# 4. Measurement of Matter

## Extra Questions

Give examples of following-

Q.1 Positive radicals –

1) $Na^{+}$, 2) $Fe^{2+}$ 3) $NH_4^{+}$, 4) $K^{+}$,
5) $Ca^{2+}$, 6) $Al3^{+}$, 7) $Cu^{2+}$, 8) ($Ag^{+}$)

Q.2 Basic radicals –

1) $Na^{+}$, 2) $K^{+}$, 3) $Ca^{2+}$,
4) $NH_4^{+}$, 5) $Al^{3+}$, 6) $Fe^{2+}$, 7) $Ag^{+}$

Q.3 Composite radicals –

1) $NO_3^{-}$, 2) $SO_4^{2-}$, 3) $ClO_3^{-}$,
4) $NH_4^{+}$, 5) $PO_4^{+}$, 6) $CO_3^{2-}$

Q.4 Metals with variable valency -

1) Iron (Fe), 2) Copper $(Cu)^3$
3) Lead (Pb), 4) Tin (Sn)

Q.5 Bivalent Acidic radicals –

1) $S^{2-}$, 2) $O^{2-}$, 3) $CO^{2-}_3$, 4) $SO^{2-}_4$,
5) $CrO^{2-}_4$, 6) $Cu^{2+}$, 7) $Ca^{2+}$

Q.6 Trivalent basic radicals –

1) $Al^{3+}$, 2) $Fe^{3+}$, 3) $Cr^{3+}$,
4) $Au^{3+}$, 5) $Ga^{3+}$

Q.7 Write the symbols of following elements and the radicals obtained from them and indicate the charge on radicals.

Ans.-

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| Sr No. | Element | Symbol | Radicals obtained | Charge on the Radical |
|---|---|---|---|---|
| 1) | Mercury | Hg | $Hg^{2+}$ | $2^{+}$ |
| | | | Hg | $1^{+}$ |
| 2) | Potassium | K | $K^{+}$ | $1^{+}$ |
| 3) | Nitrogen | N | $N^{3-}$ | $3^{-}$ |
| 4) | Copper | Cu | $Cu^{+}$ | $1^{+}$ |
| | | | $Cu^{2+}$ | $2^{+}$ |
| 5) | Sulphur | S | $S^{2-}$ | $2^{-}$ |
| 6) | Carbon | C | $C^{4-}$ | $4^{-}$ |
| 7) | Chlorine | Cl | $Cl^{-}$ | $1^{-}$ |
| 8) | Oxygen | O | $O^{2-}$ | $2^{-}$ |

Q 8) Write the steps in deducing the chemical formulae of the following compounds.

Ans.- Firstly, it is important to know the symbols and valency of various radicals. Secondly, we need to follow a specific procedure, while writing the molecular formulae.

The procedure is as follows,

I) Write down the symbols of the radicals. II) The basic radicals are to be written towards left and acidic radicals on the right.

III) Now, write the valency of the radicals below it.

IV) Now, cross multiply the valency number and radicals indicate it using arrows.

V) Now, write down the chemical formulae of the compound.

Sodium Sulphate - Let us follow the above given procedure to find the chemical formulae.

i) Write the symbols of basic radicals to left

Na $SO_4$

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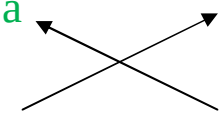
ii) Write valency of the radical.

Na $SO_4$

1 2

iii) Now cross multiply the valency number and radicals.

Na $SO_4$



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The chemical formulae formed $Na_2SO_4$

Q.9 Write the steps in deducing the chemical formulae of the following compounds.

Potassium Nitrate- Let us follow the above given procedure to find the chemical formulae.

1) Write the symbols of basic radicals to left.

K NO3

2) Write the valency of the radical.

K NO3

1 1

3) Now, cross multiply the valency number and radicals.

