Gas Laws: Stoichiometry

1. **Long Answer question**

Christine and Danine did a lab using Mg(s) and 4.0 mol/L HCl(aq) where they collected the $H_2(g)$ that was produced. The lab conditions were SATP. They made the following table of observations.

Trial	Mass of Mg(s)	Volume of HCl(aq)	Volume of $H_2(g)$ collected	R value calculated $\frac{LkPa}{Kmol}$
I	0.100g	10.0 mL	130 mL	
II	0.100 g	10.0 mL	108 mL	
III	0.100 g	10.0 mL	102 mL	
IV	0.100 g	10.0 mL	92.0 mL	

- Which chemical reagent is the **limiting reagent?** (1 mark)
- Calculate the experimental value of the ideal gas constant (R) for each trial. (4 marks)
- Describe at least one procedural error that these girls may have made that would result in the R value being too small. (1 mark)
- Calculate the percentage yield for trial I. Express to the nearest tenth of a percent. (1 mark)

2. **Numerical response question**

Left justify your answer in the boxes provided below

Use the following equation to answer this question

$4\ NH_3(g) + 5\ O_2(g) \rightarrow 4\ NO(g) + 6\ H_2O(g)$

The first step in making nitric acid is to convert ammonia to nitrogen monoxide. This is done under constant conditions of high temperature and pressure and in the presence of a platinum catalyst.

A volume of _____ L of $O_2(g)$ is consumed per liter of NO(g) formed. Express your answer to the **nearest hundredth** of a litre.

3. **Numerical response question**

Left justify your answer in the boxes provided below

Use the balanced reaction below to help answer this question.

$N_2(g) + 3H_2(g) \rightarrow 2\ NH_3(g)$

If all gases are measured at the same temperature and pressure, what volume of $NH_3(g)$ is produced when 225 L $H_2(g)$ is consumed in the following reaction

4. What volume of $O_2(g)$ is consumed in the combustion of 75.6 L $C_3H_8(g)$ if both gases are measured at STP?

   a. 75.6
   b. 126
   c. 227
   d. 378

5. Calculate the volume of $H_20(g)$, produced by 1.75 L of $H_2(g)$ in the following reaction. Assume all gases are under identical conditions

   $3\ CO(g) + 7\ H_2(g) \rightarrow C_3H_8(g) + 3\ H_2O(l)$

   a. 4.08 L
   b. 1.75 L
   c. 5.25 L
   d. 0.750 L

6. **Numerical response question**

   Left justify your answer in the boxes provided.

   The catalytic converter changes carbon monoxide to carbon dioxide as shown below.

   $2CO_{(g)} + O_{2(g)} \rightarrow 2CO_{2(g)}$

   When 48.6 mL of $CO_{(g)}$ is consumed, then _____ mL of $CO_{2(g)}$ is produced. .Assume all gases are under identical conditions

7. **Numerical response question**

   Left justify your answer in the boxes provided.

   Butane lighters undergo combustion reactions according to the following balance chemical reaction.

   $2C_4H_{10(g)} + 13O_{2(g)} \rightarrow 8CO_{2(g)} + 10H_2O_{(g)}$

   If the lighter uses 115 mL of butane, the carbon dioxide produced by the lighter will be _____mL. Assume all gases are under identical conditions

8. **Numerical response question**

   Left justify your answer in the boxes provided.

   A sample of methane gas undergoes complete combustion at SATP. If 40 g of methane is used, then _____ L of oxygen is consumed. Express the answer as a.b x 10^c L, where a,b,c are the first three boxes of the answer space.

9. **Numerical response question**

Left justify your answer in the boxes provided.

If 25.0 g of formaldehyde ($CH_2O(g)$ is formed from its elements, what volume of oxygen gas is consumed at 280 K and 100 kPa. Express the answer in Litres.

10. **Numerical response question**

Left justify your answer in the boxes provided.

Acetylene ($C_2H_2(g)$) undergoes complete combustion. If 50 g of the fuel is consumed what volume of carbon dioxide will form at 120 kPa and 300 K? Express the answer in Litres.

Answers:

1. Magnesium is the limiting reagent
   R values are 10.6, 8.81, 8.32 and 7.51
   The magnesium may not have been all used up …. Or other reasonable answers
   27.5 %

2. 1.25
3. 150
4. D
5. D
6. 48.6
7. 460
8. 122
9. 9.69
10. 79.8