CH301 Worksheet 8—Gases

1. What do we assume about ideal gases? What is the ideal gas law? Give the units for each variable.

2. If you know the number of moles of an ideal gas, what is the minimum number of variables that you need to know in order to fully determine the system?

3. Assuming a constant molar quantity of gas, hoe could you produce the following effects?

a. decrease pressure

b. decrease volume

c. increase pressure

d. increase volume

4. You are scuba diving in a large fish tank. While you are at the bottom of the tank, you release a baloon full of air and watch it as it rises to the surface. What do you notice about the volume of the baloon?

5. What is the temperature of .75 moles of argon in a 18 L container with a pressure of 790 Torr?

6. Rank the following in order of increasing density:

1 mole of CH_4 at .1 atm and 273 K

2 moles O_2 at 1 atm and 300 K

3 mol H_2 3 atm and 290 K

7. You are a little boy or girl and stole your parents' hot air balloon. You are also a thirsty kid and brought some cans of soda (each can holds 354 mL) with you. As you get higher in altitude you notice that your soda cans start to expand and then eventually explode. So now you are thirsty and desperate to figure out what happened. You find out that the pressure at sea level is 1 atm and where the cans exploded is .7 atm. You also note that at sea level the temperature is 30 °C and 25 °C where the cans exploded. Why did the cans explode?

8. An adult's lungs can hold about 6L. How many grams of air can an adult hold at a pressure of 102 kPa? Normal body temperature is 37 °C and air is about 20% oxygen and 80% nitrogen. (101,325 Pa = 1 atm)

9. Is it possible for 1 mole of air in an adult's lungs to be at STP? Explain and prove by use the ideal gas law.

10. A gas exerts a pressure of 1.12 atm in a 4 L container at 19C. You know the density of the gas is 1.5 g/L. What is the molecule?

11. What assumptions do we make when using the ideal gas law? Which of these are pretty good and which are pretty bad?

12. What are the the two "fudge factors" (aka coefficients) in the van der Waals equation? Which terms in the ideal gas law do they correct/modify?

13. Rank the following gases from most to least ideal in terms of the van der Waals coefficient b: CO_2, SF_6, O_2, H_2, He, CH_4, Rn,

14. At a given temperature, what will be the ratio of the rate of effusion of ozone to rate of effusion of molecular oxygen?

15. What is meant by STP? What are its values? Do you need to memorize these values?

16. Balance the reaction below. If it goes to completion, what total volume will it occupy at STP? Will the volume have increased or decreased? By how much? (Assume ideality.)

$C_3H_6O(l) + 4\ O_2(g) \rightarrow 3\ CO_2(g) + 3\ H_2O(g)$

17. If a gas molecule is moving at 800 miles per hour at a given temperature, by what factor would we need to increase the temperature in order to double the velocity of the gas

molecule?

18. Why are diffusion and effusion so much slower than the actual velocity of a gas, (e.g. a gas molecule moving at 1000 km/hr diffuses at a tiny fraction of that rate)?

19. An unidentified gas has a velocity of 753 m·s-1 at STP. What is the identity of this gas? (Yes, this problem contains enough information to answer the question. Yes, it is hard.)

20. Rank the following gases from least to most ideal in terms of the van der Waals coefficient a: N_2, H_2, HCl, HF, NH_3