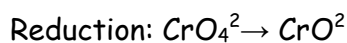
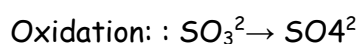


Question 5 :

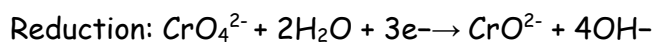
A sample of chromium containing alloy weighing 3.45 g was dissolved in acid and all chromium was oxidised to CrO_4^{2-} . 3.15g of Na_2SO_3 was required to reduce the CrO_4^{2-} to CrO^{2-} in a basic solution while SO_3^{2-} ion being oxidised to SO_4^{2-} . Calculate mass % of chromium in sample. [Molar mass of Cr=52]

Answer : (option 1) 25.13%

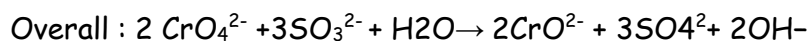
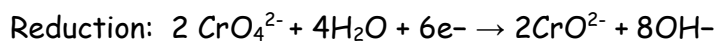
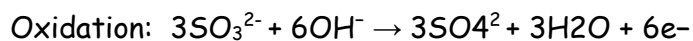
The given reaction can be separated into two reactions:



Then, we will balance each reaction by adding hydroxide ions (since it occurs in a basic medium), water molecules, and electrons.



Finally, we can obtain the balanced redox reaction by multiplying each reaction by a factor to eliminate the electrons. We will multiply the oxidation reaction by 3 and the reduction reaction by 2.



moles of Na_2SO_3 (molar mass=126.043 g/mol) that was required to reduce CrO_4^{2-}

$$= 3.18\text{g} / 126.043\text{g/mol}$$

$$= 0.02523\text{mol}$$

the moles of CrO_4^{2-} that reacted

$$= 0.02523 \text{ mol Na}_2\text{SO}_3 \times (2 \text{ mol CrO}_4^{2-} / 3 \text{ mol SO}_3^{2-})$$

$$= 0.01682 \text{ mol}$$

Now, we will use the mole ratio of chromium to CrO_4^{2-} and the molar mass of chromium (51.9961 g/mol) to calculate the mass of Cr in the alloy sample.

$$\text{Mass Cr} = 0.01682 \text{ mol} \times (1 \text{ mol Cr} / 1 \text{ mol CrO}_4^{2-} \times 51.9961 \text{ g/mol})$$

$$\text{Mass Cr} = 0.8746 \text{ g}$$

percentage by mass of chromium in the alloy:

$$\% \text{Cr} = (0.8746 \text{ g} / 3.450 \text{ g}) \times 100\%$$

$$\% \text{Cr} = \mathbf{25.35\%}$$