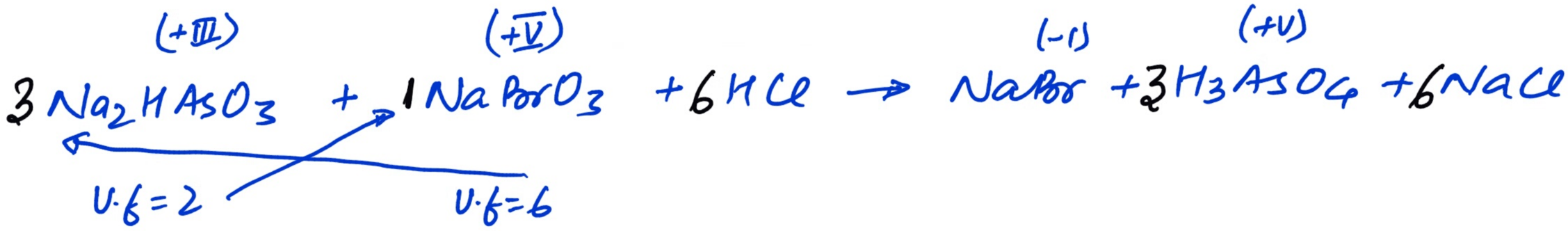
1. Given : **[JEE(Main-online)-2013]**

$X\ Na_2HAsO_3 + Y\ NaBrO_3 + ZHCl \rightarrow NaBr + H_3AsO_4 + NaCl$

The values of X, Y and Z in the above redox reaction are respectively :

(1) 2, 1, 3 (2) 3, 1, 6 (3) 2, 1, 2 (4) 3, 1, 4



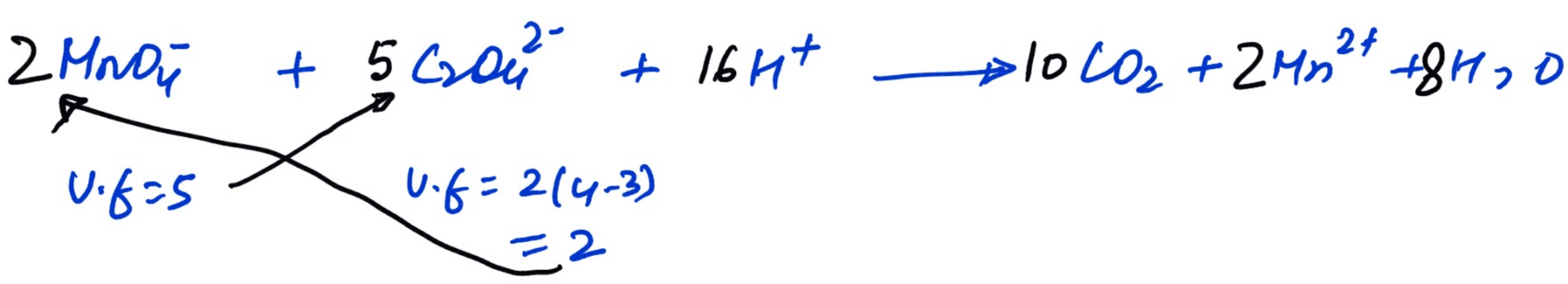
2. Consider the following reaction: **[JEE(Main)-2013]**

$$xMnO_4^- + yC_2O_4^{2-} + zH^+ \rightarrow$$

$$xMn^{2+} + 2yCO_2 + \frac{z}{2} H_2O$$

The values of x, y and z in the reaction are respectively :-

(1) 5,2 and 16 (2) 2,5 and 8 (3) 2, 5 and 16 (4) 5,2 and 8



3. How many electrons are involved in the following redox reaction ? **[JEE(Main-online)-2014]**

$Cr_2O_7^{2-} + Fe^{2+} + C_2O_4^{2-} \rightarrow Cr^{3+} + Fe^{3+} + CO_2$ (Unbalanced)

(1) 3 (2) 4 (3) 5 (4) 6 ✓

At Anode :- $Fe^{2+} + C_2O_4^{2-} \longrightarrow Fe^{3+} + 2CO_2 + 3e^-] \times 2$

At Cathode : $Cr_2O_7^{2-} + 14H^+ + 6e \longrightarrow 2Cr^{3+} + 7H_2O$

So 6 mole electrons are involved.

