layer that is epidermis undergoes certain changes the epidermis of the stem is replaced. There is cork cambium which is simple tissue having one type of the cell. The cell of cork cambium are rectangular and their protoplast is vacuolated contain tannins. The cork cambium gives off new cell from its both side. The cell of the cork cambium is dead and compactly arranged without the intercellular space and there is suberin deposition.

(i) A strip of secondary meristem called phellogen replaced the epidermis of the stem.

(ii) Cork protects the plant against mechanical injury, extreme temperature, It also prevents the loss of water by evaporation.

OR

Suberin makes cell impermeable to water and gases.

38. Read the text carefully and answer the questions:

India has the maximum cattle population in the world. However, their productivity is less than half the productivity of many exotic breeds of cattle. The exotic breeds live in cold countries. They cannot live comfortably in hotter India. The only way to improve the productivity of Indian cattle is to produce hybrids which are acclimatised to Indian conditions and are resistant to most local diseases. For hybridisation exotic bulls are kept in colder climate. Their semen is collected and cryopreserved. The same is sent to various parts of the country for artificial insemination.

(i) Brown Swiss and Jersey

(ii) Frieswal and Karan-Swiss

(iii) Some factors governing the yield of milk are:

1. Number of milkings per day
2. Amount of milk at each milking
3. Length of the lactation period

OR

Only when it is in heat.

39. Read the text carefully and answer the questions:

A solution of a solid in a liquid such as water can be prepared by adding it slowly to water with constant stirring at a certain temperature (room temperature). If the addition process is continued, a stage is ultimately reached in the dissolution process when no more of the solid dissolves. Rather it starts settling at the bottom of the container such as a glass beaker. The solution at this stage is said to be saturated. The solubility of a solute is always expressed with respect to the saturated solution. It may be defined as the maximum amount of the solute that can be dissolved in 100 g of the solvent to form a saturated solution at a given temperature. Please remember that the role of temperature is very important. If temperature is increased, the solution becomes unsaturated. In case the temperature is decreased, the solution becomes supersaturated. As a result, crust of the solute gets deposited on the surface.

(i) The maximum amount of solute that can dissolve in a given amount of solvent.

(ii) Given, Mass of solute = 20g

Mass of solvent = 500g

$$\text{Mass-Volume percentage} = \frac{20}{500} \times 100$$
$$= 4\%$$

$$\text{Solubility of 500 g of solute} = \frac{4}{100} \times 500$$
$$= 20\text{g}$$

Hence, the solubility of 20g of solute in 500g of solvent is 20g.

(iii) A saturated solution becomes unsaturated by either heating it or by adding more of the solvent.

OR

Concentration of a solution is defined as the amount of solute that is present in a given amount of solution. It can be expressed in terms of: Mass by the mass percentage of a solution = $\frac{\text{mass of solute}}{\text{mass of solution}} \times 100$.