OXIDATION-REDUCTION REACTIONS
ADDITIONAL PRACTICE

I. After studying sections 4.6 – 4.7 in you text, determine the oxidation number for each element in the following compounds. Answers are listed at the end of the worksheet.

Hint: Always work from the outside (of formula) to determine the oxidation number for transition metals and/or nonmetals in polyatomic ions.

(a) S_8 (b) $TiCl_4$ (c) N_2O_4 (d) H_3PO_4 (e) $Cr_2(SO_4)_3$ (f) $Fe(NO_2)_3$

II. Determine the oxidation numbers. Label which reactant species is oxidized and which is reduced; then label which reactant is the oxidizing agent and which is the reducing agent.

(a) $4\,Fe + 3\,O_2 \rightarrow 2\,Fe_2O_3$

(b) $Mg + 2\,AgNO_3 \rightarrow Mg(NO_3)_2 + 2\,Ag$

(c) $I_2 + 2\,S_2O_3^{2-} \rightarrow S_4O_6^{2-} + 2\,I^-$

(d) $2\,K + 2\,H_2O \rightarrow 2\,KOH + H_2$

(e) $3\,H_3AsO_3 + BrO_3^- \rightarrow Br^- + 3\,H_3AsO_4$

ANSWERS:

I. (a) S = 0 (b) Ti=4+ Cl=1–

(c) N=4+ O=2– (d) H=1+ P=5+ O=2–

(e) Cr=3+ S=6+ O=2– (f) Fe=3+ N=3+ O=2–

II.

(a) $\overset{0}{4\,Fe} + \overset{0}{3\,O_2} \rightarrow 2\,\overset{3+\;2-}{Fe_2O_3}$

Each Fe lost 3 e^- so Fe is oxidized & is reducing agent.
Each O gained 2e^- so O_2 was reduced & is oxidizing agent.

(b) $\overset{0}{Mg} + 2\,\overset{1+\;5+\;2-}{AgNO_3} \rightarrow \overset{2+\;5+\;2-}{Mg(NO_3)_2} + 2\,\overset{0}{Ag}$

Each Mg lost 2 e^- so Mg is oxidized & is reducing agent.
Each Ag gained 1e^- so Ag in $AgNO_3$ was reduced & $AgNO_3$ is oxidizing agent.

(c) $\overset{0}{I_2} + 2\,\overset{2+\;2-}{S_2O_3^{2-}} \rightarrow \overset{2.5+\;2-}{S_4O_6^{2-}} + 2\,\overset{1-}{I^-}$

Each S lost 0.5 e^- so S in $S_2O_3^{2-}$ is oxidized & $S_2O_3^{2-}$ is reducing agent.
Each I gained 1e^- so I_2 was reduced & is oxidizing agent.

(d) $2\,\overset{0}{K} + 2\,\overset{1+}{H_2}\overset{2-}{O} \;\text{–>}\; 2\,\overset{1+}{K}\overset{2-}{O}\overset{1+}{H} + \overset{0}{H_2}$

Each K lost 1 e^- so K is oxidized & is reducing agent.
Each H gained $1e^-$ so H in H_2O was reduced & H_2O is oxidizing agent.

(e) $3\,\overset{1+}{H_3}\overset{3+}{As}\overset{2-}{O_3} + \overset{5+}{Br}\overset{2-}{O_3}{}^- \;\text{–>}\; \overset{1-}{Br^-} + 3\,\overset{1+}{H_3}\overset{5+}{As}\overset{2-}{O_4}$

Each As lost 2 e^- so As in H_3AsO_3 is oxidized & H_3AsO_3 is reducing agent.
Each Br gained $6e^-$ so Br in BrO_3^- was reduced & BrO_3^- is oxidizing agent.