# Solution

## Section A

1.

    **(c)** Both Spindle-shaped, uninucleated and Elongated, without striations

    **Explanation:**

    The image shows non-striated muscles or smooth muscles. The cells are spindle-shaped, uninucleated, elongated, and have no striations.

2.

    **(c)** Rough endoplasmic reticulum

    **Explanation:**

    The proteins and lipids, essential for building the cell membrane, are synthesized by the rough endoplasmic reticulum (RER). The ribosomes attached to the RER help in this process.

3.

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

    **Explanation:**

    **Mycoplasma** is a genus of bacteria that lack a cell wall around their cell membrane. Without a cell wall, they are unaffected by many common antibiotics that target cell wall synthesis. **Mycoplasma** species are the smallest free-living organisms. **Prokaryote** is a unicellular organism that lacks a membrane-bound nucleus (karyon), mitochondria, or any other membrane-bound organelle.

| (1) Largest cell | (D) Ostrich egg |
|---|---|
| (2) Smallest cell | (A) Mycoplasma |
| (3) Single cell | (C) Amoeba |
| (4) Prokaryotic cell | (B) Bacteria |

4.

    **(d)** A : Sclerenchyma, B : Parenchyma, C : Cheek cells, D : Onion Peel

    **Explanation:**

    A. Sclerenchyma: Sclerenchyma cells are the permanent tissues present in the plants. They provide hardness and stiffness to the plant and are composed of dead cells.

    B. Parenchyma: Parenchyma serves as a packing tissue in plants therefore they do not have intercellular spaces.

    C. Figure show Cheek cells.

    D. Figure show Onion peel.

5.

    **(d)** Dr.V. Kurein

    **Explanation:**

    Dr.V. Kurein is called as the 'Father of white revolution' in India because of his initiatives and immense contribution to the dairy sector.

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

    **Explanation:**

    Animals of colder regions and fishes of cold water have a thicker layer of subcutaneous fat. The thick layer of subcutaneous fat acts as an insulator and prevents the heat of the body to escape out. The layer of fat acts as subcutaneous insulation of the body for thermoregulation.

7.

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

      **Explanation:**

      The compost is rich in organic matter and nutrients. Compost prepared by using earthworms to hasten the process of decomposition of plant and animal for refuse is called vermicompost. Composting done with the help of earthworms is called vermicomposting.

8. **Functions of the various epithelial tissues are as follows:**

    (i) Epithelial cells protect the underlying cells from drying, injury and chemical effects. They also protect the body from viral or bacterial infections. E.g. Skin epithelial cells which are arranged in many layers prevent wear and tear.

    (ii) They help in the absorption of water, nutrients and gases. E.g. Inner lining of the small intestine, lung alveoli, blood vessels, etc.

    (iii) Columnar epithelium facilitates movement across the epithelial barrier.

    (iv) Cuboidal epithelium provides mechanical support to the kidney tubules and ducts of the salivary glands.

    (v) Glandular epithelium secretes useful chemicals like sweat, saliva, enzymes from the food, etc. in the body.

9.   i. Kharif crop is grown during the months from June to October.

    ii. Two factors for which crop variety improvement is done are:

        a. **Higher yied-** To increase the productivity of crop per acre.

        b. **Improved quality-** The definition of quality is different for different crops, e.g. baking quality is important in wheat, protein quality in pulses, etc.

<div align="center">OR</div>

    The poultry birds are fed on agricultural waste material and broken grains etc which are not useful for humans but the birds consuming such waste provide us with eggs and meat. It is highly nutritious animal protein food hence the statement made is quite appropriate.

10. White Revolution – Increased production of milk is known as white revolution. It involved use of new improved high milk – yielding cross breeds of milch animals.

    Silver revolution – Tremendous increase in egg production is known as silver revolution.

    Blue revolution – It refers to the increased production of fish.

11.   i. The tissue given in the figure is collenchyma.

    ii. The cells of collenchyma are living, elongated, thickened at the corners and have very little intercellular space.

    iii. It provides mechanical support and flexibility to the plant.

    iv. It is present in leaf stalks, below the epidermis.

12.   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.
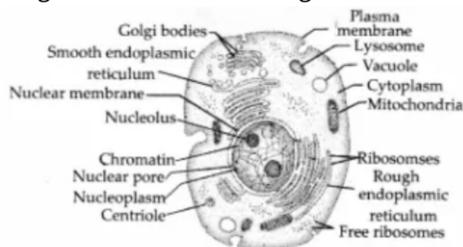
13.   i. Columnar.

    ii. columnar epithelial.

    iii. No, providing mechanical support is the main function of the cuboidal epithelium.

