Name: _____ Date: _____ Period: _____

Gas Laws Test Review

Select the correct answer for the following questions. For any calculation you MUST show **ALL work with units**. For any multiple choice question you **MUST list the textbook page number** or section that help you select the correct answer.

1. If temperature and pressure are held constant, the volume and number of moles of a gas are:
   a. directly proportional b. independent of each other
   c. not enough information given d. equal e. inversely proportional

2. If volume and number of moles of a gas are held constant, the temperature and pressure are:
   a. directly proportional b. independent of each other
   c. not enough information given d. equal e. inversely proportional

3. If temperature and number of moles of a gas are held constant, the volume and pressure are:
   a. directly proportional b. independent of each other
   c. not enough information given d. equal e. inversely proportional

4. If pressure and number of moles of a gas are held constant, the volume and temperature are:
   a. directly proportional b. independent of each other
   c. not enough information given d. equal e. inversely proportional

5. One mole of NH_3 at STP will have what volume?
   a. 22.4 L b. 44g c. 1.0 L d. 24.5 L

6. Which of the following statements is true about the kinetic molecular theory?
   a) Pressure is due to the collisions of the gas particles with the walls of the container.
   b) Adding an ideal gas to a closed container will cause an increase in temperature.
   c) The volume of a gas particle is considered to be small about 0 .1 mL.
   d) Gas particles have random motion.
   e) At least two of these statements are true.

7. Which of the following statements is true concerning ideal gases?
   a) The gas particles in a sample exert attraction for one another.
   b) At STP 1.0L of Ar gas contains about twice the number of atoms as 1.0L of Ne gas.
   c) A gas exerts pressure as a result of the collisions of the gas molecules with the walls of the container.
   d) The temperature of the gas sample is indirectly related to the average velocity of the gas particles.

8. Use the kinetic molecular theory of gases to predict what would happen to a closed sample of a gas whose temperature increased while its volume decreased.
   a) Its pressure would decrease c) Its pressure would hold constant.
   b) Its pressure would increase. d) the number of moles would increase.

9. Perform the following conversions of pressure units: **5.0×10^9 Pa = _____ atm**
   a. 4.9×10^4 b. 1.7×10^5 c. 4.3×10^4 d. 2.5×10^4 e. 9.8×10^4

10. The pressure of a given mass of gas varies directly with the temperature when the volume remains constant.
    a. Boyle's Law b. combined gas law c. Gay-Lussac's Law
    d. ideal gas law e. Charles's Law

11. If the temperature is held constant, what will happen to the pressure exerted by a gas if the volume of the container is decreased?
    a. increase b. decrease c. remain the same d. increase or decrease (it depends)

12. If the temperature of a sample of gas is decreased at constant pressure, the volume of the gas will:
    a. increase b. decrease c. remain the same d. you cannot predict this.

13. Which of the following is NOT true about pressure?
    a. pressure is exerted equally in all directions
    b. pressure is defined as force per unit area
    c. gas pressure can only be measured in units of mm of Hg
    d. atmospheric pressure decreases with increasing altitude.

14. Consider the following: You have 3 liters of neon gas at a pressure of 5 atmospheres, 3 liters of carbon dioxide gas at a pressure of 4 atmospheres, and 3 liters of nitrogen gas at a pressure of 2 atmospheres. All three samples are at room temperature. It you transfer all 3 gases to a 6 liter container, what is the pressure exerted by the carbon dioxide in the final mixture?
    a. 22 atm b. 2 atmc. 4 atmd. 8 atme. 11 atm

15. Which of these changes would not cause an increase in the pressure of a contained gas?
    a. Another gas is added to the container.
    b. Additional amounts of the same gas are added to the container
    c. The temperature is increased.
    d. The gas is moved to a larger container.

16. The volume of a gas is doubled while the temperature is held constant. The pressure of the gas
    a. Remains unchanged b. is doubled
    c. is reduced by one half d. depends on the kind of gas in the container.

