GAS LAWS PRACTICE #2: "ADVANCED GAS LAWS" AP CHEMISTRY

1. The empirical formula for an unknown compound is found to be CH_3. At 20.0°C and 1.00 atm, 1.22g of this unknown gas takes up a volume of 1.00L.
A) What is the molar mass of the unknown?
B) What is the molecular formula of the unknown?

2. In the news there was a sad story about some poor sap who ate 5 heaping tablespoons of baking soda, $NaHCO_3$, to neutralize his acid reflux. The baking soda reacted with his stomach acid as follows:

$$NaHCO3 + HCl \rightarrow CO_2 + H_2O + NaCl$$

They reported that the guy exploded! Given the following data, calculate the pressure his stomach *would* have experienced - had it not exploded first.

Volume of stomach = 1.5 liters
Body Temperature = 37.0°C
One heaping teaspoon of baking soda = 3.0 grams

3. The balanced equation for the combustion of octane is shown below:

$$2C_8H_{18} + 25\ O_2 \rightarrow 16\ CO_2 + 18\ H_2O$$

The volume of one cylinder in an automobile is about 0.500L. If the air intake is 45.0°C and 1.00 atm of pressure, calculate the grams of octane that the fuel injection should send to the cylinder to completely react with the O_2 in the sample of air. Assume that air is 20.0% oxygen.

4. Gas laws can be used to solve for the Molar Mass of a gas. What is the formula used to calculate the density of a gas (mass/volume)?
A) The N_2 gas inside a fire extinguisher is pressurized to 1345 kPa. What is the density of the N_2 gas at 25.0°C if the volume of the tank is 1.00L?
B) How does this compare with the density of the N_2 gas in the air we breathe at 25.0°C and 1.00 atm?

5. In retrospect we might think that whoever decided to fill the Hindenburg Zeppelin with Hydrogen gas to be very silly! Didn't they know that H_2 gas is flammable? For safety reasons Helium gas is a much better choice. However, hydrogen gas has significantly greater "lifting power", meaning hydrogen is much less dense that helium. Explain why an equal volume of H_2 gas would be so much less dense than helium?