K NO3

1 1

The chemical formula KNO3

Q10 Write the steps in deducing the chemical formulae of the following compounds.

Ans.-Ferric Phosphate- Let us follow the above given procedure to find the chemical formulae.

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1) Write the symbols of basic radicals to left.

Fe $Po_4$

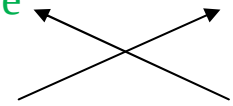
2) Write the valency of the radical

Fe $PO_4$

3 3

3) Now, cross multiply the valency number and radicals.

Fe $PO_4$



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The chemical formulae $FePO_4$

Q11. Write the steps in deducing the chemical formulae of the following compounds.

Calcium Oxide - Let us follow the above given procedure to find the chemical formulae.

1) Write the symbols of basic radicals to left.

Ca O

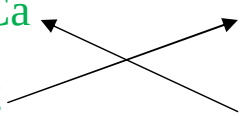
2) Write the valency of the radical.

Ca O

2 2

3) Now, cross multiply the valency number and radicals

Ca O



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The chemical formulae - CaO

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Q.12 Write the steps in deducing the chemical formulae of the following compounds.

Aluminium Hydroxide- Let us follow the above given procedure to find the chemical formulae.

1) Write the symbols of basic radicals to left

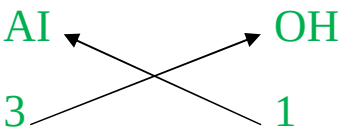
AI OH

2) Write the valency of the radical

AI OH

3 1

3) Now, cross multiply the valency number and radical.




The chemical formulae $AI(OH)_3$

Q.13 Write the answers to following questions and explain.

a. Explain how the element sodium is monovalent.

Ans. 1) The valency is decided by the number of electrons, an atom accepts to complete the octet of electrons. In its outermost shell to complete the octet, and get a stable stat.

2) Sodium's atomic number is 11.

3) It's electronic configuration is (2,8,1)

4) Sodium donates 1 electron during the chemical reaction, completes its octet state, and becomes stable Hence the configuration becomes (2,8)

5) Due to loss of an electron, leads to the formation of sodium ion ($Na^+$) with a positive charge.

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6) After the exchange of electrons, the electronic configuration of both ions. Complete octet state hence, the element sodium is monovalent.

b. M is a bivalent metal. Write down the steps to find the chemical formulae of its compounds formed with radicals, sulphate and phosphate.

Ans. We need to follow a procedure to find out the chemical formulae of its compounds formed with the radicals, sulphate and phosphate. M is a bivalent metal.

1) Compound of 'M' metal with radical sulphate.

Step 1 - Write the symbols of the radicals-

Write basic radicals to the left side and acidic towards the right.

M $SO_4$

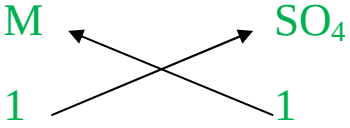
Step 2 - Write the valency below the respective radical

| Symbol | M | $SO_4$ |
|---|---|---|
| Valency | 2 | 2 |

Now divide the valency by common factor.

| M | $SO_4$ |
|---|---|
| 1 | 1 |

Step 3 - Cross multiply the valencies




Step 4 - The chemical formula formed, will be

$MSO_4$

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II) Compound of metal 'M' with radical phosphate.

Step 1 - Write the symbols of the radicals.

Write basic radicals to the left side and acidic towards the right.

M $PO_4$

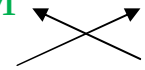
Step 2 - Write the valency below the respective radical.

| Symbol | M | $PO_4$ |
|---|---|---|
| Valency | 2 | 3 |

Step 3 - Cross multiply the valencies

M $PO_4$

2 3



Step 4 - The chemical formula formed, will be.