      **OR**

      Glandular epithelium.

14. **Diagram of an animal cell is given below:**



OR

Both xylem and phloem consist of more than one type of cells, which coordinate to perform a common function.

| Xylem | Phloem |
|---|---|
| Is composed of tracheids, vessels, xylem parenchyma and xylem fibres. | Is composed of sieve tubes, phloem parenchyma, phloem fibres and companion cells. |
| Only xylem parenchyma is composed of a living cell in xylem tissue. | Only phloem fibre is composed of the dead cell is in the phloem. |
| Transports water and minerals. | Transports food. |
| Movement of materials is in one direction. | Movement of materials is in both directions. |

**Section B**

15.

**(c)** A

**Explanation:**

Cooling is not caused during boiling. Evaporation is a surface phenomenon but boiling is a bulk phenomenon. Evaporation causes cooling because when a liquid evaporates, it draws the latent heat of evaporation from anything which it touches or from the environment. Evaporation takes place at a temperature below the boiling point. Thus evaporation causes cooling but boiling causes heating.

16. **(a)** (i) and (iii)

**Explanation:**

- A pure substance contains only one type of particles which can either be atoms or molecules or elements or compounds.
- A pure substance cannot be separated into other kinds of matter by any physical process but a mixture can as they are impure substances because they contain more than one particle.
  For example, salt solutions.
- A pure substance has fixed composition as well as fixed melting and boiling points.
  For example, salt.
- Pure substances cannot be exemplified by all elements other than nickel because pure nickel is an element containing only one kind of particle.

17.

**(d)** starch

**Explanation:**

Many different food groups contain a carbohydrate known as starch. Using an iodine solution, you can test for the presence of starch. When starch is present, the iodine changes from brown to blue-black or purple.

18.

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

**Explanation:**

| **(a)** Deuterium | **(iv)** An isotope of Hydrogen |
|---|---|
| **(b)** Carbon-14 | **(i)** A radioactive isotope of carbon used in radiocarbon dating |
| **(c)** Isotope of Uranium | **(iii)** Used in nuclear reactors |
| **(d)** Cobalt-60 | **(ii)** Used in the treatment of cancer |

Deuterium is one of two stable isotopes of Hydrogen. It is also known as heavy hydrogen. The nucleus of deuterium, called a deuteron, contains one proton and one neutron. It has major applications in nuclear magnetic resonance studies. Radio carbon-dating (also referred to as carbon dating or carbon-14 dating) is a method for determining the age of an object containing organic material by using the properties of C14 - a radioactive isotope of carbon. Uranium is used in a nuclear reactor as a fuel. A controlled fission chain reaction is achieved and the heat generated by splitting the U-235 atoms is used to make steam. The steam spins a turbine to drive an electric generator thus producing electricity. Cobalt-60 is a synthetic radioactive isotope of cobalt produced artificially in nuclear reactors. Cobalt therapy or cobalt-60 therapy is the medical use of gamma rays from cobalt-60 for the treatment of cancer.

19.

**(b)** 22.0 g

**Explanation:**

The molecular mass of $CO_2$ is 44 (12 + 26 × 2).

$6.022 \times 10^{23}$ molecules of carbon will contain 44 g.

Hence, $3.011 \times 10^{23}$ molecules of $CO_2$ will contain a mass of 22 g.

20. **(a)** All (A), (B) and (C) are correct

**Explanation:**

A. During the change of state, given heat is used to change the state. So temperature remains same. AB and CD parts show constant temperature

B. BC part represents increase in temperature.

C. CD is water starts boiling and temperature remains the same during the conversion of water into steam.

21. **(a)** iodine

**Explanation:**

Place a slice of a potato on a paper towel at top of a paper plate and add a drop of the iodine solution to the potato slice. Note the color change. A change of color to blue-black or purple color suggests that starch is present. If there is no change in color, this suggests no starch is detectable.

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

**Explanation:**

A molecule is a group of two or more atoms chemically bonded together. A molecule is the smallest particle of an element or a compound which has properties of the element or the compound and can exist in a free state.

23. Mass of one molecule of substance = $4.65 \times 10^{-23}$

Mass of $6.022 \times 10^{23}$ molecules of substance

$6.022 \times 10^{23} \times (4.65 \times 10^{-23}) = 28$ g.

