Exercise 1A

Page No: 9-10

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_2 c) 2H d) $2H_2$
Solution:

a) H stands for one atom of Hydrogen
b) H_2 stands for one molecule of Hydrogen
c) 2H stands for 2 atoms of Hydrogen
d) $2H_2$ 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) $MgSO_4$
b) $(NH_4)_2$
c) $Al2(SO_4)_3$
d) $ZnCO_3$
e) $Mg(OH)_2$
Solution:

	Acid Radical	Basic radical
a) $MgSO_4$	SO_4^{2-}	Mg^{2+}
b) $(NH_4)_2SO_4$	SO_4^{2-}	NH_4^{+}
c) $Al_2(SO_4)_3$	SO_4^{2-}	Al^{3+}
d) $ZnCO_3$	CO_3^{2-}	Zn^{2+}
e) $Mg(OH)_2$	OH^{-}	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 $Al_2(SO_4)_3$, $(NH_4)_2SO_4$, $ZnSO_4$

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 A_2B_3.

14. Match the following

Compound	Formula
Boric acid	NaoH
Phosphoric acid	SiO_2
Nitrous acid	Na_2CO_3
Nitric acid	KOH
Sulphorous acid	$CaCO_3$
Sulphuric acid	$NaHCO_3$
Hydrochloric acid	H_2S
Silica (Sand)	H_2O
Caustic soda (Sodium Hydroxide)	PH_3
Caustic potash (Potassium hydroxide)	CH_4
Washing soda (Sodium carbonate)	NH_3
Baking Soda (Sodium bi carbonate)	HCl
Lime stone (Calcium carbonate)	H_2SO_3
Water	HNO_3
Hydrogen Sulphide	HNO_2
Ammonia	H_3BO_3
Phosphine	H_3PO_4
Methane	H_2SO_4

Solution:

Compound	Formula
Boric acid	H_3BO_3
Phosphoric acid	H_3PO_4
Nitrous acid	HNO_2
Nitric acid	HNO_3
Sulphorous acid	H_2SO_3
Sulphuric acid	H_2SO_4
Hydrochloric acid	HCl
Silica (Sand)	SiO_2
Caustic soda (Sodium Hydroxide)	NaOH
Caustic potash (Potassium hydroxide)	KOH
Washing soda (Sodium carbonate)	Na_2CO_3
Baking Soda (Sodium bi carbonate)	$NaHCO_3$
Lime stone (Calcium carbonate)	$CaCO_3$
Water	H_2O
Hydrogen Sulphide	H_2S
Ammonia	NH_3
Phosphine	PH_3
Methane	CH_4

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	SO_4^{-2}	Ba^{+2}	$BaSO_4$
b) Bismuth nitrate	NO_3^-	Bi^{+3}	$Bi(NO_3)_3$
c) calcium bromide	Br^-	Ca^{+2}	$CaBr_2$
d) Ferrous sulphide	S^{2-}	Fe^{+2}	FeS
e) Chromium sulphate	SO_4^{2-}	Cr^{+3}	$Cr_2(SO_4)_3$
f) Calcium silicate	SiO_4^{2-}	Cr^{+3}	$Cr_2(SO_4)_3$
g) Stannic oxide	O^{2-}	Sn^{+2}	SnO_2
h) Sodium Zincate	ZnO^{2-}	Na^{+1}	Na_2ZnO_2
i) Magnesium phosphate	PO_4^{3-}	Mg^{+2}	$Mg_3(PO_4)_2$
j) Sodium thiosulphate	$(S_2O_3)^{2-}$	Na^{+1}	$Na_2S_2O_3$
k) Stannic phosphate	$(PO_4)^{3-}$	Sn^{+4}	$Sn_3(PO_4)_4$
l) Nickel-bi-silphate	H_2SO^{4-}	Ni^{+3}	$NiH(SO_4)_3$
m) Potassium mangnate	MnO_4^{2-}	K^{+1}	K_2MnO_4
n) Potassium ferrocynide	$[Fe(CN)_6]^{4-}$	K^{+1}	$K_4[Fe(CN)_6]$

