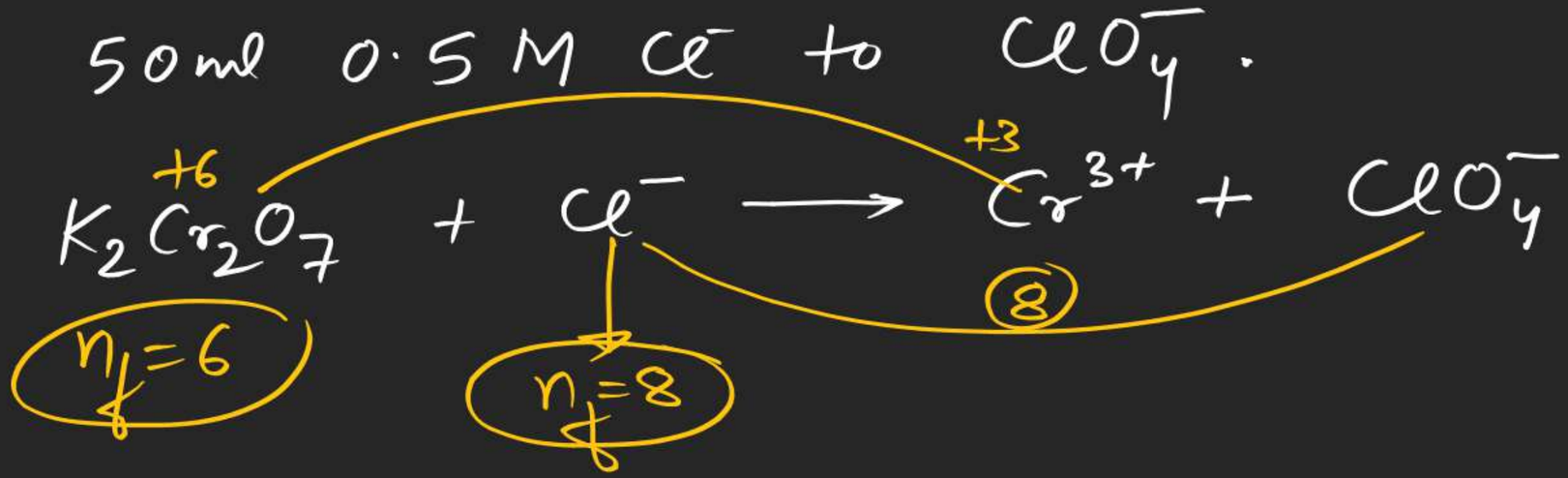
Nishant Jindal

Q. find volume of 0.2M $K_2Cr_2O_7$ required to oxidise 50ml 0.5M Cl^- to ClO_4^-.



$M \times V \times n\text{-factor} = M \times V \times n\text{-factor}$

$V \times \frac{0.2 \times 6}{3} = 0.5 \times 50 \times 2$

$V = \frac{50}{3}$

Nishant Jindal

Q: Calculate volume of 0.5M $Na_2S_2O_3$ required to react with 508 gm I_2.

