**Quiz 4**

# Directions: Answer each of the following questions. Be sure to use complete sentences where appropriate. For full credit be sure to show all of your work. Where appropriate answers should be boxed for clarity, written to the correct number of significant figures, and, include the proper units.

1. In the Calorimetry experiment, you will react \_\_\_magnesium, Mg\_\_\_\_\_\_ and \_\_magnesium oxide, MgO\_\_\_\_\_\_\_\_\_ with hydrochloric acid (2 points)
2. A gas mixture contains an equal number of moles of He and Ne. The total pressure of the mixture is 3.00 atm (2 points).
	1. What is the partial pressure of He? \_\_\_\_1.50 atm
	2. What is the partial pressure of Ne? \_\_\_\_1.50 atm
3. Carbon monoxide gas reacts with hydrogen gas to form methanol, CH3OH (16 points):

CO (g) + 2 H2 (g) → CH3OH (g)

A 1.30 L reaction vessel, initially at 305 K, contains carbon monoxide gas at a partial pressure of 232 mmHg and hydrogen gas at a partial pressure of 39.5 kPa.

* 1. How many moles of carbon monoxide are in the container?

$PV=nRT⟹n=\frac{PV}{RT}=\frac{\left(232 mmHg\right)\left(1.30 L\right)}{\left(0.08206 \frac{L atm}{mol K}\right)\left(305 K\right)}×\frac{1 atm}{760 mmHg}=0.015855736 mol CO≈0.0159 mol CO $

* 1. How many moles of hydrogen gas are in the container?

$PV=nRT⟹n=\frac{PV}{RT}=\frac{\left(39.5 kPa\right)\left(1.30 L\right)}{\left(0.08206 \frac{L atm}{mol K}\right)\left(305 K\right)}×\frac{1 atm}{101.325 kPa}=0.020248483 mol H\_{2} ≈0.0202 mol H\_{2}$

* 1. Using an ICE table identify the limiting reactant.

|  |  |  |  |
| --- | --- | --- | --- |
|  | CO (g) + | 2 H2 (g) → | CH3OH (g) |
| I | 0.0159 mol  | 0.0202 mol  | 0 mol  |
| C | -x | -2x | +x |
| E | 0.0159 mol – x =0.0159 mol – 0.0134 mol =0.0026 mol  | 0.0202 mol -2x =0.0202 mol – 2(0.0101 mol) =0 mol  | x = 0.0101 mol  |

Compare ratios: $theoretical ratio: \frac{0.0202 mol H\_{2}}{0.0159 mol CO}=\frac{1.27 mol H\_{2} }{1 mol CO}<acutal ratio \frac{2 mol H\_{2} }{1 mol CO}$

Therefore, H2 is the limiting reagent

$$0.0202 mol-2x=0 mol$$

$$x=0.0101 mol $$

* 1. Determine the theoretical yield of methanol in grams.

$$0.0101 mol CH\_{3}OH×\frac{32.042 g CH\_{3}OH}{1 mol CH\_{3}OH}=0.324 g CH\_{3}OH$$

* 1. If 0.322 g of methanol is actually produced, what is the percent yield?

$$\%yield= \frac{m\_{actual}}{m\_{theoretical}}×100=\frac{0.322 g}{0.324 g}×100=99.4\% $$