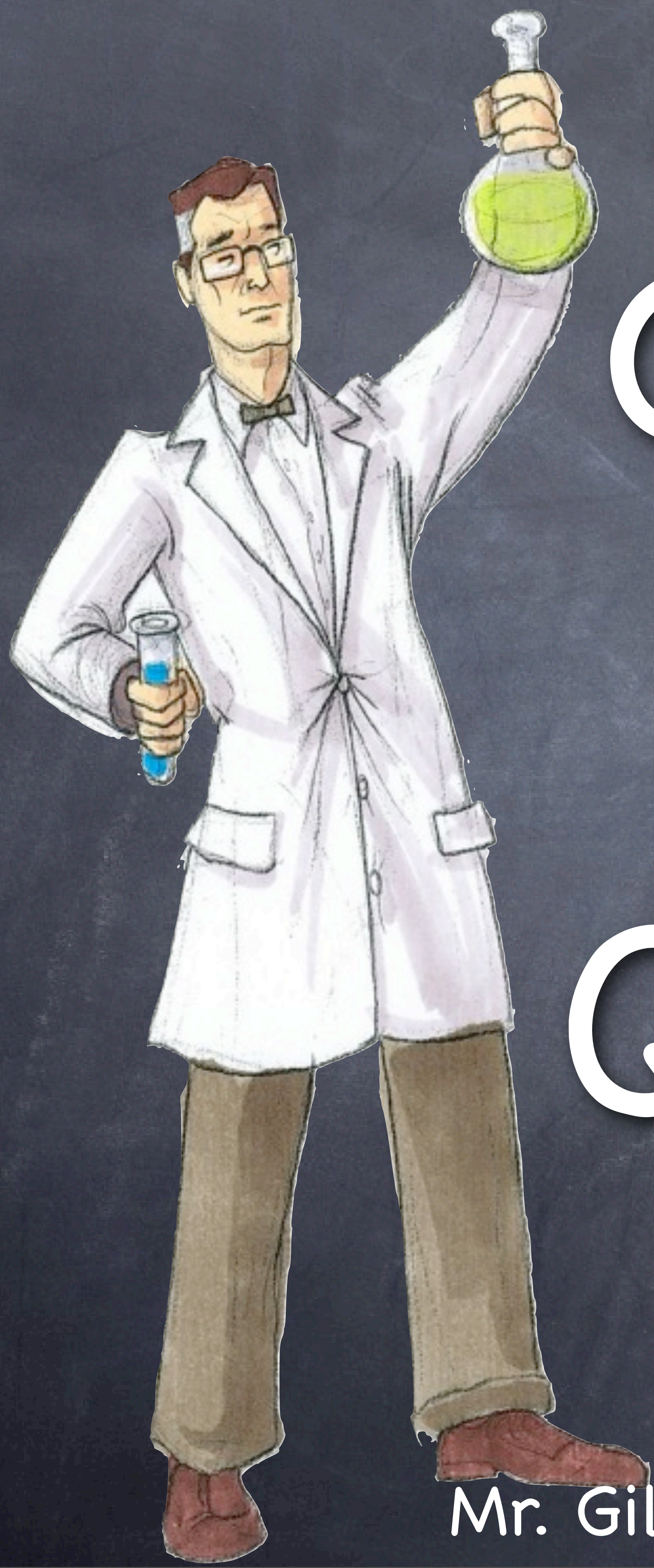

CHAPTER 6 REVIEW QUESTIONS

Mr. Gilliland - PreAICE Chemistry @ SHS

***1)** Nitrogen monoxide and carbon monoxide react to produce nitrogen gas and carbon dioxide.If 67.2 dm^3 of nitrogen monoxide reacts with 62.5 dm^3 of carbon monoxide:*

$$2NO_{(g)} + 2CO_{(g)} \rightarrow N_{2\,(g)} + 2CO_{2\,(g)}$$

CO a. Which reactant is the limiting reagent?

$$\frac{67.2\ \cancel{dm^3\ NO}}{1} \times \frac{1\ \cancel{mole\ NO}}{24\ \cancel{dm^3\ NO}} \times \frac{2\ \cancel{mole\ CO}}{2\ \cancel{mole\ NO}} \times \frac{24\ dm^3\ CO}{1\ \cancel{mole\ CO}}$$

67.2 dm^3 of CO is required...

but you only have 62.5 dm^3 of CO

4.7 dm^3 NO b. How much of the excess reagent will be left over after the reaction?

$$\frac{62.5\ \cancel{dm^3\ CO}}{1} \times \frac{1\ \cancel{mole\ CO}}{24\ \cancel{dm^3\ CO}} \times \frac{2\ \cancel{mole\ NO}}{2\ \cancel{mole\ CO}} \times \frac{24\ dm^3\ NO}{1\ \cancel{mole\ NO}}$$

67.2 dm^3 NO is available

\- 62.5 dm^3 NO is needed!