$M_3(PO_4)_2$

Q.15 Explain the need for a reference atom for atomic mass give some information about two reference atoms

Ans. 1) The size of an atom is extremely small. Since an atom is very tiny it becomes difficult to measure the atomic mass accurately. The mass of an atom is in nucleus and is due to protons (p) and neutrons (n). The concept of the relative mass was introduced. A reference atom is required to express the relative mass of an atom.

2) The initial reference atom is hydrogen - The Hydrogen atom (H) was lightest and was considered as the reference atom in olden days. The relative mass of hydrogen atomic mass is 1, 1 proton in nucleus. Hence the magnitude of the relative atomic masses of various atoms becomes equal to the atomic mass number. i.e sum of the number of protons and neutrons.

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3) The relative atomic masses, of elements were fractional. Thus carbon was selected as a reference atom.

4) Carbon C atom- 1) The relative mass of carbon atom is 12. The relative atomic mass of a hydrogen atom is the average mass of an atom of hydrogen as compared to $1/12^{th}$, the mass of carbon atom and this value is equal to 1.

2) The relative atomic mass of 1 hydrogen (H) atom compared to the carbon (C) atom becomes $12 \times \frac{1}{2}$ i.e '1'.

Q.16 What is meant by 'Unified Atomic Mass'.

Ans. 1) Recently, highly accurate methods are present for measuring the mass of an atom in earlier times, the relative mass of an atom were used to measure the mass of an atom.

2) Instead of relative mass, we can find the atomic masses in kg.

3) 'Unified Mass' is now considered, as unit of atomic mass.

4) Unified atomic mass, is the unit of atomic mass the unified atomic mass Dalton is accepted.

5) Its symbol is 'u'. $1u = 1.66053904 \times 10^{-27}$ kg.

Q.17 Explain with example, what is meant by a 'mole' of a substance.

Ans. The mole of a substance is, the mass in grams, which is equal to magnitude to the molecular mass of a substance in Daltons. The SI unit is mole. Few examples –

a) The atomic mass of oxygen atom (O) is 16u. The molecular mass of oxygen molecule ($O_2$) is $16 \times 2 = 32u$. 32g of oxygen is 1 mole of oxygen.

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b) The molecular mass of carbon dioxide is 44u. 44g of carbon dioxide is 1 mole of carbon. c) The molecular mass of $H_2O$ is 18u.18g $H_2O$ is 1 mole of water.

Number of moles of a substances (n)= $\frac{\text{Mass of substqance in grams}}{\text{Molecular mass of substance}}$

Q.18 Write the names of the following compounds and deduce their molecular masses.
($Na_2SO_4$, $K_2CO_3$, $CO_2$, $MgCl_2$, NaOH, $AIPO_4$, $NaHCO_3$ )
Ans.- Let us consider the atomic masses
Atomic masses H(1), O(16), N(14), C(12), K(39), S(32), Ca(40), Na(23), Mg(24), AI(27), Cl(35.5)
1) $Na_2SO_4$ – Sodium Sulphate.-

| Molecule | Name of the compound | Constituent elements | Atomic Mass (u) |
|---|---|---|---|
| $Na_2SO_4$ | Sodium Sulphate | Sodium | 23 |
| | | Sulphur | 32 |
| | | Oxygen | 16 |

| Number of atoms in the molecule | Atomic mass × Number of atoms | Mass of the Constituents (u) |
|---|---|---|
| 2 | 23 × 2 | 46 |
| 1 | 32 × 1 | 32 |
| 4 | 16 × 4 | 64 |

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Molecular mass of $Na_2SO_4$ = Sum of Constituent atomic masses= (Atomic mass of Na) × 2 + (Atomic mass of S) × 1 + (Atomic mass of 0) × 4 = 46 + 32 + 64 = 142u

Molecular mass of $Na_2SO_4$ is 142u.

