

### ONE MARK QUESTIONS

- State the law of conservation of mass.  
**Ans :**  
This law states that the mass can neither be created nor destroyed in a chemical reaction. That is 'mass of reactants is always equal to mass of products.'
- Who was the first scientist to give the concept of formation of compounds?  
**Ans :**  
Antoine L. Lavoisier gave the concept of formation of compounds.
- Who stated the Law of Constant Proportion?  
**Ans :**  
Joseph Louis Proust stated the Law of Constant Proportion.
- What is the building block of all matter?  
**Ans :**  
Atom is the building block of all matter.
- What is the measuring unit of atomic radius?  
**Ans :**  
Nanometre (nm) is the measuring unit of atomic radius.
- Name the instrument which produces image of the surface of element that shows atoms.  
**Ans :**  
Scanning tunnelling microscope.
- What is the full form of IUPAC?  
**Ans :**  
International Union of Pure and Applied Chemistry.
- Give the derivation source of symbol of sodium (Na).  
**Ans :**  
The symbol of 'Na' for sodium is derived from its Latin name 'Natrium'.
- Give the full form of amu?  
**Ans :**  
The full form of amu is atomic mass unit.
- What is the latest short form of atomic mass unit?  
**Ans :**  
The latest short form of atomic mass unit is u, according to IUPAC.  

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- Name any two monatomic atoms.  
**Ans :**  
Sodium, Aluminium.
- What do we get if 3 atoms of oxygen unite into a molecule, instead of usual 2 ?  
**Ans :**  
We get (O<sub>3</sub>) ozone.
- Give difference between 2H and H<sub>2</sub>.  
**Ans :**  
2H indicates 2 atoms of hydrogen and H<sub>2</sub> indicates one molecule of hydrogen.
- Give two examples of triatomic molecules.  
**Ans :**  
Carbon dioxide (CO<sub>2</sub>) and water (H<sub>2</sub>O).
- Define valency.  
**Ans :**  
The combining power of an element to attain the noble gas configuration is called valency. Or, it is defined as number of electrons lost or gained by an atom to acquire noble gas configuration.
- Who introduced the word 'Mole'?  
**Ans :**  
'Wilhelm Ostwald' introduced the word 'Mole'.
- What is Avogadro Constant?  
**Ans :**  
The number of particles present in one mole of any substance is fixed with a value of  $6.022 \times 10^{23}$ .
- How does an atom exist?  
**Ans :**  
Atom exists in the form of atom, molecule or ions.
- Give Latin name of Silver.  
**Ans :**

Latin name of Silver is 'Argentum'.

20. What is the symbol of the element of molybdenum?

Ans :

'Mo' is the symbol of the element of molybdenum.

21. What is ion?

Ans :

An ion is a charged particle. It can be positive or negative.

22. What do you mean by symbols of elements?

Ans :

Each element is represented by a letter or group of two letters to write the chemical reactions conveniently. It is called symbol.

23. Give the symbol of copper, silver, gold, oxygen, zinc.

Ans :

Copper - Cu  
Silver - Ag  
Gold - Au  
Oxygen - O  
Zinc - Zn

24. What is the difference between an atom and molecule?

Ans :

An atom is the smallest particle of an element which may or may not have independent existence. For example : Na, Al, Fe, etc.

Molecule is the smallest particle of the element or compound which can exist independently. For example : O<sub>2</sub>, H<sub>2</sub>, N<sub>2</sub>, etc.

25. Name two elements which have same atomic number.

Ans :

Two elements cannot have the same atomic number.

26. An element has 8 electrons in its valence shell. What is its general name?

Ans :

Noble gas.

27. Write the value of charge of electron.

Ans :

$1.6 \times 10^{-19}$  coulomb.

28. Name the gas which gives the lightest positively charged particle.

Ans :

Hydrogen.

29. How did the scientist lay the foundation of chemical sciences? Name the scientist.

Ans :

Antoine Laurent Lavoisier laid the foundation of chemical science by establishing two important laws

of chemical combination.

30. Define law of conservation of mass.

Ans :

Law of conservation of mass states that, 'Mass is neither created nor destroyed in a chemical reaction.'

31. Define law of constant proportion.

Ans :

Law of constant proportion states that, 'In a pure chemical substance, the elements are always present in definite proportions by mass.'

32. Which organisation approves the names of elements all over the world?

Ans :

International Union of Pure and Applied Chemistry (IUPAC).

33. Write the symbols of tungsten and iron.

Ans :

(i) Tungsten (W) and  
(ii) Iron (Fe)

34. Name the element which is used as the reference for atomic mass.

Ans :

Carbon.

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35. Name two atoms which exist as independent atoms.

Ans :

Noble gases such as argon (Ar) and helium (He) exist as independent atoms.

36. What is the number of electrons in Mg atom and Mg<sup>2+</sup> ion?

Ans :

$$\text{Mg} = 12e^-$$

$$\text{Mg}^{2+} = 10e^-$$

37. Write atomicity of the following :

(i) Sulphur, (ii) Phosphorus

Ans :

(i) Polyatomic, (ii) Tetra atomic.

38. Define atomicity.

Ans :

The number of atoms present in one molecule of an element or a compound is known as its atomicity.

39. What are polyatomic ions? Give two examples.

Ans :

A group of atoms having a charge is known as polyatomic ion.

