CHAPTER -3 ATOMS AND MOLECULES

Formulae for solving Numerical problems related to MOLAR CONCEPT

1 mol = M g (gram molecular /atomic mass) = 6.022×10^{23} particles

X mole	Y gram		Z partie	cles
1 mole	M gram	_	6.022 X (10) ²³	particles

{ Note: Equate any two required terms from above equation }

X = Number of moles	;	Y = Given mass or mass to be found;
Z = Number of particles (atoms,ions,molecules)	•	M = Molar mass

Question 1: In a reaction, 5.3 g of sodium carbonate reacted with 6 g of ethanoic acid. The products were 2.2 g of carbon dioxide, 0.9 g of water and 8.2 g of sodium ethanoate. Show that these observations are in agreement with the law of conservation of mass.

Sodium carbonate + ethanoic acid → sodium ethanoate + carbon dioxide + water

ANSWER: Total mass of reactants = mass of sodium carbonate + mass of ethanoic acid

$$= 5.3 \text{ g} + 6 \text{ g} = 11.3 \text{ g}$$

Total mass of products = mass of sodium ethanoate + mass of carbon dioxide + mass of water

= 8.2 g + 2.2 g + 0.9 g = 11.3 g

Thus, the mass of reactants is equal to the mass of products, therefore the observations are in agreement with the law of conservation of mass.

Question 2: Hydrogen and oxygen combine in the ratio of 1:8 by mass to form water. What mass of oxygen gas would be required to react completely with 3 g of hydrogen gas?

ANSWER- \therefore 1 g of hydrogen reacts with = 8 g of oxygen

 \therefore 3 g of hydrogen reacts with = 8 \times 3 = 24 g of oxygen

Thus, 24 g of oxygen gas would be required to react completely with 3 g of hydrogen gas.

Question 3: Which postulate of Dalton's atomic theory is the result of the law of conservation of mass?

ANSWER- "atoms can neither be created nor destroyed in a chemical reaction"

Question 4: Which postulate of Dalton's atomic theory can explain the law of definite proportions?

ANSWER- "A chemical compound always consists of the same elements combined together in the same proportion by mass"

Question 5: Define the atomic mass unit.

ANSWER- Atomic mass unit is a mass unit equal to exactly one-twelfth the mass of a carbon-12 atom. It is used to measure the masses of subatomic particles.

9th Science, English Medium, Syllabus of July and August Question 6: Why is it not possible to see an atom with naked eyes? ANSWER- The size of atom is very very small and is of the order of 1 nm. Thus, we cannot see an atom with naked eyes. Question 7: Write down the formula of 1. sodium oxide 2. aluminium chloride 3. sodium sulphide

4. magnesium hydroxide.

ANSWER-1.Sodium oxide

Ions present Formula



Question 8: Write down the names of compounds represented by the following formulae:

1. AI₂(SO₄)₃

2. CaCI₂

- 3. K₂SO₄
- 4. KNO₃
- 5. $CaCO_3$

ANSWER- (i) Aluminium sulphate

(ii) Calcium chloride

(iii) Potassium sulphate

(iv) Potassium nitrate

(v) Calcium carbonate

Question 9: What is meant by the term chemical formulae?

ANSWER- The chemical formula of a compound is a symbolic representation of its composition.

Question 10: How many atoms are present in a

(i) H₂S molecule and

(ii) PO_4^{3-} ion?

ANSWER- (i) $H_2S = 3$ Atoms

(ii) $PO_4^{3-} = 5$ Atoms.

Question 11: Calculate the molecular masses of H₂, O₂ Cl₂, CO₂, CH₄ C₂H₆, C₂H₄, NH₃, CH₃OH.

ANSWER- (i) Molecular (Molar) Mass of $H_2 = 2 \times Mass$ of $H = 2 \times 1 = 2 u$. (u = amu-atomic mass unit)

(ii) Molecular (Molar) Mass of $O_2 = 2 \times Mass$ of $O = 2 \times 16 = 32 \text{ u}$.

(iii) Molecular (Molar) Mass of $Cl_2 = 2 \times Mass$ of $Cl = 2 \times 35.5 = 71 \text{ u}.$

(iv) Molecular (Molar) Mass of CO_2 = Mass of C + 2 x Mass of O = 12 + 2 x 16 = 12+32=44 u.

(v) Molecular (Molar) Mass of CH_4 = Mass of $C + 4 \times Mass$ of $H = 12 + 4 \times 1 = 12 + 4 = 16 \text{ u}$.

(vi) Molecular (Molar) Mass of $C_2H_6 = 2 \times Mass$ of $C + 6 \times Mass$ of $H = 2 \times 12 + 6 \times 1 = 24 + 6 = 30 \text{ u}$.

(vii) Molecular (Molar) Mass of $C_2H_4 = 2 \times Mass$ of $C + 4 \times Mass$ of $H = 2 \times 12 + 4 \times 1 = 24+4=28 \text{ u}$.

(viii) Molecular (Molar) Mass of $NH_3 = Mass$ of $N + 3 \times Mass$ of $H = 14 + 3 \times 1 = 14 + 3 = 17 \text{ u}$.

