Honors Chemistry
Chapter 3 Exam - Pretest

1. When 10.0mol of V_2O_5 are mixed with 10.0mol of Ca, which is the limiting reactant according to the following equation when balanced?
$V_2O_{5(s)} + Ca_{(l)} \rightarrow V_{(l)} + CaO_{(s)}$

Ca because Ca reacts in a 5/1 mole ratio with V_2O_5, meaning you always need 5 times as many moles of Ca as you do V_2O_5.
$V_2O_{5(s)} + 5Ca_{(l)} \rightarrow 2V_{(l)} + 5CaO_{(s)}$

2. What is the theoretical yield of chromium that can be produced by the reaction of 40.0g of Cr_2O_3 with 8.00g of aluminum according to the following equation?
$2Al + Cr_2O_3 \rightarrow Al_2O_3 + 2Cr$

40.0g Cr_2O_3 (1mol Cr_2O_3 / 151.99g Cr_2O_3) = .263mol Cr_2O_3
8.00g Al (1mol Al / 26.98g Al) = .297mol Al
Al limits because you need twice as many moles of Al as Cr_2O_3 therefore
using the limiting reagent to calculate products
.297mol Al (2mol Cr / 2mol Al) = .297 mol Cr
.297mol Cr (52.00g Cr / 1mol Cr) = **15.44g Cr**

3. The mass of $1.21x10^{20}$ atoms of sulfur is:

$1.21x10^{20}$atom s (1mol S / $6.022x10^{23}$atoms S)(32.07g S / 1mol S) =
$6.44x10^{-3}$g S

4. What is the mass of 0.0250mol P_2O_5?

0.0250mol P_2O_5 (141.94g P_2O_5 / 1mol P_2O_5) =
3.55g P_2O_5

5. Balance the following: $SF_4 + H_2O \rightarrow H_2SO_3 + HF$

1,3,1,4

6. A chemistry student performs a laboratory experiment to determine the empirical formula for tungsten oxide (W_xO_y). The data that is gathered is shown below:
Weight of crucible: 11.120g
Weight of tungsten: 8.820g
Weight of crucible and oxide of tungsten: 23.012g
What is the mass percent of tungsten in the compound?
What is the empirical formula for Tungsten oxide?

Moles of tungsten (W) = 8.820g (1mol W / 183.84g W) = .0480mol W
Moles of oxygen (O) = 23.012g – 11.120g – 8.820g = 3.072g O (1mol O / 16.00g O) = .192mol O
$W_{.0480/.0480}O_{.192/.0480}$ = **WO_4**
Mass % of W = 8.820gW / (23.012g – 11.120g) = **74.2%**

7. Aluminum carbide (carbide is C^{4-}) reacts with water to produce aluminum hydroxide and methane (carbon tetrahydride). Write a balanced chemical equation for this reaction.

$Al_4C_3 + 12H_2O \rightarrow 4Al(OH)_3 + 3CH_4$

8. How many grams of water can be produced from 48.0g of oxygen and 2.00mol of hydrogen according to $2H_2 + O_2 \rightarrow 2H_2O$

48.0g O_2 (1mol O_2 / 32.0g O_2) = 1.50mol O_2
The 2.00mol of H_2 is limiting because you would need 2.00mol H_2 to react completely with the 1.50mol of O_2 according to the coefficients of the balanced equation.
2.00mol H_2 (2mol H_2O / 2mol H_2) = 2.00mol H_2O
2.00mol H_2O (18.016g H_2O / 1mol H_2O) =
36.0g H_2O

9. An atom of carbon has a mass about three times greater than the mass of a helium atom. How many grams of helium will contain the same number of atoms as 600.g of carbon?

For a given number of particles
Mass of particles of C = 3 times the mass of the same particles of He
or 1 He particle has a mass that is 1/3 the mass of a C atom. Therefore
Grams of He = 1/3 (600.g C) =
200.g He

10. What is the percent yield of a reaction in which 29.50g of ammonia (NH_3) are formed in the lab (as an exclusive product) when 28.02g of nitrogen gas are reacted with 8.064g of hydrogen gas?

$N_2 + 3H_2 \rightarrow 2NH_3$
28.02g N_2 / 28.02g/mol = 1mol N_2
1mol N_2 (3mol H_2 / 1mol N_2) = 3mol H_2 required

8.064g H_2 / 2.016g/mol H_2 = 4mol H_2 available nitrogen limits
1mol N_2 (2mol NH_3 / 1mol N_2) = 2mol NH_3
2mol NH_3 (17.034g/mol) = 34.068g NH_3
29.50g act / 34.07g theor. = **86.6%**