

**CLASS-IX 'B'**

**CHEMISTRY**

**CHAPTER-1**

**THE LANGUAGE OF CHEMISTRY**

**Exercise :1 (B)**

**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 -  $\text{Zn(s)} + 2\text{HCl(aq)} \longrightarrow \text{ZnCl}_2\text{(aq)} + \text{H}_2\text{(g)}$ , 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  $\longrightarrow$  Carbon-di-oxide
- b) Nitrogen + Oxygen  $\longrightarrow$  Nitrogen monoxide
- c) Calcium + Nitrogen  $\longrightarrow$  Calcium nitride
- d) Calcium oxide + carbon dioxide  $\rightarrow$  Calcium carbonate
- e) Magnesium + Sulphuric acid  $\longrightarrow$  Magnesium sulphate + Hydrogen

**Solution:**

- a)  $2\text{C} + \text{O}_2 \longrightarrow \text{CO}_2$
- b)  $\text{N}_2 + \text{O}_2 \longrightarrow 2\text{NO}$
- c)  $3\text{Ca(s)} + \text{N}_2\text{(g)} \rightarrow \text{Ca}_3\text{N}_2$
- d)  $\text{CaO} + \text{CO}_2 \rightarrow \text{CaCO}_3$
- e)  $\text{Mg(s)} + \text{H}_2\text{SO}_4\text{(aq)} \rightarrow \text{MgSO}_4\text{(aq)} + \text{H}_2\text{(g)}$

### 5. Balance the following equations

- a)  $\text{Fe} + \text{H}_2\text{O} \longrightarrow \text{Fe}_3\text{O}_4 + \text{H}_2$
- b)  $\text{Ca} + \text{N}_2 \longrightarrow \text{Ca}_3\text{N}_2$
- c)  $\text{Zn} + \text{KOH} \longrightarrow \text{K}_2\text{ZnO}_2 + \text{H}_2$
- d)  $\text{Fe}_2\text{O}_3 + \text{CO} \rightarrow \text{Fe} + \text{CO}_2$
- e)  $\text{PbO} + \text{NH}_3 \rightarrow \text{Pb} + \text{H}_2\text{O} + \text{N}_2$
- f)  $\text{Pb}_3\text{O}_4 \longrightarrow \text{PbO} + \text{O}_2$
- g)  $\text{PbS} + \text{O}_2 \longrightarrow \text{PbO} + \text{SO}_2$
- h)  $\text{S} + \text{H}_2\text{SO}_4 \rightarrow \text{SO}_2 + \text{H}_2\text{O}$
- i)  $\text{S} + \text{HNO}_3 \longrightarrow \text{H}_2\text{SO}_4 + \text{NO}_2 + \text{H}_2\text{O}$
- j)  $\text{MnO}_2 + \text{HCl} \rightarrow \text{MnCl}_2 + \text{H}_2\text{O} + \text{SO}_2$
- 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)  $\text{NaHCO}_3 \longrightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2$
- 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:-**

1.  $3\text{Fe} + 4\text{H}_2\text{O} \rightarrow \text{Fe}_3\text{O}_4 + 4\text{H}_2$
2.  $3\text{Ca} + \text{N}_2 \rightarrow \text{Ca}_3\text{N}_2$
3.  $\text{Zn} + 2\text{KOH} \rightarrow \text{K}_2\text{ZnO}_2 + \text{H}_2$
4.  $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$
5.  $3\text{PbO} + 2\text{NH}_3 \rightarrow 3\text{Pb} + 3\text{H}_2\text{O} + \text{N}_2$
6.  $2\text{Pb}_3\text{O}_4 \rightarrow 6\text{PbO} + \text{O}_2$
7.  $2\text{PbS} + 3\text{O}_2 \rightarrow 2\text{PbO} + 2\text{SO}_2$
8.  $\text{S} + 2\text{H}_2\text{SO}_4 \rightarrow 3\text{SO}_2 + 2\text{H}_2\text{O}$
9.  $\text{S} + 6\text{HNO}_3 \rightarrow \text{H}_2\text{SO}_4 + 6\text{NO}_2 + 2\text{H}_2\text{O}$
10.  $\text{MnO}_2 + 4\text{HCl} \rightarrow \text{MnCl}_2 + 2\text{H}_2\text{O} + \text{Cl}_2$
11.  $\text{C} + 2\text{H}_2\text{SO}_4 \rightarrow \text{CO}_2 + \text{H}_2\text{O} + \text{SO}_2$
12.  $2\text{KOH} + \text{Cl}_2 \rightarrow \text{KCl} + \text{KClO} + \text{H}_2\text{O}$
13.  $2\text{NO}_2 + \text{H}_2\text{O} \rightarrow \text{HNO}_2 + \text{HNO}_3$
14.  $\text{Pb}_3\text{O}_4 + 8\text{HCl} \rightarrow 3\text{PbCl}_2 + 4\text{H}_2\text{O} + \text{Cl}_2$
15.  $2\text{H}_2\text{O} + 2\text{Cl}_2 \rightarrow 4\text{HCl} + \text{O}_2$
16.  $2\text{NaHCO}_3 \rightarrow \text{Na}_2\text{CO}_3 + \text{H}_2\text{O} + \text{CO}_2$
17.  $2\text{HNO}_3 + \text{H}_2\text{S} \rightarrow 2\text{NO}_2 + 2\text{H}_2\text{O} + \text{S}$
18.  $\text{P} + 5\text{HNO}_3 \rightarrow 5\text{NO}_2 + \text{H}_2\text{O} + \text{H}_3\text{PO}_4$