Examples : (NH<sub>4</sub>)<sup>+</sup> (SO<sub>4</sub>)<sup>2-</sup>

40. What is the atomicity of argon?

Ans :

Mono atomic.

41. Give one relevant reason, why scientists choose  $\frac{1}{16}$ <sup>th</sup> of the mass of an atom of naturally occurring oxygen as the atomic mass unit?

Ans :

Initially,  $\frac{1}{16}$ <sup>th</sup> of the mass of naturally occurring oxygen was taken as the atomic mass unit because this unit gave masses of most of the elements as whole numbers.

42. State the number of hydrogen atoms in 1 g of hydrogen.

Ans :

$$\begin{aligned} \text{One gram of hydrogen} &= \text{One mole} \\ &= 6.022 \times 10^{23} \text{ atoms} \end{aligned}$$

43. What is molar mass? What are its units?

Ans :

The mass of one mole of a substance is called its molar mass. Its unit is gram per mole ( $\text{gmol}^{-1}$ ).

44. The relative atomic mass of oxygen atom is 16. Explain its meaning.

Ans :

The relative atomic mass of an atom is the average masses of the atom, as compared to  $\frac{1}{12}$ <sup>th</sup> the mass of one carbon-12 atom.

45. Distinguish between molecular mass and molar mass.

Ans :

The molecular mass of a substance is the sum of the atomic masses of all atoms in a molecule, whereas the mass of 1 mole of any substance is called its molar mass.

46. Define the atomic mass unit.

Ans :

The mass of  $\frac{1}{12}$ <sup>th</sup> part of C-12 is equivalent to one atomic mass unit. Previous, it was denoted by symbol 'amu' but nowadays it is denoted by symbol 'u'.

47. Why is it not possible to see an atom with naked eyes?

Ans :

Because an atom is too small, i.e., the atomic radii of an atom is of the order  $10^{-10}$  m to  $10^{-9}$  m.

48. What is meant by the term chemical formula?

Ans :

The chemical formula of a compound is a symbolic representation of its composition and actual number of atoms in one molecule of a pure substance may be an atom or a compound.

49. If 9 g of water is decomposed, how many grams of hydrogen and oxygen are obtained?

Ans :

If 9 g of water is decomposed, 1 g of hydrogen and 8 g of oxygen are always obtained.

50. Name the two laws of chemical combination.

Ans :

Law of conservation of mass and law of constant proportions.

51. How was the relative atomic mass determined?

Ans :

Relative atomic masses were determined by using the laws of chemical combinations and the compound formed.

52. What did Antoine L. Lavoisier observe regarding the formation of compound?

Ans :

He noted that many compounds were composed of two or more elements. Each compound had the same elements in the same proportions.

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53. 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?

Ans :

$$\begin{aligned} 1 \text{ g of hydrogen reacts with oxygen} &= 8 \text{ g} \\ 3 \text{ g of hydrogen reacts with oxygen} &= 8 \times 3 \text{ g} = 24 \text{ g} \end{aligned}$$

54. Write the chemical symbols of two elements which are formed from the first letter of the elements' name.

Ans :

N (Nitrogen), F (Fluorine), I (Iodine), O (Oxygen) (any two).

55. Why atoms form ions?

Ans :

Atoms get stability by acquiring the stable electronic configuration of the nearest noble gas for which either they lose electrons or gain electrons and thus acquire noble gas configuration.

56. Give an example in each of the following cases :

- a divalent anion
- a trivalent cation
- a mono-valent anion.

Ans :

- $\text{O}^{2-}$
- $\text{Fe}^{3+}$
- I

### THREE MARKS QUESTIONS

57. What is the ratio by mass of combining elements in  $\text{H}_2\text{O}$ ,  $\text{CO}_2$  and  $\text{NH}_3$  ?

Ans :

$\text{H}_2\text{O}$  ratio by mass of combining elements

$$\begin{aligned} &= 2 : 16 = 1 : 8 \text{ (H : O)} \\ \text{CO}_2 \text{ ratio by mass of combining elements} \\ &= 12 : 32 = 3 : 8 \text{ (C : O)} \\ \text{NH}_3 \text{ ratio by mass of combining elements} \\ &= 14 : 3 = 14 : 3 \text{ (N : H)} \end{aligned}$$

58. Calculate the ratio of the numbers of atoms for magnesium sulphide.

Ans :

$$\text{Atomic mass of Mg} = \frac{3}{24} = \frac{1}{8}$$

$$\text{Atomic mass of S} = \frac{4}{32} = \frac{1}{8}$$

$$\text{Ratio of atoms in MgS} = \frac{1}{8} : \frac{1}{8} \text{ or } 1 : 1$$

59. Give the chemical name, chemical formulae for the following : Washing soda, blue vitriol, baking soda, green vitriol, oil of vitriol, soda ash, marble chips, lime water.