16. Write chemical names of the following compounds:
a) $Ca_3(PO_4)_2$
b) K_2CO_3
c) K_2MnO_4
d) $Mn_3(BO_3)_2$
e) $Mg(HCO_3)_2$
f) $Na_4Fe(CN)_6$
g) $Ba(Cl_3)_2$
h) Ag_2SO_3
i) $(CH_3COO)_2Pb$
j) Na_2SiO_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) KClO
b) $KClO_2$
c) $KClO_3$
d) $KClO_4$

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) AlO_3

ii) AlO_2
iii) Al_2O_3
iv) Al_3O_2

c) The valency of Nitrogen in Nitrogen di oxide (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 Al_2O_3
c) The valency of Nitrogen in Nitrogen di oxide (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 (NaHCO3)
d) Ammonia
e) Ammonium dichromate

Solution:

a) Sodium sulphate
Chemical formula is Na_2SO_4
Atoms - 2 sodium, one Sulphur and 4 oxygen atoms.

b) Quick lime
Chemical formula is CaO
Atoms - one Calcium atom and 1 oxygen atom

c) Baking soda ($NaHCO_3$)
Chemical formula of is $NaHCO_3$
Atoms - 1 Sodium, 1 hydrogen, 1 carbon and 3 oxygen atoms.

d) Ammonia
Chemical formula is NH_3
Atoms - 3 hydrogen and 1 nitrogen atom.

e) Ammonium dichromate
Chemical formula is $(NH_4)_2Cr_2O_7$.
Atoms - 2 ammonium, 2 chromium and 7 oxygen atoms.

20. The formula of the sulphate of an element M is $M_2(SO_4)_3$. 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.
$Zn(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + H_2$
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 - $Zn(s) + 2HCl(aq) \rightarrow ZnCl_2(aq) + H_2(g)$, Zinc (Zn) is a reductant metal that displaces hydrogen (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 → Carbon-di-oxide
b) Nitrogen + Oxygen → Nitrogen monoxide
c) Calcium + Nitrogen → Calcium nitride
d) Calcium oxide + carbon dioxide → Calcium carbonate
e) Magnesium + Sulphuric acid → Magnesium sulphate + Hydrogen
Solution:

a) $2C + O_2 \rightarrow CO_2$
b) $N_2 + O_2 \rightarrow 2NO$
c) $3Ca_{(s)} + N_{2(g)} \rightarrow Ca_3N_2$
d) $CaO + CO_2 \rightarrow CaCO_3$
e) $Mg(s) + H_2SO_4(aq) \rightarrow MgSO_4(aq) + H_2(g)$

5. Balance the following equations
a) $Fe + H_2O \rightarrow Fe_3O_4 + H_2$
b) $Ca + N_2 \rightarrow Ca_3N_2$
c) $Zn + KOH \rightarrow K_2ZnO_2 + H_2$
d) $Fe_2O_3 + CO \rightarrow Fe + CO_2$
e) $PbO + NH_3 \rightarrow Pb + H_2O + N_2$
f) $Pb_3O_4 \rightarrow PbO + O_2$
g) $PbS + O_2 \rightarrow PbO + SO_2$

h) $S + H_2SO_4 \rightarrow SO_2 + H_2O$
i) $S + HNO_3 \rightarrow H_2SO_4 + NO_2 + H_2O$
j) $MnO_2 + HCl \rightarrow MnCl_2 + H_2O + Cl_2$
k) $C + H_2SO_4 \rightarrow CO_2 + H_2O + SO_2$
l) $KOH + Cl_2 \rightarrow KCl + KClO + H_2O$
m) $NO_2 + H_2O \rightarrow HNO_2 + HNO_3$
n) $Pb_3O_4 + HCl \rightarrow PbCl_2 + H_2O + Cl_2$
o) $H_2O + Cl_2 \rightarrow HCl + O_2$
p) $NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$
q) $HNO_3 + H_2S \rightarrow NO_2 + H_2O + S$
r) $P + HNO_3 \rightarrow NO_2 + H_2O + H_3PO_4$
s) $Zn + HNO_3 \rightarrow Zn(NO_3)_2 + H_2O + NO_2$