2) $K_2CO_3$ – Potassium carbonate -

| Molecule | Name of the compound | Constituent Elements | Atomic mass (u) |
|---|---|---|---|
| $K_2CO_3$ | Potassium carbonate | Potassium | 39 |
| | | Carbon | 12 |
| | | Oxygen | 16 |

| Number of atoms in the molecule | Atomic mass × Number of atoms | Mass of the constituents (u) |
|---|---|---|
| 2 | 39 × 12 | 78 |
| 1 | 12 × 1 | 12 |
| 3 | 16 × 3 | 48 |

Molecular mass of $K_2CO_3$ = Sum of Constituent atomic masses= (Atomic mass of K) × 2 + (Atomic mass of C) × 1 + (Atomic mass of O) × 3

= 78+12+48=138u

Molecular mass $K_2CO_3$ = 138u

3) $CO_2$ – Carbon – dioxide

| Molecule | Name of the compound | Constituent Elements | Atomic mass (u) |
|---|---|---|---|
| $CO_2$ | Carbon dioxide | Carbon | 12 |
| | | Oxygen | 16 |

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| Number of atoms in molecule | Atomic mass × Number of atoms | Mass of the constituents (u) |
|---|---|---|
| 1 | 12 × 1 | 12 |
| 2 | 16 × 2 | 32 |

Molecular mass of $CO_2$ =Sum of constituent atomic masses,
= (Atomic mass of C) × 1 + (Atomic mass of O) × 2
= 12+32=44u.
Molecular mass of $CO_2$=44u

4) $MgCl_2$

| Molecule | Name of the compound | Constituent Elements | Atomic masse (u) |
|---|---|---|---|
| $MgCl_2$ | Magnesium Chloride | Magnesium | 24 |

| Number of atoms | Atomic × No. of atoms | Mass of the constituents |
|---|---|---|
| 1 | 24 × 1 | 24 |
| 2 | 35.5 × 2 | 71 |
| | Chlorine | 35.5 |

Molecular mass of $MgCl_2$ = Sum of constituent atomic masses
= (Atomic mass of Mg) × 1 + (Atomic mass of Cl) × 2
= 24 +71
= 95u Molecular mass of $MgCl_2$

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## 5) NaOH – Sodium Hydroxide

| Molecule | Name of the compound | Constituent Elements | Atomic mass (u) |
|---|---|---|---|
| NaOH | Sodium Hydroxide | Sodium | 23 |
| | | Oxygen | 16 |
| | | Hydrogen | 1 |

| Number of atoms in molecule | Atomic mass × Number of atoms | Mass of the constituents (u) |
|---|---|---|
| 1 | 23 × 1 | 23 |
| 1 | 16 × 1 | 16 |
| 1 | 1 × 1 | 1 |

Molecular mass of NaOH = Sum of constituent atomic masses
= ( Atomic mass of Na) × 1+ (Atomic mass of O) × 1 + (Atomic mass of H) × 1
= 23 + 16 + 1
= 40u
Molecular mass of NaOH = 40u

## 6) $AlPO_4$ – Aluminium Phosphate

| Molecule | Name of compound | Constituent Elements | Atomic mass (u) |
|---|---|---|---|
| $AlPO_4$ | Aluminium Phosphate | Aluminium | 27 |
| | | Phosphate | 31 |
| | | Oxygen | 16 |

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| Number of atoms in molecule | Atomic mass × Number of atoms | Mass of the constituents |
|---|---|---|
| 1 | 27 × 1 | 27 |
| 1 | 31 × 1 | 31 |
| 4 | 16 × 4 | 64 |

Molecular mass of $AlPO_4$ = Sum of constituent atomic masses.