(ix) Molecular (Molar) Mass of $CH_3OH = 12 + 3 \times 1 + 16 + 1 = 12 + 3 + 16 + 1 = 32 \text{ u}.$

Question 12: Calculate the formula unit masses of ZnO, Na₂O, K₂CO₃. Given atomic masses of Zn = 65 u,

Na = 23 u, K = 39 u, C = 12 u and, O= 16 u.

ANSWER- Formula unit mass of ZnO = 65 + 16 = 81 u

Formula unit mass of Na₂O = $(2 \times 23) + 16 = 62 \text{ u}$

Formula unit mass of $K_2CO_3 = (2 \times 39) + 12 + (3 \times 16) = 138 u$

Question 13: If one mole of carbon atoms weighs 12 gram, what is the mass (in gram) of 1 atom of carbon?

Number of atoms = Z = 1 atom Mass of 1 atom of carbon = Y = ? $\frac{Y \text{ gram}}{M \text{ gram}} = \frac{Z \text{ particles}}{6.022 \text{ X} (10)^{23} \text{ particles}}$ We know $\frac{Y \text{ gram}}{12 \text{ gram}} = \frac{1 \text{ atom}}{6.022 \text{ X} (10)^{23} \text{ atoms}}$ Hence, $Y = \frac{1 X 12}{6.022 X (10)^{23}} = 1.99 \times 10^{-23}$ atoms. Question 14: Which has more number of atoms, 100 grams of sodium or 100 grams of iron (given atomic mass of Na = 23 u, Fe = 56 u? **ANSWER-** <u>For Sodium</u> given mass of sodium = Y = 100 gMolar mass of sodium= M = 23Number of atoms = Z = ? $\frac{Y \text{ gram}}{M \text{ gram}} = \frac{Z \text{ particles}}{6.022 X (10)^{23} \text{ particles}}$ We know $\frac{100}{23} = \frac{Z}{6.022 X (10)^{23}}$ Hence $Z = \frac{100 \times 6.022 \times (10)^{23}}{23} = 2.62 \times 10^{24}$ atoms (sodium) given mass of iron = Y = 100 gFor Iron Molar mass of iron = M = 56Number of atoms = Z = ? $\frac{Y \text{ gram}}{M \text{ gram}} = \frac{Z \text{ particles}}{6.022 X (10)^{23} \text{ particles}}$ We know $\frac{100}{56} = \frac{Z}{6.022 X (10)^{23}}$ Hence $Z = \frac{100 \times 6.022 \times (10)^{23}}{56} = 1.07 \times 10^{24}$ atoms (iron) Thus 100g sodium has more atoms

ANSWER- Here, for carbon molar mass = M = 12

EXERCISE QUESTION-ANSWERS

Question 1: A 0.24 g sample of compound of oxygen and boron was found by analysis to contain 0.096 g of boron and 0.144 g of oxygen. Calculate the percentage composition of the compound by weight.

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x 100

ANSWER- We know that, % of any element in a compound $=\frac{mass \ of \ element}{mass \ of \ compound}$

Thus % of boron =
$$\frac{0.096g}{0.24g} X \ 100 = 40 \%$$

And % of oxygen = $\frac{0.144g}{0.24g} X \ 100 = 60 \%$

Question 2: When 3.0 g of carbon is burnt in 8.00 g oxygen, 11.0 g of carbon dioxide is produced. What mass of carbon dioxide will be formed when 3.0 g of carbon is burnt in 50.00 g of oxygen? Which law of chemical combination will govern your answer?

ANSWER- Carbon dioxide contains carbon and oxygen in a fixed ratio by mass, which is 3:8. Thus, by the law of constant proportions. 3 g of carbon must also combine with 8 g of oxygen only to form 11 g of carbon dioxide. This means that (50 - 8) = 42 g of oxygen will remain un reacted.

Question 3: What are polyatomic ions? Give examples.

ANSWER- A polyatomic ion is a group of atoms carrying positive or negative charge. For example : PO_4^{3-} , NH₄⁺, OH⁻, SO₄²⁻ etc.

Question 4: Write the chemical formulae of the following:

- (a) Magnesium chloride
- (b) Calcium oxide
- (c) Copper nitrate
- (d) Aluminium chloride
- (e) Calcium carbonate

ANSWER- (a) Magnesium chloride



(b) Calcium oxide



(c) Copper nitrate



(d) Aluminium chloride



(e) Calcium carbonate



Ca2(CO3)2 or CaCO3

Question 5: Give the names of the elements present in the following compounds:

- (a) Quick lime
- (b) Hydrogen bromide
- (c) Baking powder
- (d) Potassium sulphate

Answer- (a) Quick lime is CaO. Elements present are calcium and oxygen.

- (b) Hydrogen bromide is HBr. Elements present are hydrogen and bromine.
- (c) Baking powder is NaHCO₃. Elements present are sodium, hydrogen, carbon and oxygen.
- (d) Potassium sulphate is K₂SO₄. Elements present are potassium, sulphur and oxygen.