Solution:

a) $3Fe + 4H_2O \rightarrow Fe_3O_4 + 4H_2$
b) $3Ca + N_2 \rightarrow Ca_3N_2$
c) $Zn + 2KOH \rightarrow K_2ZnO_2 + H_2$
d) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$
e) $3PbO + 2NH_3 \rightarrow 3Pb + 3H_2O + N_2$
f) $2Pb_3O_4 \rightarrow 6PbO + O_2$
g) $2PbS + 3O_2 \rightarrow 2PbO + 2SO_2$
h) $S + 2H_2SO_4 \rightarrow 3SO_2 + 2H_2O$
i) $S + 6HNO_3 \rightarrow H_2SO_4 + 6NO_2 + 2H_2O$
j) $MnO_2 + 4HCl \rightarrow MnCl_2 + 2H_2O + Cl_2$
k) $C + 2H_2SO_4 \rightarrow CO_2 + H_2O + SO_2$
l) $2KOH + Cl_2 \rightarrow KCl + KClO + H_2O$
m) $2NO_2 + H_2O \rightarrow HNO_2 + HNO_3$
n) $Pb_3O_4 + 8HCl \rightarrow 3PbCl_2 + 4H_2O + Cl_2$
o) $2H_2O + 2Cl_2 \rightarrow 4HCl + O_2$
p) $2NaHCO_3 \rightarrow Na_2CO_3 + H_2O + CO_2$
q) $2HNO_3 + H_2S \rightarrow 2NO_2 + 2H_2O + S$
r) $P + 5HNO_3 \rightarrow 5NO_2 + H_2O + H_3PO_4$
s) $Zn + 4HNO_3 \rightarrow Zn(NO_3)_2 + 2H_2O + 2NO_2$

Exercise 1C

Page No: 18-20

1. Fill in the blanks

a) Dalton used symbol _____ for oxygen _____ for hydrogen.

b) Symbol represents _____ atom(s) of an element.

c) Symbolic expression for a molecule is called _____.

d) Sodium chloride has two radicals. Sodium is a _____ radical, while chloride is a ___ radical.

e) Valency of Phosphorous in PCl_3 is _____, in PCl_5 is _____.

f) Valency of iron in $FeCl_2$ is ____ and in $FeCl_3$ it is _____.

g) Formula of iron (III) carbonate is _____.

Solution:

a) Dalton used symbol **[O]** for oxygen, **[H]** for hydrogen.
b) Symbol represents **gram** atom(s) of an element.
c) Symbolic expression for a molecule is called **molecular formula**.
d) Sodium chloride has two radicals. Sodium is a **basic** radical, while chloride is an **acid** radical.
e) Valency of Phosphorous in PCl3 is **3**, in PCl5 is **5**,
f) Valency of iron in $FeCl_2$ is **2** and in $FeCl_3$ it is **3**.
g) Formula of iron (III) carbonate is **$Fe_2[CO_3]_3$**.

2. Complete the following table

Acid Radical → / Basic radical ↓	**Chloride**	**Nitrate**	**Sulphate**	**Carbonate**	**Hydroxide**	**Phosphate**
Magnesium	**$MgCl_2$**	**$Mg(NO)_2$**	**$MgSO_4$**	**$MgCO_3$**	**$Mg(OH)_2$**	**$Mg_3(PO_4)_2$**
Sodium						
Zinc						
Silver						
Ammonium						
Calcium						
Iron (II)						
Potassium						

Solution:

Acid Radical → / Basic radical ↓	**Chloride**	**Nitrate**	**Sulphate**	**Carbonate**	**Hydroxide**	**Phosphate**
Magnesium	$MgCl_2$	$Mg(NO)_2$	$MgSO_4$	$MgCO_3$	$Mg(OH)_2$	$Mg_3(PO_4)_2$
Sodium	NaCl	$NaNO_3$	Na_2SO_4	Na_2CO_3	NaOH	Na_3PO_4
Zinc	$ZnCl_2$	$ZnNO_3$	$ZnSO_4$	$ZnCO_3$	$Zn(OH)_2$	$Zn_3(PO_4)_2$
Silver	AgCl	$AgNO_3$	Ag_2SO_4	$AgCO_3$	AgOH	Ag_3PO_4
Ammonium	NH_4Cl	NH_4NO_3	$(NH_4)_2SO_4$	$(NH_4)_2CO_3$	NH_4OH	$(NH_4)_3(PO_4)_2$
Calcium	$CaCl_2$	$CaNO_3$	$CaSO_4$	$CaCO_3$	$Ca(OH)_2$	$Ca_3(PO_4)_2$

Iron (II)	$FeCl_2$	$Fe(NO_3)_2$	$FeSO_4$	$FeCO_3$	$Fe(OH)_2$	$Fe_3(PO_4)_2$
Potassium	KCl	KNO_3	K_2SO_4	K_2CO_3	KOH	K_3PO_4

3. Sodium chloride reacts with silver nitrate to produce silver chloride and sodium nitrate
a) Write the equation
b) Check whether it is balanced, if not balance it.
c) Find the weights of reactants and products.
d) State the law that this equation satisfies?