### EXERCISE-1 (C)

#### 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
<b>Magnesium</b>	$\text{MgCl}_2$	$\text{Mg}(\text{NO}_3)_2$	$\text{MgSO}_4$	$\text{MgCO}_3$	$\text{Mg}(\text{OH})_2$	$\text{Mg}_3(\text{PO}_4)_2$
<b>Sodium</b>						
<b>Zinc</b>						
<b>Silver</b>						
<b>Ammonium</b>						
<b>Calcium</b>						
<b>Iron( II)</b>						
<b>Potassium</b>						

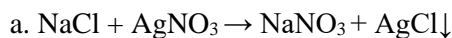
#### Solution:

Acid Radicals ↓	Chloride	Nitrate	Sulphate	Carbonate	Hydroxide	Phosphate
<b>Magnesium</b>	$\text{MgCl}_2$	$\text{Mg}(\text{NO}_3)_2$	$\text{MgSO}_4$	$\text{MgCO}_3$	$\text{Mg}(\text{OH})_2$	$\text{Mg}_3(\text{PO}_4)_2$
<b>Sodium</b>	$\text{NaCl}$	$\text{NaNO}_3$	$\text{Na}_2\text{SO}_4$	$\text{Na}_2\text{CO}_3$	$\text{NaOH}$	$\text{Na}_3\text{PO}_4$
<b>Zinc</b>	$\text{ZnCl}_2$	$\text{Zn}(\text{NO}_3)_2$	$\text{Zn}(\text{SO}_4)_2$	$\text{ZnCO}_3$	$\text{Zn}(\text{OH})_2$	$\text{Zn}_3(\text{PO}_4)_2$
<b>Silver</b>	$\text{AgCl}$	$\text{AgNO}_3$	$\text{Ag}_2\text{SO}_4$	$\text{AgCO}_3$	$\text{AgOH}$	$\text{Ag}_3\text{PO}_4$
<b>Ammonium</b>	$\text{NH}_4\text{Cl}$	$\text{NH}_4\text{NO}_3$	$(\text{NH}_4)_2\text{SO}_4$	$(\text{NH}_4)_2\text{CO}_3$	$\text{NH}_4\text{OH}$	$(\text{NH}_4)_3\text{PO}_4$
<b>Calcium</b>	$\text{CaCl}_2$	$\text{CaCO}_3$	$\text{CaSO}_4$	$\text{CaCO}_3$	$\text{Ca}(\text{OH})_2$	$\text{Ca}_3(\text{PO}_4)_2$
<b>Iron (II)</b>	$\text{FeCl}_2$	$\text{Fe}(\text{NO}_3)_2$	$\text{FeSO}_4$	$\text{FeCO}_3$	$\text{Fe}(\text{OH})_2$	$\text{Fe}_3(\text{PO}_4)_2$
<b>Potassium</b>	$\text{KCl}$	$\text{KNO}_3$	$\text{K}_2\text{SO}_4$	$\text{K}_2\text{CO}_3$	$\text{KOH}$	$\text{K}_3\text{PO}_4$

### 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?

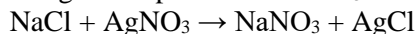
#### Solution:



b. It is a balanced equation.

c. Weights of reactants:  $\text{NaCl}$  - 58.44,  $\text{AgNO}_3$  - 169.87

Weights of products:  $\text{NaNO}_3$  - 84.99,  $\text{AgCl}$  - 143.32



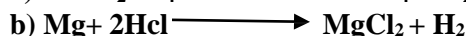
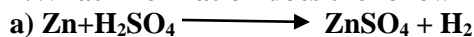
$$(23+35.5) + (108+14+48) \rightarrow (23+14+48) + (108+35.5)$$

$$58.5 + 170 \rightarrow 85 + 143.5$$

$$228.5 \text{ g} \rightarrow 228.5 \text{ g}$$

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

- Name the fundamental law involved in every equation.