4. Consider the reaction **[JEE(Main-online)-2014]**

$$H_2SO_{3(aq)} + Sn^{4+}_{(aq)} + H_2O_{(l)} \rightarrow Sn^{2+}_{(aq)} + HSO^{-}_{4(aq)} + 3H^{+}_{(aq)}$$

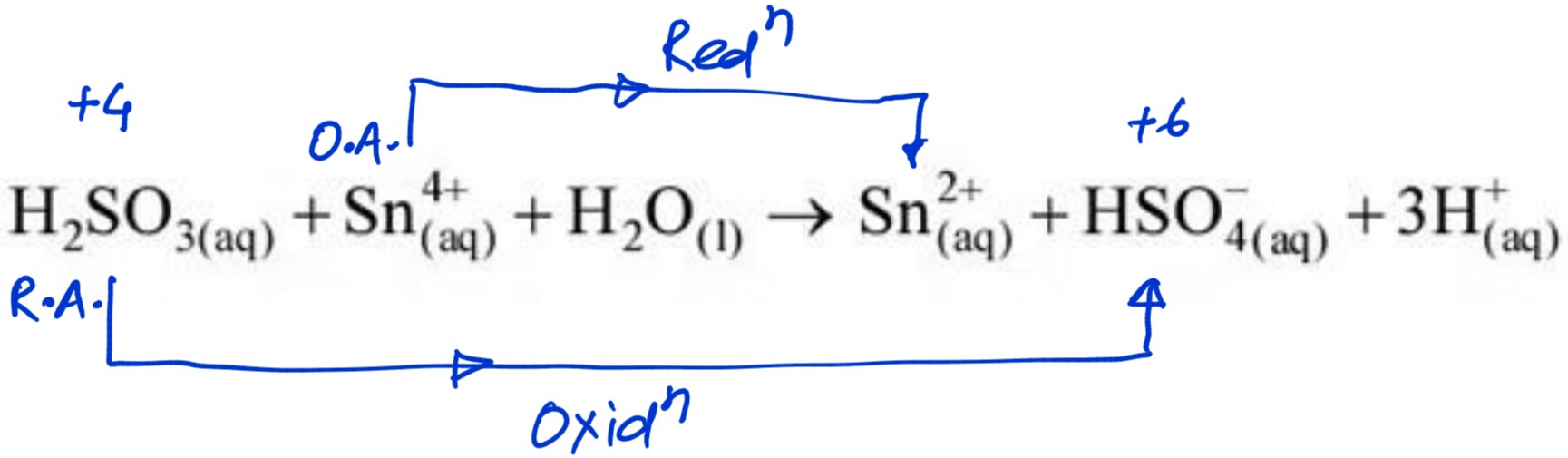
Which of the following statements is correct?

(1) H_2SO_3 is the reducing agent because it undergoes oxidation

(2) H_2SO_3 is the reducing agent because it undergoes reduction

(3) Sn^{4+} is the reducing agent because it undergoes oxidation

(4) Sn^{4+} is the oxidizing agent because it undergoes oxidation



Sn^{4+} is an oxidising agent because it undergoes reduction.

5. In which of the following reaction H_2O_2 acts as a reducing agent ? **[JEE(Main)-2014]**

(a) $H_2O_2 + 2H^+ + 2e^- \rightarrow 2H_2O$

(b) $H_2O_2 - 2e^- \rightarrow O_2 + 2H^+$

(c) $H_2O_2 + 2e^- \rightarrow 2OH^-$

(d) $H_2O_2 + 2OH^- - 2e^- \rightarrow O_2 + 2H_2O$

(1) (a), (c) (2) (b), (d) (3) (a), (b) (4) (c), (d)

(a) $H_2O_2 + 2H^+ + 2e^- \rightarrow 2H_2O$ Gain of e ⇒ O.A.