Question 6: Calculate the molar mass of the following substances:

- (a) Ethyne, C₂H₂
- (b) Sulphur molecule, S₈
- (c) Phosphorus molecule, P₄ (atomic mass of phosphorus = 31)
- (d) Hydrochloric acid, HCI
- (e) Nitric acid, HNO₃

Answer: (a) Molecular mass of ethyne, $C_2H_2 = 2 \times Mass$ of $C + 2 \times Mass$ of $H = 2 \times 12 + 2 \times = 26 \text{ u}$

- (b) Molecular mass of sulphur molecule, $S_8 = 8 \times Mass$ of $S = 8 \times 32 = 256 \text{ u}$
- (c) Molecular mass of phosphorus molecule, $P_4 = 4 x$ Mass of P = 4 x 31 = 124 u
- (d) Molecular mass of HCl = Mass of H + Mass of Cl = 1 + 35.5 = 36.5 u
- (e) Molecular mass of $HNO_3 = Mass$ of H + Mass of $N + 3 \times Mass$ of $O = 1 + 14 + 3 \times 16 = 63 \text{ u}$

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Question 7: What is the mass of (a) 1 mole of nitrogen atoms? (b) 4 moles of aluminium atoms (atomic mass of aluminium = 27)? (c) 10 moles of sodium sulphite (Na₂SO₃)? Answer: (a) Mass of nitrogen = Y = ?Number of moles = X = 1Molar mass of nitrogen = M = 14 $\frac{X \text{ mole}}{1 \text{ mole}} = \frac{Y \text{ gram}}{M \text{ gram}}$ We know $\frac{1}{1} = \frac{Y}{14}$ Y = 14 gMass of aluminium = Y = ?(b) Number of moles = X = 4Molar mass of aluminium = M = 27 $\frac{X \text{ mole}}{1 \text{ mole}} = \frac{Y \text{ gram}}{M \text{ gram}}$ We know $\frac{4}{1} = \frac{Y}{27}$ Y = 4 x 27 = 108 gMass of sodium sulphite = Y = ?(c) Number of moles = X = 10Molar mass of sodium sulphite $(Na_2SO_3) = M = 2 \times 23 + 32 + 3 \times 16 = 46+32+48 = 126$ $\frac{X \text{ mole}}{1 \text{ mole}} = \frac{Y \text{ gram}}{M \text{ gram}}$ We know $\frac{10}{1} = \frac{Y}{126}$ Y = 10 x 126 = 1260 g**Question 8- Convert into mole.** (a) 12 g of oxygen gas (b) 20 g of water

(c) 22 g of carbon dioxide

Answer: (a) Number of moles = X = ?

Given mass = Y = 12 g

Molar mass of oxygen gas $(O_2)= 2 \times 16 = 32$

We know,

$$1 \text{ mole} \qquad M \text{ gram}$$
$$\frac{X}{1} = \frac{12}{32} = 0.375 \text{ mol}$$

X mole Y gram

Number of moles = X = ?(b)

X mole

Given mass = Y = 20 g

Molar mass of water (H₂O)= $2 \times 1 + 16 = 18$

$$\frac{X \text{ mole}}{1 \text{ mole}} = \frac{Y \text{ gram}}{M \text{ gram}}$$

$$=\frac{20}{18}$$
 = 1.1 mol

Number of moles = X = ?(c)

 $\frac{X}{1}$

Given mass = Y = 22 g

Molar mass of carbon dioxide (CO₂)= $12 + 2 \times 16 = 12 + 32 = 44$

 $\frac{X \text{ mole}}{1 \text{ mole}} = \frac{Y \text{ gram}}{M \text{ gram}}$ We know,

$$\frac{X}{1} = \frac{22}{44} = 0.5 \text{ mol}$$

Question 9: What is the mass of

(a) 0.2 mole of oxygen atoms?

(b) 0.5 mole of water molecules?

Answer- (a) Mass = Y = ?

Number of moles = X = 0.2

Molar mass of oxygen atom = M = 16X mole Y gram

We know

$$\frac{0.2}{1} = \frac{Y}{16}$$

$$Y = 0.2 x 16 = 3.2 g$$

(b) Mass =
$$Y = ?$$

Number of moles = X = 0.5

Molar mass of water $(H_2O)= 2 \times 1 + 16 = 18$

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We know

$$\frac{X \text{ mole}}{1 \text{ mole}} = \frac{Y \text{ gram}}{M \text{ gram}}$$
$$\frac{0.5}{1} = \frac{Y}{18}$$
$$Y = 0.5 \text{ x } 18 = 9 \text{ g}$$

Question 10: Calculate the number of molecules of sulphur (S₈) present in 16 g of solid sulphur?

Answer- Mass = Y = 16 g

Number of molecues (particles) = Z = ?

Molar mass of sulphur $(S_8) = 8 \times 32 = 256$

We know

$$\frac{Y \text{ gram}}{M \text{ gram}} = \frac{Z \text{ particles}}{6.022 X (10)^{23} \text{ particles}}$$

Hence,

$$\frac{16}{256} = \frac{Z}{6.022 X (10)^{23}}$$

 $Z = \frac{16 X 6.022 X (10)^{23}}{256} = 3.76 \times 10^{22}$ molecules

Question 11: Calculate the number of aluminium ions present in 0.051 g of aluminium oxide. (Hint: The mass of an ion is the same as that of an atom of the same element. Atomic mass of Al = 27 u)

Answer- Number of aluminium ions = ?