#### Solution:

- A charged ion that consists of two or more covalently bounded atoms are called as polyatomic ions. Ex:  $\text{CaCO}_3$ ,  $\text{MgSO}_4$
- Fundamental law involved in every equation is "the law of conservation of mass".

### 6. What is the valency of?

a) Fluorine in  $\text{CaF}_2$

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.

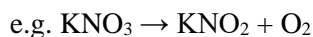
e) Valency of nitrogen in the given compounds:-

- i) 3                      ii)5                      iii)2                      iv)2
- f) Valency of Manganese in  $MnO_2$  is 2
- g) Valency of Copper in  $Cu_2O$  is 1.
- h) Valency of Magnesium in  $Mg_3N_2$  is 2

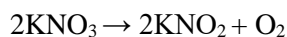
**7. Why should an equation be balanced? Explain with the help of simple equation.**

**Solution:**

An equation should not 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.



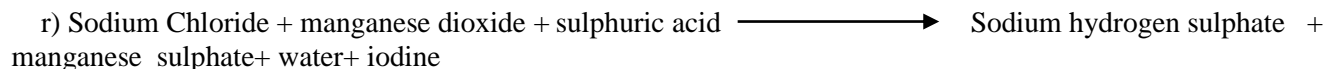
In this equation number of atoms in left and right side are not equal hence the balanced equation will be written as.



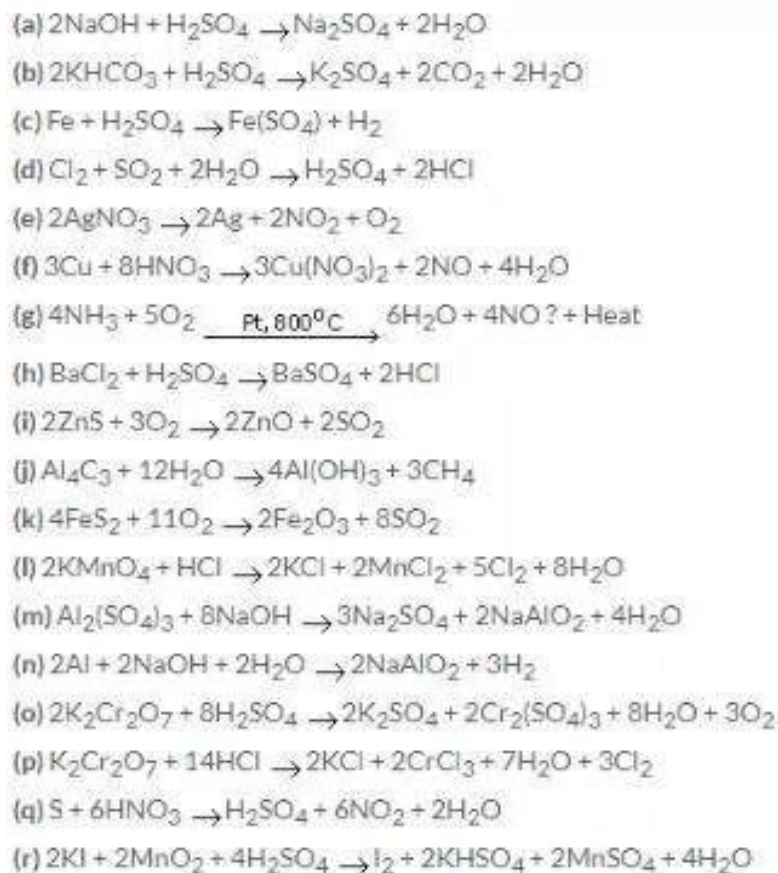
**8. Write the balanced chemical equations of the following word equations**