(b) $H_2O_2 - 2e^- \rightarrow O_2 + 2H^+$ loss of e ⇒ R.A.

(c) $H_2O_2 + 2e^- \rightarrow 2OH^-$ gain of e ⇒ O.A.

(d) $H_2O_2 + 2OH^- - 2e^- \rightarrow O_2 + 2H_2O$ loss of e ⇒ R.A.

6. The molecular formula of a commercial resin used for exchanging ions in water softening is $C_8H_7SO_3Na$ (Mol. w.t 206). What would be the maximum uptake of Ca^{2+} ions by the resin when expressed in mole per gram resin ? **[JEE(Main)-2015]**

(1) $\frac{2}{309}$ (2) $\frac{1}{412}$ (3) $\frac{1}{103}$ (4) $\frac{1}{206}$

$2C_8H_7SO_3Na + Ca^{2+} \longrightarrow (C_8H_7SO_3)_2Ca + 2Na^+$

1 gram

$= \frac{1}{206}$ mole

$\frac{1}{2} \times \frac{1}{206}$ mole $= \boxed{\frac{1}{412} \text{ mole}}$ Ans.

7. The volume of 0.1N dibasic acid sufficient to neutralize 1 g of a base that furnishes 0.04 mole of OH^- in aqueous solution is : **[JEE(Main)-OnLine-2016]**

(1) 400 mL (2) 200 mL (3) 600 mL (4) 800 mL

$H_2X + OH^- \longrightarrow$

0.1N 0.04 mole

V ml 0.6=1

eq. of H_2X = eq. of OH^-

$\therefore, \quad 0.1 \times V \times 10^{-3} = 0.04 \times 1$

$\therefore, \quad V = \boxed{\frac{40}{0.1} = 400 \text{ ml}.}$ Ans.

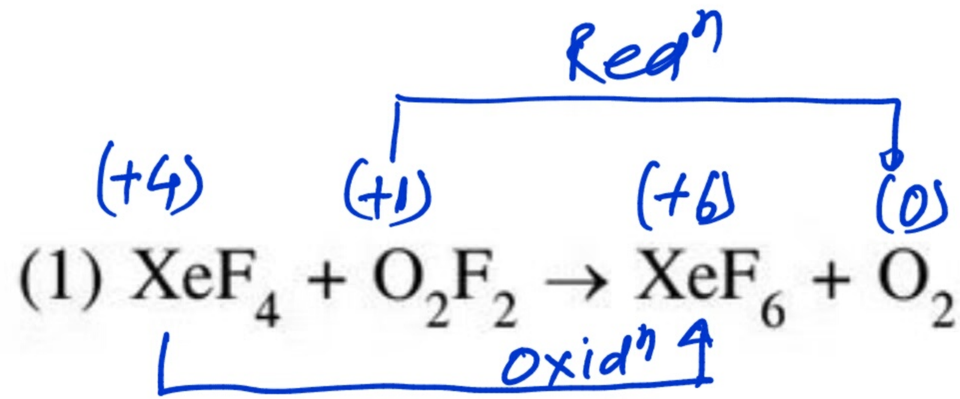
8. Which of the following reactions is an example of a redox reaction ? **[JEE(Main)-2017]**

(1) $XeF_4 + O_2F_2 \rightarrow XeF_6 + O_2$

(2) $XeF_2 + PF_5 \rightarrow [XeF]^+PF_6^-$

(3) $XeF_6 + H_2O \rightarrow XeOF_4 + 2HF$

(4) $XeF_6 + 2H_2O \rightarrow XeO_2F_2 + 4HF$



(2) $XeF_2 + PF_5 \rightarrow [XeF]^+PF_6^-$

(3) $XeF_6 + H_2O \rightarrow XeOF_4 + 2HF$

(4) $XeF_6 + 2H_2O \rightarrow XeO_2F_2 + 4HF$

9. In which of the following reaction, hydrogen peroxide acts as an oxidizing agent ?

(1) $I_2 + H_2O_2 + 2OH^- \rightarrow 2I^- + 2H_2O + O_2$ **[JEE(Main)-OnLine-2017]**

