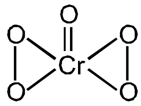
Self Practice Paper (SPP)

1. Oxidation number of Os in OsO_4 :

(1) + 2 (2) + 4 (3) + 8 (4) + 10

2. The oxidation number of sulphur in $H_2S_2O_7$ is :

(1) + 2 (2) + 6 (3) + 4 (4) + 8

3. CrO_5 has structure as shown 

The oxidation number of chromium in the above compound is

(1) 4 (2) 5 (3) 6 (4) 0

4. Which of the following is a set of reducing agents ?

(1) HNO_3, Fe^{2+} , F_2 (2) F^- , Cl^- ,MnO_4^- (3) I^- , Na, Fe^{2+} (4) $Cr_2O_7^{2-}$, CrO_4^{2-} , Na

5. Both oxidation and reduction takes place in :

(1) $NaBr + HCl \longrightarrow NaCl + HBr$

(2) $HBr + AgNO_3 \longrightarrow AgBr + HNO_3$

(3) $H_2 + Br_2 \longrightarrow 2HBr$

(4) $CaO + H_2SO_4 \longrightarrow CaSO_4 + H_2O$

6. $MnO^{2-}{}_4$ (1 mol) in neutral aqueous medium is disproportionate to :

(1) 2/3 mol of $MnO^-{}_4$ and 1/3 mol MnO_2

(2) 1/3 mol of $MnO^-{}_4$ and 2/3 mol MnO_2

(3) 1/3 mol of Mn_2O_7 and 1/3 mol MnO_2

(4) 2/3 mol of Mn_2O_7 and 1/3 mol MnO_2

7. Which of the following is not a redox reaction ?

(1) $KCN + Fe(CN)_2 \longrightarrow K_4\,[Fe(CN)_6]$

(2) $Rb + H_2O \longrightarrow RbOH + H_2$

(3) $H_2O_2 \longrightarrow H_2O + O$

(4) $CuI_2 \longrightarrow CuI + I_2$

8. Which of the following reaction is balanced ?

(1) $AsO_4^{2-} + MnO_4^- \longrightarrow AsO_4^{3-} + MnO_2 + 2H_2O$

(2) $MnO_4^- + C_2O_4^{2-} \longrightarrow Mn^{2+} + CO_2$

(3) $Cu + 4HNO_3 \longrightarrow Cu(NO_3)_2 + 2NO_2$

(4) $H_2S + HNO_3 \longrightarrow H_2O + NO + S$

9. In the reaction

$As_2S_5 + x\,HNO_3 \longrightarrow 5\,H_2SO_4 + yNO_2 + 2\,H_3AsO_4 + 12\,H_2O$

the values of x and y are

(1) 40, 40 (2) 10, 10 (3) 30, 30 (4) 20, 20

10. The normality of orthophosphoric acid having purity of 70% by weight and specific gravity 1.54 is :

(1) 11 N (2) 22 N (3) 33 N (4) 44 N

11. Normality of 0.3 M H_3PO_4 solution is :

(1) 0.3 N (2) 0.4 N (3) 0.6 N (4) 0.9 N

12. The normality of mixture obtained by mixing 100 mL of 0.2 M H_2SO_4 and 200 mL of 0.2 M HCl is :

(1) 0.0267 (2) 0.2670 (3) 1.0267 (4) 1.1670

13. One gram equimolecular mixture of Na_2CO_3 and $NaHCO_3$ is reacted with 0.1 NHCl. The milliliters of 0.1 N HCl required to react completely with the above mixture is :
(1) 15.78 mL (2) 157.8 mL (3) 198.4 mL (4) 295.5 mL

14. The reagent commonly used to determine hardness of water titrimetrically is :
(1) oxalic acid (2) disodium salt of EDTA
(3) sodium citrate (4) sodium thiosulphate

15. Consider the redox reaction $2S_2O_3^{2-} + I_2 \longrightarrow S_4O_6^{2-} + 2\,I^-$:
(1) $S_2O_3^{2-}$ gets reduced to $S_4O_6^{2-}$ (2) $S_2O_3^{2-}$ gets oxidised to $S_4O_6^{2-}$
(3) I_2 gets reduced to I^- (4) I_2 gets oxidised to I^-