Ans :

Compound Name	Chemical Name	Chemical Formulae
Washing soda	Sodium carbonate	$\text{Na}_2\text{CO}_3 \cdot 10\text{H}_2\text{O}$
Blue vitriol	Copper sulphate	$\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$
Baking soda	Sodium bicarbonate	$\text{NaHCO}_3$
Green vitriol	Ferrous sulphate	$\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$
Oil of vitriol	Sulphuric acid	$\text{H}_2\text{SO}_4$
Soda ash	Sodium carbonate	$\text{Na}_2\text{CO}_3$
Lime water	Calcium hydroxide	$\text{Ca(OH)}_2$
Marble chips	Calcium carbonate	$\text{CaCO}_3$

60. Find the molecular mass of the following :  $\text{H}_2$ ,  $\text{O}_2$ ,  $\text{CH}_4$ ,  $\text{CH}_3\text{OH}$ ,  $\text{CO}_2$ ,  $\text{HCl}$ ,  $\text{Na}_2\text{O}$ ,  $\text{MgCl}_2$ ,  $\text{NaF}$ ,  $\text{Na}_2\text{CO}_3$ ,  $\text{NaNO}_3$ ,  $\text{H}_2\text{SO}_4$

Ans :

$\text{H}_2$	=	$2 \times 1$	=	2u
$\text{O}_2$	=	$2 \times 16$	=	32u
$\text{CH}_4$	=	$1 \times 12 + 4 \times 1$	=	16u
$\text{CH}_3\text{OH}$	=	$1 \times 12 + 3 \times 1 + 1 \times 16 + 1 \times 1$	=	32u
$\text{CO}_2$	=	$1 \times 12 + 2 \times 16$	=	44u
$\text{HCl}$	=	$1 \times 1 + 1 \times 35.5$	=	36.5u
$\text{Na}_2\text{O}$	=	$2 \times 23 + 1 \times 16$	=	62u
$\text{MgCl}_2$	=	$1 \times 24 + 2 \times 35.5$	=	95u
$\text{NaF}$	=	$1 \times 23 + 1 \times 19$	=	42u

$\text{Na}_2\text{CO}_3$	=	$2 \times 23 + 1 \times 12 + 3 \times 16$	=	106u
$\text{NaNO}_3$	=	$1 \times 23 + 1 \times 14 + 3 \times 16$	=	85u
$\text{H}_2\text{SO}_4$	=	$1 \times 2 + 1 \times 32 + 16 \times 4$	=	98u

61. Calculate the following in 5.6 g of nitrogen :

- (a) Number of moles of nitrogen  
 (b) Number of molecules of nitrogen  
 (c) Number of atoms of nitrogen

Ans :

- (a) Molar mass of nitrogen = 14 g

$$5.6 \text{ g of nitrogen} = \frac{5.6}{14} = 0.4 \text{ mole}$$

- (b) 28 g of nitrogen =  $6.022 \times 10^{23}$  molecules  
 5.6 g of nitrogen =  $2.15 \times 10^{22}$  molecules  
 (c) 14 g of nitrogen =  $6.023 \times 10^{23}$  atoms  
 5.6 g of nitrogen =  $4.30 \times 10^{23}$  atoms

62. What is Avogadro number?

Ans :

The number  $6.022 \times 10^{23}$  is referred to as Avogadro number and is denoted by symbol  $N_A$ .

63. What are ionic compounds?

Ans :

Ionic compounds are charged particles. Such compounds form by joining or losing or sharing the electron. For example : Sodium chloride is an ionic compound. Its constituent particles are positively charged sodium ion ( $\text{Na}^+$ ) and negatively charged chloride ion ( $\text{Cl}^-$ ).

64. What is the similarity between chlorine molecule, nitrogen molecule and hydrogen molecule?

Ans :

Chlorine molecule, nitrogen molecule and hydrogen molecule are diatomic molecules. These are formed by the union of two atoms of the same element.

65. What is the difference between hydrogen chloride and nitrogen molecule formation?

Ans :

Hydrogen chloride is molecular compound and formed by the union of different kinds of atoms while nitrogen is diatomic molecule and formed by union of two atoms of same kinds.

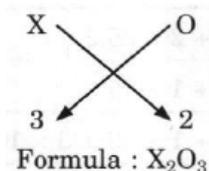
66. All elements have charged valency. Explain.

Ans :

No, all elements do not form ions thus they, do not have a charge. For example : Carbon has a valency of 4 and nitrogen has a valency of 3. Non-metals are formed without a charged valency. Example : In carbon tetrachloride, carbon has valency of 4 and chlorine has a valency of 1.

67. If the valency of an element X is 3, then write the chemical formula of its oxide.

Ans :



68. Write the meaning of these formulae :

- (i)  $2O$ ,  
 (ii)  $O_2$ ,  
 (iii)  $O_3$

Ans :

- (i)  $2O$  = Two atoms of oxygen  
 (ii)  $O_2$  = One molecule of oxygen  
 (iii)  $O_3$  = One molecule of ozone

69. Write the name of the compounds :  $NaBr$ ,  $Al_2O_3$ ,  $CaCO_3$ .

Ans :

$NaBr$  = Sodium bromide  
 $Al_2O_3$  = Aluminium oxide  
 $CaCO_3$  = Calcium carbonate

70. Out of these  $Na^+$ ,  $K^+$ ,  $Al^{3+}$  and  $O^{2-}$ , which is iso-electronic?

Ans :

Iso-electronic means species having same number of electrons.

Ions	Atomic number of element	Atomic number of ions	Number of electron
$Na^+$	11	10	10
$K^+$	19	18	18
$Al^{3+}$	13	10	10
$O^{2-}$	8	10	10

$Na^+$ ,  $Al^{3+}$  and  $O^{2-}$  have 10 electrons each Hence, they are iso-electronic.