(2) $HOCl + H_2O_2 \rightarrow H_3O^+ + Cl^- + O_2$

(3) $PbS + 4H_2O_2 \rightarrow PbSO_4 + 4H_2O$

(4) $2MnO_4^- + 3H_2O_2 \rightarrow 2MnO_2 + 3O_2 + 2H_2O + 2OH^-$

Reduction

(-1) (-2) (-2)

(3) $PbS + 4H_2O_2 \rightarrow PbSO_4 + 4H_2O$

O.A.

10. The pair of compounds having metal in their highest oxidation state is :

(1) $[NiCl_4]^{2-}$ and $[CoCl_4]^{2-}$ **[JEE(Main)-OnLine-2017]**

(2) $[Fe(CN)_6]^{3-}$ and $[Cu(CN)_4]^{2-}$

(3) $[FeCl_4]^{-}$ and Co_2O_3

(4) MnO_2 and CrO_2Cl_2

(1) $[NiCl_4]^{2-}$ (+2) and $[CoCl_4]^{2-}$ (+2)

(2) $[Fe(CN)_6]^{3-}$ (+3) and $[Cu(CN)_4]^{2-}$ (+2)

(3) $[FeCl_4]^{-}$ (+3) and Co_2O_3 (+3)

(4) MnO_2 (+4) and CrO_2Cl_2 (+6)

11. In KO_2, the nature of oxygen species and the oxidation state of oxygen atom are, respectively

(1) Superoxide and –1/2

(2) Oxide and –2

[JEE(Main)-OnLine-2018]

(3) Peroxide and –1/2

(4) Superoxide and –1

KO_2 = Potassium superoxide

O.S. = $-\frac{1}{2}$.

12. In the reaction of oxalate with permaganate in acidic medium, the number of electrons involved in producing one molecule of CO_2 is : **[JEE(Main)-(Jan.)-2019]**

(1) 10 (2) 2 (3) 1 (4) 5

$$5C_2O_4^{2-} + 2MnO_4^- + 16H^+ \longrightarrow 10CO_2 + 2Mn^{2+} + 8H_2O$$

V.f = 5

$\therefore$ no. of moles of e transferred $= 2 \times 5 = 10$.

$\therefore$ In producing 1 molecule of CO_2, no. of e transferred

$$= \frac{10}{10} = 1$$

13. The chemical nature of hydrogen preoxide is :- **[JEE(Main)-(Jan.)-2019]**

(1) Oxidising and reducing agent in acidic medium, but not in basic medium.

(2) Oxidising and reducing agent in both acidic and basic medium

(3) Reducing agent in basic medium, but not in acidic medium

(4) Oxidising agent in acidic medium, but not in basic medium.

Memorise as information.

14. The hardness of a water sample (in terms of equivalents of $CaCO_3$) containing 10^{-3} M $CaSO_4$ is :
(molar mass of $CaSO_4$ = 136 g mol^{-1}) **[JEE(Main)-(Jan.)-2019]**

(1) 100 ppm (2) 50 ppm (3) 10 ppm (4) 90 ppm

Basis of calculation = 10^6 g hard water = 1000 L hard water
($\because$ d = 1 g/ml)

$CaSO_4 = 10^{-3}$ M, 1000 L = 1 mole

$\therefore$ $CaCO_3$ = 1 mole = 100 g $\equiv$ 100 ppm

15. 50 mL of 0.5 M oxalic acid is needed to neutralize 25 mL of sodium hydroxide solution. The amount of NaOH in 50 mL of the given sodium hydroxide solution is : **[JEE(Main)-(Jan.)-2019]**

(1) 4 g (2) 2 g (3) 8 g (4) 1 g

$H_2C_2O_4 + NaOH \longrightarrow$

0.5M, 50ml 25ml, M

v.f = 2 v.f = 1

meq. of $H_2C_2O_4$ = meq of NaOH

or, $0.5 \times 50 \times 2 = M \times 25 \times 1$

or, $M = \frac{50}{25} = 2M.$

$\therefore$ In 50 ml, NaOH = 50×2 mmole = 100 mmole = 0.1 mole = 0.1×40 g

= 4 g.

