/50

AP Chemistry – Redox – 59

Name _____Per ___

1. Indicate whether the following balanced equations involve oxidation-reduction. If they do, identify the elements that undergo changes in oxidation number.
(a) $PBr_{3(l)} + 3H_2O_{(l)} \rightarrow H_3PO_{3(aq)} + 3HBr_{(aq)}$

(b) $NaI_{(aq)} + 3HOCl_{(aq)} \rightarrow NaIO_{3(aq)} + 3HCl_{(aq)}$

(c) $3SO_{2(g)} + 2HNO_{3(aq)} + 2H_2O_{(l)} \rightarrow 3H_2SO_{4(aq)} + 2NO_{(g)}$

(d) $2H_2SO_{4(aq)} + 2NaBr_{(s)} \rightarrow Br_{2(l)} + SO_{2(g)} + Na_2SO_{4(aq)} + 2H_2O_{(l)}$

2. Hydrazine, N_2H_4, and dinitrogen tetroxide form a self-igniting mixture that has been used as a rocket propellant. The reaction produces N_2 and H_2O. (a) Write a balanced chemical equation for this reaction.

(b) Which substance serves as the reducing agent, and which as the oxidizing agent?

3. Complete and balance the following half-reactions. In each case indicate whether oxidation or reduction occurs.
(a)$Mo^{3+}_{(aq)} \rightarrow Mo_{(s)}$

(b) $H_2SO_{3(aq)} \rightarrow SO_4^{2-}{}_{(aq)}$ (acidic solution)

(c) $NO_3^-{}_{(aq)} \rightarrow NO_{(g)}$ (acidic solution)

(d) $Mn^{2+}_{(aq)} \rightarrow MnO_{2(s)}$ (basic solution)

(e) $Cr(OH)_{3(s)} \rightarrow CrO_4^{2-}{}_{(aq)}$ (basic solution)

4. Complete and balance the following equations, and identify the oxidizing and reducing agents:
(a) $NO_2^-{}_{(aq)} + Cr_2O_7^{2-}{}_{(aq)} \rightarrow Cr^{3+}_{(aq)} + NO_3^-{}_{(aq)}$ (acidic solution)

(b) $As_{(s)} + ClO_3^-{}_{(aq)} \rightarrow H_3AsO_{3(aq)} + HClO_{(aq)}$ (acidic solution)

(c) $Cr_2O_7^{2-}{}_{(aq)} + CH_3OH_{(aq)} \rightarrow HCO_2H_{(aq)} + Cr^{3+}{}_{(aq)}$ (acidic solution)

(d) $MnO_4^-{}_{(aq)} + Cl^-{}_{(aq)} \rightarrow Mn^{2+}{}_{(aq)} + Cl_{2(aq)}$ (acidic solution)

(e) $H_2O_{2(aq)} + ClO_{2(aq)} \rightarrow ClO_2^-{}_{(aq)} + O_{2(g)}$ (basic solution)

(f) $H_2O_{2(aq)} + Cl_2O_{7(aq)} \rightarrow ClO_2^-{}_{(aq)} + O_{2(g)}$ (basic solution)

5. Using $K_{sp} = 6 \times 10^{-51}$ for Ag_2S, $K_{a1} = 9.5 \times 10^{-8}$ and $K_{a2} = 1 \times 10^{-19}$ for H_2S, and $K_f = 1.1 \times 10^5$ for $AgCl_2^-$, calculate the equilibrium constant for the reaction:

$Ag_2S_{(s)} + 4Cl^-{}_{(aq)} + 2H^+{}_{(aq)} \leftrightarrow 2AgCl_2^-{}_{(aq)} + H_2S_{(aq)}$