

1. Inter-varietal: Between two varieties of the same crop

Inter-generic: Between two different genera

Inter-specific: Between two species of the same genus

2. Organic farming yields healthier crops since it has good nutrient content; by maximum use of organic manure, recycled field wastes, bio-fertilizers, bio-pesticides; with minimal or no chemicals.

3. When the weather is cold, there is fog formation due to condensation of water. The smoky un-decomposed carbon particles released due to combustion of fossil fuels combine with the fog and forms smog. Smog pollutes the air severely, reduces air quality and visibility

**OR**

During daytime, the air above the land heats up faster, rises above and creates an area of low pressure. So, the air above sea moves in to fill this low-pressure area. During night time, the air above the sea remains warmer than the land because water cools slowly.

4. a. **Ammonia:** nitrogen and hydrogen with a ratio by mass of 14:3

b. **Carbon dioxide:** carbon and oxygen with a ratio by mass of 3:8

5.

a. Winding a key in a toy: Potential energy

b. A running fast bowler: Kinetic energy

c. A falling apple: Kinetic energy

d. A stretched bow: Potential energy

6. Difference between Acceleration due to gravity and gravitational force:

**Acceleration due to gravity:** The acceleration of a free falling body due to the earth's gravitational force is acceleration due to gravity.

**Gravitational force:** The attractive force between any two objects with masses that pulls them with each other.

**Difference between Buoyancy and upthrust:**

**Buoyancy:** The tendency of an object immersed in a fluid to rise and float due to the buoyant force of fluid.

**Upthrust:** The upward force exerted by the fluid when an object is immersed into it is upthrust.

7. **Composting:** A process where farm organic waste materials like crop and vegetable waste, livestock excreta and refuse, domestic and sewage waste are decomposed in pits to produce compost or vermicompost.

**Green manure:** The fields are grown with crops like sun hemp, legumes, guar, etc., and then mulched into the soil prior to cropping season. These crops turn into green manure and increase soil fertility.

**OR**

**Cattle breeding:** The reproduction of cows, buffaloes through inbreeding or selective hybridization is called cattle breeding. Inbreeding involves reproduction through natural mating of animals.

Selective breeding involves the selection of parent animals with desired traits and allowing them to breed so as to produce offspring with the best-desired qualities of both parent animals.

**Example:** The exotic foreign breed, Jersey, with long lactation period can be selectively bred with the local Red Sindhi breed that has good disease resistant power.

8.

**i.** The maximum number of electrons in a shell is defined by the formula  $2n^2$  with 'n' being the energy level index or the orbit number.  
1<sup>st</sup> orbit (K shell):  $2n^2 = 2 \times 1^2 = 2$  electrons

**ii.** The maximum number of electrons in the outermost shell is only 8 and is referred as octet.

**iii.** Electrons are arranged in a shell in a step-wise manner.

9.

a. Tides rise above the sea because of the combined gravitational force of sun and moon on the earth.

b. Satellite follows a circular path because of uniform circular motion and centripetal force.

c. The sound waves after reaching the curved ceiling reflect to reach all corners of the hall.

10. When the ball approaches the fielder, he lowers his hands to catch the ball to decrease the acceleration of the ball and reduce the impact of the force on his hands and prevent from hurting. If the high velocity of the ball is suddenly dropped to zero in a short time, then rate of change of momentum of the ball will be large and will fall on the fielder's hand with huge impact, according to Newton's second law of motion.

11. Mass of the object:  $m = 5$  kg

Displacement (height)  $h = 5$  m

Acceleration due to gravity  $g = 9.8 \text{ ms}^{-2}$

Formula to find potential energy: mass  $\times$  gravity  $\times$  height = mgh

Substituting,  $5\text{kg} \times 9.8 \text{ ms}^{-2} \times 5 \text{ m} = 245 \text{ J}$

Potential energy = 245 J

**OR**

Power of the tube light:  $40 \text{ W} = 0.04 \text{ kW}$   
Time consumed,  $t = 8 \text{ h}$   
Energy = Power  $\times$  time  
 $= 0.04 \text{ kW} \times 8 \text{ h}$   
 $= 0.32 \text{ kWh} = 0.32 \text{ units}$   
Energy consumed by the tube light:  $0.32 \text{ units}$

12. Molecular mass = mass  $\times$  number of moles

To find Mass of NaOH:

Atomic weight of Na: 22.98976928

Atomic weight of O: 15.994

Atomic weight of H: 1.00794

Adding up, we get mass of NaOH =  $39.99711 \text{ g/mol}$

So molecular mass =  $39.99711 \times 0.125 = 4.99 \text{ g}$

**OR**

a. Ammonium dichromate:  $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$

b. Aluminium sulphate:  $\text{Al}_2(\text{SO}_4)_3$

c. Calcium phosphate:  $\text{Ca}_3(\text{PO}_4)_2$

d. Iron (III) oxide:  $\text{Fe}_2\text{O}_3$

13.

a. The movement of certain elements across the cells from a region of higher concentration to a region of lower concentration through the selectively permeable cell membrane is cellular diffusion.

b. Oxygen and carbon dioxide are transported through cellular diffusion

c. Cellular diffusion helps in cellular gaseous exchange and to maintain water, fluid and electrolyte balance.

14. Penicillin is an antibiotic that is given to fight against bacterial infections. This acts by inhibiting cell wall formation of the invading bacterial cell, which restricts its growth and spread. Human cells do not have cell walls and hence the action of penicillin does not affect us.

15. Although there is huge increase in carbon dioxide production by various human activities, the atmospheric carbon dioxide level is amounted in small quantities like around 409 parts per million. This is because the atmospheric carbon dioxide is fixed through natural processes like photosynthesis by plants and chemo-bio synthesis by marine animals. The inorganic carbon compounds are converted to organic carbon compounds and later assimilated by living organisms. The current amount of atmospheric  $\text{CO}_2$  about 409 ppm is already higher than normal levels. Hence reduction of  $\text{CO}_2$  is encouraged to prevent global warming.

16. a.

**i) Symbiosis:** A close living interrelationship between two organisms of different species, where one or both are benefitted from each other's co-existence. Example: Fungus growing on roots of host plant. The fungus helps the plants in better nutrient absorption through the roots and also protects the plants.

**ii) Parasitism:** Parasitic plants get all its nutrients from its host plant but does not benefit the host plant in any way and sometimes may damage the host plant. Example: Climbers like cuscuta.

**iii) Autotrophs:** Plants that produce their own food with carbon dioxide and water with the energy from sunlight are called autotrophs. Example: Green plants, certain algae and bacteria.

b. Identify the plant group with:

**i) Stems and leaves but with hidden reproductive organs:** Pteridophyta

**ii) Stems and leaves but with no vascular system for conduction:** Bryophyta

17.

a) According to Newton's second law of motion:  $F = ma$

Substituting,

$$F = ma$$

$$2 \text{ N} = 3.5 \text{ kg} \times a$$

$$\frac{2 \text{ N}}{3.5 \text{ kg}} = a$$

$$a = 0.57 \text{ m/s}^2$$

b) Work done = Force  $\times$  Displacement

$$W = F \times s$$

$$W = 20 \text{ N} \times 15 \text{ m}$$

$$W = 300 \text{ Joules}$$

**OR**

a) Mass = Force/acceleration

$$M = 300 \text{ N} / 5 \text{ m/s}^2$$

$$M = 300 / 5 = 60 \text{ kg}$$

$$\text{Mass} = 60 \text{ kg}$$

b) Acceleration  $a = 10 \text{ ms}^{-2}$

$$\text{Mass } m = 1500 \text{ kg}$$

$$\text{Force } F = ?$$

$$\text{Force} = m \times a$$

$$F = 1500 \text{ kg} \times 10 \text{ ms}^{-2}$$

$$F = 15000 \text{ N}$$

18. Solubility of a substance, solute, is its ability to dissolve in a solvent. At any given temperature, if the solute completely dissolves in a solvent to its maximum capability, then the solution is said to be a saturated solution. If the amount of solute is less than that of the saturation level, then it is said to be unsaturated solution. From this, the concentration of a solution can be determined which is the amount of solute present in a given amount of solution. It is represented as:

$$\text{Mass by mass percentage of a solution} = \frac{\text{Mass of solute}}{\text{Mass of solution}} \times 100$$

Also in terms of mass by volume percentage of a solution and volume by volume percentage of a solution.

**OR**

a) **Isotopes:** Atoms of a same element with same atomic number but different mass number. Hydrogen has three isotopes - protium, deuterium, tritium. The atomic number of the three forms is the same at 1 but the mass numbers are 1, 2 and 3 accordingly.