The substance can be carbon monoxide (CO) with molecular mass

= 12 + 16 = 28 u or 28 g

24. Ice (solid state) is expected to be heavier than water (liquid state). But it is lighter and floats over water. Actually, ice expands on cooling and has a cage like structure which means that vacant spaces are left when H2O molecules are linked in ice. The number of these spaces are comparatively less in water. Therefore, water is dense as compared to ice or ice floats over water.

OR

Gases are compressible because the inter-molecular space is very large and kinetic energy is higher in gases, whereas liquids are not compressible because in liquids, the inter-molecular space is less and kinetic energy is comparatively lesser.

25. (a) If 'X' contains 6 electrons in 'M' shell as valence electrons, then the K shell and L shell must be fully filled.An atom with three shells can accommodate a maximum of 2, 8 and 18 electrons respectively.The electronic configuration of element 'X' will be K = 2, L = 8, M = 6.

Therefore, the atomic number of the element is **16** (2 + 8 + 6)

(b) 'X' is a **non-metal** since it is electronegative in nature. It can accept 2 electrons to form an anion and achieve an octet.

26. i. Water is solvent and sugar is solute.

ii. 1 nm in diameter

iii. Pure substances are substances that are made up of only one kind of particle and have a fixed or constant structure.

**OR**

The meaning of the term 'alloy' is a substance formed from the combination of two or more metals. Alloys can also be formed from combinations of metals and other elements. ex- steel.

27. The valency of an element is the combining capacity of that element. It is determined by the number of electrons present in the outermost shell (valence shell) of an atom of that element, if the number of valence electrons of an atom of an element is less than or equal to 4, then the valency of that element is equal to the number of valence electrons.

On the other hand, if the numbcr of valence electrons of the atom of an element is greater than 4, then the valency of that element is obtained by subtracting the number of valence electrons from 8.

**Valency of Silicon (Si) :** Atomic number of the element is 14. Its electronic distribution is; K(2), L(8), M(4).

As silicon atom has four valence electrons, it can lose four electrons to complete its octet. At the same time, it can also gain four electrons. Thus, the valency of silicon is 4.

**Valency of oxygen (O) :** Atomic number of the element is 8. Its electronic distribution is : K(2), L(6)

As oxygen atom has six valence electrons, it needs two electrons to complete its octet (8 - 6 = 2). Therefore, valency of oxygen is 2.

OR

a. (F) because in J.J Thomson's model, the nucleus was not present.

b. (F) Neutron is a fundamental particle (a subatomic particle) of the atom of an element, thus cannot be made by combining an electron and a proton. It is neutral, as it carries no charge.

c. (T) Mass of an electron is $\frac{1}{1840}$ times, which is nearly about $\frac{1}{2000}$ times that of a proton.

d. (T) Tincture of iodine is made by dissolving an isotope of iodine in alcohol (I-131).

**Section C**

28.

**(d)** changes its shape

**Explanation:**

When we press a rubber ball with both the hands, it changes its shape as the force is applied to it.

29.

**(c)** Statement B

**Explanation:**

In general, work represents any physical or mental activity. But work has a precise meaning in physics. Work is said to be done when a net force acts on a body and the body undergoes displacement. So statement A is false.

Work done by a force is positive if the applied force has a component in the direction of the displacement. So, statement B is true.

30.

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

**Explanation:**

 i. The SI unit of velocity is meter per second.

 ii. The SI unit of acceleration is the metre per second square.

 iii. The SI unit of displacement is the meter.

 iv. Retardation is negative acceleration.Therefore its SI unit is metre per second squared with a negative sign.

31.

**(c)** Less

**Explanation:**

Pressure is inversely proportional to cross- sectional area.

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

**Explanation:**

Compression is a region of the medium in which particles are compressed i.e., particles come closer i.e., the distance between the particle becomes less than the normal distance between them. Thus there is a temporary decrease in volume and a consequent increase in density of the medium. Similarly, in rarefaction, particles get farther apart and a consequent decrease in density.

33. $Here, the\ mass\ of\ the\ hammer = 500\,g = \frac{500}{1000}\,kg = 0.5\,kg,$

Initial velocity, u = 50 $ms^{-1}$

Final velocity, $v$ =0

Time taken, t = 0.01 s

From Newton's second law of motion, we have

$F = ma = \frac{m(v-u)}{t} = \frac{0.5\,kg(0\,ms^{-1}-50\,ms^{-1})}{0.01\ s}$

$= \frac{-25\,kg\,ms^{-1}}{0.01\,s}$

= -2500 kg $ms^{-2}$ = -2500 N

So, the force of the nail on the hammer is 2500 N. Negative sign indicates that the force is acting opposite to the motion.