16. Equivalent weight of chlorine molecule in the equation is :
$$3\,Cl_2 + 6\,NaOH \longrightarrow 5\,NaCl + NaClO_3 + 3\,H_2O$$
(1) 42.6 (2) 35.5 (3) 59.1 (4) 71

17. $Cr_2O_7^{2-} \xrightarrow{H^+} Cr^{3}+$, Eq. wt of $Cr_2O_7^{2-}$ is
(1) mol. wt./6 (2) mol.wt./3 (3) mol.wt./4 (4) mol.wt./1

18. One mole of acidified $K_2Cr_2O_7$ on reaction with excess KI will liberate ...... mole (s) of I_2
(1) 6 (2) 1 (3) 7 (4) 3

19. Number of moles of $K_2Cr_2O_7$ reduced by 1 mole of Sn^{2+} is
(1) 1/6 (2) 1/3 (3) 2/3 (4) 1

20. Which compound decolourises iodine solution ?
(1) H_2SO_4 (2) Na_2S (3) Na_2SO_4 (4) $Na_2S_2O_3$

21. For neutralisation of one mol of NaOH the mass of 70% H_2SO_4 required is :
(1) 48 g (2) 70 g (3) 49 g (4) 35 g

22. Which will be the proper alternative in place of A in the following equation.
$$2Fe^{3+}(aq) + Sn^{2+}(aq) \longrightarrow 2Fe^{2+}(aq) + A$$
(1) Sn^{4+} (2) Sn^{3+} (3) Sn^{2+} (4) Sn

23. Which of the following reaction is disproportionation?
(1) $2H_2S + SO_2 \longrightarrow 2H_2O + 3S$
(2) $Ca + H_2 \longrightarrow CaH_2$
(3) $4\,P + 3NaOH \longrightarrow 3H_2O + PH_3 + 3NaH_2PO_2$
(4) All of the above

24. In which of the following metal is reduced (this is not balanced equation) :
(1) $[Cr_2O_7]^{2-} \longrightarrow [CrO_4]^{2-}$ (2) $[Fe(CN)_6]^{4-} \longrightarrow [Fe(CN)_6]^{3-}$
(3) $MnO_4^- \longrightarrow MnO_2$ (4) $MnO_4^{2-} \longrightarrow MnO_2^{-1}$

25. In the reaction : $Na_2S_2O_3 + 4Cl_2 + 5H_2O \longrightarrow Na_2SO_4 + H_2SO_4 + 8HCl$,
the equivalent weight of $Na_2S_2O_3$ will be : (M = molecular weight of $Na_2S_2O_3$)
(1) M/4 (2) M/8 (3) M/1 (4) M/2

26. In the reaction, $2CuSO_4 + 4KI \longrightarrow 2Cu_2I_2 + I_2 + 2K_2SO_4$
the equivalent weight of $CuSO_4$ will be :
(1) 79.75 (2) 159.5 (3) 329 (4) None of these

27. 100 milli moles of dichloroacetic acid ($CHCl_2$ COOH) can neutralize how many moles of ammonia to form ammonium dichloroacetate :
(1) 0.0167 (2) 0.1 (3) 0.3 (4) 0.6

28. The number of moles of ferrous oxalate oxidised by one mole of $KMnO_4$ in acidic medium is :
(1) 5/2 (2) 2/5 (3) 3/5 (4) 5/3

29. How many moles of $KMnO_4$ are needed to oxidise a mixture of 1 mole of each $FeSO_4$ & FeC_2O_4 in acidic medium :
(1) 4/5 (2) 5/4 (3) 3/4 (4) 5/3

30. 22.7 mL of (N/10) Na_2CO_3 solution neutralises 10.2 mL of a dilute H_2SO_4 solution. The volume of water that must be added to 400 mL of this H_2SO_4 solution in order to make it exactly N/10.
(1) 490.2 mL (2) 890.2 mL (3) 90.2 mL (4) 290.2 mL

31. HNO_3 oxidises NH_4^+ ions to nitrogen and itself gets reduced to NO_2. The moles of HNO_3 required by 1 mole of $(NH_4)_2SO_4$ is :
(1) 4 (2) 5 (3) 6 (4) 2

32. The mass of oxalic acid crystals ($H_2C_2O_4 \cdot 2H_2O$) required to prepare 50 mL of a 0.2 N solution is :
(1) 4.5 g (2) 6.3 g (3) 0.63 g (4) 0.45 g