Number of aluminum oxide molecules = Z = ?

Mass = Y = 0.051 g

Molar mass of aluminium oxide $(Al_2O_3) = 2 \times 27 + 3 \times 16 = 54 + 48 = 102$

We know

$$\frac{Y \text{ gram}}{M \text{ gram}} = \frac{Z \text{ particles}}{6.022 \text{ X} (10)^{23} \text{ particles}}$$

Hence,

$$\frac{0.051}{102} = \frac{Z}{6.022 X (10)^{23}}$$

$$Z = \frac{51 X 6.022 X (10)^{23}}{100 X 102} = 3.011 \times 10^{20} \text{ molecules}$$

Hence Number of aluminium ions = $2 \times Z = 2 \times 3.011 \times 10^{20} = 6.022 \times 10^{20}$ ions

Some Importants things to remember

Table 3.2: Atomic masses of a few elements

Element	Atomic Mass (u)
Hydrogen	1
Carbon	12
Nitrogen	14
Oxygen	16
Sodium	23
Magnesium	24
Sulphur	32
Chlorine	35.5
Caleium	40

Table 3.6: Some common, simple and polyatomic ions

Vale- ncy	Name of ion	Symbol	Non- metallic element	Symbol	Polyatomic ions	Symbol
1.	Sodium Potassium Silver Copper (I)*	Na⁺ K⁺ Ag⁺ Cu⁺	Hydrogen Hydride Chloride Bromide Iodide	H⁺ H ⁺ Cl ⁺ Br ⁻ I ⁻	Ammonium Hydroxide Nitrate Hydrogen carbonate	NH_4^+ OH^- NO_3^- HCO_3^-
2.	Magnesium Calcium Zinc Iron (II)* Copper (II)*	Mg^{2+} Ca^{2+} Zn^{2+} Fe^{2+} Cu^{2+}	Oxide Sulphide	${ m O}^{2}$ · ${ m S}^{2}$ ·	Carbonate Sulphite Sulphate	CO ₃ ²⁻ SO ₃ ²⁻ SO ₄ ²⁻
3.	Aluminium Iron (III)*	Al ³⁺ Fe ³⁺	Nitride	N ³⁻	Phosphate	PO ₄ ³⁻

CHAPTER 6 -TISSUES

Question 1: What is a tissue?

Answer: A group of cells that are similar in structure and functions grouped together to form a tissue.

Question 2: What is the utility of tissues in multi-cellular organisms?

Answer- Different tissues carry out different functions. This is called division of labour. A tissue gives the highest possible efficiency of function in multi-cellular organisms.

Question 3: Name types of simple tissues.

Answer- (i). Parenchyma, (ii). Collenchyma, (iii). Sclerenchyma

Question 4: Where is apical meristem found?

Answer- Apical meristem is found at the growing tips of stems and roots. It helps in increasing the length of stem and root.

Question 5: Which tissue makes up the husk of coconut?

Answer- Sclerenchyma

Question 6: What are the constituents of the phloem?

Answer- Phloem is made up four types of elements. They are:

- (i) Sieve tubes
- (ii) Companion cells

(iii) Phloem parenchyma

(iv) Phloem fibres.

Question 7: Name the tissue responsible for movement in our body.

Answer- Muscular tissue.

Question 8: What does a neuron look like?

Answer- A neuron or a nerve cell consists of a cell body with a nucleus and cytoplasm. Many long thin hairlike cytoplasmic extensions arise from the cell body called as dendrites. A single long extension is called the axon.



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Question 9 : Give three features of cardiac muscles.

Answer- i. Cardiac muscles show rhythmic contraction and relaxation throughout the life.

ii. They are cylindrical, branched and uninucleated.

iii. Cardiac muscles are involuntary muscles.

Question 10: What are the functions of areolar tissue?

Answer- Areolar tissues are found between the skin and muscle as well as around the blood vessels. This tissue fills the gap between the organs and protects the internal organs. It also repairs the damaged tissues.

EXERCISE QUESTION-ANSWERS

Question 1: Define the term "tissue".

Answer: A group of cells that are similar in structure and functions grouped together to form a tissue.

Question 2: How many types of elements together make up the xylem tissue? Name them.

Answer: There are four different types of cells that make up the xylem tissue. They are:-

- 1. Tracheids
- 2. Vessels
- 3. Xylem fibres
- 4. Xylem parenchyma

Question 3: How are simple tissues different from complex tissues in plants?

Answer:

Simple tissue	Complex tissue
	1. These tissues are made up of more than one type
1. Simple tissues consist of only one type of cells	of cells.
	2. The cells of complex tissue may perform
2. The cells of simple tissue perform similar function.	different functions.
3.Example of simple tissues are collenchymas, parenchyma	3. Examples of complex tissues are xylem and
and sclerenchyma	phloem.

Question 4: Differentiate between parenchyma, collenchyma and sclerenchyma, on the basis of their cell wall.

Answer:

Parenchyma	Collenchyma	Sclerenchyma
Cell wall is thin	Cell wall is thick	Cell wall is very thick also hard and rigid

(c) Cardiac Muscle

Question 5: What are the functions of the stomata?