Solution:

a) $NaCl + AgNO_3 \rightarrow NaNO_3 + AgCl\downarrow$

b) It is a balanced equation

c) Weights of reactants: NaCl - 58.44, $AgNO_3$ - 169.87
Weights of products: $NaNO_3$ - 84.99, AgCl - 143.32
$NaCl + AgNO_3 \rightarrow NaNO_3 + AgCl$
$(23+35.5) + (108+14+48) \rightarrow (23+14+48) + (108+35.5)$
$58.5 + 170 \rightarrow 85 + 143.5$
Thus, 228.5 g of reactants → 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?
a) $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$
b) $Mg + 2HCl \rightarrow MgCl_2 + H_2$
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: $CaCO_3$, $MgSO_4$

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

6. What is the valency of?
a) Fluorine in CaF_2

b) Sulphur in SF_6
c) Phosphorous in PH_3
d) Carbon in CH_4
e) Nitrogen in the following compound
i) N_2O_3 ii) N_2O_5 iii) NO_2 iv) NO
f) Manganese in MnO_2
g) Copper in Cu_2O
h) Magnesium in Mg_3N_2

Solution:

a) Valency of fluorine in CaF_2 is -1
b) Valency of sulphur in SF_6 is -6
c) Valency of phosphorus in PH_3 is +3
d) Valency of carbon in CH_4 is +4
e) Valency of nitrogen in the given compounds:
i) N_2O_3 = +3
ii) N_2O_5 = +5
iii) NO_2 = +4
iv) NO = +2

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

An equation should n 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 if a chemical reaction. An unbalanced equation either deletes or adds extra atoms in the equation.
e.g. $KNO_3 \rightarrow KNO_2 + O_2$

In this equation number of atoms in left and right side are not equal hence the balanced equation will be written as.
$2KNO_3 \rightarrow 2KNO_2 + O_2$

8. Write the balanced chemical equations of the following word equations
a) Sodium hydroxide + Sulphuric acid → Sodium Sulphate + Water
b) Potassium bicarbonate + Sulphuric acid → Potassium Sulphate + Carbon di oxide + Water
c) Iron + Sulphuric acid → Ferrous sulphate + Hydrogen
d) Chlorine + Sulphur di oxide + Water → Sulphuric acid + Hydrogen Chloride
e) Silver Nitrate → Silver + Nitrogen di oxide + Oxygen
f) Copper + Nitric acid → Copper nitrate + Nitric oxide + water
g) Ammonia + Oxygen → Nitric oxide + Water
h) Barium chloride + Sulphuric acid → Barium Sulphate + Hydrochloric acid
i) Zinc sulphide + Oxygen → Zinc oxide + Sulphur dioxide
j) Aluminium carbide + Water → Aluminium hydroxide + methane
k) Iron Pyrites + Oxygen → Ferric oxide + Sulphur di oxide
l) Potassium permanganate + Hydrochloric acid → Potassium chloride + Manganese

chloride + chlorine + Water
m) Aluminium sulphate + Sodium hydroxide → Sodium sulphate + Sodium meta aluminate + Water
n) Aluminium + Sodium hydroxide + Water → Sodium meta aluminate + Hydrogen
o) Potassium dichromate + Sulphuric acid → Potassium sulphate + Chromium sulphate + Water + Oxygen
p) Potassium dichromate + Hydrochloric acid → Potassium chloride + Chromium chloride+ Water + Chlorine
q) Sulphur + Nitric acid → Sulphuric acid + Nitrogen dioxide + Water
r) Sodium chloride + Manganese dioxide + Sulphuric acid → Sodium hydrogen sulphate + Manganese sulphate + Water+ Chlorine