= (Atomic mass of Na) × 1 + (Atomic mass of O) × 4

= 27 + 31 + 64

Molecular mass of $AlPO_4$ is 122u

7) $NaHCO_3$ – Sodium – Bicarbonate

| Molecule | Name of the compound | Constituent Elements | Atomic mass (u) |
|---|---|---|---|
| $NaHCO_3$ | Sodium bi carbonate | Sodium | 23 |
| | | Hydrogen | 1 |
| | | Carbon | 12 |
| | | Oxygen | 16 |

| Number of atoms in molecule | Atomic mass × Number of atoms | Mass of the constituents |
|---|---|---|
| 1 | 23 × 1 | 23 |
| 1 | 1 × 1 | 1 |
| 1 | 12 × 1 | 12 |
| 3 | 16 × 3 | 48 |

Molecular mass of $NaHCO_3$ = Sum of constituent atomic masses

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= (Atomic mass of Na) × 1 + (Atomic mass of H) × 1 + ( Atomic mass of C) × 1 + (Atomic mass of O) × 3
= 23 + 1 + 12 + 48 = 84u
Molecular mass of $NaHCO_3$ is 84u.

Q. 19 Two samples ‘m’ and ‘n’ of stacked lime were obtained from two different reactions. The details about their composition are as follows-
‘Sample m’ mass : 7g, Mass of constituent oxygen : 2g
Mass of constituent calcium: 5g, ‘Sample n’ mass : 1.4g
Mass of constituent oxygen : 0.4g, Mass of constituent calcium : 1.0g
Ans 1) The proportion by weight of constituent elements that are in quick lime will be from molecular formula CaO. The proportion by weight of the constituents elements Ca and O, in the compound CaO is 40:16 The atomic mass of Ca is 40 and O is 16 which will be 5:2.
The sample ‘m’ of CaO = 5g
Mass of the given sample = 7g
7g of calcium oxide contains 5g of calcium (Ca) and 2g of oxygen (0)
Mass of Ca + mass of O = 5g + 2g = 7g
7g of slacked lime is formed by chemical combination of 5g of ca and 2g of O.
2) In sample ‘n’ of CaO mass of given sample
CaO = 1.4g from 1.4g of sample ‘n’, 1g of Ca and 0.49 of oxygen were obtained, that means in sample n, elements Ca and O are in proportion 1 : 0 by weight .
Mass of constituent Ca in sample ‘n’ = 1.0g,

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Mass of constituent O in Sample 'n' = 0.4g

3) Mass of Ca:Mass of O

= 1 : 04 = 1 × 5:0.4 × 5 = 5.2

4) Mass of Ca + Mass of O =1g+0.4g = 1.4g

1.4g slaked lime is formed by combination of 1g of Ca and 0.4g of O, ratios of masses of Ca and O are constant. The proportion by weight of the constituent elements in different samples of a compound is always constant. Hence in samples of calcium oxide (CaO) is constant.

5) The law of constant proportion is verified as – the value of proportion by weight of the constituent elements matched with the expected proportion, calculated by the molecular mass.

Q. 20 Deduce the number of molecules of following compound in the given quantities.

32g oxygen, 90g water, 8.8g, carbon di oxide, 7.1g chlorine

1) Mass of ($O_2$) m = 32g.

Molecular mass of oxygen ($O_2$) M = 16 × 2=32

(Atomic mass of 0) × 2 = 16 × 2

∴ Number of moles in the given $O_2$ (n)

$$= \frac{\text{Mass of O2 in grams (m)}}{\text{Molecular mass of O2 (M)}} = \frac{32}{32} = 1$$

∴ n=1 mol.

2) Mass of ($H_2O$) M = 90g

Molecular mass of ($H_2O$) M

= (Atomic mass of H) × 2 + (Atomic mass of O) × 1

= 1 × 2 + 16

= 18

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Molecular mass of ($H_2O$) M =18

∴ No. of moles in the given $H_2O$ (n)

$$= \frac{\text{Mass of H2O in grams (m)}}{\text{Molecular mass of H2O (M)}} = \frac{90}{18} = 5$$

∴ n= 5mol.

3) 8.8g carbon dioxide.