Protium: [ ${}^1_1\text{H}$ ]

Deuterium: [ ${}^2_1\text{H}$ ]

Tritium: [ ${}^3_1\text{H}$ ]

Isobars: The atoms of different elements with different atomic number but same mass numbers. For example,  ${}^{40}\text{S}$ ,  ${}^{40}\text{Cl}$ ,  ${}^{40}\text{K}$  all have same mass number of 40 but different atomic numbers.

b) Isotope of cobalt: Cancer treatment

Isotope of iodine: Goitre treatment

c) Represent the atomic number and mass number of isotopes of chlorine and carbon

Chlorine:  ${}^{35}_{17}\text{Cl}$  and  ${}^{37}_{17}\text{Cl}$

Carbon:  ${}^{12}_6\text{C}$  and  ${}^{14}_6\text{C}$

19. a) Speed of sound  $v = 345 \text{ ms}^{-1}$

Time taken to hear the echo  $t = 5 \text{ s}$

Distance travelled by the sound  $= v \times t = 345 \text{ ms}^{-1} \times 5 \text{ s} = 1725 \text{ m}$

In 5 s, sound of the voice travels twice from the person to the cliff and then back to him, hence the distance from the cliff to the person  $= 1725/2 = 862.5 \text{ m}$

b) Frequency  $f = 210 \text{ Hz}$

Wavelength  $\lambda = 20 \text{ m}$

Velocity  $v = ?$

Velocity = wavelength  $\times$  frequency

$v = 20 \text{ m} \times 210 \text{ Hz} = 4200 \text{ m/s}$

Since the frequency of audible sound ranges from 20 Hz to 20,000 Hz, the sound has a frequency of 210 Hz in the above situation which is in the audible limits, it will be audible.

**20. a) Functions of Golgi apparatus**

- i. Helps in storage of protein.
- ii. Modifies, sorts and packs protein.
- iii. Creates lysosomes.

**Functions of Mitochondria**

- i. Produce ATP, the energy currency of the cells.
- ii. Cellular metabolism

**b)**

- i.** A- Rough endoplasmic reticulum (RER)  
B- Smooth endoplasmic reticulum (SER)

**ii.** Differentiate between A and B

SER	RER
No ribosomes	Has ribosomes
Tubules are present	Cisternae are present
Located near the cell membrane	Located in the cytoplasm
Formed from shedding of RER	Formed from nuclear membrane

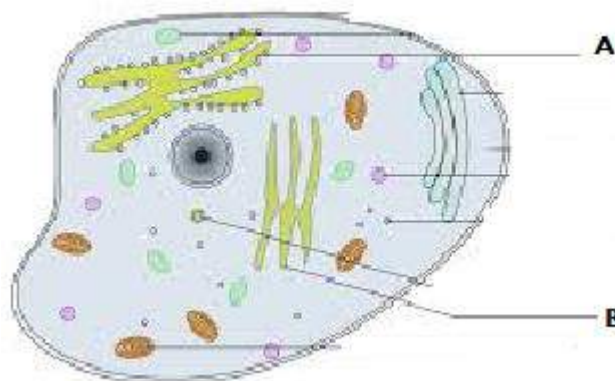
**iii.** Functions of SER and RER:

SER can synthesize and store protein.

RER can synthesize and store lipids.

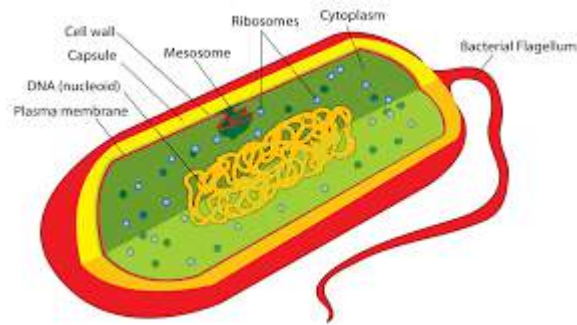
These protein and lipids are used in biogenesis of cell membranes.

They are also used as enzymes and hormones.



**OR**

**a) i.** Diagram of a prokaryotic cell



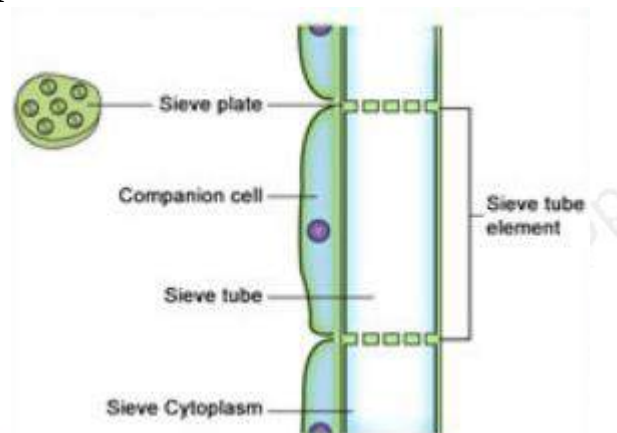
ii. Explain how prokaryotes differ from eukaryotes with respect to cell division

Prokaryotes undergoes mitosis

Eukaryotes undergoes meiosis

**b)**

i. Diagram of a phloem cell.



ii. Name the phloem cell that is tubular in structure

The sieve tubes are the phloem cells that are tubular in nature and also have perforated walls.