71. Find the number of atoms in the 0.5 mole of C atom.

Ans :

0.5 mole of C atom :

Number of atoms in 1 mole of C atom

$$= 6.022 \times 10^{23} \text{ atoms}$$

Number of atoms in 0.5 mole of C atom

$$= 6.022 \times 10^{23} \times 0.5$$

$$= 3.011 \times 10^{23} \text{ atoms}$$

72. Write the postulate given by the Indian philosopher Maharishi Kanad.

Ans :

Indian philosopher Maharishi Kanad postulated if we divide matter we will get smaller and smaller particles.

He said that a time will come when we come across smallest particles beyond which further division will not be possible.

73. What is the significance of symbol of an element? Explain with an example.

Ans :

- (i) The symbol of an element represents the name of the element.  
 (ii) It represents one atom of the element.  
 (iii) It represents a definite mass of the element.

For example :

- (i) The symbol 'H' represents the element hydrogen.  
 (ii) The symbol 'H' represents one atom of the element hydrogen.  
 (iii) The symbol 'H' represents 1u.

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74. How can Dalton's atomic theory explain the Law of Constant Proportions?

Ans :

According to Dalton's atomic theory, atoms of the same elements are same. Also atoms combine in whole number. This means that the atoms can combine with each other in a simple fixed ratio to form molecules.

75. Give one example each of (i) Monovalent cation, (ii) Bivalent cation, (iii) Monovalent anion, (iv) Bivalent anion.

Ans :

- (i)  $K^+$  or  $Na^+$   
 (ii)  $Mg^{+2}$  or  $Ca^{+2}$   
 (iii)  $F^-$  or  $Cl^-$   
 (iv)  $O^{2-}$  or  $S^{2-}$

76. What is meant by a chemical formula? Give examples.

Ans :

A chemical formula of a compound shows its constituent elements and the number of atoms of each combining element, e.g., chemical formula of ammonia is  $NH_3$ , water is  $H_2O$  and carbon dioxide is  $CO_2$ .

77. What is meant by a molecule? Give examples.

Ans :

A molecule is the smallest particle of an element or a compound capable of independent existence under ordinary conditions. It shows all the properties of the substance, e.g., molecule of oxygen is  $O_2$ , ozone is  $O_3$ , phosphorus is  $P_4$ , sulphur is  $S_8$ , etc.

78. Define one mole, give its relationship with Avogadro constant.

Ans :

One mole of any species (atoms, molecules, ions or particles) is that quantity in number having a mass equal to its atomic or molecular mass in grams. The number of particles (atoms, molecules or ions) present in 1 mole of any substance is fixed, with a value of  $6.022 \times 10^{23}$ . This number is called Avogadro constant

or Avogadro number.

79. What is the mass of :

- (a) 0.2 mole of oxygen atoms?  
 (b) 0.5 mole of water molecules?

Ans :

- (a) 1 mole of oxygen atoms =  $1 \times 16 = 16$  g  
 0.2 mole of oxygen atoms =  $16 \text{ g} \times 0.2 = 3.2$  g  
 (b) 1 mole of water ( $\text{H}_2\text{O}$ ) molecules  
 $= 2 \times 1 \text{ g} + 1 \times 16 \text{ g} = 18$  g  
 0.5 mole of water ( $\text{H}_2\text{O}$ ) molecules  
 $= 18 \text{ g} \times 0.5 = 9.0$  g

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80. State two examples in each case and write their chemical formulae :

- (a) Molecules having same kind of atoms only.  
 (b) Molecules having two different kinds of atoms.  
 (c) Molecules having three different kinds of atoms.

Ans :

- (a)  $\text{F}_2$ ,  $\text{Cl}_2$ ,  $\text{P}_4$ ,  $\text{S}_8$   
 (b) Ammonia ( $\text{NH}_3$ ), Sulphur dioxide ( $\text{SO}_2$ ), Carbon disulphide ( $\text{CS}_2$ ).  
 (c) Calcium sulphate ( $\text{CaSO}_4$ ), Sodium nitrate ( $\text{NaNO}_3$ ).

81. Write the names of the following compounds :

- (a) NiS  
 (b)  $\text{Mg}(\text{NO}_3)_2$   
 (c)  $\text{Na}_2\text{SO}_4$   
 (d)  $\text{Al}(\text{NO}_3)_3$   
 (e)  $\text{K}_3\text{PO}_4$   
 (f)  $\text{Ca}_3\text{N}_2$

Ans :

- (a) Nickel sulphide,  
 (b) Magnesium nitrate,  
 (c) Sodium sulphate,  
 (d) Aluminium nitrate,  
 (e) Potassium phosphate,  
 (f) Calcium nitride.

82. The atomic mass of an element is in fraction." What does it mean?

Ans :

If the atomic mass of an element is in fraction, this means that it exists in the form of isotopes. The atomic mass of such element is the average of atomic masses of its isotopes and is generally in fraction.

83. Why the number of atoms in one mole of hydrogen gas is double the number of atoms in one mole of helium gas? Explain.

Ans :

The number of atoms in one mole of hydrogen gas is double the number of atoms in one mole of helium gas because hydrogen molecule is diatomic, i.e., a molecule of hydrogen consists of two atoms of hydrogen, whereas helium is monatomic.

84. Write three points of difference between an atom and a molecule.

or

What is the difference between an atom and a molecule?

Ans :

S. No.	Atom	Molecule
1.	Atom is the smallest particle of an element that takes part in a chemical reaction.	Smallest particle of an element or compound that can exist independently.
2.	An atom is usually not stable itself.	A molecule is usually stable itself.
3.	When similar atoms combine together in varying numbers, molecules of different properties can be formed. E.g. $\text{O}_2$ , $\text{O}_3$ .	When same molecules combine together in any numbers, a simple similar product is formed.