(A) 4 lit (B) 8 lit (C) 16 lit (D) $\frac{2016}{127}$

Atomic mass = 127 of Iodine

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

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

0.5

$n_{I_2} = \frac{508}{254}$

$= 2$ mol

2 moles × 2 = M × V × n

$4 = 0.5 \times V \times 1$

$8 = V$

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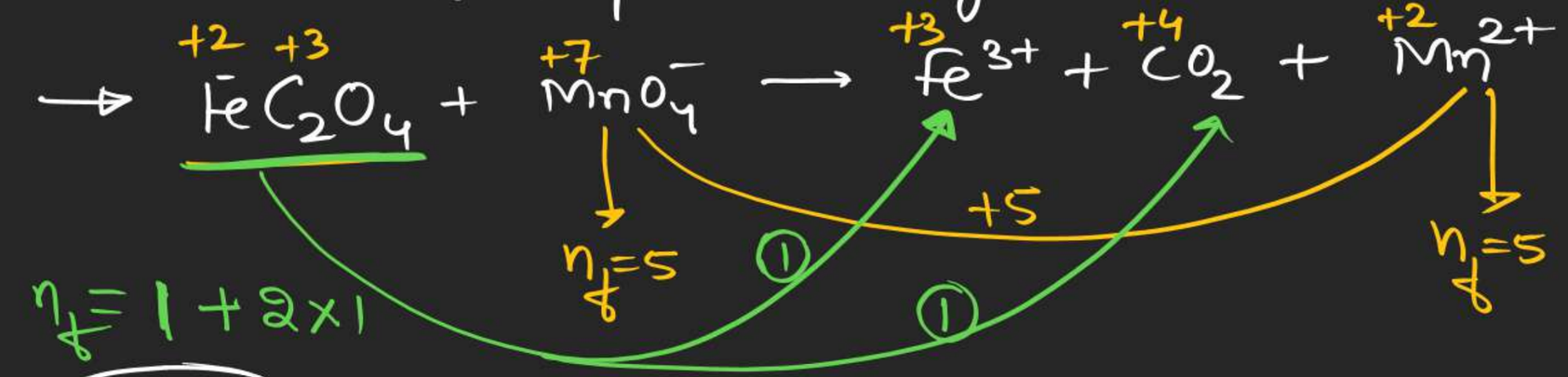
Type-2 Rxn : Rxns in which more than one element in a compound undergoes oxidⁿ or Redⁿ



$1\ FeC_2O_4 \longrightarrow Fe^{3+} + 2CO_2 + 3e^-$

$n_f = 3$ | $n_f = 3$ | $n_f = 3/2$

1 mol | 1 mol | 2 mol

1 x 3 eq | 1 x 3 eq | 2 x 3/2 eq

n-factor = no. of e^- exchanged per molecule

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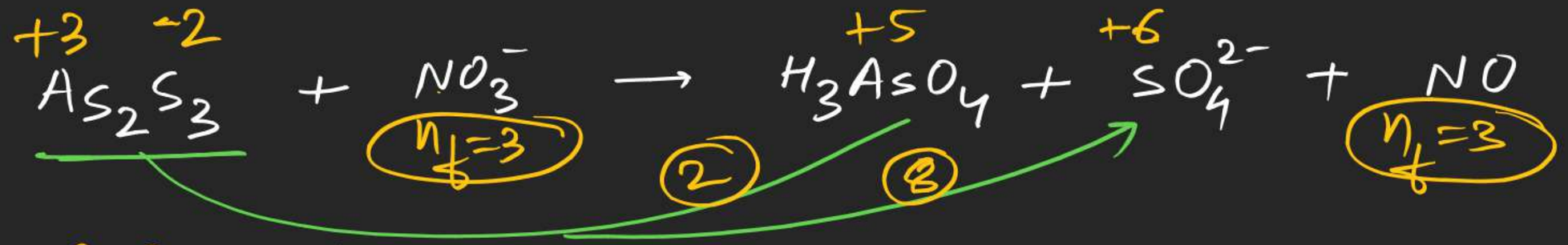


$n_f = 2 \times 2 + 3 \times 8$

$n_f = 28$

$$20\,H_2O + As_2S_3 \longrightarrow 2H_3AsO_4 + 3SO_4^{2-} + 34H^+ + 28e^-$$

As_2S_3: $n_f = 28$

H_3AsO_4: $n_f = 14$

SO_4^{2-}: $n_f = 28/3$

Nishant Jindal

$$MnO_4^- + \underset{+1\ \ -3}{Cu_3P} \longrightarrow \underset{+2}{Cu^{2+}} + \underset{+5}{PO_4^{3-}} + Mn^{2+}$$