21. Scattering of light as a beam of light by the colloidal particles when it passes through a colloidal suspension is referred as Tyndall effect, named after John Tyndall who studied it.

When sunlight passes through a canopy of forest, it is reflected by the mist present in the air that has colloidal water particles that are dispersed in air. Similarly fog also exhibits Tyndall effect.

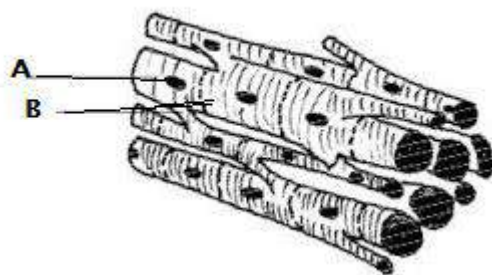
When a beam of light is passed through milk, it is reflected throughout because milk is a colloid.

When light is passed through water or other solutions like copper sulphate solution, it is not reflected, because the solute particles are finely dissolved in the solvent in solutions.

22. a) The given diagram is Cardiac muscle cell.

A- Nucleus

B- Striations.



b) The given type of muscle cells is involuntary striated muscles.

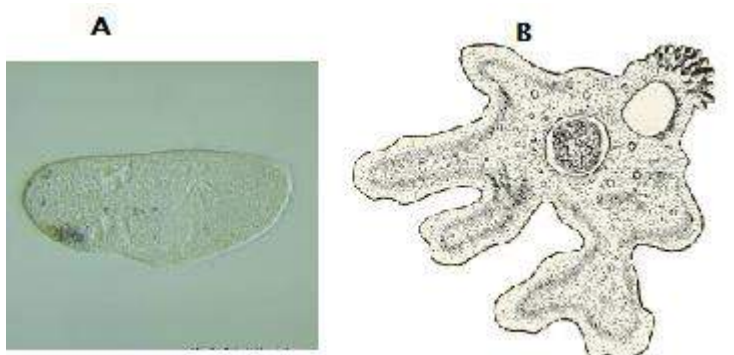
23. i) The given two organisms as seen under a microscope are

A - Paramecium

B - Amoeba

ii) Phylum: Protozoa

Feature: Unicellular and eukaryotic



24. Equation:  $\text{NaHCO}_3 + \text{CH}_3\text{COOH} \rightarrow \text{CH}_3\text{COONa} + \text{H}_2\text{O} + \text{CO}_2$

According to the data:

$\text{NaHCO}_3$ : 4.5 g

$\text{CH}_3\text{COOH}$ : 5 g

$\text{CH}_3\text{COONa}$ : 6.5 g

$\text{H}_2\text{O}$ : 0.6 g

$\text{CO}_2$ : 2.4 g

Substituting:

$\text{NaHCO}_3 + \text{CH}_3\text{COOH} \rightarrow \text{CH}_3\text{COONa} + \text{H}_2\text{O} + \text{CO}_2$

$4.5 \text{ g} + 5 \text{ g} \rightarrow 6.5 \text{ g} + 0.6 \text{ g} + 2.4 \text{ g}$

Reactants' total mass = 9.5 g

Products' total mass = 9.5 g

Since the total mass of the reactants and products are equal, this equation abides to the law of conservation of energy.

**OR**

The given pure substances and mixtures are:

a) Tin: Mixture

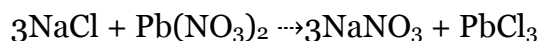
b) Ice: Pure substance

c) Carbon dioxide: Mixture

d) Milk: Mixture



25. Sodium chloride reacts with lead nitrate in a double decomposition reaction and produces sodium nitrate and lead chloride.



26. According to the law of flotation, the body A will float since it displaces equal amount of weight by its body of water and the body B will sink because it displaces water more than its body weight.

27. True solutions are homogenous and are mixed completely in the solvent. They do not have any suspended particles and hence will pass through the filtration paper completely without any residue. Hence true solutions are transparent and stable.

**OR**

Oil will form a separate upper layer on the top in a mixture of oil and water.

The density of the liquid at the lower layer of the mixture will be higher than that of the upper layer.