85. Define formula unit mass. Calculate formula unit mass of NaCl (atomic mass of Na = 23u, Cl = 35.5u).

Ans :

The formula unit mass is same as molecular mass which is equal to the sum of masses of atoms present in a formula unit. Formula unit mass of NaCl =  $(23 + 35.5) = 58.5$ u.

86. Calculate the mass of the following :

- (i) 2 moles of carbon dioxide.  
 (ii)  $6.022 \times 10^{23}$  molecules of carbon dioxide.

Ans :

- (i) Molar mass of  $\text{CO}_2 = 12 + 2 \times 16 \text{ g} = 44 \text{ g}$   
 1 mole of carbon dioxide = 44 g  
 2 mole of carbon dioxide =  $44 \text{ g} \times 2 = 88 \text{ g}$   
 (ii) Molar mass of  $\text{CO}_2 = 44 \text{ g}$   
 $= 6.022 \times 10^{23}$  molecules of carbon dioxide

87. Write the symbols of the following elements : Aluminium, Argon, Barium, Bromine, Beryllium, Calcium, Cobalt, Chlorine, Chromium, Helium, Lithium, Magnesium, Manganese, Neon, Nickel, Silicon, and Platinum.

Ans :

Element	Symbol	Element	Symbol
Aluminium	Al	Argon	Ar
Barium	Ba	Bromine	Br
Beryllium	Be	Calcium	Ca
Cobalt	Co	Chlorine	Cl
Chromium	Cr	Helium	He
Lithium	Li	Magnesium	Mg
Manganese	Mn	Neon	Ne

Nickel	Ni	Silicon	Si
Platinum	Pt		

88. Name the scientists whose experimentation established laws of chemical combination. Name the laws also.

Ans :

Antoine Laurent Lavoisier and Joseph L. Proust experimented and established two laws of chemical combination.

These laws are :

- Law of conservation of mass,
- Law of constant proportions.

89. Give two drawbacks of Dalton's atomic theory.

Ans :

Drawbacks of Dalton's atomic theory :

- According to modern theory, atom is not the ultimate indivisible particle of matter. Atoms are divisible, i.e., they are themselves made-up of particles (protons, electrons, neutrons, etc.).
- The assumption that the atoms of the same element have same mass does not hold good, in case of isotopes of an element.

90. Calculate molar mass of sulphuric acid.

Ans :

Formula of sulphuric acid =  $\text{H}_2\text{SO}_4$

$$\begin{aligned} \text{Molar mass of } \text{H}_2\text{SO}_4 &= 2 \times \text{mass of H} \\ &+ 1 \times \text{mass of S} + 4 \times \text{mass of O} \\ &= 2 \times 1 + 1 \times 32 + 4 \times 16 \\ &= 2 + 32 + 64 = 98 \text{ gmol}^{-1} \end{aligned}$$

91. Give the electronic configuration of : Al atom and its ion.

Ans :

Al atom and its ion

Al atom	K	L	M
	2	8	3
$\text{Al}^{3+}$	K	L	
	2	8	

92. Sunita calculated molecular mass of  $\text{S}_8$  molecule and reported it as 64u from the given atomic mass of 32u. But teacher considered her answer as wrong. What is the correct molecular mass of  $\text{S}_8$ ? Calculate the number of moles of  $\text{S}_8$  in 25.6 g of the sample.

Ans :

$$\begin{aligned} \text{Molecular mass of } \text{S}_8 &= 32 \times 8 = 256\text{u} \\ \text{Moles of } \text{S}_8 \text{ in } 25.6 \text{ g sample} &= \frac{25.6}{256} = 0.1 \text{ mole} \end{aligned}$$

## FIVE MARKS QUESTIONS

93. Glucose has the molecular formula  $\text{C}_6\text{H}_{12}\text{O}_6$ . Calculate

:

- Its molecular mass.
- The number of atoms in one molecule of glucose.
- The number of gram molecule in 18 g of glucose.

Ans :

- Molecular mass of  $\text{C}_6\text{H}_{12}\text{O}_6$   

$$= (6 \times 12\text{u}) + (12 \times 1\text{u}) + (6 \times 16\text{u})$$

$$= 72\text{u} + 12\text{u} + 96\text{u} = 180\text{u}$$
- The number of atoms in one molecule of  $\text{C}_6\text{H}_{12}\text{O}_6$   

$$= 6 \text{ atoms of C} + 12 \text{ atoms of H}$$

$$+ 6 \text{ atoms of O}$$

$$= 6 + 12 + 6 = 24 \text{ atoms}$$
- Number of gram molecules  

$$= \frac{\text{Mass of glucose (g)}}{\text{Molecular mass of glucose (g)}}$$

$$= \frac{18}{180} = 0.1$$

94. What is the mass of (i) 2.5 moles of  $\text{CO}_2$  and (ii) 1 mole of water?

Ans :

- 1 mole of  $\text{CO}_2$  = Molecular mass expressed in grams  

$$= 1 \times 44 \text{ g}$$
2.5 moles of  $\text{CO}_2$  =  $2.5 \times 44 = 110 \text{ g}$
- Mass of the substance = Moles of substance  

$$\times \text{Molecular mass in grams}$$
Mass of water =  $1 \times 18 \text{ g} = 18 \text{ g}$

