Chem 2 AP Homework #4-4: Problems pg. 153-154 #4.41, 4.44, 4.46, 4.48, 4.50; pg. 158 #4.142

4.41 Is it possible to have a reaction in which oxidation occurs and reduction does not? Explain

No; a redox reaction must contain both a reduction and an oxidation. Electrons must come from and go to some species simultaneously.

4.44 For the complete redox reactions given below, write the half-reactions and identify the oxidizing and reducing agents.

(a) $\mathbf{4\ Fe + 3\ O_2 \rightarrow 2\ Fe_2O_3}$

The product is an ionic compound whose ions are Fe^{3+} and O^{2-}.

$$Fe \longrightarrow Fe^{3+} + 3e^-$$

$$O_2 + 4e^- \longrightarrow 2O^{2-}$$

O_2 is the oxidizing agent (was reduced); Fe is the reducing agent (was oxidized).

(b) $\mathbf{Cl_2 + 2\ NaBr \rightarrow 2\ NaCl + Br_2}$

Na^+ does not change in this reaction. It is a "spectator ion."

$$2Br^- \longrightarrow Br_2 + 2e^-$$

$$Cl_2 + 2e^- \longrightarrow 2Cl^-$$

Cl_2 is the oxidizing agent (was reduced); Br^- is the reducing agent (was oxidized).

(c) $\mathbf{Si + 2\ F_2 \rightarrow SiF_4}$

Assume SiF_4 is made up of Si^{4+} and F^-.

$$Si \longrightarrow Si^{4+} + 4e^-$$

$$F_2 + 2e^- \longrightarrow 2F^-$$

F_2 is the oxidizing agent (was reduced); Si is the reducing agent (was oxidized).

(d) $\mathbf{H_2 + Cl_2 \rightarrow 2\ HCl}$

Assume HCl is made up of H^+ and Cl^-.

$$H_2 \longrightarrow 2H^+ + 2e^-$$

$$Cl_2 + 2e^- \longrightarrow 2Cl^-$$

Cl_2 is the oxidizing agent (was reduced); H_2 is the reducing agent (was oxidized).

4.46 Phosphorus forms many oxoacids. Indicate the oxidation number of phosphorus in each of the following acids:

(a) HPO_3: $x + 1 + (3)(-2) = 0$, $\boldsymbol{x = +5}$

(b) H_3PO_2: $x + (3)(+1) + (2)(-2) = 0$, $\boldsymbol{x = +1}$

(c) H_3PO_3: $x + (3)(+1) + (3)(-2) = 0$, $\boldsymbol{x = +3}$

(d) H_3PO_4: $x + (3)(+1) + (4)(-2) = 0$, $\boldsymbol{x = +5}$

(e) $H_4P_2O_7$: $2x + (4)(+1) + (7)(-2) = 0$, $2x = 10$, $\boldsymbol{x = +5}$

(f) $H_5P_3O_{10}$: $3x + (5)(+1) + (10)(-2) = 0$, $3x = 15$, $\boldsymbol{x = +5}$

The molecules in part (a), (e), and (f) can be made by strongly heating the compound in part (d). Are these oxidation-reduction reactions?

4.47 Give the oxidation number of the underlined atoms in the following molecules and ions:

(a) $\underline{Cl}F$: F −1, **Cl +1**

(b) $\underline{I}F_7$: F −1, **I +7**

(c) $\underline{C}H_4$: H +1, **C −4**

(d) $\underline{C}_2H_2$: H +1, **C −1**

(e) $\underline{C}_2H_4$: H +1, **C −2**,

(f) $K_2\underline{Cr}O_4$: K +1, O −2, **Cr +6**

(g) $K_2\underline{Cr}_2O_7$: K +1, O −2, **Cr +6**

(h) $K\underline{Mn}O_4$: K +1, O −2, **Mn +7**

(i) $NaH\underline{C}O_3$: Na +1, H +1, O −2, **C +4**

(j) $\underline{Li}_2$: **Li 0**

(k) $Na\underline{I}O_3$: Na +1, O −2, **I +5**

(l) $K\underline{O}_2$: K +1, **O −1/2**

(m) $\underline{P}F_6^-$: F −1, **P +5**

(n) $K\underline{Au}Cl_4$: K +1, Cl −1, **Au +3**

4.50 Give the oxidation number of the underlined atoms in the following molecules and ions:

(a) **Mg_3N_2:** N: −3

(b) **CsO_2:** O: −1/2

(c) **CaC_2:** C: −1

(d) **CO_3^{2-} :** C: +4

(e) **$C_2O_4^{2-}$:** C: +3

(f) **ZnO_2^{2-}** O: −2

(g) **$NaBH_4$:** B: +3

(h) **WO_4^{2-}** W: +6

4.142 What is the oxidation number of O in HFO?

Structurally this is actually HOF: Using the rules for assigning oxidation numbers given in Section 4.4, H is +1, F is −1, so the oxidation number of O must be **zero**.