- a) Sodium hydroxide + Sulphuric acid  $\longrightarrow$  Sodium Sulphate + Water
- b) Potassium bicarbonate + Sulphuric acid  $\longrightarrow$  Potassium Sulphate + carbon dioxide + water
- c) Iron + Sulphuric acid  $\longrightarrow$  Ferrous sulphate + Hydrogen
- d) Chlorine + Sulphur dioxide + Water  $\longrightarrow$  Sulphuric acid + Hydrogen Chloride
- e) Silver Nitrate  $\longrightarrow$  Silver + Nitrogen dioxide + Oxygen
- f) Copper + Nitric acid  $\longrightarrow$  Copper nitrate + Nitric oxide + water
- g) Ammonia + oxygen  $\longrightarrow$  nitric oxide + water
- h) Barium chloride + Sulphuric acid  $\longrightarrow$  Barium Sulphate + Hydrochloric acid
- i) Zinc sulphide + oxygen  $\longrightarrow$  zinc oxide + sulphur dioxide
- j) Aluminium carbide + water  $\longrightarrow$  aluminium hydroxide + methane
- k) iron Pyrites ( $FeS_2$ ) + Oxygen  $\longrightarrow$  Ferriic oxide + sulphur dioxide
- l) Potassium permanganate + hydrochloric acid  $\longrightarrow$  potassium chloride + manganese chloride + chlorine + water
- m) Aluminium sulphate + sodium hydroxide  $\longrightarrow$  sodium sulphate + sodium meta aluminate + water
- n) Aluminium + sodium hydroxide + water  $\longrightarrow$  sodium meta aluminate + hydrogen
- o) Potassium dichromate + sulphuric acid  $\longrightarrow$  potassium sulphate + chromium sulphate + water + oxygen
- p) Potassium dichromate + hydrochloric acid  $\longrightarrow$  potassium chloride + chromium chloride + water + chlorine
- q) Sulphur + nitric acid  $\longrightarrow$  sulphuric acid + nitrogen dioxide + water
- r) Potassium iodide + manganese dioxide + sulphuric acid  $\longrightarrow$  Potassium hydrogen sulphate + manganese sulphate + water + iodine

OR



Solution:



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 1/12th of the mass of an atom of carbon.

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

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

(b)

$$\begin{aligned} 1) \text{ The relative molecular mass of } &= \text{CuSO}_4 \cdot 5\text{H}_2\text{O} \\ &= 63.5 + 32 + (16 \times 4) + 5(2 + 16) \\ &= 159.5 + 90 \\ &= 249.5 \end{aligned}$$

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

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

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                      d) Alchemist
- b) The number of carbon atoms in a hydrogen carbonate radical is  
 (i) one                      (ii) two                      (iii) Three                      (iv) Four

(b) The formula of iron(III) sulphate is

- (i)  $\text{Fe}_3\text{SO}_4$   
 ii)  $\text{Fe}(\text{SO}_4)_3$   
 iii)  $\text{Fe}_2(\text{SO}_4)_3$   
 (iv)  $\text{FeSO}_4$

(c) In water, the hydrogen-to-oxygen mass ratio is

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

(d) 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)  $\text{Ca}_2\text{HCO}_3$   
 (iv)  $\text{Ca}(\text{HCO}_3)_3$

**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**

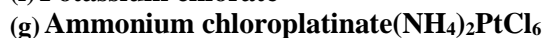
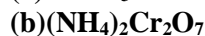
- (a) A molecular formula represents an element.  
 (b) Molecular formula of water is  $\text{H}_2\text{O}_2$ .  
 (c) A molecule of sulphur is monoatomic.  
 (d) CO and Co both represent cobalt.  
 (e) Formula of iron(III) oxide is FeO.

**Solution:**

- a) Molecular formula represents molecule of an element or a compound.  
 b) Molecular formula of water is  $\text{H}_2\text{O}$

- c) A molecule of sulphur is diatomic.
- d) CO represents carbon monoxide and Co represent cobalt.
- e) Formula of iron(III)oxide is  $\text{Fe}_2\text{O}_3$ .

