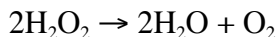


LECTURE 25

1. Determine the oxidation number of the underlined element in each of the following compounds or ions:

- (a) HCl +1
- (b) NH₄⁺ +1
- (c) NaH -1
- (d) NaAlH₄ -1
- (e) FeCl₄²⁻ +2
- (f) ICl₃ +3
- (g) SO₄²⁻ +6
- (h) Cu(OH)₂ +2

2. Hydrogen peroxide (H₂O₂) is a harmful and reactive byproduct of metabolism. To prevent H₂O₂ from causing oxidative damage to cells, the enzyme catalase catalyzes the conversion of H₂O₂ to much less reactive molecules, oxygen and water.



Using oxidation numbers, determine if H₂O₂ is reduced and/or oxidized in this reaction.

H₂O₂ is both reduced and oxidized

3. Using half-reactions, balance the following equations in **acidic** solution. Determine which atom or compound is the oxidizing agent and which is the reducing agent in each reaction.

- (a) $\text{Cr}_2\text{O}_7^{2-} (aq) + \text{C}_2\text{H}_6\text{O} (aq) \rightarrow \text{Cr}^{+3} (aq) + \text{C}_2\text{H}_4\text{O} (aq)$
 $\text{Cr}_2\text{O}_7^{2-} (aq) + 6 e^- + 14 \text{H}_3\text{O}^+ (aq) \rightarrow 2 \text{Cr}^{+3} (aq) + 21 \text{H}_2\text{O} (aq)$
 $\text{C}_2\text{H}_6\text{O} (aq) + 2 \text{H}_2\text{O} (l) \rightarrow \text{C}_2\text{H}_4\text{O} (aq) + 2 e^- + 2 \text{H}_3\text{O}^+ (aq)$
 $\text{Cr}_2\text{O}_7^{2-} (aq) + 3 \text{C}_2\text{H}_6\text{O} (aq) + 8 \text{H}_3\text{O}^+ (aq) \rightarrow 2 \text{Cr}^{+3} (aq) + 3 \text{C}_2\text{H}_4\text{O} (aq) + 15 \text{H}_2\text{O} (l)$
Cr₂O₇²⁻ (aq) is the oxidizing agent, C₂H₆O (l) is the reducing agent

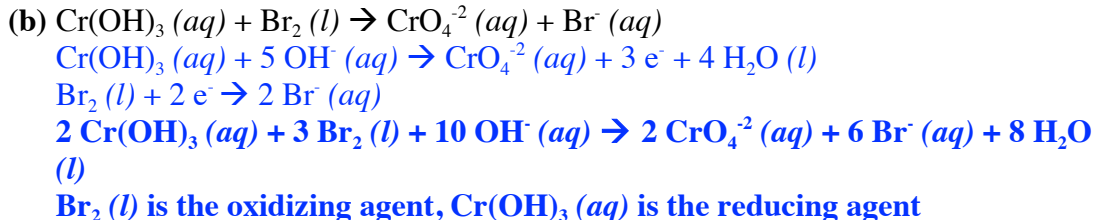
- (b) $\text{MnO}_4^- (aq) + \text{H}_2\text{O}_2 (aq) \rightarrow \text{Mn}^{2+} (aq) + \text{O}_2 (g)$
 $\text{MnO}_4^- (aq) + 5 e^- + 8 \text{H}_3\text{O}^+ (aq) \rightarrow \text{Mn}^{2+} (aq) + 12 \text{H}_2\text{O} (l)$
 $\text{H}_2\text{O}_2 (aq) + 2 \text{H}_2\text{O} (l) \rightarrow \text{O}_2 (g) + 2 e^- + 2 \text{H}_3\text{O}^+ (aq)$
 $2 \text{MnO}_4^- (aq) + 5 \text{H}_2\text{O}_2 (aq) + 6 \text{H}_3\text{O}^+ (aq) \rightarrow 2 \text{Mn}^{2+} (aq) + 5 \text{O}_2 (g) + 14 \text{H}_2\text{O} (l)$
MnO₄⁻ (aq) is the oxidizing agent, H₂O₂ (aq) is the reducing agent

4. Using half-reactions, balance the following equations in **basic** solution. Determine which atom or compound is the oxidizing agent and which is the reducing agent in each reaction.

- (a) $\text{CO}_2 (g) + \text{F}_2 (g) \rightarrow \text{FO}_3^- (aq) + \text{C}_2\text{O}_4^{2-} (aq)$
 $2 \text{CO}_2 (g) + 2 e^- \rightarrow \text{C}_2\text{O}_4^{2-} (aq)$
 $\text{F}_2 (g) + 12 \text{OH}^- (aq) \rightarrow 2 \text{FO}_3^- (aq) + 10 e^- + 6 \text{H}_2\text{O} (l)$
10 CO₂ (g) + F₂ (g) + 12 OH⁻ (aq) → 5 C₂O₄²⁻ (aq) + 2 FO₃⁻ (aq) + 6 H₂O (l)

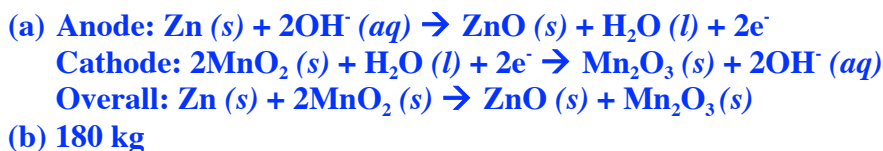
LECTURE 25

$\text{CO}_2(g)$ is the oxidizing agent, $\text{F}_2(g)$ is the reducing agent



5. In some alkaline batteries, a solid zinc electrode in a basic solution is oxidized to ZnO while solid manganese (IV) oxide is reduced to solid manganese (III) oxide.

- (a) Write the half-reactions for both the anode and cathode of the cell, as well as the overall reaction.
(b) Calculate the mass in kg of ZnO(s) formed if 1.0×10^4 A are passed through the cell for 12 hours.



6. A jeweler is investigating a novel method for electroplating tungsten onto base metal. The jeweler passes a 30.0 A current through a solution for 1.00 hours and 100. g of tungsten is deposited on the ring. What is the oxidation number of tungsten in the solution?

2, W^{2+}

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