Lesson 30: Metallurgy and Redox

text: 488-504

handout: occurrences of metals (17), alloys (18)

what to know:

-examples of the types of minerals used as ores, handout

-various steps involved in metallurgy, §12-1

- relative reactivity of metals, §12-1

-metallurgy of copper and iron (and steel formation), §12-1

-alloys, handout

-concept of half-reactions and balancing redox reactions, §12-2

questions:

1.What chemical property characterizes metals which can be mined as native metals?

2.Name several commonly used metals produced from ores containing:
a) oxide minerals. b) sulfide minerals. c) native metals.

3.Iron can be prepared by using carbon as a reducing agent but electrolysis is required for the preparation of sodium. Explain.

4.Describe the metallurgy of iron.

a. What is the actual reducing agent for Fe_2O_3 in a blast furnace?

b. The presence of what element makes pig iron so brittle?

c. Steel has a (lower, higher) carbon content than pig iron?

d. What element is largely responsible for the corrosion resistance of stainless steel?

e. Why is limestone added to the blast furnace?

5.What products are formed when Cu_2S is heated strongly in air?

6.What does it mean for a metal to be ductile? malleable?

7.What element is common to the alloys, brass and bronze as well as pennies. What is an amalgam?

8.Balance the following half reactions, classify each reaction as oxidation or reduction and classify each first named substance as either a reducing or oxidizing agent.

a. NO to NO_3^- in acid

b. SO_3^{2-} to SO_4^{2-} in base

c. MnO_4^- to Mn^{2+} in acid

d. MnO_4^- to MnO_2 in base

e. aluminum metal to aluminum ion

f. bromide ion to Br_2

g. SO_3^{2-} to SO_4^{2-} in base

h. $Cr_2O_7^{2-}$ to Cr^{3+} in acid

9.Write balanced net ionic equations for the following reactions. Assume aqueous solutions and use half reactions.

a. Sn^{2+} reacts with IO_4^- to form Sn^{4+} and I^- in acid.

b. $Na_2Cr_2O_7$ plus $Fe(NO_3)_2$ forms $Cr(NO_3)_3$ and $Fe(NO_3)_3$ in acid.

c. Cu + HNO_3 forms cupric nitrate and NO.

d. $Bi(OH)_3$ + SnO_2^{2-} forms SnO_3^{2-} and Bi in base.

e. Br_2 forms BrO_3^- and Br^- in base

f. Zn(s) + $AgNO_3$ forms $Zn(NO_3)_2$ and Ag(s)