

## Exercise 1A

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**1. What is a symbol? What information does it convey?**

**Solution:**

Short form of atom of specific element or the abbreviations used to refer names of the element is known as symbol.

1. It represents a specific element.
2. It represents one atom of an element.
3. A symbol represents how many atoms are present in its one gram (gm) atom.
4. It represents the number of times an atom is heavier than one atomic mass unit (amu) taken as a standard.

**2. Why is the symbol S for Sulphur, but Na for Sodium and Si for Silicon.**

**Solution:**

While naming an element first letter of the element is taken and written in capital (e.g. for sulphur, we use the symbol S). In case if the letter is already adopted. We use a symbol derived from Latin word of the element name (e.g., for sodium/Natrium, we use the symbol Na). In some cases, we use the initial letter in capital together with a small letter from its name (e.g., for silicon, we use the symbol Si).

**3. Write the full form of IUPAC. Name the elements represented by the following Symbols:**

**Au, Pb, Sn, Hg**

**Solution:**

IUPAC stands for The International Union of Pure and Applied Chemistry (IUPAC)

Au - Gold

Pb - Lead

Sn - Tin

Hg - Mercury

**4. If the symbol for cobalt, Co was written as CO. What would be wrong with it?**

**Solution:**

If we write CO it means it consist of two non-metals namely Carbon and Oxygen and it would represent Carbon- monoxide but not Cobalt.

**5. What do the following symbols stand for?**

**a) H b) H<sub>2</sub> c) 2H d) 2H<sub>2</sub>**

**Solution:**

- a) H stands for one atom of Hydrogen
- b) H<sub>2</sub> stands for one molecule of Hydrogen
- c) 2H stands for 2 atoms of Hydrogen
- d) 2H<sub>2</sub> stands for 2 molecules of Hydrogen.

**6. What is meant by atomicity? Name a diatomic element.**

**Solution:**

A set of atoms of the same type together forms a molecule of the element. The number of atoms in a molecule of an element is called its atomicity.

Examples of diatomic elements are  $H_2$  – Hydrogen,  $O_2$  – Oxygen,  $N_2$  – Nitrogen

**7. a) Explain the terms valency and variable valency**

**b) How are the elements with variable valency named? Explain with an example.**

**Solution:**

a) Valency is the capacity of an atom to lose, gain or share atoms during a chemical reaction is called its valency. Sometimes atom of an element can lose more electron than they are present which means they lose electron from its penultimate shell. Such an element is said to exhibit variable valency.

b) If an element exhibits two different positive valencies, then

1. For the lower valency, use the suffix -OUS at the end of the name of the metal

2. For the higher valency, use the suffix -IC at the end of the name of the metal.

**8. Give the formula and valency of**

**a) aluminate**

**b) chromate**

**c) aluminium**

**d) cupric**

**Solution:**

Name	Formula	Valency
Aluminate	$AlO_2$	-2
Chromate	$CrO_4$	-2
Aluminium	Al	+3
Cupric	Cu	+2

**9. a) What is a chemical formula?**

**b) What is the significance of a formula? Give an illustrate.**

**Solution:**

a) Chemical formula is a symbolic representation of the number of atoms present in a molecule of that substance.

b) Significance of Chemical Formula

Chemical formula is very important in finding information about chemical compounds as it tells us about the elements and the number of atoms in a substance

Example - Salt - NaCl, ethanol  $C_2H_6O$  because the molecule of ethanol contains two Carbon, 6 Hydrogen and 1 Oxygen atom.

**10. What do you understand by following terms?**

a) Acid radical b) Basic radical

**Solution:**

a) Negatively charged radical is called as acidic radical.

b) Positively charged radical is called as basic radical.

**11. Select the basic radical in the following compounds**

a)  $\text{MgSO}_4$

b)  $(\text{NH}_4)_2$

c)  $\text{Al}_2(\text{SO}_4)_3$

d)  $\text{ZnCO}_3$

e)  $\text{Mg}(\text{OH})_2$

**Solution:**

	Acid Radical	Basic radical
a) $\text{MgSO}_4$	$\text{SO}_4^{2-}$	$\text{Mg}^{2+}$
b) $(\text{NH}_4)_2\text{SO}_4$	$\text{SO}_4^{2-}$	$\text{NH}_4^+$
c) $\text{Al}_2(\text{SO}_4)_3$	$\text{SO}_4^{2-}$	$\text{Al}^{3+}$
d) $\text{ZnCO}_3$	$\text{CO}_3^{2-}$	$\text{Zn}^{2+}$
e) $\text{Mg}(\text{OH})_2$	$\text{OH}^-$	$\text{Mg}^{2+}$

**12. Write the chemical formulae of sulphates of Aluminium, Ammonium and Zinc.**

**Solution:**

Valencies of aluminium, ammonium and zinc are 3, 1 and 2, respectively. The valency of sulphate is 2. Hence, chemical formulae of the sulphates of aluminium, ammonium and zinc are  $\text{Al}_2(\text{SO}_4)_3$ ,  $(\text{NH}_4)_2\text{SO}_4$ ,  $\text{ZnSO}_4$

**13. The valency of element A is 3 and that of element B is 2. Write the formula of the compound formed by the combination of A and B.**

**Solution:**

Formula of compound having valency of elements are 3 and 2 is  $\text{A}_2\text{B}_3$ .

