**Quiz 5**

# 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 Alloy experiment, you will react \_\_ zinc, Zn\_\_\_\_\_\_ and \_\_\_aluminum, Al\_\_\_\_\_\_\_ with hydrochloric acid (2 points).
2. You have a gas, one of the three known phosphorus-fluorine compounds (PF3, PF5, and P2F4). To find out which, you decide to measure its molar mass (12 points).
	1. First you determine that the density of the gas is 5.60 g/L at a pressure of 0.971 atm and a temperature of 18.2 °C. Calculate the molar mass and identify the compound.

$$MM=\frac{DRT}{P}$$

$$MM=\frac{\left(5.60\frac{g}{L}\right)\left(0.08206 \frac{L atm}{mol K}\right)\left(18.2+273.15\right)K }{0.971 atm}$$

$$MM=\frac{DRT}{P}=\frac{\left(5.60\frac{g}{L}\right)\left(0.08206 \frac{L atm}{mol K}\right)\left(291.35 K\right) }{0.971 atm}=137.884463\frac{g}{mol}≈138\frac{g}{mol}$$

The molar mass is closest to that of P2F4, which has a molar mass of 137.94 g/mol.

* 1. To check the results from part (a), you decide to measure the molar mass based on the relative rates of effusion of the unknown gas and CO2. You find that CO2 effuses at a rate of 0.050 mol/min, whereas the unknown phosphorus fluoride effuses at a rate of 0.028 mol/min. Calculate the molar mass of the unknown gas based on these results.

$$\frac{rate 1}{rate 2}=\sqrt{\frac{MM 2}{MM 1}}⟹MM2=\left(\frac{rate 1}{rate 2}\right)^{2}MM1=\left(\frac{0.050 \frac{mol}{min}}{0.028 \frac{mol }{min}}\right)^{2}\left(44.009\frac{g}{mol}\right)=140.3348214\frac{g}{mol}≈140\frac{g}{mol}$$

This is consistent with the results from part a.

1. A balloon does 324 J of work on the surroundings as it expands under a constant pressure of 7.33 × 104 Pa. What is the change in volume (in L) of the balloon (6 points)?

$$w=-P∆V⟹∆V=\frac{w}{-P}$$

$$∆V=\frac{324 J}{7.33 ×10^{4} Pa}×\frac{1000 Pa}{1 kPa}×\frac{101.325 kPa}{1 atm}×\frac{1 L atm}{101.325 J}=4.420190996 L≈4.42 L$$