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Q. find moles of $K_2Cr_2O_7$ and KOH required to titrate (react) 100 ml 0.5M $H_2C_2O_4 \cdot 2KHC_2O_4$ separately

$$K_2Cr_2O_7 + H_2C_2O_4 \cdot 2KHC_2O_4 \rightarrow CO_2 + Cr^{3+} \qquad \frac{1}{20}, \frac{3}{20}$$

$n_f = 6$ $\quad$ $n_f = 6$

$$n \times 6 = \frac{100 \times 0.5 \times 6}{1000}$$

$$n = 0.05 = \frac{1}{20}$$

$$KOH + H_2C_2O_4 \cdot 2KHC_2O_4 \rightarrow K_2C_2O_4 \cdot 2K_2C_2O_4$$

$n_f = 1$ $\quad$ $n_f = 4$

$$n \times 1 = \frac{100 \times 0.15}{1000/10} \times 4 = \frac{1}{10} \times 4$$

$$n = 0.2$$

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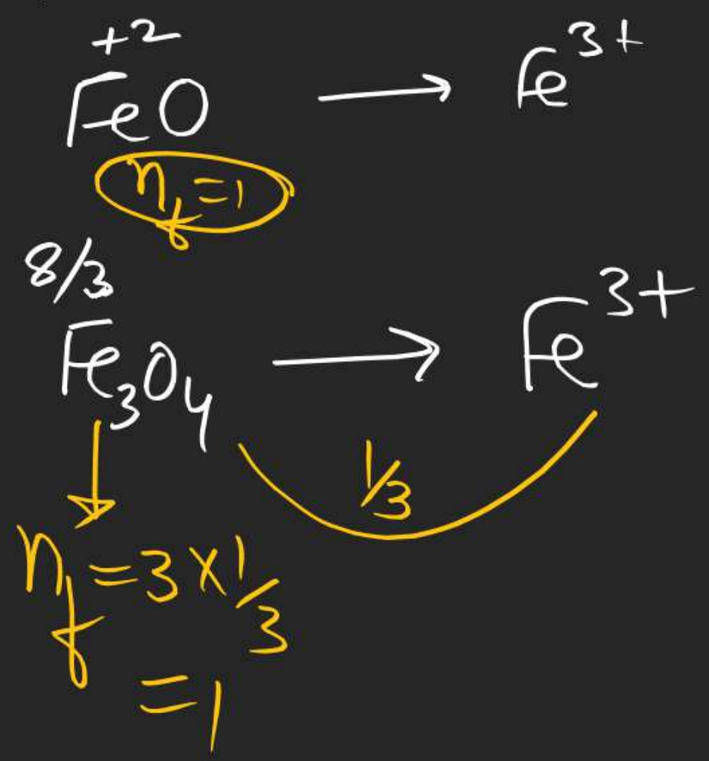
Mixture related problems

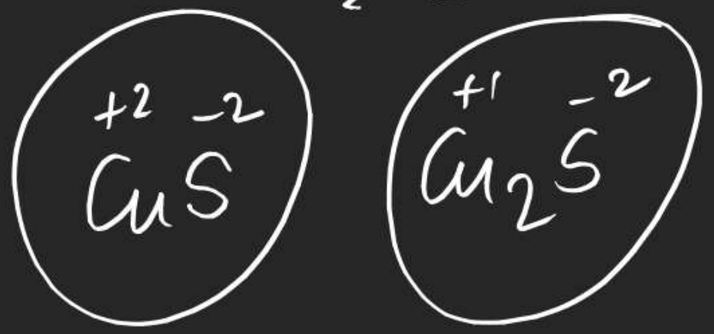
Q. An equimolar mixture of FeO & Fe_3O_4 is oxidised by 4 moles of $K_2Cr_2O_7$. find moles of each in original mixture.



eq of FeO + eq of Fe_3O_4 = eq of $K_2Cr_2O_7$

$x \times 1 + x \times 1 = 4 \times 6$

$2x = 24$



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$$A + B \xrightarrow{n_1} C + D$$

$e_1 \quad e_1 \quad e_1/n_1 \quad e_1$

$$n_2\,C + E \longrightarrow F + G$$

$n_2 \times \left[\frac{e_1}{n_1} \text{ moles}\right]$ Iodimetry

$= \frac{n_2}{n_1} \times e_1$ eq

eq of $KMnO_4$ = eq of $Na_2S_2O_3$

$50 \times M \times 5 = 100 \times 0.2 \times 1$

$M = \frac{2}{5} \times 0.2 = \frac{0.4}{5} = 0.08$

Q. 50ml $KMnO_4$ soln is mixed with excess KI in acidic medium. Evolved $I_2(g)$ is collected and is titrated with 100 ml 0.2M $Na_2S_2O_3$ soln find molarity of $KMnO_4$ soln

$KMnO_4 + KI \rightarrow I_2 + Mn^{2+}$ ($n_1 = 2$ for I_2)

$I_2 + Na_2S_2O_3 \rightarrow I^- + Na_2S_4O_6$ ($n_1 = 2$ for I_2, $n_1 = 1$ for $Na_2S_2O_3$)

Iodometry

Iodimetry $\quad R.A. + I_2 \longrightarrow I^-$

$Na_2S_2O_3 + I_2$

eq of R.A. + eq of $Na_2S_2O_3$ = eq of I_2

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Q. 50 ml KIO_3 is mixed with excess KI. Evolved I_2 is collected and titrated with 100 ml 0.4 M $Na_2S_2O_3$. find molarity of KIO_3 soln?