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

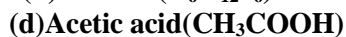


[At.mass: C=12, H=1, O=16, Cl=35.5, N=14, Cu=63.5, S=32, Na=23, K=39, Pt=195, Ca=40, P=31, Mg=24]

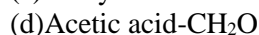
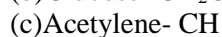
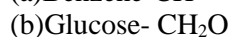
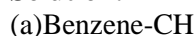
**Solution:**

1. Relative molecular mass of  $\text{CHCl}_3$   
 $= 12 + 1 + (3 \times 35.5)$   
 $= 12 + 1 + 106.5$   
 $= 119.5$
2. Relative molecular mass of  $(\text{NH}_4)_2\text{Cr}_2\text{O}_7$   
 $= (14 \times 2) + (1 \times 8) + (52 \times 2) + (16 \times 7)$   
 $= 28 + 8 + 104 + 112 = 252$
3. Relative molecular mass of  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$   
 $= 63.5 + 32 + (16 \times 4) + 5(2 + 16)$   
 $= 159.5 + 90$   
 $= 249.5$
4. Relative molecular mass of  $(\text{NH}_4)_2\text{SO}_4$   
 $= (2 \times 14) + (8 \times 1) + 32 + (4 \times 16)$   
 $= 28 + 8 + 32 + 64$   
 $= 132$
5. Relative molecular mass of  $\text{CH}_3\text{COONa}$   
 $= (12 \times 2) + (1 \times 3) + (16 \times 2) + 23$   
 $= 24 + 3 + 32 + 23$   
 $= 82$
6. Potassium chlorate ( $\text{KClO}_3$ )  $= 39.1 + 35.5 + 16 \times 3$   
 $= 39.1 + 35.5 + 48$   
 $= 122.6$
7. Ammonium chloroplatinate  $(\text{NH}_4)_2\text{PtCl}_6$   
 $= (14 \times 2) + (1 \times 8) + 195.08 + (35.5 \times 6)$   
 $= 28 + 8 + 195.08 + 213$   
 $= 444.08$

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



**Solution:**



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

**Solution:**

Relative molecular mass of  $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$

$$= 24 + 32 + (16 \times 4) + 7(2 + 16)$$

$$= 24 + 32 + 64 + 126 = 246$$

26 g of Epsom salt contains 126 g of water of crystallisation.

Hence, 100 g of Epsom salt contains  $100 \times 126/246$

The % 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:**

**(a) Relative molecular mass of  $\text{Ca}(\text{H}_2\text{PO}_4)_2$**

$$= 40.07 + (1 \times 4) + (30.9 \times 2) + (16 \times 8)$$

$$= 40.07 + 4 + 61.8 + 128$$

$$= 233.87$$

233.87 g  $\text{Ca}(\text{H}_2\text{PO}_4)_2$  contains 61.8 g P

So, 100 g  $\text{Ca}(\text{H}_2\text{PO}_4)_2$  contains

$$\frac{100 \times 61.8}{233.87} = 26.42 \text{ g}$$

The % of P in  $\text{Ca}(\text{H}_2\text{PO}_4)_2$  is 26.42%.

**(b) Relative molecular mass of  $\text{Ca}_3(\text{PO}_4)_2$**

$$= (40.07 \times 3) + (30.9 \times 2) + (16 \times 8)$$

$$= 120.21 + 61.8 + 128$$

$$= 310.01$$

310.01 g  $\text{Ca}_3(\text{PO}_4)_2$  contains 61.8 g P

So, 100 g  $\text{Ca}(\text{H}_2\text{PO}_4)_2$  contains

(IMAGE)

The % of P in  $\text{Ca}(\text{H}_2\text{PO}_4)_2$  is 19.93%.

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

**Solution:**

$$\begin{aligned} \text{Relative molecular mass of } \text{KClO}_3 & \\ &= 39.09 + 35.5 + (3 \times 16) \\ &= 122.59 \text{ g} \end{aligned}$$

122.59 g  $\text{KClO}_3$  contains 39.09 g K  
Hence, 100 g  $\text{KClO}_3$  contains

$$= \frac{100 \times 39.09}{122.59} = 31.9 \text{ g}$$

122.59 g  $\text{KClO}_3$  contains 35.5 g Cl  
Hence, 100 g  $\text{KClO}_3$  contains

$$= \frac{100 \times 35.5}{122.59} = 28.9 \text{ g}$$

122.59 g  $\text{KClO}_3$  contains 48 g O  
Hence, 100 g  $\text{KClO}_3$  contains

$$= \frac{100 \times 48}{122.59} = 39.1 \text{ g}$$

The percentages 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  $\text{CON}_2\text{H}_4$ . Calculate the percentage of carbon in urea. (C=12, O=16, N=14 and H=1)

**Solution:**

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

$$[12 + 16 + 28 + 4 = 60\text{g}]$$

Hence, relative molecular mass of urea = 60

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

$$= \frac{12 \times 100}{60}$$

$$= 20 \text{ or } 20\%$$