Answer: Functions of the stomata:

- 1. The exchange of gases $(CO_2 \text{ and } O_2)$ with the atmosphere.
- 2. The loss of excess water in the form of water vapour. This process is known as transpiration.

Question 6: Diagrammatically show the difference between the three types of muscle fibres.

Answer: (a) Striated Muscle, (b) Smooth Muscle,



Question 7: What is the specific function of the cardiac muscle?

Answer: The specific function of the cardiac muscle is to control the contraction and relaxation of the heart.

Question 8- Differentiate between striated, unstriated and cardiac muscles on the basis of their structure and site/location in the body.

Answer:

Striated muscle	Unstriated muscle	Cardiac muscle
1. They are cylindrical in shape and	1. They spindle shaped and uninucleate.	1. They are cylindrical branched
multi nucleate.		and uninucleate.
2. They are present in body parts	1. They are present in the wall of food	1. They are present in the heart.
such as hands and legs.	canal, stomach, mouth, iris etc.	

Question 9: Draw a labelled diagram of a neuron.

Answer:



Question 10: Name the following:

- 1. Tissue that forms the inner lining of our mouth \rightarrow squamous epithilium
- 2. Tissue that connects muscle to bone in humans \rightarrow tendons
- 3. Tissue that transports food in plants \rightarrow Phloem
- 4. Tissue that stores fat in our body \rightarrow Adipose tissue
- 5. Connective tissue with a fluid matrix \rightarrow Blood
- 6. Tissue present in the brain \rightarrow Nervous tissue

Question 11: Identify the type of tissue in the following: skin, bark of tree, bone, lining of kidney tubule, vascular bundle.

Answer: - Skin: Stratified squamous epithelial tissue

Bark of tree: cork (secondary meristem)

Bone: Connective tissue

Lining of kidney tubule: Cuboidal epithilium

Vascular bundle: Complex permanent tissue (Xylem and Phloem)

Question 12: Name the regions in which parenchyma tissue is present.

Answer: The parenchyma tissue is present in leaves, fruits, and flowers of a plant.

Question 13: What is the role of epidermis in plants?

Answer: Role of epidermis in plants:

i. Protection of the underlying cells and tissues.

ii. Prevention of water loss.

iii. Prevention of mechanical injury and attack by parasitic fungi.

iv. Exchange of gases and transpiration through stomata.

Question 14: How does the cork act as a protective tissue?

Answer: Several layers of epidermal cells constitute the cork. These cells are dead and compactly arranged without intercellular spaces. They also possess a chemical called suberin in their walls which makes them impervious to water and gases.

Question 15: Complete the table:



<u>CHAPTER 7 - DIVERSITY IN LIVING ORGANISMS</u>

Question 1: Why do we classify organisms?

Answer: There are large number of organisms and it is very difficult to study them individually, So for easier and convenient study we classify organisms

Question 2: Give three examples of the range of variations that you see in life forms around you.

Answer- i). Size: Organisms vary greatly in size-from microscopic bacteria to elephants, whales and large trees.ii). Colour: The colour of various animals is quite different. Some worms are even colourless or transparent.Various types of pigments are found in plants.

iii). Life span: Life span of different organisms also varies greatly. Example - a mosquito lives only for a few days while a turtle can live for around 200 years. Some pine trees live for thousands of years.

Question 3: Which do you think is a more basic characteristic for classifying organisms? (a) the place where they live.

(b) the kind of cells they are made of. Why?

Answer - The more basic characteristic for classifying organisms is the kind of cells they are made of. It is because different organisms may share same habitat but may have entirely different form and structure..

Question 4: What is the primary characteristic on which the first division of organisms is made?

Answer - Organization of nucleus is the primary characteristic on which the first division of organisms is made. Based on this, organisms can be either prokaryotic or eukaryotic.

Question 5: On what bases are plants and animals put into different categories?

Answer- Plants are autotrophs, while animals are heterotrophs. Cell wall is present in plant cells, while it is absent in animal cells.

Question 6: Which organisms are called primitive and how are they different from the so-called advanced organisms?

Answer- An organism which is simple is called primitive. On the other hand, an organism with high level of division of labour, by formation of organs and organ system is called advanced.

Question 7: Will advanced organisms be the same as complex organisms? Why?

Answer- Yes, advanced organisms means greater degree of evolution which leads to more complexity.

Question 8: What is the criterion for classification of organisms as belonging to kingdom Monera or Protista?

Answer -Organisms which are prokaryotes belong to the kingdom Monera. On the other hand, organisms which are eukaryotes and unicellular belong to the kingdom Protista.

Question 9 : In which kingdom will you place an organism which is single-celled, eukaryotic and

photosynthetic?

Answer- Plant Kingdom

Question 10: In the hierarchy of classification, which grouping will have the smallest number of

organisms with a maximum of characteristics in common and which will have the largest number of organisms?

Answer - Species will have the smallest number of organisms with a maximum of characteristics in common. And kingdom will have the largest number of organisms.

Question 11: Which division among plants has the simplest organisms?

Answer- Thallophyta

Question 12: How are pteridophytes different from the phanerogams?