## 14. Match the following

Compound	Formula
Boric acid	NaOH
Phosphoric acid	SiO <sub>2</sub>
Nitrous acid	Na <sub>2</sub> CO <sub>3</sub>
Nitric acid	KOH
Sulphurous acid	CaCO <sub>3</sub>
Sulphuric acid	NaHCO <sub>3</sub>
Hydrochloric acid	H <sub>2</sub> S
Silica (Sand)	H <sub>2</sub> O
Caustic soda (Sodium Hydroxide)	PH <sub>3</sub>
Caustic potash (Potassium hydroxide)	CH <sub>4</sub>
Washing soda (Sodium carbonate)	NH <sub>3</sub>
Baking Soda (Sodium bi carbonate)	HCl
Lime stone (Calcium carbonate)	H <sub>2</sub> SO <sub>3</sub>
Water	HNO <sub>3</sub>
Hydrogen Sulphide	HNO <sub>2</sub>
Ammonia	H <sub>3</sub> BO <sub>3</sub>
Phosphine	H <sub>3</sub> PO <sub>4</sub>
Methane	H <sub>2</sub> SO <sub>4</sub>

## Solution:

Compound	Formula
Boric acid	H <sub>3</sub> BO <sub>3</sub>
Phosphoric acid	H <sub>3</sub> PO <sub>4</sub>
Nitrous acid	HNO <sub>2</sub>
Nitric acid	HNO <sub>3</sub>
Sulphurous acid	H <sub>2</sub> SO <sub>3</sub>
Sulphuric acid	H <sub>2</sub> SO <sub>4</sub>
Hydrochloric acid	HCl
Silica (Sand)	SiO <sub>2</sub>
Caustic soda (Sodium Hydroxide)	NaOH
Caustic potash (Potassium hydroxide)	KOH
Washing soda (Sodium carbonate)	Na <sub>2</sub> CO <sub>3</sub>
Baking Soda (Sodium bi carbonate)	NaHCO <sub>3</sub>
Lime stone (Calcium carbonate)	CaCO <sub>3</sub>
Water	H <sub>2</sub> O
Hydrogen Sulphide	H <sub>2</sub> S
Ammonia	NH <sub>3</sub>
Phosphine	PH <sub>3</sub>
Methane	CH <sub>4</sub>

## 15. Write the basic and acidic radicals of the following and then write the chemical formulae of these compounds.

- a) Barium sulphate
- b) Bismuth nitrate
- c) calcium bromide
- d) Ferrous sulphide
- e) Chromium sulphate
- f) Calcium silicate
- g) Stannic oxide
- h) Sodium Zincate
- i) Magnesium phosphate
- j) Sodium thiosulphate
- k) Stannic phosphate
- l) Nickel-bi-silphate
- m) Potassium mangnate
- n) Potassium ferrocynide

**Solution:**

Compounds	Acidic radical	Basic radical	Chemical formulae
a) Barium sulphate	$\text{SO}_4^{2-}$	$\text{Ba}^{+2}$	$\text{BaSO}_4$
b) Bismuth nitrate	$\text{NO}_3^-$	$\text{Bi}^{+3}$	$\text{Bi}(\text{NO}_3)_3$
c) calcium bromide	$\text{Br}^-$	$\text{Ca}^{+2}$	$\text{CaBr}_2$
d) Ferrous sulphide	$\text{S}^{2-}$	$\text{Fe}^{+2}$	$\text{FeS}$
e) Chromium sulphate	$\text{SO}_4^{2-}$	$\text{Cr}^{+3}$	$\text{Cr}_2(\text{SO}_4)_3$
f) Calcium silicate	$\text{SiO}_4^{2-}$	$\text{Cr}^{+3}$	$\text{Cr}_2(\text{SO}_4)_3$
g) Stannic oxide	$\text{O}^{2-}$	$\text{Sn}^{+2}$	$\text{SnO}_2$
h) Sodium Zincate	$\text{ZnO}^{2-}$	$\text{Na}^{+1}$	$\text{Na}_2\text{ZnO}_2$
i) Magnesium phosphate	$\text{PO}_4^{3-}$	$\text{Mg}^{+2}$	$\text{Mg}_3(\text{PO}_4)_2$
j) Sodium thiosulphate	$(\text{S}_2\text{O}_3)^{2-}$	$\text{Na}^{+1}$	$\text{Na}_2\text{S}_2\text{O}_3$
k) Stannic phosphate	$(\text{PO}_4)^{3-}$	$\text{Sn}^{+4}$	$\text{Sn}_3(\text{PO}_4)_4$
l) Nickel-bi-silphate	$\text{H}_2\text{SO}_4^{4-}$	$\text{Ni}^{+3}$	$\text{NiH}(\text{SO}_4)_3$
m) Potassium mangnate	$\text{MnO}_4^{2-}$	$\text{K}^{+1}$	$\text{K}_2\text{MnO}_4$
n) Potassium ferrocynide	$[\text{Fe}(\text{CN})_6]^{4-}$	$\text{K}^{+1}$	$\text{K}_4[\text{Fe}(\text{CN})_6]$

**16. Write chemical names of the following compounds:**

- a)  $\text{Ca}_3(\text{PO}_4)_2$
- b)  $\text{K}_2\text{CO}_3$
- c)  $\text{K}_2\text{MnO}_4$
- d)  $\text{Mn}_3(\text{BO}_3)_2$
- e)  $\text{Mg}(\text{HCO}_3)_2$
- f)  $\text{Na}_4\text{Fe}(\text{CN})_6$
- g)  $\text{Ba}(\text{ClO}_3)_2$
- h)  $\text{Ag}_2\text{SO}_3$
- i)  $(\text{CH}_3\text{COO})_2\text{Pb}$
- j)  $\text{Na}_2\text{SiO}_3$

**Solution:**

- a) Calcium phosphate
- b) Potassium carbonate
- c) Potassium manganate
- d) Manganese(II) Borate
- e) Magnesium bicarbonate.
- f) Sodium ferrocyanide
- g) Barium Chlorate
- h) Silver sulfite
- i) Lead(II) acetate
- j) Sodium silicate