95. Calculate the number of  $\text{H}_2\text{O}$  molecules in one drop of water having a mass of 0.05 g.

Ans :

$$\begin{aligned} \text{Number of moles of } \text{H}_2\text{O} \text{ in } 0.05 \text{ g of water} &= \frac{0.05 \text{ g}}{18 \text{ g}} \text{ (molar mass of water = 18)} \\ &= \frac{0.05 \text{ g} \times 6.022 \times 10^{23}}{18 \text{ g}} \\ &= 1.673 \times 10^{23} \text{ molecules} \end{aligned}$$

96. What is the mass percentage of different elements in calcium carbonate? (Atomic mass : Ca = 40, O = 16)

Ans :

Molecular mass of  $\text{CaCO}_3$  = At. Mass of Ca + At. Mass of C + 3  $\times$  At. Mass of O

$$= 40 + 12 + 3 \times 16 = 100$$

Mass percentage of Ca

$$= \frac{\text{Mass of element}}{\text{Mass of molecule}} \times 100$$

$$= \frac{40}{100} \times 100 = 40\%$$

$$\text{C} = \frac{12}{100} \times 100 = 12\%$$

$$\text{O} = \frac{16 \times 3}{100} \times 100 = 48\%$$

97. What is the use of mole concept?

Ans :

Applications of mole concept :

- (i) We can calculate the number of basic particles from the number of moles as the number of moles of a substance is directly proportional to the number of elementary particles.
- (ii) One mole of gas occupies 22.4 litres at 273K.
- (iii) One mole of any gas occupies the same volume at same pressure and temperature.
- (iv) One mole is equal to  $6.022 \times 10^{23}$  atoms. So, we can calculate the absolute masses of atoms and molecules.

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98. Define the term gram atom. How is it related to mole and Avogadro number?

Ans :

The atomic mass of an element expressed in grams is called gram atomic mass. One gram atom of any element contains  $6.022 \times 10^{23}$  atoms of the element. It is equal to one mole of atoms.

One gram atomic mass =  $6.022 \times 10^{23}$  atoms = 1 mole

99. Give symbol and valency of : Potassium, Barium, Aluminium, Calcium, Cobalt, Fluorine, Lead, Zinc, Iodine, Sulphide.

Ans :

Name of Ion	Symbol	Valency
Potassium	K <sup>+</sup>	+1
Barium	Ba <sup>2+</sup>	+2
Aluminium	Al <sup>3+</sup>	+3
Calcium	Ca <sup>2+</sup>	+2
Cobalt	Co <sup>2+</sup>	+2
Fluorine	F <sup>-</sup>	-1
Lead	Pb <sup>+</sup>	+1
Zinc	Zn <sup>2+</sup>	+2
Iodine	I <sup>-</sup>	-1
Sulphide	S <sup>2-</sup>	-2

100. Ca<sub>2</sub>P<sub>2</sub>O<sub>7</sub> is the formula of calcium pyrophosphate. Write the formula for ferric pyrophosphate.

Ans :

Valency of calcium is +2. Ca<sub>2</sub>P<sub>2</sub>O<sub>7</sub> has two calcium atoms. So, calcium have total of +4 charges. Thus, pyrophosphate has a valency of -4. Since ferric ion has a valency of +3, the formula of ferric pyrophosphate is Fe<sub>4</sub>(P<sub>2</sub>O<sub>7</sub>)<sub>3</sub>.

101. The mass of any single atom X is  $3.05 \times 10^{-22}$  g. What is its atomic weight? Name the possible element.

Ans :

$$1 \text{ mole} = \text{atomic mass} \\ = 6.022 \times 10^{23} \text{ atoms}$$

Now, mass of one atom of X =  $3.05 \times 10^{-22}$  g

Mass of  $6.022 \times 10^{23}$  atoms of X

$$= 3.05 \times 10^{-22} \times 6.022 \times 10^{23} \text{ g} \\ = 183.7 \text{ g}$$

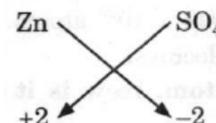
This element could be tungsten.

102. Write formula for the following :

- (a) Zinc sulphate,
- (b) Methane,
- (c) Ammonium carbonate.

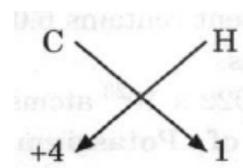
Ans :

- (a) Zinc sulphate



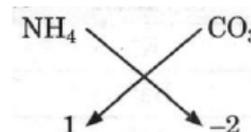
Thus, Zn<sub>2</sub>(SO<sub>4</sub>)<sub>2</sub> and finally = ZnSO<sub>4</sub>

- (b) Methane



Thus, finally = CH<sub>4</sub>

- (c) Ammonium carbonate



Thus, finally = (NH<sub>4</sub>)<sub>2</sub>CO<sub>3</sub>

103. 50 g of 10% lead nitrate is mixed with 50 g of 10% sodium chloride in a closed vessel. It was found after reaction that 6.83 g of lead chloride was precipitated. Besides, the reaction mixture contained 90 g water and sodium nitrate. Calculate the amount of sodium nitrate formed.