$n_f = 5$

$KIO_3 + KI \longrightarrow I_2$

$5/3 = \frac{2 \times 10}{2+10}$

20 mmoles $\times 5/3$

$n_f = 2$ $\quad$ $n_f = 1$

$I_2 + Na_2S_2O_3 \longrightarrow I^- + Na_2S_4O_6$

$100 \times 0.4 \times 1$

40 meq $= 40$ meq

$\frac{40}{2}$ mmol

$20 \times 5/3 = \text{eq of } KIO_3$

$= 50 \times M \times 5$

$\frac{2}{15} = M$

$40/3$

$2/5$

$4/15$

$4/3$

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Type - IV Rxns : Rxns in which an elements undergoes partial oxidn or Redn

$$KMnO_4 + \underset{-1}{HCl} \longrightarrow MnCl_2 + \overset{0}{Cl_2} + KCl + H_2O$$

$$\left[KMnO_4 \longrightarrow MnCl_2 \quad (5)\right] \times 2 \qquad \left[2HCl \longrightarrow Cl_2 \quad (2)\right] \times 5$$

$$2KMnO_4 + 16HCl \longrightarrow 2MnCl_2 + 5Cl_2 + 2KCl + 8H_2O$$

$\eta_f = \frac{10}{2} = 5$; $\eta_f = \frac{10}{16}$; $\eta_f = 10/2 = 5$; $\eta_f = 10/5$; $\eta_f = 10/2$; $\eta_f = 10/8$

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Type-I Rxn Substance involved in redox rxn but does not undergo any redn or oxidn

$$\underline{Cl_2} + \text{(NaOH)} \longrightarrow \underline{NaCl} + NaClO_3 + H_2O$$

$n_f = 5/3$

$n_f = 1$ $\quad$ $n_f = 5$

S-I 29 – 37

S-II 1 – 5

O-I 37-41

S-I 23-28

O-II 1-13

25 Fe_2O_3 FeO

$KMnO_4 + FeO \longrightarrow Mn^{2+} + Fe^{3+}$

CuO
x

Cu_2O + $KMnO_4$ → Cu^{2+} + Mn^{2+}

(+1) (+2)

$n = 2$

x mmol

$x \times 2 = 100 \times 0.1 \times 5 = 50$

$x = 25$ mmoles

CuO 25 | Cu_2O 25 mmol

CuO

Cu^{2+}

FeO $CuSO_4$

Fe^{2+}

3, 7, 8, 9

(B) hold

(3) $\underset{\eta_f = 1}{H_3PO_4} + NaOH \rightarrow NaH_2PO_4 + H_2O$

(4) $\overset{0}{Na} + \frac{1}{2}\overset{0}{H_2} \rightarrow \overset{+1}{Na}\overset{-1}{H}$

oxid

Redn

Ans (D)

(7)
(A) $1 \times 5 = n \times 1$ false

(B) $1 \times 6 = n \times 1$ false

(C) $2 \times 8 = n \times 5$ false

$16/5 = n = 3.2$

(D) $2 \times 8 = n \times 6$ True

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(27)

KHC_2O_4 + $KMnO_4$

1 mol

$H_2C_2O_4$ + $KMnO_4$

2 mol

1×2 + 2×2 = eq of $KMnO_4$

(38) $\overset{+3}{KHC_2O_4} \cdot 2\overset{+3}{H_2C_2O_4} + H_2O_2 \longrightarrow CO_2 + H_2O$

$n_f = 6$ $\quad$ $n_f = 2$

$$n \times 6 = 3000 \times M \times 2$$

(39) $NaHC_2O_4 \cdot 2H_2C_2O_4 \cdot 3K_2C_2O_4 \cdot 4Al_2(C_2O_4)_3 \cdot 3FeC_2O_4 \rightarrow Fe^{3+} + CO_2$

$n_f = 2 + 4 + 6 + 24 + 6 + 3 = 45$

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(41) $K_2Cr_2O_7 + N_2H_4 \longrightarrow$

$e_1 \quad e_1$

$KMnO_4 + N_2H_4$

$e_1 \quad e_1$

eq of $KMnO_4$ = eq of $K_2Cr_2O_7$