Ch. 10-11 Gas Law Test Review

STUDYING MY TEST REVIEW IS NOT STUDYING!!!! YOU SHOULD WORK THROUGH YOUR TEST REVIEW AND THEY USE MY REVIEW TO CHECK YOUR ANSWERS.

1. Define a REAL gas. **A real gas is a gas that does not behave completely according to the assumptions of the kinetic molecular theory.**
2. Define an Ideal gas. **An ideal gas is an imaginary gas that perfectly fits all the assumption of the kinetic molecular theory.**
3. How do gas particles collide according to the kinetic molecular theory? **According to KMT, collisions between gas particles and between particles and container walls are elastic collisions. An elastic collision is one in which there is no net loss of kinetic energy.**
4. Summarize all 5 points of the KMT (kinetic molecular theory). **1) Gases consist of large numbers of tiny particles that are far apart relative to their size. 2) Collisions between gas particles and between particles and container walls are elastic collisions. An elastic collision is one in which there is no net loss of kinetic energy. 3) Gas particles are in continuous, rapid, random motion. They therefore possess kinetic energy, which is energy of motion. 4) There are no forces of attraction of repulsion between gas particles. 5) the average kinetic energy of a gas particle depends on the temperature of the gas.**
5. What is diffusion of a gas? (Give an example.) **Diffusion is the spontaneous mixing of the particles of two substances caused by their random particle motion. Example is Smelling someone perfume in a room from far away.**
6. What is effusion of a gas? (Give an example.) **Effusion is the process by which gas particles pass through a tiny opening. Example: a pinhole in a tire.**
7. Why does a can collapse when you drop the pressure? *(Re-watch the Charles's Law Video if you don't know)*. **When the pressure inside the can is greatly reduced (for example, when a gas is cooled) the atmospheric pressure on the outside of the can pushes the walls of the can in.**
8. What are the values of STP? **1 atmosphere of pressure at 0°C.**
9. Review the law of conservation of mass! Recall that mass is conserved at all times in an experiment and that the mass of the products must = the total mass of the reactants. Even if one is a gas. In the reaction of $N_2 + 3H_2 \rightarrow 2\ NH_3$ if I have 28 g of nitrogen and 12g of hydrogen, how much NH_3 will I make? **If you know the mass of both reactants, you can add them together to determine the mass of the product formed. 28g of nitrogen combined with 12 g of hydrogen should form 40g of NH_3.**
10. Many aerosols or things that can vaporize in a container – often carry warnings to keep away from a flame. How does temperature affect the pressure of a container? (And the volume!) **Any increase in the temperature of a gas causes the particles to have more kinetic energy. More kinetic energy means faster particle motion which means more collisions with the gas particles against the wall of the container. This causes an increase in the pressure on the walls fo the container which mean it may rupture (blow up) the container. In addition, many aerosols are flammable which increases the risk and danger if they were to rupture. The chemistry reason behind this can be explained by Charles's law which states there is a direct relationship between volume and temperature. If temperature increases, the volume will also increase.**
11. As you get closer to sea level….air pressure increases….how would this affect an object's volume? (What is the relationship between pressure and volume)? **Air pressure at sea lever is a result of all the air above putting pressure on an object. As the elevation of a balloon for example increases, the gas from the atmosphere pushing down decreases and the volume of the gas in the balloon expands because there is less pressure pushing on the balloon. Boyle's law describes the relationship between pressure and volume. The pressure-volume relationship is an inverse relationship. As pressure is decreased, the volume increases, and as volume is decreased the pressure increases.**

12. Unlike most solids --- gases have the opposite trend in terms of how much can be dissolved into solution! As you heat a solution w/ a gas inside it can hold LESS and LESS gas. IF aquatic life needs dissolved oxygen for respiration….what water temperature would have more? Warm or cool? **You can dissolve more gas in a cold liquid then a warm liquid. This affects aquatic life in waters of different temperatures. Also, if the water somewhere was artificially warmed, for example by a power plant, this would affect the ability of the fish in that water to survive because warmer water cannot hold as much dissolved oxygen.**
13. The same amount of gas in a larger container would have (more/less/or the same) volume? **If you had the same amount of gas in a larger container it would have a larger volume and a smaller pressure.**
14. What is pressure and what are the units of pressure? **Pressure is a measure of the force per unit area. Air pressure is caused by gas particles bouncing off a surface. The units of pressure in gasses are atmospheres, torr, mm HG, pascals (Pa) and kilopascals (kPa). 1 atm. = 760 torr = 760 mm Hg = 101.325 kPa, = 101,325 Pa.**
15. What device measures pressure? **A barometer measures atmospheric pressure.**
16. What is Boyle's law IN WORDS: **Boyle's law states that the volume of a fixed mass of gas varies inversely with the pressure at constant temperature.**
17. What does STP stand for and what are STP conditions? **STP stands for standard temperature and pressure. STP conditions are 0 °C and 1 atmosphere of pressure.**
18. How many Liters are in one mole of a gas at STP? **The standard molar volume of a gas tells us that one mole of any gas occupies 22.4 L of volume at STP conditions.**
19. In any equation how can you tell how many MOLES there are of a substance… Ex: $N_2 + 3H_2 \rightarrow 2\ NH_3$ How many moles of nitrogen? **1 mol nitrogen** How many of Hydrogen? **3 mol hydrogen.**