33. When HNO_3 is converted into NH_3, the equivalent weight of HNO_3 will be :
(1) M/2 (2) M/1 (3) M/6 (4) M/8
(M = molecular weight of HNO_3)

34. In the conversion $NH_2OH \longrightarrow N_2O$,
the equivalent weight of NH_2OH will be :
(1) M/4 (2) M/2 (3) M/5 (4) M/1
(M = molecular weight of NH_2OH)

35. In the reaction : $Na_2S_2O_3 + 4Cl_2 + 5H_2O \longrightarrow Na_2SO_4 + H_2SO_4 + 8HCl$,
the equivalent weight of $Na_2S_2O_3$ will be : (M = molecular weight of $Na_2S_2O_3$)
(1) M/4 (2) M/8 (3) M/1 (4) M/2

36. In the reaction $Ca(OH)_2 + H_3PO_4 \longrightarrow Ca_3(PO_4)_2 + H_2O$, the equivalent mass of H_2O is : (M molecular mass)
(1) M (2) M / 2 (3) M / 3 (4) M / 6

37. When hypo solution is added to $KMnO_4$ solution then
(1) $Na_2S_2O_3$ is converted to Na_2SO_4 (2) $Na_2S_2O_3$ is converted to $Na_2S_4O_6$
(3) $KMnO_4$ is converted to K_2MnO_4 (4) $KMnO_4$ is converted to $MnSO_4$

38. In the reaction $H_2O_2^{18} + O_3 \rightarrow$ water + oxygen, radioactivity will be shown by which of the product :
(1) water (2) oxygen (3) both (1) & (2) (4) none of these

39. The equivalent mass of $MnSO_4$ is half its molecular mass when it is converted to :

(1) Mn_2O_3 (2) MnO_2 (3) MnO_4^- (4) MnO_4^{2-}

40. An aqueous solution of 6.3 g of oxalic acid dihydrate is made upto 250 mL. The volume of 0.1 N NaOH required to completely neutralise 10 mL of this solution is :

(1) 40 mL (2) 20 mL (3) 10 mL (4) 4 mL

41. Which amongst the following has the highest normality ?

(1) 16.0 g of NaOH in 200 mL of water (2) 1 N oxalic acid

(3) 2 M sulphuric acid (4) 1.5 hydrochloric acid

42. The number of moles of $KMnO_4$ that will be needed to react completely with one mole of ferrous oxalate $[Fe(C_2O_4)]$ in acidic solution is

(1) 1 (2) 2/5 (3) 3/5 (4) 4/5

43. What volume of water should be added to 1600 ml of a 0.205 N solution so that the resulting solution will be 0.2 N ?

(1) 40 mL (2) 50 mL (3) 100 mL (4) 20 mL

44. In alkaline medium, $KMnO_4$ reacts as follows (Atomic weights K = 39.09, Mn = 54.94, O = 16.00)

$2KMnO_4 + 2KOH \rightarrow 2K_2MnO_4 + H_2O + [O]$

Hence, its equivalent weight is :

(1) 31.6 (2) 63.2 (3) 126.4 (4) 158

45. 0.14 g of a substance when burnt in oxygen yields 0.28 g of oxide. The substance is –

(1) nitrogen (2) carbon (3) sulphur (4) phosphorous

SPP Answers

1.	(3)	**2.**	(2)	**3.**	(3)	**4.**	(3)	**5.**	(3)	**6.**	(1)	**7.**	(1)
8.	(3)	**9.**	(1)	**10.**	(3)	**11.**	(4)	**12.**	(2)	**13.**	(2)	**14.**	(2)
15.	(3)	**16.**	(1)	**17.**	(1)	**18.**	(4)	**19.**	(2)	**20.**	(4)	**21.**	(2)
22.	(1)	**23.**	(3)	**24.**	(3)	**25.**	(2)	**26.**	(2)	**27.**	(2)	**28.**	(4)
29.	(1)	**30.**	(1)	**31.**	(3)	**32.**	(3)	**33.**	(4)	**34.**	(2)	**35.**	(2)
36.	(1)	**37.**	(1)	**38.**	(2)	**39.**	(2)	**40.**	(1)	**41.**	(3)	**42.**	(3)
43.	(1)	**44.**	(4)	**45.**	(3)								