34. i) Weight of hot air = Volume × Density × g

= 50 × 0.4 × g

= 20 kgf

ii) Weight of hot air, balloon and equipment

= 20 +12 + P = (32 + P) kgf

iii) Upthrust = Weight of air displaced

= hdg

= 50 × 1.3 × g

= 65 kgf

By law of floatation we have,

32 + P = 65

P = 65 - 32 = 33 kgf

<div align="center">OR</div>

The boy has to overcome the force of gravity. Hence force of gravity on the boy

F = mg = 40 × 9.8 = 392 N

Total distance covered s = 50 × 10 = 500 cm = 5 m

i) Work done by the body in climbing = force × distance = W = 392 × 5 = 1960 J

ii) Power developed = $\frac{W}{t} = \frac{1960}{5}$ = 392 W

35. All objects fall on ground with constant acceleration,acceleration due to gravity(in the absence of air resistance).It is constant and does not depend upon the mass of an object.Hence,heavy objects do not fall than lighter objects.

36. i. a. As potential energy decreases with decreasing height, the speed of the object will increase and hence its kinetic energy will increase.

   b. Total mechanical energy will remain constant.

   It is based on the law of conservation of energy which states that energy can neither be created nor be destroyed/. It can only be transformed from one form to another.

   ii. 1 kWh = 3.6 × $10^6$ J

37. Initial speed = u=72 km/hr

$= \frac{72 \times 5}{18} = 20 m/s$

Final speed = v = 54km/h

$= \frac{54 \times 5}{18} = 15 m/s$

Distance = s = 70 m

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

$(15)^2 - (20)^2 = 2 \times a \times 70$

225 - 400 =140 a

- 175 =140 a

a = -1.25 m/s$^2$ (negative sign shows retardation)

38. i. When a force of 1 Newton causes a displacement of 1 m in its own direction, the work done is said to be one joule.

   ii. p = 5000 W, t = 2 h

iii. Energy consumed = pt = 5000 × 2 = 10000 Wh = 10 kW = 10 units.

When a carpet is beaten with a stick, the dust comes out of it because of the law of inertia. Initially, the dust particles are at rest along with the carpet. Beating the carpet with the stick makes the carpet move but the dust particles remain at rest due to inertia at rest, thus the dust gets detached from the carpet.

**OR**

Given W = 1000J, t = 10s, P = ?

We know, $P = \frac{W}{t} = \frac{1000}{10} = 100W$

39. According to law of conservation of momentum; the momentum of bullet forwad will be equal to the momentum of rifle backward . In case of light rifle; velocity will be more than the velocity of heavier rifle because of mass so that momentum (product of mass and velocity) for both shall not be equal. Due to this, the lighter rifle will hurt the shoulder more.In both cases it has been called recoied.

OR

Force,F = 5N

Mass,m = 2 kg

i. $F = m \times a$

$\implies 5 = 2 \times a$

$\implies a = 2.5 \ m/s^2$

Therefore,acceleration produced by the body is 2.5 ms$^{-2}$

ii. Final velocity,v = 0
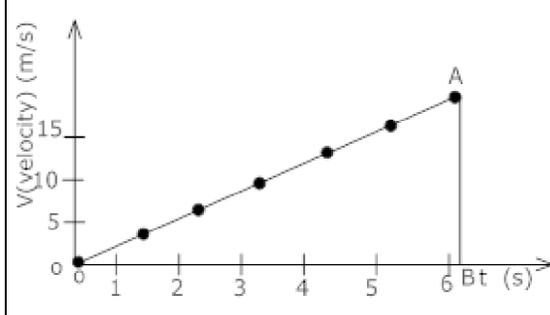
Initial velocity ,u = 0 (body starts from Rest)

Time,t = 4 s

From the relation,

$v = u + at$

$\implies v = 2.5 \times 4$

$\implies v = 10 \ m/s$

Therefore,the velocity at t=4 s is 10ms$^{-1}$

iii.

| For t = 0 | 1 | 2 | 3 | 4 | 5 | 6 |
|---|---|---|---|---|---|---|
| V = 0 | 2.5 | 5 | 7.5 | 10 | 12.5 | 15 |



iv. Distance Travelled = Area under v/t curve = Area of ΔAOB

$= \frac{1}{2} \times \text{Base} \times \text{Height}$

$= \frac{1}{2} \times OB \times AB$

$= \frac{1}{2} \times 6 \times 15$

$= 45 \ m$

Therefore, distance travelled in 6 s is 45 m.