Big Chem Problem Set

Oxidation and Reduction

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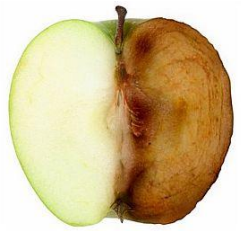

1. Determine the oxidation states for the stated element in each compound: $KClO_4$, $Ba(NO_3)_2$, $Ca_3(PO_4)_2$, $LiMnO_4$, Na_2SO_3, $CaCrO_4$, MgS_2O_3, $Zn(NO_2)_2$, $HClO_3$, CaC_2O_4, $KHSO_4$

2. Determine which is oxidized and which is reduced. Note, for some reactions the same element could be oxidized and reduced:
   (a) $2Mg + O_2 \rightarrow 2MgO$
   (b) $Zn + 2HCl \rightarrow ZnCl_2 + H_2$
   (c) $Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$
   (d) $2KClO_3 \rightarrow 2KCl + 3O_2$
   (e) $3P + 5HNO_3 + 2H_2O \rightarrow 5NO + 3H_3PO_4$
   (f) $3Cu + 8HNO_3 \rightarrow 2NO + 3Cu(NO_3)_2 + 4H_2O$
   (g) $2PbSO_4 + 2H_2O \rightarrow PbO_2 + Pb + 2H_2SO_4$
   (h) $4HCl + MnO_2 \rightarrow MnCl_2 + 2H_2O + Cl_2$
   (i) $4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$
   (j) $Cu + 2H_2SO_4 \rightarrow CuSO_4 + SO_2 + H_2O$
   (k) $8HNO_3 + 6KI \rightarrow 6KNO_3 + 3I_2 + 2NO + 4H_2O$
   (l) $I_2 + 5HClO + H_2O \rightarrow 2HIO_3 + 5HCl$
   (m) $SnCl_2 + 2HgCl_2 \rightarrow SnCl_4 + Hg_2Cl_2$

3. Write the half reactions for each:
   (a) $3Sn + 4HNO_3 + H_2O \rightarrow 3H_2SnO_3 + 4NO$
   (b) $2Fe(OH)_2 + H_2O_2 \rightarrow 2Fe(OH)_3$
   (c) $2Na + 2H_2O \rightarrow 2\ NaOH + H_2$
   (d) $Zn + 2HNO_3 \rightarrow Zn(NO_3) + NO_2 + H_2O$
   (e) $2H_2O_2 \rightarrow 2H_2O + O_2$
   (f) $2K_2Cr_2O_7 + 2H_2O + 3S \rightarrow 3SO_2 + 4KOH + 2Cr_2O_3$

4. For each, use the activity series to see if a reaction will take place. If it does, write the reaction and balance it.
   (a) $Cu_{(s)} + HBr_{(aq)}$
   (b) $Cu_{(s)} + AgCH_3COO_{(aq)}$
   (c) $Sn_{(s)} + H2SO_{4(aq)}$
   (d) $Mg_{(s)} + Pb(NO_3)_{2(aq)}$
   (e) $Pb_{(s)} + AuCl_{(aq)}$
   (f) $Au_{(s)} + LiCl_{(aq)}$

5. In an electrochemical cell how do electrons flow?

6. At which location are in an electrochemical cell are electrons being gained? At what location are they lost?.

7. For each electrode pair, which would be the anode? Cu/Zn, Pb/Sn, K/Al, Ba/Li, Au/Pb, Mn/Zn, Fe/Zn, Co/Ca, Co/Ni, H_2/Ag, Cu/Mg

8. Draw a diagram of an electrochemical cell.

9. What happens at the anode of an electrochemical cell? Is it oxidized or reduced?

10. What happens at the cathode of an electrochemical cell? Is it oxidized or reduced?

11. Aluminum is found in the mineral bauxite (Al2O3). To get pure aluminum, the aluminum needs to be separated from oxygen using electrolysis in an electrolytic cell. Bauxite forms by the following reaction: 4Al + 3O2 --> 2Al2O3. Write the half reactions.

12. During the formation of bauxite from its elements, what is oxidized, and what is reduced? Does this make sense considering that aluminum is a metal? Explain.

13. Write the reaction for the purification of aluminum from bauxite (it's the reverse reaction).

14. Write the half reactions for the purification of aluminum. During the purification, what is oxidized, and what is reduced?