Ans :

$$50 \text{ g of } 10\% \text{ lead nitrate} = 5 \text{ g lead nitrate} \\ + 45 \text{ g water}$$

$$50 \text{ g of } 10\% \text{ sodium chloride} = 5 \text{ g sodium chloride} \\ + 45 \text{ g water}$$

Total content before reaction = 5 + 5 + 90 = 100

Total content after reaction = 90 g

Amount of precipitate = 6.83 g

According to law of conservation,

Total mass of reaction mixture = 100 g

Amount of sodium nitrate = 100 - 90 - 6.83 = 3.17 g

104. Explain the law of multiple proportions.

Ans :

According to law of multiple proportions, when two elements combine to make one or more compounds then the ratio of weights of these element remain in fixed ratio to one another. For example : Hydrogen and oxygen combine to form water (H<sub>2</sub>O) and hydrogen

peroxide ( $\text{H}_2\text{O}_2$ ) under different condition. 2 grams of hydrogen combines with 16 grams of oxygen in case of water while 2 grams of hydrogen combines with 32 grams of oxygen to form hydrogen peroxide. Now, the weights of oxygen combine with a fixed weight of hydrogen in water and hydrogen peroxide respectively are 16 and 32 which are in simple ratio of 16: 32 or 1 : 2.

**105.** Explain the form of atoms in a solid.

**Ans :**

A solid element is a cluster of atoms. The property of solid does not depend on a single atom but on cluster of atoms. For example : Diamond and graphite though both are composed of carbon atoms but due to different arrangements of carbon atoms in these. They are different in physical and chemical properties.

**106.** What are molecules? Give brief explanation of the arrangement of the constituent atoms in the molecules.

**Ans :**

A molecule is the smallest particle of an element or compound which is stable in normal conditions. And it can freely show all the properties of that element or compound. It may be made up of one, two or more atoms. Molecule with one atom called monoatomic. E.g. helium, neon, etc.

Molecule with two atoms called diatomic. E.g.  $\text{Cl}_2$ ,  $\text{O}_2$ . Similarly, there are molecules containing three atoms ( $\text{CO}_2$ ), four atoms ( $\text{P}_4$ ) and so on.

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**107.** The mass of one molecule of a substance is  $4.65 \times 10^{23}$  grams. What is its molecular mass?

**Ans :**

Mass of 1 molecule of a substance =  $4.65 \times 10^{23}$  grams  
 Mass of  $6.023 \times 10^{23}$  molecules of a substance  

$$= 4.65 \times 10^{23} \times 6.023 \times 10^{-23}$$

$$= 28 \text{ g}$$
 Molecular mass of the substance = 28 g

**108.** Chlorine occurs in nature in two isotopic forms with masses 35u and 37u in the ratio of 3 : 1. What should be the mass of chlorine atom?

**Ans :**

$$35 \times \frac{75}{100} + 37 \times \frac{25}{100} = \frac{105}{4} + \frac{37}{4}$$

$$= \frac{142}{4} = 35.5\text{u}$$

**109.** An element  ${}_{12}\text{X}^{24}$  loses two electron to form a cation which combines with the anion of element  ${}_{17}\text{Y}^{35}$  formed by gaining an electron.

- Write the electronic configuration of element X.
- Write the electronic configuration of the anion of element Y.
- Write the formula for the compound formed by combination of X and Y.

**Ans :**

- X = 2, 8, 2
- $\text{Y}^-$  = 2, 8, 8
- $\text{XY}_2$

**110.** Calculate the formula unit masses of  $\text{ZnO}$ ,  $\text{Na}_2\text{O}$ ,  $\text{K}_2\text{CO}_3$  given atomic masses of Zn = 65u, Na = 23u, K = 39u, C = 12u, and O = 16u.

**Ans :**

$$\begin{aligned} \text{Formula unit mass of ZnO} &= 1 \times 65\text{u} + 1 \times 16\text{u} \\ &= 81\text{u} \end{aligned}$$

$$\begin{aligned} \text{Formula unit mass of Na}_2\text{O} &= 2 \times 23\text{u} + 1 \times 16\text{u} \\ &= 62\text{u} \end{aligned}$$

$$\begin{aligned} \text{Formula unit mass of K}_2\text{CO}_3 &= 2 \times 39\text{u} + 1 \times 12\text{u} + 3 \times 16\text{u} \\ &= 138\text{u} \end{aligned}$$

**111.** If one mole of carbon atoms weighs 12 grams, what is the mass (in gram) of 1 atom of carbon?

**Ans :**

$$1 \text{ mole of carbon weighs} = 12 \text{ g}$$

$$\begin{aligned} 1 \text{ atom of carbon weighs} &= \frac{12}{6.022 \times 10^{23}} \\ &= 1.99 \times 10^{-23} \text{ g} \end{aligned}$$

**112.** What is the mass of :

- 1 mole of nitrogen atoms?
- 4 moles of aluminium atoms (atomic mass of aluminium = 27)?
- 10 moles of sodium sulphite ( $\text{Na}_2\text{SO}_3$ )?

**Ans :**

- 1 mole of nitrogen atoms  
 $= 1 \times \text{gram atomic mass of nitrogen atom}$   
 $= 1 \times 14 \text{ g} = 14 \text{ g}$
- 4 moles of aluminium atoms  
 $= 4 \times \text{gram atomic mass of aluminium atoms}$   
 $= 4 \times 27 \text{ g} = 108 \text{ g}$
- 10 moles of sodium sulphite ( $\text{Na}_2\text{SO}_3$ )  
 $= 10 (2 \times \text{gram atomic mass of Na}$   
 $\quad + 1 \times \text{gram atomic mass of sulphur}$   
 $\quad + 3 \times \text{gram atomic mass of oxygen})$   
 $= 10 (2 \times 23 \text{ g} + 1 \times 32 \text{ g} + 3 \times 16\text{g})$   
 $= 10 (46 \text{ g} + 32 \text{ g} + 48 \text{ g})$   
 $= 10 \times 126 \text{ g} = 1260 \text{ g}$

**113.** Give the postulates of Dalton's atomic theory.

**Ans :**

Every element is composed of extremely small particles called atoms. Atoms of a given element are identical, both in mass and properties. Different chemical elements have different kinds of atoms; in particular, their atoms have different masses.