**17. Give the names of the following compounds**

- a)  $\text{KClO}$
- b)  $\text{KClO}_2$
- c)  $\text{KClO}_3$
- d)  $\text{KClO}_4$

**Solution:**

- a) Potassium hypochlorite
- b) Potassium chlorite
- c) Potassium chlorate
- d) Potassium per chlorate

**18. Complete the following statements by selecting the correct option.**

**a) The formula of a compound represents**

- i) an atom
- ii) a particle
- iii) a molecule
- iv) a combination

**b) The correct formula of aluminium oxide is**

- i)  $\text{AlO}_3$

- ii)  $\text{AlO}_2$
- iii)  $\text{Al}_2\text{O}_3$
- iv)  $\text{Al}_3\text{O}_2$

c) The valency of Nitrogen in Nitrogen di oxide ( $\text{NO}_2$ ) is

- i) One
- ii) Two
- iii) Three
- iv) Four

**Solution:**

- a) The formula of a compound represents a molecule
- b) The correct formula of aluminium oxide is  $\text{Al}_2\text{O}_3$
- c) The valency of Nitrogen in Nitrogen di oxide ( $\text{NO}_2$ ) is four

**19. Give the names of the elements and number of atoms of those elements, present in the following compounds.**

- a) Sodium sulphate
- b) Quick lime
- c) Baking soda ( $\text{NaHCO}_3$ )
- d) Ammonia
- e) Ammonium dichromate

**Solution:**

- a) Sodium sulphate  
Chemical formula is  $\text{Na}_2\text{SO}_4$   
Atoms - 2 sodium, one Sulphur and 4 oxygen atoms.
- b) Quick lime  
Chemical formula is  $\text{CaO}$   
Atoms - one Calcium atom and 1 oxygen atom
- c) Baking soda ( $\text{NaHCO}_3$ )  
Chemical formula of is  $\text{NaHCO}_3$   
Atoms - 1 Sodium, 1 hydrogen, 1 carbon and 3 oxygen atoms.
- d) Ammonia  
Chemical formula is  $\text{NH}_3$   
Atoms - 3 hydrogen and 1 nitrogen atom.
- e) Ammonium dichromate  
Chemical formula is  $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$ .  
Atoms - 2 ammonium, 2 chromium and 7 oxygen atoms.

**20. The formula of the sulphate of an element M is  $\text{M}_2(\text{SO}_4)_3$ . Write the formula of it.**

- a) Chloride
- b) Oxide
- c) Phosphate
- d) Acetate

**Solution:**

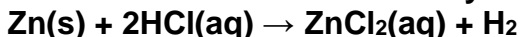
Answer is a) Chloride



**Exercise 1B****Page No: 15****1. What is a chemical equation? Why it is necessary to balance it.****Solution:**

A chemical equation is a symbolic representation of a chemical reaction. Here we use symbols and formulas of the substance involved in the reaction.

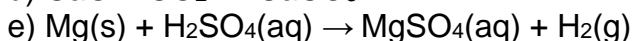
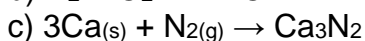
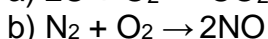
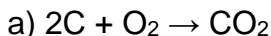
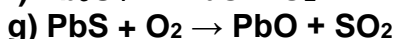
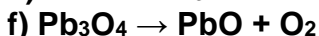
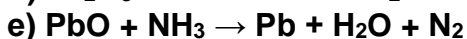
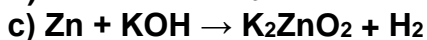
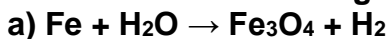
According to law of conservation of mass, "matter can neither be created nor be destroyed in a chemical reaction. This is possible only, if total number of atoms on the reactants side is equals to total number of atoms on products side. Thus, a chemical reaction should be always balanced.

**2. State the information conveyed by the following equation.****Solution:**

This chemical equation shows 'single displacement reaction', in which a non-metal is displaced by a metal. Here, non-metal is hydrogen which is evolved as gas. It is displaced by the metal zinc. In the given equation -  $\text{Zn(s)} + 2\text{HCl(aq)} \rightarrow \text{ZnCl}_2\text{(aq)} + \text{H}_2\text{(g)}$ , Zinc (Zn) is a reductant metal that displaces hydrogen ( $\text{H}_2$ ) from aqueous solution of Hydrochloric acid (HCl).

**3. Write the limitation of reaction given in question 2.****Solution:**

HCl will be the limiting reagent in the reaction and Zn will be excess reagent.

**4. Write chemical equations for the following equations and balance them.****a) Carbon + Oxygen  $\rightarrow$  Carbon-di-oxide****b) Nitrogen + Oxygen  $\rightarrow$  Nitrogen monoxide****c) Calcium + Nitrogen  $\rightarrow$  Calcium nitride****d) Calcium oxide + carbon dioxide  $\rightarrow$  Calcium carbonate****e) Magnesium + Sulphuric acid  $\rightarrow$  Magnesium sulphate + Hydrogen****Solution:****5. Balance the following equations**