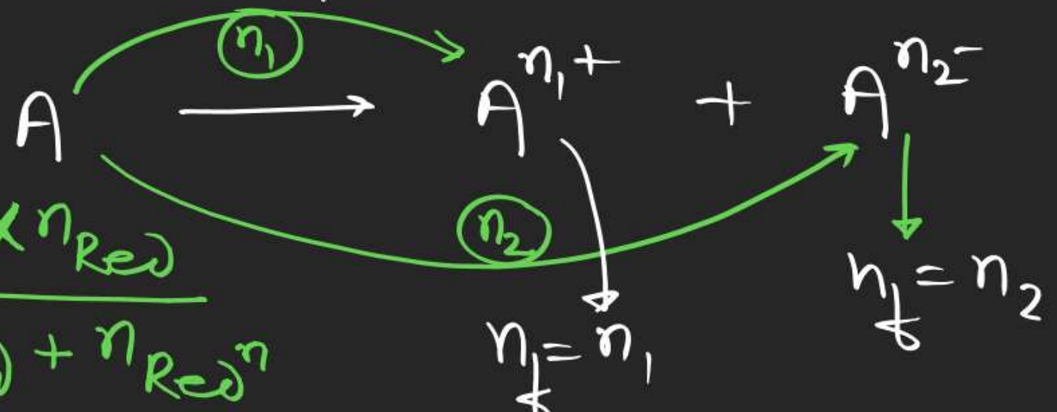
$n_f = 3\times1+8$

$n_f = 11$

$$4H_2O + Cu_3P \longrightarrow 3Cu^{2+} + PO_4^{3-} + 8H^+ + 11e^-$$

$n_f = 11$ $\quad$ $n_f = 11/3$ $\quad$ $n_f = 11$

Type-3 Rxn disproportionation Rxns:



$$\eta_f = \frac{n_{oxi} \times n_{Red}}{n_{oxi} + n_{Red}}$$

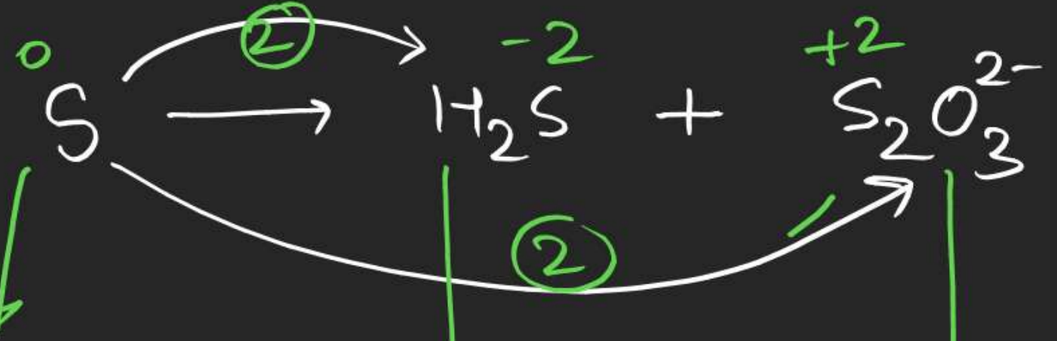
$n_2 \times \left[A \longrightarrow A^{n_1+} + n_1 e^- \right] \Big| \left[A \longrightarrow A^{n_2-} + n_2 e^- \right] \times n_1$

$(n_1+n_2)\,A + n_1 n_2 e^- \longrightarrow n_2 A^{n_1+} + n_1 A^{n_2-} + n_1 n_2 e^-$

$$\eta_f = \frac{n_1 n_2}{n_1 + n_2}$$

$$\eta_f = \frac{n_1 n_2}{n_2} = n_1 \qquad \eta_f = \frac{n_1 n_2}{n_1} = n_2$$

Nishant Jindal



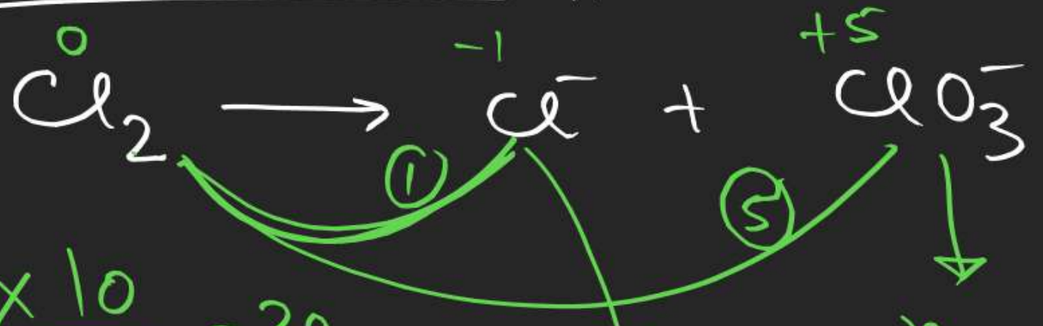
$$n_f = \frac{2 \times 2}{2+2} = 1$$

$n_f = 2$

$n_f = 4$

O-I	23-36
S-I	10-22

×



$$n_f = \frac{2 \times 10}{2+10} = \frac{20}{12} = \frac{5}{3}$$

$n_f = 1$

$n_f = 5$

3. The energy required to dislodge electron from excited isolated H-atom, $IE_1 = 13.6eV$ is

(A) $= 13.6eV$

(B) $> 13.6eV$

(C) $<> 13.6$ and $3.4eV$

(D) $\leq 3.4eV$

5. In a chemical reaction

$$K_2Cr_2O_7 + xH_2SO_4 + ySO_2 \rightarrow K_2SO_4 + Cr_2(SO_4)_3 + zH_2O$$

the value of x, y and z respectively are:

(A) $x = 1, y = 3, z = 1$

(B) $x = 4, y = 1, z = 4$

(C) $x = 3, y = 2, z = 1$

(D) $x = 2, y = 2, z = 1$

7. The pressure of sodium vapour in a $1.0\ \mathrm{L}$ container is $0.013\ \mathrm{atm}$ at $727^{\circ}\mathrm{C}$. How many atoms are in the container? $\left(\mathrm{R} = 0.08,\ \mathrm{N_A} = 6.022 \times 10^{23}\right)$

(A) 3.2×10^{17}

(B) 5.6×10^{17}

(C) 9.78×10^{19}

(D) 13.2×10^{19}

-2 oxidation 0

9. In the reaction, $2FeCl_3 + H_2S \rightarrow 2FeCl_2 + 2HCl + S$

(A) $FeCl_3$ acts as an oxidizing agent

(B) Both H_2S and $FeCl_3$ are oxidized

(C) $FeCl_3$ is oxidised while H_2S is reduced

(d) H_2S acts as an oxidizing agent

11. If volume occupied by CO_2 molecules is negligible, then the pressure exerted by one mole of CO_2 gas in terms of temperature (T), assuming V to be single valued,is

(A) $P = \frac{RT}{4a}$ (B) $P = \frac{RT}{4 \times a - b}$ (C) $P = \frac{R^2T^2}{4a}$ (D) $\frac{R^2\ T^2}{4ab}$

$$\left(P + \frac{an^2}{V^2}\right)(V) = RT$$

$$PV^2 + an^2 = VRT$$

$$PV^2 - RTV + an^2 = 0$$

$$b^2 - 4ac = 0$$

15. If uncertainty in the measurement of position and momentum of an electron are equal then uncertainly in the measurement of its velocity is approximately :

$\left(h = 6.62 \times 10^{-34}\right.$ joule-seconds, $\left.\sqrt{\frac{h}{\pi}} = 1.44 \times 10^{-17}\right)$

(A) $9 \times 10^{12}\ m\ s^{-1}$

(B) $5 \times 10^{12}\ m\ s^{-1}$

(C) $7 \times 10^{12}\ m\ s^{-1}$

(D) $2 \times 10^{12}\ m\ s^{-1}$

$\Delta x\ \Delta p = (\Delta p)^2 = \frac{h}{4\pi}$

$\Delta p = \frac{1}{2}\sqrt{\frac{h}{\pi}} = 0.72 \times 10^{-17}$

$m \times \Delta v = \frac{0.72 \times 10^{-17}}{9.1 \times 10^{-31}} 10^{14}$

$= \frac{72}{9.1} \times 10^{12}$

17. If 100 mL of H_2SO_4 and 100 mL of H_2O are mixed, the mass percent of H_2SO_4 in the resulting solution is $(d_{H_2SO_4} = 0.09\ g\ mL^{-1}, d_{H_2O} = 1.0\ g\ mL^{-1})$

(A) 90 (B) 47.36 (C) 50 (D) 60

Bonus

$W_{H_2SO_4} = 9\ gm$ $W_{H_2O} = 100\ gm$

$$\text{mass \% of } H_2SO_4 = \frac{9}{109} \times 100$$

25. The energy of separation of an electron is 30.6eV moving in an orbit of Li^{+2}. Find out the number of waves made by the electron in one complete revolution in the orbit.

$$30.6 = 13.6 \times \frac{9}{n^2}$$

$$n = 2$$

27. Two flasks A and B have equal volumes. A is maintained at 300 K and B at 600 K. while A contains H_2 gas, B has an equal mass of CH_4 gas. Assuming ideal behaviour for the both gases find the ratio of $(u_{av})_A : (u_{av})_B$.

29. In the redox reaction,

$$xNO_3^- + yAs_2S_3 + zH_2O \rightarrow AsO_4^{3-} + NO + SO_4^{2-} + H^+$$

What is the value of $\frac{x}{z}$?

9

5