Answer –

Pteridophytes	Phanerogams
1. Reproductive organs are hidden.	1. Reproductive organs are conspicuous.
2. They do not produce seeds.	2. They produce seeds.

Question 13: How do gymnosperms and angiosperms differ from each other?

Answer –

Gymnosperms	Angiosperms
1. Seeds are naked	1. Seeds are covered.
2. They do not bear flowers.	2. They bear flowers.
3. Examples: Pine, Deodar etc	3. Examples: Rose, tomato etc.

Question 14: How do poriferan animals differ from coelenterate animals?

Answer –

Poriferan	Coelenterate
1. Body has numerous pores.	1. Pores are absent.
2. Body cavity is absent.	2. Body has a cavity.
3. Examples: Sycon.	3. Examples: Hydra.

Question 15: How do annelid animals differ from arthropods?

Answer –

Annelida	Arthropoda
1. Body is Segmented.	1. No true segmentation.
2. Joined appendages are absent.	2. They have joined appendages.
3. Examples: earthworm.	3. Examples: house-fly.

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Question 16: What are the differences between amphibians and reptiles?

Answer –

Amphibians	Reptiles
1. They need water to lay eggs.	1. They do not need water to lay eggs.
2. Fertilization is external.	2. Fertilization is internal.
3. They use skin, gills or lungs for breathing.	3. They use lungs for breathing.
4. Example: Frog.	4. Example: Snake.

Question 17: What are the differences between animals belonging to the Aves group and those in the mammalian group?

Answer-

Aves	Mammalian
1. Body is covered with feathers.	1. Body is covered with hairs.
2. Mammary glands are absent.	2. Mammary glands are present.
3. Aves are oviparous.	3. Mammals are viviparous.
4. Example: Sparrow.	4. Example: Human.

EXERCISE QUESTION-ANSWERS

Question 1: What are the advantages of classifying organisms?

Answer - There are large number of organisms and it is very difficult to study them individually, So for easier and convenient study we classify organisms

Question 2: How would you choose between two characteristics to be used for developing a hierarchy in classification?

Answer- The characteristic which is more basic should be considered first.

Next, choose those characteristics which are dependent on the previous ones and would decide the variety in the next level for developing a hierarchy in classification.

Question 3: Explain the basis for grouping organisms into five kingdoms.

Answer- Basis of Classification:

- (a) Number of cells
- (b) Layer of cells
- (c) Presence or absence of cell wall
- (d) Mode of nutrition
- (e) Level of organization

Question 4: What are the major divisions in the Plantae? What is the basis for these divisions?

Answer- The major divisions of Plantae and the basis for these divisions are as follows:

- 1) Thallophyta: Simple body design; with no differentiation into root, stem and leaves.
- 2) Bryophyta: Body is differentiated into stem and leaf-like structures.
- 3) Pteridophyta: Body is differentiated into root, stem and leaves.
- 4) Gymnosperms: Seeds are naked.
- 5) Angiosperms: Seeds are covered.

Question 5: How are the criteria for deciding divisions in plants different from the criteria for deciding the subgroups among animals?

Answer- In the plant kingdom, morphological characters are taken into consideration while deciding about the divisions. Morphology is the study of shapes and forms of various parts.

In the animal kingdom, anatomical characters are taken into consideration while deciding about subgroups. Anatomy is the study of various organs' design in animals.

Question 6: Explain how animals in Vertebrata are classified into further subgroups.

Answer- Vertebrata is divided into two super classes, i.e. Pisces and Tetrapoda. Animals of Pisces have streamlined body with fins and tails to assist in swimming.

Animals of Tetrapoda have four limbs for locomotion. Tetrapoda is further classified into following classes:

(a) Amphibia: Are adapted to live in water and on land. Can breathe oxygen through skin when under water.

(b) Reptilia: These are crawling animals. Skin is hard to withstand extreme temperatures.

(c) Aves: Forelimbs are modified into wings to assist in flying. Beaks are present. Body is covered with feathers.

(d) Mammalia: Mammary glands present to nurture young ones. Skin is covered with hair. Most of the animals are viviparous.

CHAPTER 10 – GRAVITATION

Question 1: State the universal law of gravitation

Answer- The universal law of gravitation states that every object in the universe attracts every other object with a force called the gravitational force. The force acting between two objects is directly proportional to the product of their masses and inversely proportional to the square of the distance between their centers.

$$F = \frac{Gm_1m_2}{r^2}$$

Where, G is the universal gravitation constant and its value is 6.67×10^{-11} Nm² kg⁻²

Question 2: Write the formula to find the magnitude of the gravitational force between the earth and an object on the surface of the earth.

Answer-

$$F = \frac{GM_Em}{R^2}$$

Question 3: What do you mean by free fall?

Answer - Whenever an object falls toward earth under the force of gravity alone, the motion of object is said to be "free fall".

Question 4: What do you mean by acceleration due to gravity?

Answer – Acceleration of free falling object towards earth is known as acceleration due to gravity. Its value near the surface of earth is 9.8 m/s^2 .

Question 5: What are the differences between the mass of an object and its weight?