Mass of carbon dioxide ($CO_2$)m=8.8g

Molecular mass of $CO_2$(M) = (Atomic mass of C) × 1 + (Atomic mass of O) × 2

∴ Molecular mass of ($CO_2$) M= 12 × 1 + 16 × 2

= 12 + 32

= 44

∴ Molecular mass of ($CO_2$) M = 44

$$\therefore \frac{\text{Mass of CO2 in grams}}{\text{Molecular mass of CO2 (M)}}$$

$$= \frac{8.8}{44} = 0.2$$

∴ n = 0.2

4) 7.1g chlorine

Mass of chlorine ($Cl_2$)m=7.1g

Molecular mass of chlorine ($Cl_2$) M = 35.5 ×2 = 71

As, Atomic mass of Cl = 35.5

$$\therefore \frac{\text{Mass of Cl2 in grams(m)}}{\text{Molecular mass of Cl2 (M)}} = \frac{7.1}{71} = 0.1$$

N = 0.1mol.

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Q.21 If 0.2 mol of the following substances are required how many grams of those substances should be taken?
Sodium chloride, Magnesium oxide, calcium carbonate.

Ans. I) Sodium chloride – NaCl

Molecular mass of NaCl = (Atomic mass of Na) × 1 + (Atomic mass of Cl) × 1

= 23 + 35.5 × 1

= 23 + 35.5 = 58.5u

$$\text{No. of moles (n)} = \frac{\text{Mass of substances in grams}}{\text{Molecular mass of substance}}$$

$$\therefore 0.2 = \frac{\text{Mass of substances in grams}}{58.5}$$

∴ Mass of NaCl = 0.2 × 58.5=11.7g

II) Magnesium oxide – MgO

Molecular mass of MgO = (Atomic mass of Mg) × 1 + (Atomic mass of O) × 1

= 24 × 1 + 16 × 1

= 24 + 16

= 40u

$$\therefore \text{No. of moles (n)} = \frac{\text{Mass of substances in grams}}{\text{Molecular mass of substance}}$$

$$\therefore 0.2 = \frac{\text{Mass of substances in grams}}{40}$$

∴ Mass of MgO = 0.2 × 40 =8g.

3) Calcium Carbonate $CaCo_3$

Molecular mass of $CaCo_3$ = (Atomic mass of Ca) × 1 + (Atomic mass of C) × 1 + (Atomic mass of O) × 3

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$= 40 \times 1 + 12 \times 1 + 16 \times 3$

$= 40 + 12 + 48$

$= 100u$

$\therefore$ Number of moles (n) = $\frac{\text{Mass of substances in grams}}{\text{Molecular mass of substance}}$

$\therefore 0.2 = \frac{\text{Mass of substances in grams}}{100}$

$\therefore$ Mass of $CaCo_3 = 0.2 \times 100$

$= 20g$

Q. 22 How are the compound formed?

Ans. Compounds are formed when atoms of different elements combine by a chemical reaction.

Q. 23 State the law of conservation of matter.

Ans. In a chemical reaction, the total weight of the reactants is same as the total weight of the product formed due to the chemical reactions.

Q. 24 What are the products obtained when copper oxide is treated with hydrogen gas?

Ans. The product obtained when copper oxide is treated with hydrogen gas are water and element copper.

Q. 25 Define valency.

Ans.- The capacity of an element to combine is called its valency.

Q. 26 Determine the valences of H, Cl, O and Na from the molecular formulae $H_2$, HCl, $H_2O$ and NaCl.

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Ans.- Valency is the number of chemical bonds formed by one atom of an element with other atoms.
Valency of H in $H_2$ is 1.
Valency of Cl in HCl is 1.
Valency of O in $H_2O$ is 2.
Valency of Na in NaCl is 1.

