Refer to *Balancing RedOx Reactions* while working on these problems. You should also refer to your textbook chapter on oxidation-reduction reactions.

1. For the complete redox reactions below (i) break down the reaction into a set of half-reactions and (ii) identify the oxidizing and reducing agents.

$$2 \text{ Cs} + \text{Cl}_2 \rightarrow 2 \text{ CsCl}$$

$$\text{Cs} \rightarrow \text{Cs}^+ + \text{e}^- \qquad \text{(Cs is the reducing agent)}$$

$$\text{Cl}_2 + 2 \text{ e}^- \rightarrow 2 \text{ Cl}^- \qquad \text{(Cl}_2 \text{ is the oxidizing agent)}$$

$$\text{Cl}_2 + 2 \text{ NaBr} \rightarrow 2 \text{ NaCl} + \text{Br}_2$$

$$\text{Cl}_2 + 2 \text{ e}^- \rightarrow 2 \text{ Cl}^- \qquad \text{(Cl}_2 \text{ is the oxidizing agent)}$$

$$2 \text{ Br}^- \rightarrow \text{Br}_2 + 2 \text{ e}^- \qquad \text{(Br}^- \text{ is the reducing agent)}$$

$$\text{Zn} + 2 \text{ HCl} \rightarrow \text{ZnCl}_2 + \text{H2}$$

$$\text{Zn} \rightarrow \text{Zn}_2^{2+} + 2 \text{ e}^- \qquad \text{(Zn is the reducing agent)}$$

$$2 \text{ H}^+ + 2 \text{ e}^- \rightarrow \text{H}_2 \qquad \text{(H}^+ \text{ is the oxidizing agent)}$$

2. Balance the following redox reactions by the <u>half-reaction</u> (ion-electron) method. Work the problems on a separate sheet of paper.

C + 2 H₂SO₄
$$\rightarrow$$
 CO₂ + 2 SO₂ + 2 H₂O
3 Cu + HNO₃ + 6 H⁺ \rightarrow 3 Cu²⁺ + 2 NO + 4 H₂O
2 MnO₄⁻ + 5 SO₂ + H⁺ + 2 H₂O \rightarrow 2 Mn²⁺ + 5 HSO₄⁻
8 Br₂ + 12 OH⁻ \rightarrow 2 BrO₃⁻ + 10 Br⁻ + 6 H₂O
2 Bi(OH)₃ + 3 SnO₂²⁻ \rightarrow 3 SnO₃²⁻ + 2 Bi + 3 H₂O
5 Fe²⁺ + MnO₄⁻ + 8 H⁺ \rightarrow 5 Fe³⁺ + Mn²⁺ + 4 H₂O

3. Balance the following redox reactions by the <u>oxidation number</u> method. Work the problems on a separate sheet of paper.

$$I_2O_5 + 5CO \rightarrow I_2 + 5CO_2$$

6 Sb + 10 HNO
$$_3$$
 \rightarrow 3 Sb $_2$ O $_5$ + 10 NO + 5 H $_2$ O

$$3~H_2S~+~2~HNO_3~\rightarrow~3~S~+~2~NO~+~4~H_2O$$

$$7 \text{ PbO}_2 + 7 \text{ H}_2 \text{SO}_4 + 2 \text{ Mn}(\text{NO}_3)_2 \rightarrow \text{PbSO}_4 + 4 \text{ HNO}_3 + 2 \text{ HMnO}_4 + 4 \text{ H}_2 \text{O}$$

$$\text{Cr}_2\text{O}_7^{2-}$$
 + 6 Fe^{2+} 14 H^+ \rightarrow 2 Cr^{3+} + 6 Fe^{3+} + 8 H_2O

$$8 \text{ Cr}^{3+} + 3 \text{ ClO}_4^- + 16 \text{ H}_2\text{O} \rightarrow 3 \text{ Cl}^- + 4 \text{ Cr}_2\text{O}_7^{2-} + 32 \text{ H}^+$$

$$\text{Cr}_2\text{O}_7^{2\text{-}} + 3 \text{SO}_3^{2\text{-}} + 8\text{H}^+ \rightarrow 2 \text{Cr}^{3\text{+}} + 3 \text{SO}_4^{2\text{-}} + 4 \text{H}_2\text{O}$$