Answer-

Mass	Weight
1. Mass is the quantity of matter contained in the body.	1. Weight is the force of gravity acting on the body.
2. It's value is constant everywhere.	2. It's value is different at different places.
3. It is a scalar quantity.	3. It is a vector quantity.
4. It's SI unit is kilogram (kg).	4. It's SI unit is newton (N).

Question 6: Why is the weight of an object on the moon 1/6th its weight on the earth?

Answer- Because value of acceleration due to gravity (g) on moon is $1/6^{th}$ of the value of 'g' on earth. And weight = W = mg.

^{9th} Science, English Medium, Syllabus of July and August Question 7: Why is it difficult to hold a school bag having a strap made of a thin and strong string? Answer- Due to smaller surface area of thin strap, it exert large pressure on our shoulders. Because pressure is inversely proportional to the area. Hence it is difficult to hold a school bag with thin strap.

Question 8: What do you mean by buoyancy?

Answer- The upward force exerted by a liquid on an object immersed in it is known as buoyancy.

Question 9: Why does an object float or sink when placed on the surface of water?

Answer- If the density of an object is more than the density of the liquid, then it sinks in the liquid, because buoyant force is less than gravity.

On the other hand, if the density of the object is less than the density of the liquid, then it floats on the surface of the liquid, because buoyant force is more than gravity.

Question 10: You find your mass to be 42 kg on a weighing machine. Is your mass more or less than 42 kg?

Answer- Our actual weight will be slightly more than 42 kg, because due to upward buoyant force of air machine gives slightly less reading.

Question 11: You have a bag of cotton and an iron bar, each indicating a mass of 100 kg when measured on a weighing machine. In reality, one is heavier than other. Can you say which one is heavier and why? Answer- The bag of cotton is heavier than iron bar. This is because the surface area of the cotton bag is larger than the iron bar. Hence, more buoyant force acts on the bag than that on an iron bar. This makes the cotton bag lighter than its actual value

EXERCISE QUESTION-ANSWERS

Question 1: How does the force of gravitation between two objects change when the distance between them is reduced to half?

Answer – Because

$$F \propto \frac{1}{r^2}$$

Hence, if the distance is reduced to half, then the gravitational force becomes four times larger than the previous value.

Question 2: Gravitational force acts on all objects in proportion to their masses. Why then, a heavy object does not fall faster than a light object?

Answer- All objects fall on ground with constant acceleration due to gravity (in the absence of air resistances).

which does not depend upon the mass of an object. Hence, heavy objects do not fall faster than light objects.

Question 3: What is the magnitude of the gravitational force between the earth and a 1 kg object on its surface? (Mass of the earth is 6×10^{24} kg and radius of the earth is 6.4×10^{6} m).

Answer-

Mass of Earth, $M = 6 \times 10^{24}$ kg Mass of object, m = 1 kg Universal gravitational constant, $G = 6.7 \times 10^{-11}$ Nm² kg⁻² Since the object is on the surface of the Earth, r = radius of the Earth (R) $r = R = 6.4 \times 10^6$ m Therefore, the gravitational force

$$F = \frac{GMm}{r^2} = \frac{6.7 \times 10^{-11} \times 6 \times 10^{24} \times 1}{(6.4 \times 10^6)^2} = 9.8 N$$

Question 4: The earth and the moon are attracted to each other by gravitational force. Does the earth attract the moon with a force that is greater or smaller or the same as the force with which the moon attracts the earth? Why?

Answer- According to the universal law of gravitation, two objects attract each other with equal force, but in opposite directions. The Earth attracts the moon with an equal force with which the moon attracts the earth.

Question 5: If the moon attracts the earth, why does the earth not move towards the moon?

Answer- The Earth and the moon experience equal gravitational forces from each other. Earth does not revolve

around the moon due to very large mass and negligible acceleration of earth ($a = \frac{F}{m}$).

Question 6: What happens to the force between two objects, if

(i) the mass of one object is doubled?

(ii) the distance between the objects is doubled and tripled?

(iii) the masses of both objects are doubled?

Answer- We know that, gravitational force is

$$F = \frac{Gm_1m_2}{r^2}$$

Hence (i) If the mass of one object is doubled, then the gravitational force will also get doubled.

(ii) If the distance is doubled, then the gravitational force becomes one-fourth of its original value.

Similarly, if the distance is tripled, then the gravitational force becomes one-ninth of its original value.

(iii) If the masses of both the objects are doubled, then the gravitational force becomes four times the original value.

Question 7: What is the importance of universal law of gravitation?

Answer- The universal law of gravitation explains several phenomena:

(i) it explains about the force that binds the earth,

- (ii) the motion of the moon around the earth,
- (iii) the motion of planets around the sun, and
- (iv) the tides due to the moon and the sun.

Question 8: What is the acceleration of free fall?

Answer- Acceleration of free falling object towards earth is known as acceleration due to gravity. Its value near the surface of earth is 9.8 m/s^2 .

Question 9: What do we call the gravitational force between the Earth and an object?

Answer- Weight of the object.

Question 10: Amit buys few grams of gold at the poles as per the instruction of one of his friends. He hands over the same when he meets him at the equator. Will the friend agree with the weight of gold bought? If not, why? [Hint: The value of g is greater at the poles than at the equator].