16. In order to oxidise a mixture one mole of each of FeC_2O_4, $Fe_2(C_2O_4)_3$, $FeSO_4$ and $Fe_2(SO_4)_3$ in acidic medium , the number of moles of $KMnO_4$ required is - **[JEE(Main)-(April)-2019]**

(1) 3 (2) 2 (3) 1 (4) 1.5

$5\,FeC_2O_4 + 3\,KMnO_4 \xrightarrow{H^+} Fe^{3+} + CO_2 + Mn^{2+}$

1 mole, v.f = 3 ; v.f = 5, $\frac{3}{5}$ mole

$5\,Fe_2(C_2O_4)_3 + 6\,KMnO_4 \xrightarrow{H^+} Fe^{3+} + CO_2 + Mn^{2+}$

1 mole ; v.f = 5, $\frac{6}{5}$ mole

v.f = 6(4-3) = 6

$5\,FeSO_4 + KMnO_4 \xrightarrow{H^+} Fe^{3+} + Mn^{2+}$

v.f = 1 ; v.f = 5

1 mole ; $\frac{1}{5}$ mole

$Fe_2(SO_4)_3 + KMnO_4 \longrightarrow$ no rek^n.

$\therefore$ $KMnO_4$ required

$= \frac{3}{5} + \frac{6}{5} + \frac{1}{5} =$ **2 mole**

17. The correct order of the oxidation states of nitrogen in NO, N_2O, NO_2 and N_2O_3 is :

(1) $NO_2 < N_2O_3 < NO < N_2O$

(2) $NO_2 < NO < N_2O_3 < N_2O$

(3) $N_2O < N_2O_3 < NO < NO_2$

(4) $N_2O < NO < N_2O_3 < NO_2$

[JEE(Main)-(April)-2019]

(+1) (+2) (+3) (+4)

(4) $N_2O < NO < N_2O_3 < NO_2$

18. The highest possible oxidation states of uranium and plutonium, respectively, are :-

(1) 6 and 4 (2) 7 and 6 **[JEE(Main)-(April)-2019]**

(3) 4 and 6 (4) 6 and 7

$_{92}U$ and Pu both are actinides which have variable valency due to 94 comparable energy of 5f, 6d and 7s. Their O.S. are listed below.

Ac	Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr
3	–	3	3	3	3	3	3	3	3	3	3	3	3	3
		4	4	4	4	4	4	4						
			5	5	5	5	5							
				6	6	6	6							
					7	7								

Highest O.S.