- h)  $\text{S} + \text{H}_2\text{SO}_4 \rightarrow \text{SO}_2 + \text{H}_2\text{O}$   
 i)  $\text{S} + \text{HNO}_3 \rightarrow \text{H}_2\text{SO}_4 + \text{NO}_2 + \text{H}_2\text{O}$   
 j)  $\text{MnO}_2 + \text{HCl} \rightarrow \text{MnCl}_2 + \text{H}_2\text{O} + \text{Cl}_2$   
 k)  $\text{C} + \text{H}_2\text{SO}_4 \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{SO}_2$   
 l)  $\text{KOH} + \text{Cl}_2 \rightarrow \text{KCl} + \text{KClO} + \text{H}_2\text{O}$   
 m)  $\text{NO}_2 + \text{H}_2\text{O} \rightarrow \text{HNO}_2 + \text{HNO}_3$   
 n)  $\text{Pb}_3\text{O}_4 + \text{HCl} \rightarrow \text{PbCl}_2 + \text{H}_2\text{O} + \text{Cl}_2$   
 o)  $\text{H}_2\text{O} + \text{Cl}_2 \rightarrow \text{HCl} + \text{O}_2$   
 p)  $\text{NaHCO}_3 \rightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2$   
 q)  $\text{HNO}_3 + \text{H}_2\text{S} \rightarrow \text{NO}_2 + \text{H}_2\text{O} + \text{S}$   
 r)  $\text{P} + \text{HNO}_3 \rightarrow \text{NO}_2 + \text{H}_2\text{O} + \text{H}_3\text{PO}_4$   
 s)  $\text{Zn} + \text{HNO}_3 \rightarrow \text{Zn}(\text{NO}_3)_2 + \text{H}_2\text{O} + \text{NO}_2$

### Solution:

- a)  $3\text{Fe} + 4\text{H}_2\text{O} \rightarrow \text{Fe}_3\text{O}_4 + 4\text{H}_2$   
 b)  $3\text{Ca} + \text{N}_2 \rightarrow \text{Ca}_3\text{N}_2$   
 c)  $\text{Zn} + 2\text{KOH} \rightarrow \text{K}_2\text{ZnO}_2 + \text{H}_2$   
 d)  $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$   
 e)  $3\text{PbO} + 2\text{NH}_3 \rightarrow 3\text{Pb} + 3\text{H}_2\text{O} + \text{N}_2$   
 f)  $2\text{Pb}_3\text{O}_4 \rightarrow 6\text{PbO} + \text{O}_2$   
 g)  $2\text{PbS} + 3\text{O}_2 \rightarrow 2\text{PbO} + 2\text{SO}_2$   
 h)  $\text{S} + 2\text{H}_2\text{SO}_4 \rightarrow 3\text{SO}_2 + 2\text{H}_2\text{O}$   
 i)  $\text{S} + 6\text{HNO}_3 \rightarrow \text{H}_2\text{SO}_4 + 6\text{NO}_2 + 2\text{H}_2\text{O}$   
 j)  $\text{MnO}_2 + 4\text{HCl} \rightarrow \text{MnCl}_2 + 2\text{H}_2\text{O} + \text{Cl}_2$   
 k)  $\text{C} + 2\text{H}_2\text{SO}_4 \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{SO}_2$   
 l)  $2\text{KOH} + \text{Cl}_2 \rightarrow \text{KCl} + \text{KClO} + \text{H}_2\text{O}$   
 m)  $2\text{NO}_2 + \text{H}_2\text{O} \rightarrow \text{HNO}_2 + \text{HNO}_3$   
 n)  $\text{Pb}_3\text{O}_4 + 8\text{HCl} \rightarrow 3\text{PbCl}_2 + 4\text{H}_2\text{O} + \text{Cl}_2$   
 o)  $2\text{H}_2\text{O} + 2\text{Cl}_2 \rightarrow 4\text{HCl} + \text{O}_2$   
 p)  $2\text{NaHCO}_3 \rightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2$   
 q)  $2\text{HNO}_3 + \text{H}_2\text{S} \rightarrow 2\text{NO}_2 + 2\text{H}_2\text{O} + \text{S}$   
 r)  $\text{P} + 5\text{HNO}_3 \rightarrow 5\text{NO}_2 + \text{H}_2\text{O} + \text{H}_3\text{PO}_4$   
 s)  $\text{Zn} + 4\text{HNO}_3 \rightarrow \text{Zn}(\text{NO}_3)_2 + 2\text{H}_2\text{O} + 2\text{NO}_2$

## Exercise 1C

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### 1. Fill in the blanks

- Dalton used symbol \_\_\_\_\_ for oxygen \_\_\_\_\_ for hydrogen.
- Symbol represents \_\_\_\_\_ atom(s) of an element.
- Symbolic expression for a molecule is called \_\_\_\_\_.
- Sodium chloride has two radicals. Sodium is a \_\_\_\_\_ radical, while chloride is a \_\_\_\_\_ radical.
- Valency of Phosphorous in  $\text{PCl}_3$  is \_\_\_\_\_, in  $\text{PCl}_5$  is \_\_\_\_\_.
- Valency of iron in  $\text{FeCl}_2$  is \_\_\_\_\_ and in  $\text{FeCl}_3$  it is \_\_\_\_\_.
- Formula of iron (III) carbonate is \_\_\_\_\_.

### Solution:

- Dalton used symbol **[O]** for oxygen, **[H]** for hydrogen.
- Symbol represents **gram** atom(s) of an element.
- Symbolic expression for a molecule is called **molecular formula**.
- Sodium chloride has two radicals. Sodium is a **basic** radical, while chloride is an **acid** radical.
- Valency of Phosphorous in  $\text{PCl}_3$  is **3**, in  $\text{PCl}_5$  is **5**.
- Valency of iron in  $\text{FeCl}_2$  is **2** and in  $\text{FeCl}_3$  it is **3**.
- Formula of iron (III) carbonate is  **$\text{Fe}_2[\text{CO}_3]_3$** .