Problems:

A. The pressure of a sample of helium is 2.0 atm P_1 in a 300-mL V_1 container. If the container is compressed to 15 mL V_2 without changing the temperature, what is the new pressure P_2? (Boyles)

$$P_1V_1 = P_2V_2 \qquad (2.0\ atm)(300\ mL) = (P_2)(15\ mL) \qquad P_2 = 40\ mL$$

B. On a cold winter morning when the temperature is –10°C $T_1 = 263$ K, the air pressure in an automobile tire is 1.3 atmP_1. If the volume does not change, what is the pressureP_2 after the tire has warmed to 15°C $T_2 = 298$K? (Charles)

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \qquad \frac{(1.3\ atm)(V_1)}{263\ K} = \frac{(P_2)(V_2)}{298K}$$

The Volumes cancel because it is held constant.

$$P_2 = 1.47\ atm$$

C. A gas at 21.0° C **T1= 294K** has a pressure of 700 mm Hg **P1** is measured to take up a volume of 15 mL **V1**. What is the calculated volume of the gas at 20.0°C **T2=293K** when the new pressure is 740 mm Hg**UNIT**? (Combined)

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \qquad \frac{(700\ mmHg)(15\ mL)}{294K} = \frac{(740\ mmHg)(V_2)}{293K} \qquad V_2 = 14.14\ \text{mL}$$

D. A mixture of four gases exerts a total pressure of 880 mm Hg**P_T**. Gases A and B each exert 210 mm Hg**P_1 & P_2**. Gas C exerts 110 mm Hg**P_3** What pressure is exerted by gas D**P_4**? (Dalton's)

$$P_T = P_1 + P_2 + P_3 + P_4$$
$$P_T = P_A + P_B + P_C + P_D$$
$$880\ mmHG = 210\ mmHg + 210\ mmHg + 110\ mmHg + P_D$$
$$880\ mmHG = 530\ mmHg + P_D$$
$$P_D = 880\ mmHG - 530\ mmHg = 350\ mmHg$$

E. A 300 mL**UNIT** quantity of ice cream has a mass of 200 grams**UNIT**. The manufacturer bubbles air into the ice cream so that its volume increases by 350 mL**UNIT**. What is the ice cream's approximate final density? *(…the MASS didn't change, so density is still mass/ volume – do the mass over your FINAL volume!) – not a gas problem, a density one!*

Before adding bubbles $D = \frac{M}{V} = \frac{200\ g}{300\ mL} = 0.67\ {}^{g}/_{mL}$

Bubbles were added which changed the volume but not the mass.

The new volume is the initial volume (300 mL) + the 350 mL the volume increased by = 650 mL

After adding bubbles $D = \frac{M}{V} = \frac{200\ g}{650\ mL} = 0.31\ {}^{g}/_{mL}$

F. The volume of a gas is 90 mL**V_1** when the temperature is 81°C **T1=354K**. If the temperature is reduced to 0°C **T_2=273K** without changing the pressure (**P1 & P2 will cancel since they are unchanged**), what is the new volume **V_2** of the gas? (Charles)

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \qquad \frac{(P_1)(90\ mL)}{354\ K} = \frac{(P_2)(V_2)}{273K}$$

The pressures cancel because it is held constant.

$$\frac{(90\ mL)}{354\ K} = \frac{(V_2)}{273K} \qquad V_2 = 69.4\ mL$$

G. Calculate the approximate volume of a 0.500 mol **n** sample of gas at 20.0°C**T=293K** and a pressure of 1.10 atm**P**. (Ideal)

$$PV = nRT \qquad V = \frac{nRT}{P} \qquad V = \frac{(0.500\ mol)(0.0821\ \frac{L\bullet atm}{mol\bullet K})(293K)}{(1.10\ atm)} \qquad V = 10.9\ L$$

H. When hydrogen burns, water vapor is produced. The equation is $2H_{2(g)} + O_{2(g)} \rightarrow 2H_2O_{(g)}$. If 8.0 L of oxygen are consumed, what volume of water vapor is produced?

$$\frac{8.0\ LO_2}{} \bullet \frac{1\ mol\ O_2}{22.4\ L\ O_2} \bullet \frac{2\ mol\ H_2O}{1\ mol\ O_2} \bullet \frac{22.4\ L\ H_2O}{1\ mol\ H_2O} = 16\ L\ H_2O$$