What is the Equivalent weight of $Al_2(SO_4)_3$.

Al	—	$27 \times 2 = 54$
S	—	$32 \times 3 = 96$
O	—	$16 \times 12 = 192$
		342

Molecular weight of $Al_2(SO_4)_3$ = 342

Valence of $Al_2(SO_4)_3$ = 6

Equivalent weight of $Al_2(SO_4)_3$ = $\frac{342}{6}$ = 57.

2.7) How many Equivalents are there in 500 g $KMnO_4$?

1 g Equivalent of $KMnO_4$ = $\frac{\text{molecular weight}}{\text{valency}}$ = $\frac{158}{5}$ = 31.6 g of $KMnO_4$

Molecular weight of $KMnO_4$ = 158.02

K	39.09
Mn	54.93
O_4	64.00
	= 158.02

31.6 g of $KMnO_4$ — 1 g Equivalent of $KMnO_4$

500 g of $KMnO_4$ — ?

$\frac{500 \times 1}{31.6}$

31.6) 500 (15.82

32

180

160

200

192

08

∴ 15.82 g Equivalent

(Q.8) The analysis of magnesite ore are obtained from Chalk Hill area, Salem district, yields 81% $MgCO_3$, 14% SiO_2 and 5% H_2O (by weight), convert the analysis into mole %.

Component	wt %
$MgCO_3$	81
SiO_2	14
H_2O	5
Total.	

28 kg — 60 kg

14 kg — ?

Basis: 100 Kg ore.

Component	wt, kg.	Mol wt.	Kmol.	mol fraction	mole %
$MgCO_3$	81	84.305	0.96	0.657	65.7
SiO_2	14	60.08	0.23	0.157	15.7
H_2O	5	18	0.27	0.184	18.4
			1.46		100.00%

Mg – 24.305
C – 12.000
O_3 – 48.000
84305

$Si O_2$ – 28.08
O_2 – 32.00
60.08

$\text{Kmol} = \frac{\text{Wt}}{\text{Mol. Wt.}}$

0.657
0.157
0.184
1.018

84) 810 (0.96
756
540
504
360

60) 140 (0.23
120
200
180
20

18) 50 (0.27
36
140
126
5

146) 960 (0.657
876
840
730
1100

146) 230 (0.157
146
0840
730
110

146) 270 (0.184
146
1240
1168
0072
584

(2.9) The analysis of a sample of glass yields 7.8% Na_2O, 7.0% MgO, 9.7% ZnO, 2.0% Al_2O_3, 8.5% B_2O_5 and 65% SiO_2 (by weight). Convert this composition into mole %.

Basis: 100 kg sample

Components	wt %	wt, kg	Mol. wt.	Kmol.	mole %
Na_2O	7.8	7.8	62	$\frac{7.8}{62} = 0.1258$	~~12.58~~ 7.84 ~
MgO	7.0	7.0	40.3	$\frac{7.0}{40.3} = 0.1736$	~~17.36~~ 10.82 ~
ZnO	9.7	9.7	81.39	$\frac{9.7}{81.39} = 0.11917$	~~11.917~~ 7.43 ~
Al_2O_3	2.0	2.0	102.00	$\frac{2}{102} = 0.0196$	~~1.96~~ 1.22 ~
B_2O_5	8.5	8.5	101.60	$\frac{8.5}{101.6} = 0.0836$	~~8.36~~ 5.21 ~
SiO_2	65.0	65.0	60.08	$\frac{65}{60.08} = 1.0818$	67.46
	100.0			1.60357	100.00

Na_2 — 46, O — 16, 62

Zn — 65.39, O — 16.00, 81.39

Al_2 — 54, O_3 — 48, 102

27, 27, 54

Mg — 24.305, O — 16.000, 40.305

B_2 — 21.6, O_5 — 80.0, 101.6

Si — 28.08, O_2 — 32.00, 60.08

$$\text{Kmol} = \frac{\text{wt}}{\text{mol. wt.}}$$

620) 780 (0.1258
620
1600
1240
03600
3100
05000
4960
0040

403) 700 (0.1736
403
2970
2821
01490
1209
02810
2418
0392

7200
124
7324

814) 970 (0.111
814
1560
814
7460
7324
01360
814
46

(2.10) A sample of seawater contains 35000 ppm solids. Express the concentration of the solids as the weight percentage.

$$\frac{35000}{10,00000} \times 100$$

$$= 3.5\ \%$$

(2.11) A sample of milliolite limestone, obtained from Porbandar, Gujarat, is found to contain 54.5 % CaO (by wt). If this CaO is present as $CaCO_3$ in the limestone find the content of $CaCO_3$ in the limestone.

$$CaCO_3 \rightarrow CaO + CO_2$$

100.078 56.078 44.

Mol. wt. of $CaCO_3$ = 100.

40.078
12.000
48.000
100.078

Mol. wt. of CaO = 56.078

Mol. wt. of CO_2 = 44.00

Mol wt. of CaO

40.078
16.000
56.078

CO_2

12.00
32.00
44.00

Basis: 100 kg limestone

CaO content of limestone = 54.5 kg

56.078 kg CaO ——— 100.078 kg $CaCO_3$

54.5 kg CaO ——— ?

$$\frac{54.5 \times 100.078}{56.078} = 97.26\%$$

(2.12) Calculate the available nitrogen in the following

(a) Commercial ammonium Sulphate (96 % pure) $(NH_4)_2SO_4$.

(b) pure Sodium nitrate (100 %) ~~(NH_4NO_3)~~ $NaNO_3$.

(2.13) A sample of caustic soda flakes contain 74.6 % Na_2O (by wt), find the purity of the flakes

$$2NaOH \longrightarrow Na_2O + H_2O$$
$$40 \qquad\qquad 62$$

Basis: 100 kg Caustic soda flakes.

Na	23	Na_2	46
O	16	O	16
H	1		
	40		62

100 kg flakes contain 74.6 kg Na_2O.

62 kg ——— 80 kg NaOH

74.6 kg Na_2O — ? $\quad \frac{74.6 \times 80}{62}$

98.25 kg NaOH.

(2.14) Nitric acid and water forms a maximum boiling azeotrope containing 62.2 mole % water (boiling ~~point~~ temperature = 403.6 K (130.6 °C)). Find the composition of the azeotrope by weight.

Basis: 100 kmol azeotropic mixture

Contain 62.2 kmol water

100.0	
62.2	
37.8	

$$\text{kmol} = \frac{\text{wt}}{\text{mol wt}}$$

wt of water = 62.2×18

$= 1119.6$

37.8 kmol HNO_3

1	
14	
48	
63	

wt. of $HNO_3 = 37.8 \times 63$

$= 2381.4$

Total wt = 3501

31.97 % water by wt.

$(100 - 31.97) = 68.03$ % HNO_3 by wt.