62.5 dm^3 CO

$$2NO_{(g)} + 2CO_{(g)} \rightarrow N_{2\,(g)} + 2CO_{2\,(g)}$$

31 dm^3 N_2
36 g N_2

c. How many dm^3 and grams of N_2 ?

$$\frac{62.5\ \cancel{dm^3\ CO}}{1} \left| \frac{1\ \cancel{mole\ CO}}{24\ \cancel{dm^3\ CO}} \right| \frac{1\ \cancel{mole\ N_2}}{2\ \cancel{mole\ CO}} \left| \frac{24\ dm^3\ N_2}{1\ \cancel{mole\ N_2}} \right.$$

to convert to grams:

$$\frac{31\ \cancel{dm^3\ N_2}}{1} \left| \frac{1\ \cancel{mole\ N_2}}{24\ \cancel{dm^3\ N_2}} \right| \frac{28.014\ g\ N_2}{1\ \cancel{mole\ N_2}}$$

62.5 dm^3 CO_2
115 g CO_2

d. How many dm^3 and grams of CO_2 ?

$$\frac{62.5\ \cancel{dm^3\ CO}}{1} \left| \frac{1\ \cancel{mole\ CO}}{24\ \cancel{dm^3\ CO}} \right| \frac{2\ \cancel{mole\ CO_2}}{2\ \cancel{mole\ CO}} \left| \frac{24\ dm^3\ CO_2}{1\ \cancel{mole\ CO_2}} \right.$$

to convert to grams:

$$\frac{62.5\ \cancel{dm^3\ CO_2}}{1} \left| \frac{1\ \cancel{mole\ CO_2}}{24\ \cancel{dm^3\ CO_2}} \right| \frac{44.010\ g\ CO_2}{1\ \cancel{mole\ CO_2}}$$

$$2NO_{(g)} + 2CO_{(g)} \rightarrow N_{2\,(g)} + 2CO_{2\,(g)}$$

e. If 26.7 dm^3 of CO_2 was produced, what is the percent yield?

$$\frac{\text{Actual yield} = 26.7\ dm^3}{\text{Ideal yield} = 62.5\ dm^3} \times 100 = \mathbf{42.7\%}$$

2) You want to produce 1.000 kg of aluminum oxide.

$$4Al_{(s)} + 3O_{2\,(g)} \rightarrow 2Al_2O_{3(s)}$$

529.2 g a. How many grams of Al will be required?

$$\frac{1000.\ \cancel{g\ Al_2O_3}}{1} \left| \frac{1\ \cancel{mole\ Al_2O_3}}{101.96\ \cancel{g\ Al_2O_3}} \right| \frac{4\ \cancel{mole\ Al}}{2\ \cancel{mole\ Al_2O_3}} \left| \frac{26.98\ g\ Al}{1\ \cancel{mole\ Al}} \right.$$

353 dm³ b. How many dm^3 of O_2 will be required?

$$\frac{1000.\ \cancel{g\ Al_2O_3}}{1} \left| \frac{1\ \cancel{mole\ Al_2O_3}}{101.96\ \cancel{g\ Al_2O_3}} \right| \frac{3\ \cancel{mole\ O2}}{2\ \cancel{mole\ Al_2O_3}} \left| \frac{24\ dm^3\ O_2}{1\ \cancel{mole\ O_2}} \right.$$

c. If you obtained 893 g of Al2O3, what is your percent yield?

$$\frac{\text{actual yield} = 893\ g}{\text{ideal yield} = 1000.\ g} \times 100 = \mathbf{89.3\%}$$

3) The average pencil contains 1.1 g of carbon.

a. Moles of carbon: 0.092 moles of C

$$\frac{1.1\ \cancel{\text{grams C}}}{1} \times \frac{1\ \text{mole C}}{12.011\ \cancel{\text{g C}}}$$

b. Atoms of carbon: 5.5×10^{22} atoms of C

$$\frac{1.1\ \cancel{\text{grams C}}}{1} \times \frac{1\ \cancel{\text{mole C}}}{12.011\ \cancel{\text{g C}}} \times \frac{6.02 \times 10^{23}\ \text{atoms of C}}{1\ \cancel{\text{mole C}}}$$

4) A compound is composed of 43.7% P & 56.3% O and has the molar mass of 282 g/mole.

