AP Chemistry
Free Response - Version A
Stoichiometry

Please answer the following questions in the space provided below. Show all of your work using dimensional analysis and the correct rules for determining significant digits. (answers are on page 2)

1. (5 points) A molecule contains only nitrogen and oxygen. 30.40% of this molecule is nitrogen (by mass). If the molar mass of the molecule is 92 g/mol, what are the empirical and molecular formuli?

2. (15 points) Mercury and bromine will react with each other to produce mercury(II)bromide.

   (a). Write a balanced equation for this reaction and label the type of reaction that is taking place (combustion, decomposition, etc.).
   (b). What mass (in grams) of mercury(II)bromide can be produced from the reaction of 10.00 grams of mercury and 9.00 grams of bromine?
   (c). What mass (in grams) of what reactant is left un-reacted?
   (d). Calculate a percent yield if when this experiment was done in lab, it produced 16.70 grams of mercury(II)bromide.

Answers to Stoichiometry Practice Free Response Test:

1.
30.40 g N X 1 mol N/14.01g N = 2.17 moles N

69.60 g O X 1 mol O /16.00 g O = 4.35 moles O

4.35/2.17 = 2.00 2.17/2.17 = 1.00 So O is 2X more present than N

Empirical formula must be NO_2 Mass of NO_2 is 46.01 g/mol

So, 92/46.01 = 1.999 = 2 So, the molecular formula is 2X that of the empirical – making it N_2O_4

2.
(a). Hg (l) + Br_2 (l) → $HgBr_2$ (s) This is a Combination or Synthesis Reaction!

(b). 10.00 g Hg X 1 mol Hg/200.59 g X 1 mol $HgBr_2$/1 mol Hg X 360.39g/1 mol $HgBr_2$

= 17.97 g

9.00 g Br_2 X 1 mol Br_2/159.80 g X 1 mol $HgBr_2$/1 mol Br_2 X 360.39g/1 mol $HgBr_2$

= 20.3 g

Hg is the limiting reagent!

(c). 17.97 g $HgBr_2$ X 1 mol $HgBr_2$/360.39 g X 1 mol Br_2/1 mol $HgBr_2$ X 159.80 g/1 mol Br_2

= 7.98 g Br_2

9.00 g Br_2 originally started with – 7.98 g Br_2 reacted = 1.02 g Br_2 in excess!

(d). % Yield = Experimental Value/Theoretical Value X 100

16.70g/17.97g X 100 = 92.93%