19. An example of a disproportionation reaction is : **[JEE(Main)-(April)-2019]**

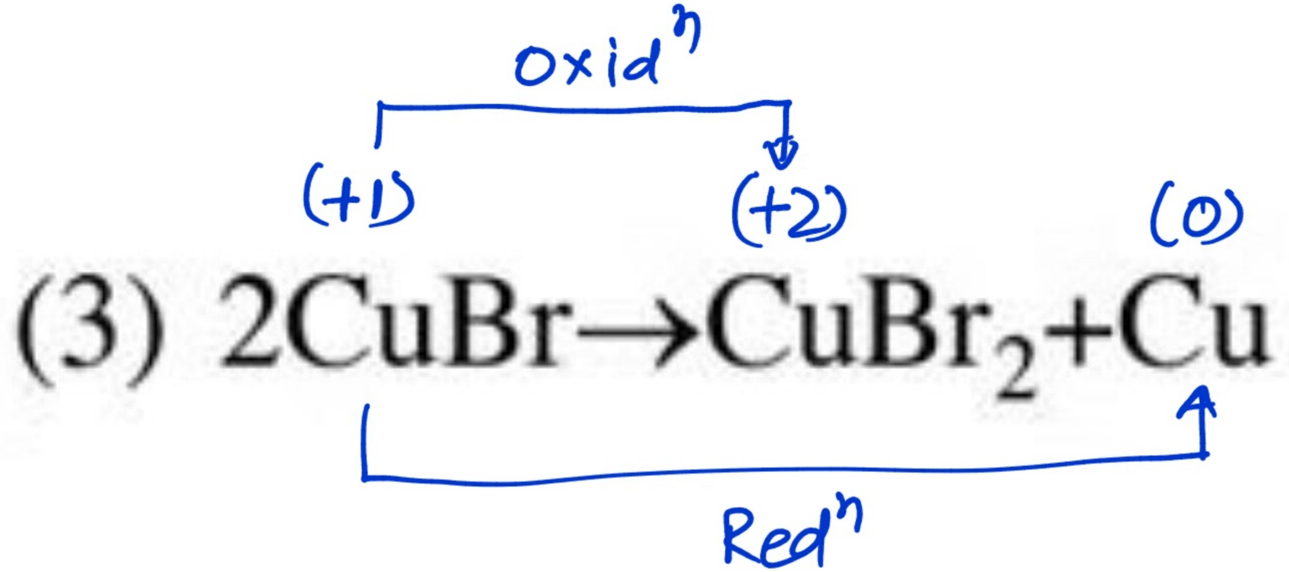
(1) $2KMnO_4 \rightarrow K_2MnO_4 + MnO_2 + O_2$

(2) $2MnO_4^- + 10I^- + 16H^+ \rightarrow 2Mn^{2+} + 5I_2 + 8H_2O$

(3) $2CuBr \rightarrow CuBr_2 + Cu$

(4) $2NaBr + Cl_2 \rightarrow 2NaCl + Br_2$

In disproportionation reaction same element undergoes oxidation as well as reduction.



20. 100 mL of a water sample contains 0.81 g of calcium bicarbonate and 0.73 g of magnesium bicarbonate. The hardness of this water sample expressed in terms of equivalents of $CaCO_3$ is:
(molar mass of calcium bicarbonate is 162 g mol^{-1} and magnesium bicarbonate is 146 $gmol^{-1}$)

(1) 1,000 ppm (2) 10,000 ppm **[JEE(Main)-(April)-2019]**

(3) 100 ppm (4) 5,000 ppm

Basis of Calculation: 10^6 g hard water = 10^6 ml hard water [$\because$ d = 1 g/ml]

$Ca(HCO_3)_2 = \frac{0.81}{100} \times 10^6 = 8100\,g = \frac{8100}{162}$ mole = 50 mole.

$Mg(HCO_3)_2 = \frac{0.73}{100} \times 10^6 = 7300\,g = \frac{7300}{146}$ mole = 50 mole.

$\therefore$ $CaCO_3$ = (50+50) = 100 mole = 100×100 g = 10,000 g

$\equiv$ 10,000 ppm

21. 25 ml of the given HCl solution requires 30 mL of 0.1 M sodium carbonate solution. What is the volume of this HCl solution required to titrate 30 mL of 0.2 M aqueous NaOH solution?

[JEE(Main)-(Jan)-2019]

(1) 25 mL (2) 50 mL (3) 12.5 mL (4) 75 mL

$HCl + Na_2CO_3 \longrightarrow$

25ml, M 30ml, 0.1M

V.f = 1 V.f = 2

meq. of HCl = meq. of Na_2CO_3 $\Rightarrow M \times 25 \times 1 = 0.1 \times 30 \times 2 \Rightarrow M = \frac{6}{25}$ M

$HCl + NaOH \longrightarrow$

$\frac{6}{25}$M, V ml 30ml, 0.2M

V.f = 1 V.f = 1

meq. of HCl = meq of NaOH

$\text{or, } \frac{6}{25} \times V \times 1 = 0.2 \times 30 \times 1 \Rightarrow V = \frac{6 \times 25}{6} = \boxed{25 ml}$