### 2. Complete the following table

Acid Radical → Basic radical ↓	Chloride	Nitrate	Sulphate	Carbonate	Hydroxide	Phosphate
Magnesium	$\text{MgCl}_2$	$\text{Mg}(\text{NO})_2$	$\text{MgSO}_4$	$\text{MgCO}_3$	$\text{Mg}(\text{OH})_2$	$\text{Mg}_3(\text{PO}_4)_2$
Sodium						
Zinc						
Silver						
Ammonium						
Calcium						
Iron (II)						
Potassium						

### Solution:

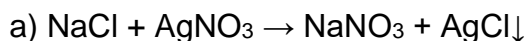
Acid Radical → Basic radical ↓	Chloride	Nitrate	Sulphate	Carbonate	Hydroxide	Phosphate
Magnesium	$\text{MgCl}_2$	$\text{Mg}(\text{NO})_2$	$\text{MgSO}_4$	$\text{MgCO}_3$	$\text{Mg}(\text{OH})_2$	$\text{Mg}_3(\text{PO}_4)_2$
Sodium	$\text{NaCl}$	$\text{NaNO}_3$	$\text{Na}_2\text{SO}_4$	$\text{Na}_2\text{CO}_3$	$\text{NaOH}$	$\text{Na}_3\text{PO}_4$
Zinc	$\text{ZnCl}_2$	$\text{ZnNO}_3$	$\text{ZnSO}_4$	$\text{ZnCO}_3$	$\text{Zn}(\text{OH})_2$	$\text{Zn}_3(\text{PO}_4)_2$
Silver	$\text{AgCl}$	$\text{AgNO}_3$	$\text{Ag}_2\text{SO}_4$	$\text{AgCO}_3$	$\text{AgOH}$	$\text{Ag}_3\text{PO}_4$
Ammonium	$\text{NH}_4\text{Cl}$	$\text{NH}_4\text{NO}_3$	$(\text{NH}_4)_2\text{SO}_4$	$(\text{NH}_4)_2\text{CO}_3$	$\text{NH}_4\text{OH}$	$(\text{NH}_4)_3(\text{PO}_4)_2$
Calcium	$\text{CaCl}_2$	$\text{CaNO}_3$	$\text{CaSO}_4$	$\text{CaCO}_3$	$\text{Ca}(\text{OH})_2$	$\text{Ca}_3(\text{PO}_4)_2$

<b>Iron (II)</b>	FeCl <sub>2</sub>	Fe(NO <sub>3</sub> ) <sub>2</sub>	FeSO <sub>4</sub>	FeCO <sub>3</sub>	Fe(OH) <sub>2</sub>	Fe <sub>3</sub> (PO <sub>4</sub> ) <sub>2</sub>
<b>Potassium</b>	KCl	KNO <sub>3</sub>	K <sub>2</sub> SO <sub>4</sub>	K <sub>2</sub> CO <sub>3</sub>	KOH	K <sub>3</sub> PO <sub>4</sub>

**3. Sodium chloride reacts with silver nitrate to produce silver chloride and sodium nitrate**

- Write the equation
- Check whether it is balanced, if not balance it.
- Find the weights of reactants and products.
- State the law that this equation satisfies?

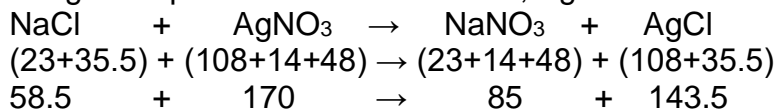
**Solution:**



b) It is a balanced equation

c) Weights of reactants: NaCl - 58.44, AgNO<sub>3</sub> - 169.87

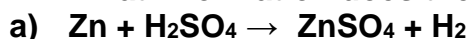
Weights of products: NaNO<sub>3</sub> - 84.99, AgCl - 143.32



Thus, 228.5 g of reactants  $\rightarrow$  228.5 g of products

d) This equation states law of conservation of mass where mass is neither created nor destroyed.

**4. What information does the following chemical equations convey?**



**Solution:**

a) This equation shows the result of a chemical change. When one molecule of zinc and one molecule of sulphuric acid reacts, it results in the production of one molecule of zinc sulphate and one molecule of hydrogen.

b) This equation shows reaction of Magnesium with HCl which gives magnesium chloride and liberated Hydrogen gas.

**5. a) What are poly-atomic ions? Give two examples**

**b) Name the fundamental law involved in every equation**

**Solution:**

a) A charged ion that consists of two or more covalently bounded atoms are called as polyatomic ions. Eg: CaCO<sub>3</sub>, MgSO<sub>4</sub>

b) Fundamental law involved in every equation is "the law of conservation of mass".

**6. What is the valency of?**

**a) Fluorine in CaF<sub>2</sub>**

- b) Sulphur in  $\text{SF}_6$
- c) Phosphorous in  $\text{PH}_3$
- d) Carbon in  $\text{CH}_4$
- e) Nitrogen in the following compound
  - i)  $\text{N}_2\text{O}_3$  ii)  $\text{N}_2\text{O}_5$  iii)  $\text{NO}_2$  iv)  $\text{NO}$
- f) Manganese in  $\text{MnO}_2$
- g) Copper in  $\text{Cu}_2\text{O}$
- h) Magnesium in  $\text{Mg}_3\text{N}_2$

**Solution:**

- a) Valency of fluorine in  $\text{CaF}_2$  is -1
- b) Valency of sulphur in  $\text{SF}_6$  is -6
- c) Valency of phosphorus in  $\text{PH}_3$  is +3
- d) Valency of carbon in  $\text{CH}_4$  is +4
- e) Valency of nitrogen in the given compounds:
  - i)  $\text{N}_2\text{O}_3 = +3$
  - ii)  $\text{N}_2\text{O}_5 = +5$
  - iii)  $\text{NO}_2 = +4$
  - iv)  $\text{NO} = +2$

**7. Why should an equation be balanced? Explain with the help of simple equation.**

**Solution:**

An equation should be balanced to make it comply with the law of conservation of matter which states that matter is neither created nor destroyed in the course of a chemical reaction. An unbalanced equation either deletes or adds extra atoms in the equation.

e.g.  $\text{KNO}_3 \rightarrow \text{KNO}_2 + \text{O}_2$

In this equation number of atoms in left and right side are not equal hence the balanced equation will be written as.

