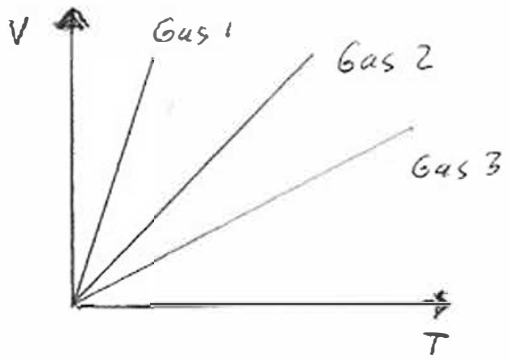
CHEM 3423 001 Spring 2026 **Name:**
ID:

WS# 1 (Total number of points you can get is **3 pts**)

1. **(1 p)** Suppose we have three containers, filled with three types of gas, H_2, N_2, and O_2, but you do not know which container is filled with which gas. Pressure P and total mass m of the included gas are the same in each container. Measuring volume V and temperature T allows you to draw the following graph:



$$PV = nRT \Rightarrow V = \frac{nR}{P}T = \frac{1}{M}\frac{mR}{P}T$$

$$\frac{1}{M_1} > \frac{1}{M_2} > \frac{1}{M_3} \Rightarrow M_3 > M_2 > M_1$$

$$\Rightarrow \text{gas 1} = H_2$$
$$\text{gas 2} = N_2$$
$$\text{gas 3} = O_2$$

Find out the type (H_2, N_2, or O_2) of gas 1, 2, and 3. Explain. Hint: Use what you know about the relation between the molar masses M of the three gases.

2. **(1 pt)** A gas that behaves ideally has a density ρ of 6.0 g dm^{-3} at pressure P= 300 kPa and T=150 K. What is its molar mass M?

$$PV = nRT \Rightarrow \frac{m}{M}RT \Rightarrow M = \frac{m}{V}\frac{RT}{P} = \frac{\rho RT}{P}$$

$$= \frac{6.0 \cdot 10^{-3}\ Kg}{10^{-3}\ m^3} \cdot \frac{8.3143 \cdot 150}{300 \cdot 10^3} \cdot 1\ \frac{K}{K \cdot mol\ Pa}$$

$$= 24.94 \cdot 10^{-3}\ \frac{Kg}{mol}$$

$$= 24.94\ \frac{g}{mol}$$

3. **(1 pt)** A certain substance, used as a manometer fluid, has a density of 1.047 g/cm^3. What pressure P will lead to a column of 3.0 mm? (g=9.8 m/s^2)

$$P = \rho \cdot g \cdot h = \frac{1.047 \cdot 10^{-3}\ Kg}{10^{-6}\ m^3} \cdot 9.8\ \frac{m}{sc} \cdot 3.0 \cdot 10^{-3}\ m$$

$$= 1.047 \cdot 9.8 \cdot 3.0\ \frac{N}{m^2}$$

$$= 30.78\ Pa$$