SPP Solutions

1. Let oxidation number of Os = x

Oxidation number of oxygen = – 2

$x + 4(-2) = 0$

$x = +8$

2. Let the oxidation number of 'S' be x

$H_2S_2O_7$

$\therefore \quad 2 \times 1 + 2x + 7 \times -2 = 0$

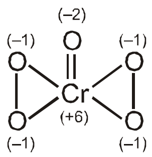
$x = +6$

Oxidation number of S = +6

$H_2S_2O_7$ is oleum.

$$\underset{\text{Sulphuric acid}}{H_2SO_4} + SO_3 \longrightarrow \underset{\text{Oleum}}{H_2S_2O_7} \longrightarrow \underset{\text{Sulphuric acid}}{2H_2SO_4}$$

3.



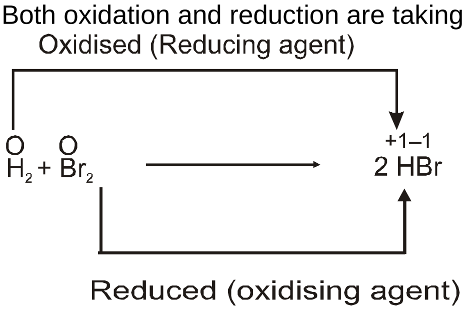
4. I^- can be oxidised to I_2

Na can be oxidised to Na^+

Fe^{2+} can be oxidised to Fe^{3+}

So, all are reducing agent.

5. Both oxidation and reduction are taking place in :



6. The reaction of MnO^{2-}_4 in aqueous medium takes place as below

$3MnO^{2-}_4 + 2H_2O \rightarrow MnO_2$

7. $KCN + Fe(CN)_2 \longrightarrow K_4[Fe(CN)_6]$
This is not redox reaction.

8. The balanced chemical equationis :
$Cu + 4HNO_3 \longrightarrow Cu(NO_3)_2 + 2NO_2 + 2H_2O$

9. $As_2S_5 + 40\ HNO_3 \longrightarrow 5\ H_2SO_4 + 40\ NO_2 + 2\ H_3AsO_4 + 12\ H_2O$

10. 70% by weight means
70 g of orthophosphoric acid is present in 100 g acid

$$N = \frac{w}{Eq.\ wt.} \times \frac{1000}{V_{(cc)}}$$

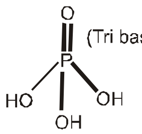
$w = 70$ g

$$Eq.\ wt. = \frac{mol.\ mass}{no.\ replacable\ H-atoms} = \frac{98}{3}$$

$$V = \frac{mass}{density} = \frac{100}{1.54}$$

$$N = \frac{70 \times 3 \times 1000 \times 1.54}{98 \times 100} = 33\ N$$

11. Normality = molarity $\times$ x
x = number of replacable H atom or OH groups in a molecule
In H_3PO_4 (orthophosphoric acid) x = 3


(Tri basic)

$N = 0.3 \times 3 = 0.9$ N

12. Normality of a mixture (N) = $\frac{N_1V_1 + N_2V_2}{V_1 + V_2}$

Normality(N_1) of H_2SO_4 = molarity $\times$ basicity = $0.2 \times 2 = 0.4$ N
$N_2 = 0.2 \times 1 = 0.2$ N
V_1 = 100mL, V_2 = 200 mL

$$N = \frac{0.4 \times 100 + 0.2 \times 200}{100 + 200} = \frac{40 + 40}{300} = \frac{80}{300} = 0.2670\ N$$

Normality of mixture of acid and base(N')

$$(N') = \frac{N_1V_1 \sim N_2V_2}{V_1 + V_2}$$

13. Suppose the molecules of Na_2CO_3 and $NaHCO_3$ in a mixture are 'a' .
milli-equivalent of HCl
$N_1V_1 + N_2V_2 = NV$
$a \times 2 \times 1000 + a \times 1 \times 1000 = 0.1\ V$
$3a = 10–4\ V$ ......(i)
[$\because$ N = basicity/acidity $\times$ M]
wt. of Na_2CO_3 + wt. of $NaHCO_3$ = 1 g
($\therefore$ wt. of mixture = 1 g)
$\Rightarrow$ $a \times 106 + a \times 84 = 1$
$a = 5.26 \times 10^{-3}$ ....(ii)
From Eqs. (i) and (ii) we have $3 \times 5.26 \times 10^{-3} = 10^{-4}V$
V = 157.8 mL

14. The hardness of water is estimated by simple titration of ethylene diamine tetra acetate (EDTA) solution.EDTA forms stable complexes with the metal ions present in the hard water since stability consatants of calcium and magnesium complexes of EDTA are different, even the selective estimation of these ions is possible.