Q. 27 Write down the symbols of the elements you know.

Ans.

| Element | Symbol |
|---|---|
| Hydrogen | H |
| Carbon | C |
| Oxygen | O |
| Calcium | Ca |

Q. 28 The valency of chlorine (Cl) is one.
Ans.- i) The electronic configuration of chlorine (Cl) is (2,8,7). It has 7 electrons is its $3^{rd}$ orbit.
ii) It tends to take one electron from another atom so that it has 8 electrons in the outermost orbit with electronic configuration (2,8,8) with stable state.
iii) The gaining of one electron leads to formation of chloride ion ($Cl^-$) which is negatively charged as it has gained one electron.

Q. 29 What is the type of chemical bond in NaCl and $MgCl_2$?
Ans.- The type of chemical bond in NaCl and $MgCl_2$ is ionic bond.

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Q. 30 Explain the term : Variable Valency?

Ans.- some elements give away or take up different numbers of electrons and thus, show more than one valency, this property of elements is called variable valency.

E.g. i) Iron exhibit variable valences 2 and 3.

Q. 31 What is difference between acidic radical and basic radical?

Ans.- Anion carrying negative charge is called acidic radical while cation carrying positive charge is called basic radical.

Q. 32 Give reasons : Potassium atom is bigger than sodium atom.

Ans.- 1) Electronic configuration of sodium (Na) is (2,8,1) while that of potassium (k) is (2,8,8,1).

ii) The size of an atom increases as the number of electron orbits increases. Hence potassium atom is bigger than sodium atom.

Q. 33 What is meant by unified Atomic Mass?

Ans.- Unified Atomic Mass is the unit of atomic mass. It is called Dalton. It is denoted by the symbol ‘u’.

$1\ u = 1.66053 \times 10^{-27}\ kg$

Q. 34 What is meant by a mole of a substance? Give an example.

Ans.- A mole is that quantity of a substance whose mass in grams is equal in magnitude to the molecular mass of that substance is in Dalton. Its SI unit is mol.

E.g. The molecular mass of oxygen (O2) is 32 u. Hence 32 g of oxygen is 1 mole of oxygen.

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Q. 35 What is Avogadro's number?

Ans.- The number of molecules present in 1 mole of any substance is a fixed number. It is called Avogadro's number. Avogadro's number is $6.022 \times 10^{23}$.

Q, 36 Distinguish between the following -

Basic radicals and acidic radicals

Ans.-

| Basic radicals | Acidic radicals |
|---|---|
| 1) They are positively charged (cations). | 1) They are negatively charged (anions). |
| 2) Basic radicals are formed by removal of electrons from atoms of metals.<br>E.g. $Na^{+}, Cu^{2+}$<br>Exception - $NH_4^{+}$. | 2) Acidic radicals are formed by adding electrons to the atoms of non – metals.<br>E.g. $Cl^{-}, S^{2-}$<br>Exception - $MnO_4^{-}$ |

Q. 37 Name two elements having independent existence.

Ans.- Elements such as helium and neon have independent existence.

Q. 38 Define - mole.

Ans.- A mole is that quantity of a substance whose mass in grams is equal in magnitude to the molecular mass of that substance in Daltons. The SI unit is mol.

Q. 39 Define – Radicals.

Ans.- A cation (Positively charged ion) and anion (negatively charged ion) are two constituents of compounds that take part

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independently in chemical reactions, and are therefore, called radicals.

Q. 40 Name the modern instruments that have the capacity to show enlarged images of an atom.
Ans.- Electron microscope, field ion microscope, scanning tunneling microscope, etc. are the modern instruments that have the capacity to show enlarged images of an atom.

Q. 41 Give reason – the valency of neon is zero. Neon is a chemically inert element.
Ans.- 1) The number of electrons that an atom of an element gives or takes to make the outermost orbit stable determines the valency of of that element.
2) The electronic configuration of neon is 2,8 thus its outermost orbit, viz the second orbit is stable. Neon is stable. It need not take or give or shares any electrons. Hence its valency is zero and it is chemically inert.