Empirical formula:

100. grams of the compound would have: 43.7 g of P

$$\frac{43.7\ \text{~~g of P~~}}{1} \Bigg| \frac{1\text{ mole of P}}{30.97\ \text{~~g of P~~}} = \frac{1.41\text{ moles P}}{1.41\text{ moles}} = 1\text{ P} \times 2 = 2\text{ P}$$

100. grams of the compound would have: 56.3 g of O

$$\frac{56.3\ \text{~~g of O~~}}{1} \Bigg| \frac{1\text{ mole of O}}{15.999\ \text{~~g of O~~}} = \frac{3.51\text{ moles O}}{1.41\text{ moles}} = 2.49\text{ O} \times 2 = 5\text{ O}$$

Empirical formula: P_2O_5

Empirical formula: P_2O_5

Molar Masses:

$$\frac{\text{Molecular Formula} = 284\ \text{g}}{\text{Empirical Formula} = 141.94\text{g}} = 2.00$$

$$P_2O_5 \times 2 = P_4O_{10}$$

Molecular Formula = P_4O_{10}

5) A solution is made by dissolving 23.00 g of sodium hydroxide in 1,350 cm^3 of solution.

a. Moles of sodium hydroxide used:

$$\frac{23.00\ \cancel{g\ NaOH}}{1} \times \frac{1\ mole\ NaOH}{40.00\ \cancel{g\ NaOH}} = 0.5750\ moles\ NaOH$$

b. Molarity of the solution:

$$\frac{0.5750\ moles\ NaOH}{1{,}350\ \cancel{cm^3}\ solution} \times \frac{1000\ \cancel{cm^3}}{1\ L} = \frac{0.426\ moles}{1\ L\ solution} = 0.426\ M$$

In the lab, 56.86 g of aluminum bromide and 34.28 grams of sodium hydroxide are reacted.

$$AlBr_{3(aq)} + 3NaOH_{(aq)} \rightarrow \downarrow Al(OH)_{3\,(s)} + 3NaBr_{(aq)}$$

a. Which is the limiting reagent? Aluminum Bromide

$$\frac{56.86\ \cancel{g\ AlBr_3}}{1} \times \frac{1\ \cancel{mole\ AlBr_3}}{266.69\ \cancel{g\ AlBr_3}} \times \frac{3\ \cancel{mole\ NaOH}}{1\ \cancel{mole\ AlBr_3}} \times \frac{40.00\ g\ NaOH}{1\ \cancel{mole\ NaOH}}$$

25.58 g of NaOH were required...

but you had 34.28 grams.

b. How many grams of excess reactant is left over?

Mass of NaOH available: 34.28 grams.

- Mass of NaOH used: 25.58 grams.

Mass of NaOH in excess: 8.70 grams.

56.86 g

$$AlBr_{3(aq)} + 3NaOH_{(aq)} \rightarrow \downarrow Al(OH)_{3\,(s)} + 3NaBr_{(aq)}$$

c. How many grams of aluminum hydroxide will form?

$$\frac{56.86\ \cancel{g\ AlBr_3}}{1} \times \frac{1\ \cancel{mole\ AlBr_3}}{266.69\ \cancel{g\ AlBr_3}} \times \frac{1\cancel{mole\ Al(OH)_3}}{1\ \cancel{mole\ AlBr_3}} \times \frac{78.004\ g\ Al(OH)_3}{1\ \cancel{mole\ Al(OH)_3}}$$

16.63 grams of aluminum oxide

c. How many grams of sodium bromide will form?

$$\frac{56.86\ \cancel{g\ AlBr_3}}{1} \times \frac{1\ \cancel{mole\ AlBr_3}}{266.69\ \cancel{g\ AlBr_3}} \times \frac{3\ \cancel{moles\ NaBr}}{1\ \cancel{mole\ AlBr_3}} \times \frac{102.89\ g\ NaBr}{1\ \cancel{mole\ NaBr}}$$

65.81 grams of sodium bromide

d. How many moles of each product will form?

$$\frac{16.63\ \cancel{g\ Al_2O_3}}{1} \times \frac{1\ mole\ Al_2O_3}{78.004\ \cancel{g\ Al_2O_3}} \qquad \frac{65.81\ \cancel{g\ NaBr}}{1} \times \frac{1\ mole\ NaBr}{102.89\ \cancel{g\ NaBr}}$$

0.2132 mole of Al_2O_3

0.6396 mole of NaBr