15. S undergoes increase in oxidation number from +2 to +2.5, while I undergoes decrease in oxidation number from 0 to –1.

17. Valency factor of $Cr_2O_7^{2-}$ = 6

Equivalent weight = $\dfrac{\text{molecular weight}}{\text{v.f}} = \dfrac{\text{molecular weight}}{6}$

18. $Cr_2O_7^{2-} + 14H^+ + 6I^- \longrightarrow 3I_2 + 2Cr^{3+} + 7H_2O$
(v.f.=6) (v.f.=2)
Equivalents of $K_2Cr_2O_7$ = equivalents of I_2
1×6 = moles of $I_2 \times 2$
Moles of $I_2 = 3$

19. Moles of $K_2Cr_2O_7$ × v.f. = moles of Sn^{2+} × v.f.

Moles of $K_2Cr_2O_7 = \dfrac{1 \times 2}{6} = \dfrac{1}{3}$

20. Hypo ($Na_2S_2O_3$) decolouriese iodine solution.

$2Na_2S_2O_3 + I_2 \longrightarrow 2NaI + Na_2S_4O_6$
Sodium tetra thionate

21. The neutralization of NaOH by H_2SO_4 takes place as follows
$H_2SO_4 + 2NaOH \rightarrow Na_2SO_4 + H_2O$
For complete neutralization
Equilvalents of acid = equivalents of base
Equilvalents of NaOH = moles × Acidity = $1 \times 1 = 1$

Equilvalents of H_2SO_4 = $\dfrac{\chi}{98} \times 2 = \dfrac{\chi}{49}$ (Mol. mass of H_2SO_4 = 98

Putting the values $1 \times 1 = \dfrac{\chi}{49} \Rightarrow \chi = 49$ g

but H_2SO_4 is 70% let y 70% H_2SO_4 is required $\dfrac{70}{100} \times y = 49$

$\Rightarrow$ y = 70 g

22. $2Fe^{3+}(aq) + Sn^{2+}(aq) \longrightarrow 2Fe^{2+}(aq) + Sn^{4+}(aq)$

23. When a compound is simultaneously get reduced as well as oxidised in a reaction, then this type of reaction is called disproportionation reaction. Following reaction is an example of it.

$4P + 3NaOH \longrightarrow 3H_2O + PH_3 + 3NaH_2PO_2$

24. $MnO_4^- \longrightarrow MnO_2$

$Mn^{+7} \longrightarrow Mn^{+4}$
In this reaction Mn^{+7} reductive by Mn^{+4}

25. $Na_2\overset{+2}{S_2}O_3 \longrightarrow Na_2\overset{+6}{S}O_4$
the total change in oxidation number = 4 × 2 = 8

$\therefore \quad E_{Na_2S_2O_3} = \dfrac{\text{mol. wt.}}{\text{V.f}} = \dfrac{M}{8}$

26. $2CuSO_4 + 4KI \longrightarrow Cu_2I_2 + I_2 + 2K_2SO_4$.

$Cu^{2+} + 1e^- \longrightarrow Cu^+$.

E_{Cu} = ?. V.F. = 1.

$E_{CuSO4} = \dfrac{159.5}{1} = 159.5$

27. $eq_{acid} = eq_{base}$ (VF = 1 for both)

$CHCl_2COOH + NH_3 \longrightarrow CHCl_2COONH_4$

From reaction, m.moles of NH_3 = m.moles of dichloroacetic acid = 100

$\therefore$ Moles of $NH_3 = \dfrac{100}{1000} = 0.1$

28. Equivalents of FeC_2O_4 = equivalents of $KMnO_4$

x (mole) × 3 = 1 × 5

$x = \dfrac{5}{3}$ mole

29. Equivalent of $KMnO_4$ = equivalent of $FeSO_4$ + equivalent of FeC_2O_4

x × 5 = 1 × 1 + 1 × 3

$x = \dfrac{4}{5}$ mole

30. meq of Na_2CO_3 = meq of H_2SO_4

$\dfrac{1}{10} \times 22.7 = N \times 10.2$

Normality = 0.2225 N

$0.2225 \times 400 = \dfrac{1}{10} \times V_f$

or V_f = 890.2 mL

$\therefore$ Volume of H_2O mixed = 890.2 – 400 = 490.2 mL

31. $HNO_3 + NH_4^+ \longrightarrow N_2 + NO_2$

V.F. of HNO_3 = (5 – 4) = 1

V.F. of NH_4^+ = [0 – (–3)] = 3

so molar ratio of HNO_3 and NH_4^+ is 3 : 1.