Q. 42 Following are atomic masses of a few elements in Daltons and the molecular formulae of some compounds. Deduce the molecular masses of those compounds.
Molecular formulae – NaCl, $MgCl_2$, $KNO_3$, $H_2O_2$, $AlCl_3$, $Ca(OH)_2$, MgO, $H_2SO_4$, $HNO_3$, NaOH.
(Atomic masses – H = 1, O = 16, N = 14, C = 12, Na = 23, Cl = 35.5, K = 39, Mg = 24, Al = 27, Ca = 40, P = 31, S = 32)
Ans.- 1) NaCl (Sodium Chloride) –

| Molecule | Constituent elements | Atomic masses (u) | Number of atoms in the molecule | Atomic mass × number of atoms | Mass of the constituent |
|---|---|---|---|---|---|
| Sodium | Na | 23 | 1 | 23 × 1 | 23 |

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| | | | | | |
|---|---|---|---|---|---|
| chloride (NaCl) | Sodium | | | | |
| | Cl Chlorine | 36.5 | 1 | 35.5 | 35.5 |

Molecular mass = sum of constituent atomic masses

Molecular mass of NaCl = (Atomic mass of Na) × 1 +
(Atomic mass of Cl) × 1

= (23 × 1) + (35.5) × 1 = 58.5 u

Molecular mass of NaCl = 58.5 u.

Q. 43 Calculate the following.

a) The number of atoms of 2.5 moles of sodium

Ans.- 1 mole of sodium contains $6.022 \times 10^{23}$ atoms of sodium.

∴ 2.5 moles of sodium contain

$6.022 \times 10^{23} \times 2.5 = 15.06 \times 10^{23}$

$15.06 \times 10^{23}$ atoms of sodium

Q. 44 Write down the cations and anions obtained from the compounds in the following chart –

| Base | Cation | Anion | Acid | Cation | Anion |
|---|---|---|---|---|---|
| NaOH | | | HCl | | |
| KOH | | | HBr | | |
| $Ca(OH)_2$ | | | $HNO_3$ | | |

Ans.-

| Base | Cation | Anion | Acid | Cation | Anion |
|---|---|---|---|---|---|
| NaOH | $Na^+$ | $OH^-$ | HCl | $H^+$ | $Cl^-$ |
| KOH | $K^+$ | $OH^-$ | HBr | $H^+$ | $Br^-$ |
| $Ca(OH)_2$ | $Ca^{++}$ | $OH^-$ | $HNO_3$ | $H^+$ | $NO_3^-$ |

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Q. 45 Write down the symbols for the following elements – antimony, iron, gold, silver, mercury, lead, sodium.

Ans.-

| Element | Symbol |
|---|---|
| Antimony | Sb |
| Iron | Fe |
| Gold | Au |
| Silver | Ag |
| Mercury | Hg |
| Lead | Pb |
| Sodium | Na |

Q. 46 What is the difference between simple radical and composite radical?

Ans.- Monoatomic radical i.e. $Na^{+}$ is called simple radical while a group of atoms carrying charge i.e. $PO_4^{3-}$ is called composite radical.

Q. 47 Give examples. Basic radicals

Ans.- Potassium ion ($K^{+}$), silver ion ($Ag^{+}$), Calcium ion ($Ca^{2+}$).

Q. 48 Give reason.

Potassium atom is bigger than sodium atom.

Ans.- i) Electronic configuration of sodium (Na) is (2, 8,1) while that of potassium (K) is (2,8,8,1).

ii) The size of an atom increases as the number of electron orbits increases.

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Hence, potassium atom is bigger than sodium atom.

Q. 49 Name the following.
The symbol of mercurous ion.
Ans.- $Hg^{+}$.

Q. 50 Odd one out.
1) $Ag^{+}$, $K^{+}$, $NH_4^{+}$, $Cu^{+}$.
Ans.- $NH_4^{+}$ - Ammonium ion ($NH_4^{+}$) is a composite radicals while others are simple radicals.

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