Solution:

a) $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$
b) $2KHCO_3 + H_2SO_4 \rightarrow K_2SO_4 + 2CO_2 + 2H_2O$
c) $Fe + H_2SO_4 \rightarrow FeSO_4 + H_2$
d) $Cl_2 + SO_2 + 2H_2O \rightarrow H_2SO_4 + 2HCl$
e) $2AgNO_3 \rightarrow 2Ag + 2NO_2 + O_2$
f) $3Cu + 8HNO_3 \rightarrow 3Cu(NO_3)_2 + 2NO + 4H_2O$
g) $4NH_3 + 5O_2 \rightarrow 6H_2O + 4NO$
h) $BaCl_2 + H_2SO_4 \rightarrow BaSO_4 + 2HCl$
i) $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$
j) $Al_4C_3 + 12H_2O \rightarrow 4Al(OH)_3 + 3CH_4$
k) $4FeS_2 + 11O_2 \rightarrow 2Fe_2O_3 + 8SO_2$
l) $2KMnO_4 + HCl \rightarrow 2KCl + 2MnCl_2 + 5Cl_2 + 8H_2O$
m) $Al_2(SO_4)_3 + 8NaOH \rightarrow 3Na_2SO_4 + 2NaAlO_2 + 4H_2O$
n) $2Al + 2NaOH + 2H_2O \rightarrow 2NaAlO_2 + 3H_2$
o) $2K_2Cr_2O_7 + 8H_2SO_4 \rightarrow 2K_2SO_4 + 2Cr_2(SO4)_3 + 8H_2O + 3O_2$
p) $K_2Cr_2O_7 + 14HCl \rightarrow KCl + 2CrCl_3 + 7H_2O + 3Cl_2$
q) $S + 6HNO_3 \rightarrow H_2SO_4 + 6NO_2 + 2H_2O$
r) $2KI + 2MnO_2 + 4H_2SO_4 \rightarrow I_2 + 2KHSO_4 + 2MnSO_4 + 4H_2O$

9. a) Define atomic mass unit
b) Calculate the molecular mass of the following
i) $Na_2SO_4.10H_2O$ ii) $(NH_4)_2CO_3$ iii) $(NH_2)_2CO$ iv) Mg_3N_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 $1/12^{th}$ of the mass of an atom of carbon
1 a.m.u. = 1.67×10^{-24}m = 1.67×10^{27} kg
1 gm mass = 6.02×10^{23} a.m.u. and 1 kg mass = 6.02×10^{26} a.m.u.

b) i) The relative molecular mass of $CuSO_4.5H_2O$
= 63.5 + 32 + (16 x 4) + 5 (2 + 16)
= 159.5 + 90
= 249.5 2

ii) The relative molecular mass of $(NH_4)_2CO_3 = N_2H_8CO_3$
= 14 x 2 + 1 x 8 + 12 + 3 x 16
= 28 + 8 + 12 + 48
= 96

iii) The relative molecular mass of $(NH_2)_2CO = N_2H_4CO$
= 2 x 14 + 1 x 4 +12 + 16
= 28 + 4 + 12 + 16
= 60

iv) The relative molecular mass of Mg_3N_2
= 3 x 24 + 2 x 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 (ii) three (iv) four

c) The formula of Iron(III) Sulphate is
(i)Fe_3SO_4 (ii) $Fe(SO)_3$ (iii) $Fe(SO_4)_3$ (iv)$FeSO_4$

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, CO, and that of calcium hydrogen carbonate is
(i)$CaHCO_3$ (ii) $Ca(HCO_3)_2$ (iii) $CaHCO_3$ (iv) $Ca(HCO)_3$

Solution:

a) Answer is (iii) Berzelius
b) Answer is (i) One
c) Answer is (iii) $Fe_2(SO_4)_3$
d) Answer is (i) 1: 8
e) Answer is (ii) $Ca(HCO_3)_2$

11. Correct the following statements
(a) A molecular formula represents an element
(b) Molecular formula of water is H_2O_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) $CuSO_4.5H_2O$
(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 x 35.5)
= 12 + 1 + 106.5
= 119.5 2

(b) Relative molecular mass of $(NH_4)_2Cr_2O_7$
= (14 x 2) + (1 x 8) + (52 x 2) + (16 x 7)
= 28 + 8 + 104 + 112
= 252

