Due Friday, 9/15/06, 10 am

Please show your work for all calculations, and report answers to the proper number of significant digits and with the correct units to receive full credit. For calculations, circle your final answer. Use a separate piece of paper to answer these questions.

1. (a) Determine the mass of gold that is equivalent to 3.14 mol of gold.

\[ 3.14 \text{ mol Au} \times \frac{197.00 \text{ g Au}}{1 \text{ mol Au}} = 623.110 \text{ g Au} \] (3 s.f.)

(b) How many carbon atoms are in a 0.00368 kg piece of graphite (pure carbon)?

\[ 0.00368 \text{ kg C} \times \frac{12 \text{ g C}}{1 \text{ kmol C}} \times \frac{6.022 \times 10^{23} \text{ molecules}}{1 \text{ g C}} = 1.3845 \times 10^{26} \text{ molecules} \]

(c) A sample of sulfur weighs 0.5668 lbs. How many moles of sulfur are in the sample?

\[ 0.5668 \text{ lbs} \times \frac{453.592 \text{ g}}{1 \text{ lbs}} \times \frac{1 \text{ mol S}}{64.07 \text{ g S}} = 8.017 \times 10^{-2} \text{ mol S} \]

2. Give the correct name for each of the following compounds.

(a) H₂S, Di-hydrogen monosulfide

(b) BrCl, Bromine monochloride

(c) CaS, Calcium sulfide

(d) XeF₄, Xenon tetroxide

(e) K₃N, Potassium nitride

(f) NiF₃, Nickel(II) fluoride

3. Give the correct name or formula for each of the following compounds.

(a) LiNO₃, Lithium nitrate

(b) ammonium carbonate

\[ \text{NH}_₄^+ + \text{CO}_₃^{2-} \rightarrow (\text{NH}_₄)_₂\text{CO}_₃ \]

(c) ammonium phosphate

\[ \text{NH}_₄^+ + \text{PO}_₄^{3-} \rightarrow (\text{NH}_₄)_3\text{P} \]

(d) Mg(OH)₂, Magnesium hydroxide

(e) iron(III) chloride

\[ \text{Fe}^{3+} + \text{Cl}^- \rightarrow \text{FeCl}_₃ \]

(f) Cu₃(PO₄)₂, Copper(II) phosphate
4. For each of the compounds in 83, give the correct formula for each ion in the compound and state the number of ions of each type is one formula unit of the compound,

(a) Li⁺ (one) \( NO_3^- \) (one)

(b) \( NH_4^+ \) (two) \( CO_3^{2-} \) (one)

(c) \( NH_4^+ \) (three) \( P^{3-} \) (one)

(d) \( Mg^{2+} \) (one) \( OH^- \) (two)

(e) \( Fe^{3+} \) (one) \( Cl^- \) (three)

(f) \( Cu^{2+} \) (one) \( PO_4^{3-} \) (two)

5. (a) Problem 3.109 in MSJ

FeTiO₃ : ilmenite

\[
\text{ore} = 6.75 \text{ g Ti} = \frac{6.75 \text{ g Ti}}{100 \text{ g ore}} \text{ Ti in 1 ton ore?}
\]

\[
1000 \text{ kg ore} \times \left( \frac{10^3 \text{ g}}{1 \text{ kg}} \right) \times \left( \frac{6.75 \text{ g Ti}}{100 \text{ g ore}} \right) = \frac{6.75 \times 10^3 \text{ g Ti}}{1 \text{ ton ore}}
\]

Work out Ti in ilmenite:

\[
\begin{align*}
55.856 \times 97.88 \text{ g Ti} & = 55.856 \times 97.88 \times 10^2 \text{ g Ti} & \times 100 \% = 31.565 \times 10^2 \text{ g Ti} \\
& = 31.565 \times 10^3 \text{ g Ti} & \text{Ti in ilmenite}
\end{align*}
\]

\[
2 \text{ d.p.} = 5.8 \%
\]

\[
\text{Use this as conversion factor:}
\]

\[
\frac{6.75 \times 10^3 \text{ g Ti}}{100 \text{ g ilmenite}} = \frac{3.14 \times 10^3 \text{ g Ti}}{1 \text{ ton ore}}
\]

(b) How many moles of ilmenite are there in exactly one metric ton of the ore?

1 mol FeTiO₃ = 151.713 g FeTiO₃ (from above)

\[
2.14 \times 10^5 \text{ g FeTiO₃ (1 mol FeTiO₃)} \times \frac{1 \text{ mol FeTiO₃}}{151.713 \text{ g FeTiO₃}} \times \frac{3 \text{ mol FeTiO₃}}{1 \text{ mol ilmenite}} \times \frac{1 \text{ ton ore}}{1.41 \times 10^3 \text{ mol ilmenite}}
\]

\[
3 \text{ s.f.}
\]

\[
6 \text{ s.f.}
\]

(c) How many formula units of ilmenite are there in exactly one metric ton of the ore?

1 mol FeTiO₃ = 6.022 \times 10^{23} \text{ formula units FeTiO₃}

\[
\frac{1409.8 \text{ mol FeTiO₃}}{6.022 \times 10^{23} \text{ formula units FeTiO₃}} = \frac{8.49 \times 10^{24} \text{ formula units}}{1 \text{ mol FeTiO₃}}
\]

3 \text{ s.f.}

4 \text{ s.f.}

2 \text{ s.f.}

1 \text{ mol FeTiO₃}

\text{of ilmenite}