Atoms cannot be created, destroyed or transformed into atoms of other elements. Compounds are formed when atoms of different elements combine with each

other in small whole number ratios. The relative number and kinds of atoms in a given compound are constant.

- 114.(a) Give one point of difference between an atom and an ion.  
 (b) Give one example each of a polyatomic cation and an anion.  
 (c) Identify the correct chemical name of  $\text{FeSO}_3$  : Ferrous sulphate, Ferrous sulphide, Ferrous sulphite.  
 (d) Write the chemical formula for the chloride of magnesium.

Ans :

- (a) An atom is electrically neutral while an ion is electrically charged particle.  
 (b) (i) Polyatomic cation :  $(\text{NH}_4)^+$   
 (ii) Polyatomic anion :  $(\text{SO}_4)^{2-}$   
 (c) Ferrous sulphite  
 (d)  $\text{MgCl}_2$  (Magnesium chloride)

- 115.Q. 115. When 3.0 g of magnesium is burnt in 2.00 g of oxygen, 5.00 g of magnesium oxide is produced. What mass of magnesium oxide will be formed when 3.00 g of magnesium is burnt in 5.00 g of oxygen? Which law of chemical combination will govern your answer? State the law.

Ans :

When 3.0 g of magnesium is burnt in 2.00 g of oxygen, 5.00 g of magnesium oxide is produced. It means magnesium and oxygen are combined in the ratio of 3 : 2 to form magnesium oxide.

Thus, when 3.00 g of magnesium is burnt in 5.00 g of oxygen, 5.00 g of magnesium oxide will be formed and the remaining oxygen will be left unused. It is governed by law of definite proportions.

It states that in a chemical substance, the elements are always present in definite proportions by mass.

- 116.A sample of ethane ( $\text{C}_2\text{H}_6$ ) gas has the same mass as  $1.5 \times 10^{20}$  molecules of methane ( $\text{CH}_4$ ). How many ( $\text{C}_2\text{H}_6$ ) molecules does the sample of gas contain?

Ans :

$$\text{Mass of 1 molecule of } \text{CH}_4 = \frac{16}{N_A} \text{ g}$$

$$\begin{aligned} \text{Mass of } 1.5 \times 10^{20} \text{ molecule of } \text{CH}_4 \\ = 1.5 \times 10^{20} \times \frac{16}{N_A} \text{ g} \end{aligned}$$

$$\text{Mass of 1 molecule of } \text{C}_2\text{H}_6 = \frac{30}{N_A} \text{ g}$$

$$\begin{aligned} \text{Mass of } 1.5 \times 10^{20} \text{ molecule of } \text{C}_2\text{H}_6 \\ = 1.5 \times 10^{20} \times \frac{16}{N_A} \text{ g} \end{aligned}$$

$$\begin{aligned} \text{Mass of } 1.5 \times 10^{20} \text{ molecule of ethane} \\ = 1.5 \times 10^{20} \times \frac{16}{N_A} \times \frac{N_A}{30} \\ = 0.8 \times 10^{20} \end{aligned}$$

- 117.(a) Calculate the number of molecules of  $\text{SO}_2$  present

in 44 g of it.

- (b) If one mole of oxygen atoms weighs 16 grams, find the mass of one atom of oxygen in grams.

Ans :

- (a) Molecular mass of  $\text{SO}_2$  = Atomic mass of S  
 + 2 × Atomic mass of O  
 = 32 + 2 × 16 = 64u  
 Molar mass = 64 g

Number of molecules, N

$$\begin{aligned} &= \text{Given mass} \times \frac{\text{Avogadro's number}}{\text{Molar mass}} \\ &= \frac{44}{64} \times 6.022 \times 10^{23} \end{aligned}$$

$$= 4.14 \times 10^{23} \text{ molecules}$$

- (b) One mole of oxygen contains  $6.022 \times 10^{23}$  atoms of oxygen

$$\begin{aligned} \text{Mass of one atom of oxygen} &= \frac{16}{6.022 \times 10^{23} \text{ g}} \\ &= 2.66 \times 10^{-23} \text{ g} \end{aligned}$$

- 118.Sodium is represented as  $^{23}\text{Na}_{11}$ .

- (a) What is its atomic mass?  
 (b) Write its gram atomic mass.  
 (c) How many atoms of Na will be there in 11.5 g of the sample?

Ans :

- (a) Atomic mass = 23u  
 (b) Gram atomic mass = 23 g  
 (c) Given mass = 11.5 g  
 Molar mass = 23 g  
 Number of atoms (N)

$$\begin{aligned} &= \text{Given mass} \times \frac{\text{Avogadro's number}}{\text{Molar mass}} \\ &= \frac{11.5 \times 6.022 \times 10^{23}}{23} \\ &= 3.011 \times 10^{23} \text{ atoms} \end{aligned}$$

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