$2\text{KNO}_3 \rightarrow 2\text{KNO}_2 + \text{O}_2$

**8. Write the balanced chemical equations of the following word equations**

- a) Sodium hydroxide + Sulphuric acid  $\rightarrow$  Sodium Sulphate + Water
- b) Potassium bicarbonate + Sulphuric acid  $\rightarrow$  Potassium Sulphate + Carbon di oxide + Water
- c) Iron + Sulphuric acid  $\rightarrow$  Ferrous sulphate + Hydrogen
- d) Chlorine + Sulphur di oxide + Water  $\rightarrow$  Sulphuric acid + Hydrogen Chloride
- e) Silver Nitrate  $\rightarrow$  Silver + Nitrogen di oxide + Oxygen
- f) Copper + Nitric acid  $\rightarrow$  Copper nitrate + Nitric oxide + water
- g) Ammonia + Oxygen  $\rightarrow$  Nitric oxide + Water
- h) Barium chloride + Sulphuric acid  $\rightarrow$  Barium Sulphate + Hydrochloric acid
- i) Zinc sulphide + Oxygen  $\rightarrow$  Zinc oxide + Sulphur dioxide
- j) Aluminium carbide + Water  $\rightarrow$  Aluminium hydroxide + methane
- k) Iron Pyrites + Oxygen  $\rightarrow$  Ferric oxide + Sulphur di oxide
- l) Potassium permanganate + Hydrochloric acid  $\rightarrow$  Potassium chloride + Manganese

chloride + chlorine + Water

m) Aluminium sulphate + Sodium hydroxide  $\rightarrow$  Sodium sulphate + Sodium meta aluminate + Water

n) Aluminium + Sodium hydroxide + Water  $\rightarrow$  Sodium meta aluminate + Hydrogen

o) Potassium dichromate + Sulphuric acid  $\rightarrow$  Potassium sulphate + Chromium sulphate + Water + Oxygen

p) Potassium dichromate + Hydrochloric acid  $\rightarrow$  Potassium chloride + Chromium chloride + Water + Chlorine

q) Sulphur + Nitric acid  $\rightarrow$  Sulphuric acid + Nitrogen dioxide + Water

r) Sodium chloride + Manganese dioxide + Sulphuric acid  $\rightarrow$  Sodium hydrogen sulphate + Manganese sulphate + Water + Chlorine

**Solution:**

a)  $2\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$

b)  $2\text{KHCO}_3 + \text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + 2\text{CO}_2 + 2\text{H}_2\text{O}$

c)  $\text{Fe} + \text{H}_2\text{SO}_4 \rightarrow \text{FeSO}_4 + \text{H}_2$

d)  $\text{Cl}_2 + \text{SO}_2 + 2\text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_4 + 2\text{HCl}$

e)  $2\text{AgNO}_3 \rightarrow 2\text{Ag} + 2\text{NO}_2 + \text{O}_2$

f)  $3\text{Cu} + 8\text{HNO}_3 \rightarrow 3\text{Cu}(\text{NO}_3)_2 + 2\text{NO} + 4\text{H}_2\text{O}$

g)  $4\text{NH}_3 + 5\text{O}_2 \rightarrow 6\text{H}_2\text{O} + 4\text{NO}$

h)  $\text{BaCl}_2 + \text{H}_2\text{SO}_4 \rightarrow \text{BaSO}_4 + 2\text{HCl}$

i)  $2\text{ZnS} + 3\text{O}_2 \rightarrow 2\text{ZnO} + 2\text{SO}_2$

j)  $\text{Al}_4\text{C}_3 + 12\text{H}_2\text{O} \rightarrow 4\text{Al}(\text{OH})_3 + 3\text{CH}_4$

k)  $4\text{FeS}_2 + 11\text{O}_2 \rightarrow 2\text{Fe}_2\text{O}_3 + 8\text{SO}_2$

l)  $2\text{KMnO}_4 + \text{HCl} \rightarrow 2\text{KCl} + 2\text{MnCl}_2 + 5\text{Cl}_2 + 8\text{H}_2\text{O}$

m)  $\text{Al}_2(\text{SO}_4)_3 + 8\text{NaOH} \rightarrow 3\text{Na}_2\text{SO}_4 + 2\text{NaAlO}_2 + 4\text{H}_2\text{O}$

n)  $2\text{Al} + 2\text{NaOH} + 2\text{H}_2\text{O} \rightarrow 2\text{NaAlO}_2 + 3\text{H}_2$

o)  $2\text{K}_2\text{Cr}_2\text{O}_7 + 8\text{H}_2\text{SO}_4 \rightarrow 2\text{K}_2\text{SO}_4 + 2\text{Cr}_2(\text{SO}_4)_3 + 8\text{H}_2\text{O} + 3\text{O}_2$

p)  $\text{K}_2\text{Cr}_2\text{O}_7 + 14\text{HCl} \rightarrow 2\text{KCl} + 2\text{CrCl}_3 + 7\text{H}_2\text{O} + 3\text{Cl}_2$

q)  $\text{S} + 6\text{HNO}_3 \rightarrow \text{H}_2\text{SO}_4 + 6\text{NO}_2 + 2\text{H}_2\text{O}$

r)  $2\text{KI} + 2\text{MnO}_2 + 4\text{H}_2\text{SO}_4 \rightarrow \text{I}_2 + 2\text{KHSO}_4 + 2\text{MnSO}_4 + 4\text{H}_2\text{O}$