Answer- Weight of a body on the Earth is given by W = mg

The value of g is greater at poles than at the equator. Therefore, gold at the equator weighs less than at the poles. Hence, Amit's friend will not agree with the weight of the gold bought.

Question 11: Why will a sheet of paper fall slower than one that is crumpled into a ball?

Answer- Due to large surface area of a sheet of paper than same paper crumpled into a ball, sheet will experience more buoyant force of air. Hence sheet will fall slower.

Question 12- Gravitational force on the surface of the moon is only $\frac{1}{6}$ as strong as gravitational force on

the Earth. What is the weight in newtons of a 10 kg object on the moon and on the Earth?

Answer- Weight of an object on the moon = $\frac{1}{6}$ × Weight of an object on the Earth

Now, weight of a 10 kg object on the Earth = $10 \times 9.8 = 98$ N

And, weight of the same object on the moon $=\frac{1}{6} \times 98 = 16.3$ N

Question 13: A ball is thrown vertically upwards with a velocity of 49 m/s. Calculate

(i) the maximum height to which it rises.

(ii) the total time it takes to return to the surface of the earth.

Answer- (i) u = Initial velocity of the ball = 49 m/s

- v = Final velocity of the ball v = 0 m/s
- S = Height achieved by the ball = h=?

 $v^2 - u^2 = 2gS$

g = Acceleration due to gravity = -9.8 m s^{-2}

Hence, using

$$0^2 - 49^2 = 2(-9.8)h$$
 $\Rightarrow h = \frac{49 \times 49}{-2 \times 98} = 122.5 \text{ m}$

(ii) Let t be the time taken by the ball to reach the height 122.5 m, then according to the equation of motion

v = u + gt

We get, $0 = 49 + (-9.8) t \implies 9.8 t = 49 \implies t = \frac{49}{9.8} = 5 s$

But, Time of ascent = Time of descent

Therefore, total time taken by the ball to return = 5 + 5 = 10 s

Question 14: A stone is released from the top of a tower of height 19.6 m. Calculate its final velocity just before touching the ground.

Answer- u = Initial velocity of the stone = 0 m/s

v = Final velocity of the stone = ?

S = Height of the stone = 19.6 m

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

$$\therefore$$
 $v^2 - u^2 = 2gS$

$$v^2 - 0^2 = 2 \times 9.8 \times 19.6 \implies v^2 = 2 \times 9.8 \times 19.6 = (19.6)^2$$

$$\Rightarrow$$
 v = 19.6 m/s

Question 15: A stone is thrown vertically upward with an initial velocity of 40 m/s. Taking $g = 10 \text{ m/s}^2$. find the maximum height reached by the stone. What is the net displacement and the total distance covered by the stone?

Answeru = Initial velocity of the stone = 40 m/s v = Final velocity of the stone = 0 m/s S = h= Height of the stone = ? g = Acceleration due to gravity = -10 ms⁻² \therefore v² - u² = 2gS 0² - 40² = 2 × (-10) h h = $-\frac{1600}{-20}$ = 80 m

Therefore, total distance covered by the stone during its upward and downward

journey = 80 + 80 = 160 m

Net displacement during its upward and downward journey = 80 + (-80) = 0.

Question 16: Calculate the force of gravitation between the earth and the Sun, given that the mass of the earth = 6×10^{24} kg and of the Sun = 2×10^{30} kg. The average distance between the two is 1.5×10^{11} m. Answer- We know that, gravitational force is

$$F = \frac{Gm_1m_2}{r^2}$$

We have, $m_1 = Mass$ of the Sun = 2×10^{30} kg

$m_2 = Mass of the Earth = 6 \times 10^{24} kg$

r = Average distance between the Earth and the Sun = 1.5×10^{11} m

G = Universal gravitational constant = $6.7 \times 10-11$ Nm² kg⁻²

$$F = \frac{6.7 \times 10^{-11} \times 2 \times 10^{30} \times 6 \times 10^{24}}{(1.5 \times 10^{11})^2} = 3.57 \times 10^{22} N$$

Hence, the force of gravitation between the Earth and the Sun is $3.57 \times 10^{22} N$

Question 19: In what direction does the buoyant force on an object immersed in a liquid act? Answer- In the upward direction.

Question 20: Why does a block of plastic released under water come up to the surface of water?

Answer- Due to less density of plastic, the upward buoyant force is greater than the weight of the object. Hence the block of plastic comes up when released under water.

Question 21: The volume of 50 g of a substance is 20 cm³. If the density of water is 1 g/ cm³, will the substance float or sink?

Answer- We know, density of the substance = Mass / Volume

$$= \frac{50}{20} = 2.5 \text{ g/cm}^3$$

The density of the substance is more than the density of water (1g/cm³). Hence, the substance will sink in water.

Question 22: The volume of a 500 g sealed packet is 350 cm³. Will the packet float or sink in water if the density of water is 1 g/cm³? What will be the mass of the water displaced by this packet?

Answer- We know, density of the substance = Mass / Volume

$$= \frac{500}{350} = 1.4 \text{ g/cm}^3$$

The density of the substance is more than the density of water (1 g/cm³). Hence it will sink in water.

The mass of water displaced by the packet is equal to the volume of the packet, i.e., **350 g.**