CHM151   Quiz 3a   100 Pts Fall 201   Name: _**Key**_

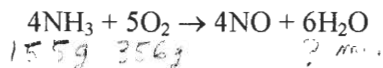******SHOW ALL WORK******

Molar Masses: H = 1.008, C = 12.01, N = 14.01, O = 16.00, Na = 22.99, P = 30.97, S = 32.06, Cu = 63.55, Ag = 107.9, I = 126.9

1. (2 Pts) If 0.66 mole of a substance has a mass of 99 g, what is the molecular mass of the substance?
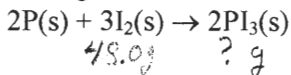
$$\frac{99\ g}{0.66\ mol} = \boxed{150\ g/mol}$$

2. (6 Pts) Determine the number of moles of water produced by the reaction of 155 g of ammonia and 356 g of oxygen.

$$4NH_3 + 5O_2 \rightarrow 4NO + 6H_2O$$

155 g   356 g   ? mol

Based on NH₃:
$$\frac{155\ g\ NH_3}{}\left|\frac{mol}{17.03\ g}\right|\frac{6\ mol\ H_2O}{4\ mol\ NH_3} = 13.65\ mol\ H_2O$$

Based on O₂:
$$\frac{356\ g\ O_2}{}\left|\frac{mol\ O_2}{32.00\ g\ O_2}\right|\frac{6\ mol\ H_2O}{5\ mol\ O_2} = \boxed{13.35\ mol\ H_2O} \leftarrow \boxed{13.4\ mol}$$
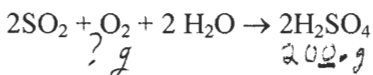
3. (6 Pts) Phosphorus reacts with iodine as shown in the chemical reaction below. What is the percent yield of the reaction if 28.2 g PI₃ is obtained from the reaction of 48.0 g of I₂ with excess phosphorus?

$$2P(s) + 3I_2(s) \rightarrow 2PI_3(s)$$

48.0 g   ? g

$$\frac{48.0\ g\ I_2}{}\left|\frac{mol\ I_2}{253.8\ g\ I_2}\right|\frac{2\ mol\ PI_3}{3\ mol\ I_2}\left|\frac{411.67\ g\ PI_3}{mol\ PI_3}\right| = 51.9\ g\ PI_3 \left(\frac{theoretical}{yld}\right)$$
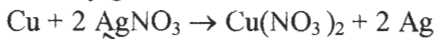
$$\frac{28.2}{51.9} \times 100 = \boxed{54.3\ \%\ yld}$$

4. (4 Pts) What is the minimum mass of oxygen gas necessary to produce 200. g of sulfuric acid in the following reaction?

$$2SO_2 + O_2 + 2H_2O \rightarrow 2H_2SO_4$$

? g   200. g

$$\frac{200\ g\ H_2SO_4}{}\left|\frac{mol\ H_2SO_4}{98.076\ g\ H_2SO_4}\right|\frac{1\ mol\ O_2}{2\ mol\ H_2SO_4}\left|\frac{32.00\ g\ O_2}{mol\ O_2}\right| = \boxed{32.6\ g\ O_2}$$

5. (4 Pts) How many grams of silver nitrate are necessary to react completely with 7.000 moles of copper?

$$Cu + 2\ AgNO_3 \rightarrow Cu(NO_3)_2 + 2\ Ag$$

7.000 mol   ? g

$$\frac{7.000\ mol\ Cu}{}\left|\frac{2\ moles\ AgNO_3}{1\ mol\ Cu}\right|\frac{169.91\ g\ AgNO_3}{mol\ AgNO_3} = \boxed{2379\ g\ AgNO_3}$$

6. (3 Pts) Calculate the percent composition by mass of carbon in Na₂CO₃.

$$\frac{12.01}{106} \times 100 = \boxed{11.3\ \%}$$

$$\begin{array}{l} 3 \times 16 \\ 1 \times 12.01 \\ 2 \times 23 \end{array} = $$

106.9 g/mol