**9. a) Define atomic mass unit**

**b) Calculate the molecular mass of the following**

i)  $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$  ii)  $(\text{NH}_4)_2\text{CO}_3$  iii)  $(\text{NH}_2)_2\text{CO}$  iv)  $\text{Mg}_3\text{N}_2$

Give atomic mass of Na = 23, H = 1, O = 16, C = 12, N = 14, Mg = 24, S = 32

**Solution:**

a) The atomic mass unit (amu) is defined as  $1/12^{\text{th}}$  of the mass of an atom of carbon

1 a.m.u. =  $1.67 \times 10^{-24}\text{g}$  =  $1.67 \times 10^{-27}\text{kg}$

1 gm mass =  $6.02 \times 10^{23}$  a.m.u. and 1 kg mass =  $6.02 \times 10^{26}$  a.m.u.

b) i) The relative molecular mass of  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$

=  $63.5 + 32 + (16 \times 4) + 5(2 + 16)$

=  $159.5 + 90$

= 249.5

ii) The relative molecular mass of  $(\text{NH}_4)_2\text{CO}_3 = \text{N}_2\text{H}_8\text{CO}_3$   
 $= 14 \times 2 + 1 \times 8 + 12 + 3 \times 16$   
 $= 28 + 8 + 12 + 48$   
 $= 96$

iii) The relative molecular mass of  $(\text{NH}_2)_2\text{CO} = \text{N}_2\text{H}_4\text{CO}$   
 $= 2 \times 14 + 1 \times 4 + 12 + 16$   
 $= 28 + 4 + 12 + 16$   
 $= 60$

iv) The relative molecular mass of  $\text{Mg}_3\text{N}_2$   
 $= 3 \times 24 + 2 \times 14$   
 $= 72 + 28$   
 $= 100$

**10. Choose the correct answer from the options given below**

**a) Modern atomic symbols are based on the methods proposed by**

**(i) Bohr (ii) Dalton (iii) Berzelius (iv) Alchemist**

**b) The number of carbon atoms in a hydrogen carbonate radical is**

**(i) one (ii) two (iii) three (iv) four**

**c) The formula of Iron(III) Sulphate is**

**(i)  $\text{Fe}_3\text{SO}_4$  (ii)  $\text{Fe}(\text{SO})_3$  (iii)  $\text{Fe}(\text{SO}_4)_3$  (iv)  $\text{FeSO}_4$**

**d) In water, the hydrogen-to-oxygen mass ratio is**

**(i) 1:8 (ii) 1:16 (iii) 1:32 (iv) 1:64**

**(e) The formula of sodium carbonate is Na<sub>2</sub>CO<sub>3</sub> and that of calcium hydrogen carbonate is**

**(i)  $\text{CaHCO}_3$  (ii)  $\text{Ca}(\text{HCO}_3)_2$  (iii)  $\text{CaHCO}_3$  (iv)  $\text{Ca}(\text{HCO})_3$**

**Solution:**

a) Answer is (iii) Berzelius

b) Answer is (i) One

c) Answer is (iii)  $\text{Fe}_2(\text{SO}_4)_3$

d) Answer is (i) 1: 8

e) Answer is (ii)  $\text{Ca}(\text{HCO}_3)_2$

**11. Correct the following statements**

**(a) A molecular formula represents an element**

**(b) Molecular formula of water is  $\text{H}_2\text{O}_2$**

**(c) A molecule of Sulphur is monoatomic**

**(d) CO and Co both represent cobalt**

**(e) Formula of Iron(III) oxide is FeO**

**Solution:**

- a) Molecular formula represents molecule of an element or a compound.
- b) Molecular formula of water is  $H_2O$
- c) A molecule of Sulphur is diatomic
- d) CO represents carbon monoxide and Co represent cobalt
- e) Formula of Iron(III) oxide is  $Fe_2O_3$

**12. Calculate the relative molecular masses of:**

**(a)  $CHCl_3$**

**(b)  $(NH_4)_2Cr_2O_7$**

**(c)  $CuSO_4 \cdot 5H_2O$**

**(d)  $(NH_4)_2SO_4$**

**(e)  $CH_3COONa$**

**(f) Potassium chlorate**

**(g) Ammonium chloroplatinate  $(NH_4)_2PtCl_6$**

[At. mass: C = 12, H = 1, O = 16, Cl = 35.5, N = 14, Cu = 63.5, S = 32, Na = 23, K = 39, Pt = 195, Ca = 40, P = 31, Mg = 24]