(c) Relative molecular mass of $CuSO_4.5H_20$
= 63.5 + 32 + (16 x 4) + 5(2 + 16)
= 159.5 + 90
= 249.5

(d) Relative molecular mass of $(NH_4)_2SO_4$
= (2 x 14) + (8 x 1) + 32 + (4 x 16)
= 28 + 8 + 32 + 64
= 132

(e) Relative molecular mass of CH_3COONa
= (12 x 2) + (1 x 3) + (16 x 2) + 23
= 24 + 3 + 32 + 23
= 82

(f) Potassium chlorate ($KClO_3$)
= 39.1 + 35.5 + 16 x 3
= 39.1 + 35.5 + 48

= 122.6

(g) Ammonium chloroplatinate $(NH_4)_2PtCl_6$
= (14 x 2) + (1 x 8) + 195.08 + (35.5 x 6)
= 28 + 8 + 195.08 + 213
= 444.08

13. Give the empirical formula of:
(a) Benzene (C_6H_6) (b) Glucose ($C_6H_{12}O_6$) (c) Acetylene (C_2H_2) (d) Acetic acid (CH_3COOH)
Solution:

(a) Benzene - CH
(b) Glucose - CH_2O
(c) Acetylene - CH
(d) Acetic acid - CH_2O

14. Find the percentage mass of water in Epsom salt $MgSO_4.7H_2O$.
Solution:

Relative molecular mass of $MgSO_4.7H_2O$
= 24 + 32 + (16 x 4) + 7(2 + 16)
= 24 + 32 + 64 + 126
= 246
26 g of Epsom salt contains 126 g of water of crystallisation.
So, 100 g of Epsom salt contains (100 x 126/246) g of water
Thus, percentage mass of H_2O in $MgSO_4.7H_2O$ = 51.2

15. Calculate the percentage of phosphorus in:
(a) Calcium hydrogen phosphate $Ca(H_2PO_4)_2$
(b) Calcium phosphate $Ca_3(PO_4)_2$
Solution:

(a) Relative molecular mass of $Ca(H_2PO_4)$
= 40.07 + (1 x 4) + (30.9 x 2) + (16 x 8)
= 40.07 + 4 + 61.8 + 128
= 233.87
Now, 233.87 g of $Ca(H_2PO_4)$ contains 61.8 g of P
So, 100 g $Ca(H_2PO_4)$ contains
(100 x 61.8)/233.87 = 26.42 g
Thus, the percentage of phosphorous in $Ca(H_2PO_4)$ is 26.42%

(b) Relative molecular mass of $Ca_3(PO_4)_2$
= (40.07 x 3) + (30.9 x 2) + (16 x 8)
= 120.21 + 61.8 + 128
= 310.01
Now, 310.01 g of $Ca_3(PO_4)_2$ contains 61.8 g of P
So, 100 g $Ca_3(PO_4)_2$ contains

(100 x 61.8)/310.01 = 19.93 g
Thus, the percentage of phosphorous in $Ca_3(PO_4)_2$ is 19.93%

16. Calculate the percentage composition of each element in Potassium chlorate, $KClO_3$.
Solution:

Relative molecular mass of $KClO_3$
= 39.09 + 35.5 + (3 x 16)
= 122.59 g
So, 122.59 g of $KClO_3$ contains 39.09 g of K
Hence, 100 g of $KClO_3$ contains
= (100 x 39.09)/122.59
= 31.9 g

Also, 122.59 g of $KClO_3$ contains 35.5 g of Cl
Hence, 100 g of $KClO_3$ contains
= (100 x 35.5)/122.59
= 28.9 g

And, 122.59 g of $KClO_3$ contains 48 g of O
Hence, 100 g of $KClO_3$ contains
= (100 x 48)/122.59
= 39.1 g

Therefore, the percentage composition of K, Cl and O in $KClO_3$ are 31.9%, 28.9% and 39.1% respectively.

17. Urea is a very important nitrogenous fertilizer. Its formula is CH_4N_2O. 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

⇒ 12 + 16 + 28 + 4 = 60
Hence, relative molecular mass of urea = 60

Thus,
Percentage of carbon = Weight of carbon/Total weight of urea x 100
= 12/60 x 100
= 20%