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n-factor calculation :-

① For non-redox Rxn

ⓐ n-factor for acid and base

$$H_2CO_3 + NaOH \longrightarrow Na_2CO_3 + H_2O$$

$n_f = 2$ $n_f = 1$

$$H_2CO_3 + NaOH \longrightarrow Na\underline{H}CO_3 + H_2O$$

$n_f = 1$ $n_f = 1$

n-factor = no. of H^+ or OH^- given/taken by per mole acid or base.

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If Chemical Rxn is not given

n-factor of acid/base = basicity or acidity

	n-factor
H_3PO_4	3
H_3PO_3	2
H_3PO_2	1
H_2SO_4	2
CH_3COOH	1

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$$1\,H_2SO_4 + 2\,NaOH \longrightarrow Na_2SO_4 + 2H_2O$$

x mol $\qquad$ y mol

(A) $x = 2y$

(B) $2x = y$

(C) $x = y$

basicity $\times\, x =$ $y \times$ acidity

Acid $\to$ basicity $\to$ H^+ given

base $\to$ acidity $\to$ OH^- given

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(2) n-factor for the ion

n-factor = charge on ion

	n-factor
PO_4^{3-}	3
SO_4^{2-}	2
Cl^-	1
$C_2O_4^{2-}$	2
NH_4^+	1

(3) n-factor compound

n-factor = Total charge on cation or anion displaced per molecule.

$$Na_3PO_4 + HCl \longrightarrow NaH_2PO_4 + NaCl$$

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

×

$$Na_3PO_4 + HCl \longrightarrow H_3PO_4 + NaCl$$

$n_f = 3$ $\quad$ $n_f = 1$ $\quad$ $n_f = 3$ $\quad$ $n_f = 1$

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$$Na_2SO_4 + BaCl_2 \longrightarrow BaSO_4 + NaCl$$

$n_f = 2$; $n_f = 2$; $n_f = 2$; $n_f = 1$

$$\underline{K_4}[Fe(CN)_6] + FeCl_3 \longrightarrow KFe[Fe(CN)_6] + KCl$$

$(n_f = 3)$; $(n_f = 3)$; $(n_f = 3)$; $n_f = 1$

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② for redox Rxn

n-factor = no. of e^- exchanged per mole of substance

Type-1 Rxn :→ Rxns in which only one element undergoes oxidn and one other element in other compound undergoes redn.

$$Zn + I_2 \longrightarrow Zn^{2+} + I^-$$

$$\underline{Zn} \longrightarrow Zn^{2+} + 2e^- \qquad 2e^- + I_2 \longrightarrow 2I^-$$

$n_f = 2$ $\qquad n_f = 2$ $\qquad n_f = 2$ $\qquad n_f = 1$

$$\overset{0}{Zn} + \overset{0}{I_2} \longrightarrow \overset{+2}{Zn^{2+}} + \overset{-1}{I^-}$$

2

1

$n_f = 1 \times 2$ $\qquad n_f = 2 \times 1 = 2$ $\qquad n_f = 1 \times 2$ $\qquad n_f = 1 \times 1$

5

(2) $\overset{+7}{MnO_4^-} + \overset{+3}{C_2O_4^{2-}} \longrightarrow \overset{+2}{Mn^{2+}} + \overset{+4}{CO_2}$

1

$n_f = 1 \times 5$

$n_f = 2 \times 1 = 2$

$n_f = 1 \times 5$

$n_f = 1$

3

(3) $\overset{+6}{K_2Cr_2O_7} + \overset{+8/3}{Fe_3O_4} \longrightarrow \overset{+3}{Cr^{3+}} + \overset{+3}{Fe_2O_3}$ $\quad 6, 1, 3, 2/3$

1/3

$n_f = 6$

$n_f = 3 \times 1/3 = 1$

$n_f = 3$

$n_f = 2 \times 1/3 = 2/3$

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$$\overset{0}{I_2} + Na_2\overset{+2}{S_2}O_3 \longrightarrow \overset{-1}{I^-} + Na_2\overset{+2.5}{S_4}O_6$$

Sodium thiosulphate (hypo)

1

0.5

$n_f = 2$

$n_f = 2 \times 0.5 = 1$

$n_f = 1$

$n_f = 4 \times 0.5 = 2$

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$$\overset{+5}{N}O_3^- + \overset{20/9}{Fe_{0.9}O} \longrightarrow \overset{-2}{N_2H_4} + \overset{+3}{Fe^{3+}}$$

7/9

7

$n_f = 1 \times 7$

$n_f = 0.9 \times 7/9$

$= 0.7$

$n_f = 14$

$n_f = 7/9$

7, 0.7, 14, 7/9

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$$\boxed{\text{Normality}(N) = \frac{\text{no. g equivalents}}{\text{Volume (lit)}}}$$

$$M = \frac{\text{no. g moles}}{\text{Vol (lit)}}$$

$$= \frac{\text{no. g moles} \times \text{n-factor}}{\text{Volume (lit)}}$$

$$\boxed{N = M \times \text{n-factor}}$$

$$\text{no. g equivalent} = N \times V$$

$$\text{no. g moles} = M \times V$$

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$$\overset{+7}{KMnO_4} \xrightarrow{\text{acidic}} Mn^{2+}$$

$$\rightarrow Mn^{4+} \quad \text{Neutral + slightly basic + basic}$$

$$\rightarrow Mn^{6+} \quad \text{strongly basic}$$

$$\overset{+6}{K_2Cr_2O_7} \longrightarrow Cr^{3+}$$

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

$$\underline{O.A.} + \overset{+3}{C_2O_4^{2-}} \longrightarrow \overset{+4}{CO_2}$$

$(Na_2C_2O_4)$

$(H_2C_2O_4)$

Q. Calculate moles of $KMnO_4$ required to oxidise 180 gm $H_2C_2O_4$ in acidic medium. Also calculate moles of CO_2 produced.

$$\overset{+7}{KMnO_4} + H_2\overset{+3}{C_2}O_4 \longrightarrow Mn^{2+} + CO_2$$

$(n_f = 5)$ $(n_f = 2)$ $(n_f = 5)$ $(n_f = 1)$

4eq

$eq = 2 \times 2 = 4eq$

4eq

4eq

$\frac{4}{5}$ mol

$\frac{4}{5}$ mol

$\frac{4}{1}$ moles

$$n_{H_2C_2O_4} = \frac{180}{90} = 2 \text{ moles}$$