1 mole $(NH_4)_2SO_4$ is found to contain 2 mole of NH_4^+

So, required moles of HNO_3 is 3 × 2 = 6 mole.

32. $H_2C_2O_4 . 2H_2O$ = 2 + 24 + 64 + 36 = 126 and Equivalent wt. = $\left[\dfrac{126}{2}\right]$

$0.2 = \dfrac{W \times 1000}{\left(\dfrac{126}{2}\right) \times 50}$ $\therefore$ W = 0.63 g

33. $H\overset{+5}{N}O_3 \longrightarrow \overset{-3}{N}H_3$ $\therefore$ V.f. of HNO_3 = 8

Eq. wt. = M/8.

34. $\underset{-1}{NH_2OH} \longrightarrow \underset{+1}{N_2O}$

$\therefore$ V.f. of NH_2OH = 2

$\therefore$ Eq wt = M/2

35. $Na_2\overset{+2}{S_2}O_3 \longrightarrow Na_2\overset{+6}{S}O_4$

the total change in oxidation number = 4 × 2 = 8

$\therefore \quad E_{Na_2S_2O_3} = \frac{\text{mol. wt.}}{\text{V. f}} = \frac{M}{8}$

36. In Acid Base neutralisation 1 H^+ combines with 1 OH^- to produce 1 H_2O therefore its equivalent mass = molecular mass.

37. $8KMnO_4 + 3Na_2S_2O_3 + H_2O \rightarrow 2KOH + 8MnO_2 + 3Na_2SO_4 + 3K_2SO_4$

38. O_3 will oxidise H_2O_2 into oxygen, hence radioacitve oxygen of H_2O_2 will go only in oxygen, not in water.

Half reactions : $O_3 + 2H^+ + 2e^- \longrightarrow O_2 + H_2O$; $\quad H_2O_2 \longrightarrow O_2 + 2H^+ + 2e^-$

39. Eq. mass $= \frac{\text{Molecular weight}}{\text{Change in oxidation No. of Mn}} = \frac{\text{Mol. wt.}}{4-2} = \frac{\text{Mol. wt.}}{2}$

(O.N. of Mn in $MnSO_4$ = +2; O.N. of Mn in MnO_2 = +4).

40. (1) Equilivalents of $H_2C_2O_4.2H_2O$ in 10 mL = Equivalents of NaOH

$\left(\frac{6.3}{126/2} \times \frac{1000}{250}\right) \times \frac{10}{1000} = 0.1 \times V$ (in litre)

$\therefore \quad V = 0.04$ L = 40 mL.

42. $\underline{K\overset{+7}{Mn}O_4} + \underline{\overset{+2}{Fe}\overset{+3}{C_2}O_4} \longrightarrow \underline{\overset{+3}{Fe^{3+}}} + \underline{\overset{+2}{Mn^{2+}}} + \underline{\overset{+4}{CO_2}}$

$5e^-$ $\quad 1e^- \quad 1e^- x2$

5 $\quad \underbrace{\qquad\qquad}_{3}$

$3KMnO_4 + 5FeC_2O_4 \longrightarrow$ Products

by mole-mole analysis.

$\frac{^{n}KMnO_4}{3} = \frac{^{n}FeC_2O_4}{5}$

$^{n}KMnO_4 = \frac{3}{5} \times 1$ moles.

45. wt of metal = 0.28 – 0.14 gm. = 0.14 gm

wt.of substance = wt. of oxygen

equivalent of substance = equivalent of oxygen

i.e. $\quad \frac{w_{(sub.)}}{E_A} = \frac{w_{(oxygen)}}{E_O}$

$E_A = E_O = \frac{32}{4} = 8$

For SO_2

$E_{Sulphur} = \frac{32}{4} = 8$