Vasquez High School -- Chemistry -- Exam #5 -- Chapter 9 -- 100 points

Read each problem carefully. Label everything. Show all work for full credit. Be neat and complete.

1) Consider the reaction: _____ Al(s) + _____ HCl(aq) ==> _____ $AlCl_3$(aq) + _____ H_2(g)
   and answer the following (two points each):

   a) Name the most massive reactant: _____

   b) Name the least massive product: _____

   c) What phase is the only metal in the reaction? _____

   d) What are the coefficients of the balanced reaction? _____, _____, _____, _____

   e) How many moles of hydrogen would you get if you reacted 20 moles of aluminum? _____

2) Now consider the rusting of iron: $4 Fe + 3 O_2 ==> 2 Fe_2O_3$ (twenty-five points total)

   a) If an 80.0 kg iron bar would completely turn to rust, how many kg of oxygen would be needed?

   b) Because this is not 100% efficient, it is found that the percentage yield of iron (III) oxide is only
      82.5%. What is the actual yield for the product in the above reaction?

   c) Now suppose you had 100 g Fe and 80 g oxygen, what is the limiting reagent, how much of what is
   in excess, and how much product would be the theoretical yield then?

Ten points apiece on these.

3) You have 2500 g of hexane, C_6H_{14}, and burn it completely in oxygen. How many grams of water would you ideally produce?

4) In the reaction between potassium and bromine gas, Br_2, it is discovered that 88.5 grams of potassium only produces an actual yield of 162.5 g KBr. What is the percentage yield here?

Fifteen points on this one.

5) Now we wish to remove the hydrogen selenide from a sample of natural gas by forcing it to react with oxygen gas under pressure...here's the recipe:

$$\underline{\hspace{1cm}} \; H_2Se + \underline{\hspace{1cm}} \; O_2 ==> \underline{\hspace{1cm}} \; Se_4 + \underline{\hspace{1cm}} \; H_2O$$
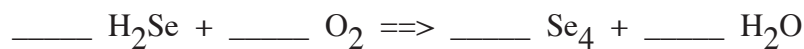
We know that we have 127.5 g of hydrogen selenide that needs to be removed (reacted with). I have just 26.0 g of oxygen gas left in the gas cylinder.

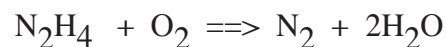a) How many moles of each do we have?

b) Is there enough oxygen for all the hydrogen sulfide to be removed?

c) If so, how much oxygen is left over? If not, state how much more we need.

d) How many moles of selenium are produced?

Ten points.

6) Hydrazine, N_2H_4, is a common type of rocket fuel because it liberates a lot of energy when burned in the air. How many grams of water **and** how many grams of nitrogen gas are produced when exactly 20.00 g of hydrazine reacts with exactly 20.00 g of pure oxygen, according to the reaction:

$$N_2H_4 + O_2 ==> N_2 + 2H_2O$$

Fifteen points here.

7) Let's make some ammonia, NH_3, this time, of course from the elemental gases nitrogen and hydrogen.

a) Write and balance the reaction: _____

b) In our chemical cabinet we have 80.0 grams nitrogen and 20.0 g hydrogen. How many moles of each do we have?

c) How many moles of ammonia can we make?

d) Which is the limiting reagent?

e) How much of which will we have in excess?

8) What does the phase abbreviation (aq) mean? _____ (five points)