Chem15, Fall 2015, SJCC, Test3 Name KEY SEC 102

Please read all the questions VERY carefully before answering. Ask your instructor if you do not understand. No outside paper is allowed. The last page is a periodeic table with constants. Total points = 64 + (24 * 3 =) 72 = 136

SHORT ANSWER. Please write the set-up equation first, then put the raw data with units before calculating. Write the word or phrase that best completes each statement or answers the question.

1) Phosphorus (P_4) reacts with chlorine gas, Cl_2 to produce PCl_5 according to the following reaction: 1) _____

$$P_4\,(s) + 10\,Cl_2\,(g) \text{ ------> } 4\,PCl_5\,(s)$$

a) How many grams of PCl_5 is formed from 95.0 g of P_4 (3 pts.).

$$95.0\text{ g } P_4 \left|\frac{1\text{ mol } P_4}{(4\times 30.974)\text{ g } P_4}\right|\frac{4\text{ mol } PCl_5}{1\text{ mol } P_4}\left|\frac{208.239\text{ g } PCl_5}{1\text{ mol } PCl_5}\right| \approx \boxed{639\text{ g } PCl_5.}$$

b) How many grams of PCl_5 is formed from 235.2 g of Cl_2 gas (3 pts.).

$$235.2\text{ g } Cl_2 \left|\frac{2\text{ mol } Cl_2}{(2\times 35.453)\text{ g } Cl_2}\right|\frac{4\text{ mol } PCl_5}{10\text{ mol } Cl_2}\left|\frac{208.239\text{ g } PCl_5}{1\text{ mol } PCl_5}\right| \approx \boxed{276.3\text{ g } PCl_5}$$

c) Which is the limiting agent if 95.0 g of P_4 and 235.2 g of Cl_2 gas was used in the rxn. (2 pts.) $\boxed{235.2\text{ g } Cl_2}$ is the limiting reagent, because it produced the smallest yield, therefore running out first. ✓

d) Calculate the % yield of PCl_5 if one obtains 120.0 g PCl_5 in the above reaction (2 pts.)

$$\%\text{ yield} = \frac{\text{Actual yield}}{\text{Theoretical yield}} \times 100\% = \frac{120.0\text{ g } PCl_5}{276.3\text{ g } PCl_5} \times 100\% \approx \boxed{43.43\ \%}$$ ✓

2) Iron, Fe(s) reacts with oxygen gas, $O_2(g)$ to produce Fe_2O_3 (s). Calculate how many grams of (a) Fe and (b) O are necessary to make 23.7 g of Fe_2O_3 (4 pts. each, total 8 pts) 2) _____

Rxn: $4\,Fe(s) + 3\,O_2(g) \longrightarrow 2\,Fe_2O_3\,(s)$

- Mass Fe needed $= (23.7\text{ g } Fe_2O_3) \times \left(\frac{1\text{ mol } Fe_2O_3}{159.687\text{ g } Fe_2O_3}\right) \times \left(\frac{4\text{ mol Fe}}{2\text{ mol } Fe_2O_3}\right) \times \left(\frac{55.845\text{ g Fe}}{1\text{ mol Fe}}\right)$

$\approx \boxed{16.6\text{ g Fe.}}$ ✓

- Mass O needed $= (23.7\text{ g } Fe_2O_3) \times \left(\frac{1\text{ mol } Fe_2O_3}{159.687\text{ g } Fe_2O_3}\right) \times \left(\frac{3\text{ mol } O_2}{2\text{ mol } Fe_2O_3}\right)$

$\times \left(\frac{2\text{ mol O}}{1\text{ mol } O_2}\right) \times \left(\frac{15.999\text{ g O}}{1\text{ mol O}}\right) \approx \boxed{7.12\text{ g O.}}$ ✓