**Solution:**

(a) Relative molecular mass of  $CHCl_3$

$$= 12 + 1 + (3 \times 35.5)$$

$$= 12 + 1 + 106.5$$

$$= 119.5$$

(b) Relative molecular mass of  $(NH_4)_2Cr_2O_7$

$$= (14 \times 2) + (1 \times 8) + (52 \times 2) + (16 \times 7)$$

$$= 28 + 8 + 104 + 112$$

$$= 252$$

(c) Relative molecular mass of  $CuSO_4 \cdot 5H_2O$

$$= 63.5 + 32 + (16 \times 4) + 5(2 + 16)$$

$$= 159.5 + 90$$

$$= 249.5$$

(d) Relative molecular mass of  $(NH_4)_2SO_4$

$$= (2 \times 14) + (8 \times 1) + 32 + (4 \times 16)$$

$$= 28 + 8 + 32 + 64$$

$$= 132$$

(e) Relative molecular mass of  $CH_3COONa$

$$= (12 \times 2) + (1 \times 3) + (16 \times 2) + 23$$

$$= 24 + 3 + 32 + 23$$

$$= 82$$

(f) Potassium chlorate ( $KClO_3$ )

$$= 39.1 + 35.5 + 16 \times 3$$

$$= 39.1 + 35.5 + 48$$



$$= 122.6$$

$$\begin{aligned} & \text{(g) Ammonium chloroplatinate } (\text{NH}_4)_2\text{PtCl}_6 \\ &= (14 \times 2) + (1 \times 8) + 195.08 + (35.5 \times 6) \\ &= 28 + 8 + 195.08 + 213 \\ &= 444.08 \end{aligned}$$

**13. Give the empirical formula of:**

**(a) Benzene ( $\text{C}_6\text{H}_6$ ) (b) Glucose ( $\text{C}_6\text{H}_{12}\text{O}_6$ ) (c) Acetylene ( $\text{C}_2\text{H}_2$ ) (d) Acetic acid ( $\text{CH}_3\text{COOH}$ )**

**Solution:**

- (a) Benzene - CH
- (b) Glucose -  $\text{CH}_2\text{O}$
- (c) Acetylene - CH
- (d) Acetic acid -  $\text{CH}_2\text{O}$

**14. Find the percentage mass of water in Epsom salt  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ .**

**Solution:**

$$\begin{aligned} & \text{Relative molecular mass of } \text{MgSO}_4 \cdot 7\text{H}_2\text{O} \\ &= 24 + 32 + (16 \times 4) + 7(2 + 16) \\ &= 24 + 32 + 64 + 126 \\ &= 246 \end{aligned}$$

26 g of Epsom salt contains 126 g of water of crystallisation.  
So, 100 g of Epsom salt contains  $(100 \times 126/246)$  g of water  
Thus, percentage mass of  $\text{H}_2\text{O}$  in  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O} = 51.2$

**15. Calculate the percentage of phosphorus in:**

**(a) Calcium hydrogen phosphate  $\text{Ca}(\text{H}_2\text{PO}_4)_2$**

**(b) Calcium phosphate  $\text{Ca}_3(\text{PO}_4)_2$**

**Solution:**

$$\begin{aligned} & \text{(a) Relative molecular mass of } \text{Ca}(\text{H}_2\text{PO}_4)_2 \\ &= 40.07 + (1 \times 4) + (30.9 \times 2) + (16 \times 8) \\ &= 40.07 + 4 + 61.8 + 128 \\ &= 233.87 \end{aligned}$$

Now, 233.87 g of  $\text{Ca}(\text{H}_2\text{PO}_4)_2$  contains 61.8 g of P  
So, 100 g  $\text{Ca}(\text{H}_2\text{PO}_4)_2$  contains  
 $(100 \times 61.8)/233.87 = 26.42$  g  
Thus, the percentage of phosphorous in  $\text{Ca}(\text{H}_2\text{PO}_4)_2$  is 26.42%

$$\begin{aligned} & \text{(b) Relative molecular mass of } \text{Ca}_3(\text{PO}_4)_2 \\ &= (40.07 \times 3) + (30.9 \times 2) + (16 \times 8) \\ &= 120.21 + 61.8 + 128 \\ &= 310.01 \end{aligned}$$

Now, 310.01 g of  $\text{Ca}_3(\text{PO}_4)_2$  contains 61.8 g of P  
So, 100 g  $\text{Ca}_3(\text{PO}_4)_2$  contains

$$(100 \times 61.8)/310.01 = 19.93 \text{ g}$$

Thus, the percentage of phosphorous in  $\text{Ca}_3(\text{PO}_4)_2$  is 19.93%

**16. Calculate the percentage composition of each element in Potassium chlorate,  $\text{KClO}_3$ .**

**Solution:**

Relative molecular mass of  $\text{KClO}_3$

$$= 39.09 + 35.5 + (3 \times 16)$$

$$= 122.59 \text{ g}$$

So, 122.59 g of  $\text{KClO}_3$  contains 39.09 g of K

Hence, 100 g of  $\text{KClO}_3$  contains

$$= (100 \times 39.09)/122.59$$

$$= 31.9 \text{ g}$$

Also, 122.59 g of  $\text{KClO}_3$  contains 35.5 g of Cl

Hence, 100 g of  $\text{KClO}_3$  contains

$$= (100 \times 35.5)/122.59$$

$$= 28.9 \text{ g}$$

And, 122.59 g of  $\text{KClO}_3$  contains 48 g of O

Hence, 100 g of  $\text{KClO}_3$  contains

$$= (100 \times 48)/122.59$$

$$= 39.1 \text{ g}$$

Therefore, the percentage composition of K, Cl and O in  $\text{KClO}_3$  are 31.9%, 28.9% and 39.1% respectively.

**17. Urea is a very important nitrogenous fertilizer. Its formula is  $\text{CH}_4\text{N}_2\text{O}$ . Calculate the percentage of carbon in urea. (C = 12, O = 16, N = 14 and H = 1)**

**Solution:**

Element	No of atoms	Atomic mass	Total
N	2	14	28
C	1	12	12
H	4	1	4
O	1	16	16

$$\Rightarrow 12 + 16 + 28 + 4 = 60$$

Hence, relative molecular mass of urea = 60

Thus,

Percentage of carbon = Weight of carbon/Total weight of urea  $\times 100$

$$= 12/60 \times 100$$

$$= 20\%$$