17. As the temperature of the gas in a balloon decreases,
    a. the volume increases b. the pressure increases
    c. the volume decreases d. the pressure decreases

18. What volume does 28.5 g of CO_2 occupy at 64.8° C and 3.35 atm?

19. A sample of gas at 215°C and a pressure of 2.70 atm occupies a volume of 6.00 L. What volume would it occupy at STP?

20. A sample of an ideal gas containing 0.554 mol is collected into a container 4.5 L at 51°C. Calculate the pressure.

21. The volume and amount of a gas are constant in a bicycle tire. The initial pressure and temperature are 3.76 atm and 24°C. At what Celsius temperature will the gas in the tire have a pressure of 4.89 atm? What law or principle did you use to solve this problem? _____

22. A sample of an ideal gas containing 0.954 mol is collected into a container 3.5 L at 31°C. Calculate the pressure.

23. The volume and amount of a gas are constant in a bicycle tire. The initial pressure and temperature are 2.73 atm and 19°C. At what Celsius temperature will the gas in the tire have a pressure of 2.89 atm? What law or principle did you use to solve this problem? _____

24. What is the pressure in kPa exerted by 53g of a Ar gas in a 250.0 mL container at 58°C?

25. At what temperature Celsius will 68.5 g of molecular Nitrogen (N_2), exert a pressure of 1953 mm Hg in a 5.12 L cylinder?

SOME OF YOUR TEST PROBLEMS **WILL** COME DIRECTLY FROM THE GAS LAWS WORKSHEET PART 1 OR GAS LAWS WORKSHEET PART 2.

13.1 The Nature of Gases

- Kinetic energy is the energy an object has because of its motion
- Kinetic theory all matter consists of tiny particles that are in constant motion
- Kinetic theory as it applies to gases includes the following fundamentals assumptions about gases
    - **The particles in a gas are considered to be small, hard spheres with an insignificant volume**
        - No attractive or repulsive forces exist between the gas particles because of the distance between them.
        - The motion of one particle is independent of the motion of all the other particles.
    - **The motion of the particles in a gas is rapid, constant, and random**
        - Cases fill their containers regardless of the shape
        - Particles travel in straight-line paths until they collide with another particle, or object.
    - **All collisions between particles in a gas are perfectly elastic**
        - Kinetic energy is transferred without loss from one particle to another.
- Gas pressure results from the force exerted b a gas per unit surface area of an object.
- **Gas pressure is the result of simultaneous collisions of billions of rapidly moving particles in a gas with an object.**
- Vacuum is an empty space with no particles and no pressure
- Atmospheric pressure results from the collisions of atoms and molecules in air with objects
- Atmospheric pressure decreases as you climb a mountain because the density of Earth's atmosphere decreases as the elevation increases.
- Barometer is a device that is used to measure atmospheric pressure.
- Pascal (Pa) is the SI unit of pressure, normal atmospheric pressure is about 100,000 Pa or 100 kilopascals (kPa)
- Standard atmosphere (atm) is the pressure required to support 760 mm of mercury in a mercury barometer at 25°C
- **1 atm =760 mmHg = 101.3 kPa**
- *an increase in the average kinetic energy of the particles causes the temperature of a substance to rise*
- *as substance cools, the particles tend to move more slowly and their average kinetic energy declines.*
- **The Kelvin temperature of a substance is directly proportional to the average kinetic energy of the particles of the substance.**

14.1 Properties of Gases

- Compressibility is a measure of how much the volume of matter decreases under pressure.
- **Gases are easily compressed because of the space between the particles in a gas**
- At room temperate the distance between particles in an enclosed gas is about 10 times the diameter of particles.
- **The amount of gas, volume and temperature are factors that affect gas pressure**
    - By adding gas you increase the number of particles
    - Increasing the number of particles increases the number of collisions, and gas pressure increases.
    - In a closed rigid container doubling the number of gas atoms will double the pressure in the container.
    - Reducing the volume of a container will increase the pressure
    - By reducing the volume of a container by ½ you will double the pressure of the gas.
    - By doubling the volume of a container you will decrease the pressure of the gas by ½
- If the volume and the number of atoms in a container are constant and if the temperature (in Kelvin) of a container is doubled the pressure also doubles.
- Halving the Kelvin temperature of a gas in a rigid container decreases the pressure by half.

14.2 The Gas Laws.

- **If the temperature is constant, as the pressure of a gas increases, the volume decreases.**
- Boyle's Law states that for a given mass of gas at constant temperature, the volume of the gas varies inversely with pressure.
- As the pressure of a gas decreases the volume increases.

- The mathematical express of Boyle's law is as follows: $P_1 \times V_1 = P_2 \times V_2$
- The graph of an inverse relationship is always a curve
- **As the temperature of an enclosed gas increase, the volume increases, if the pressure is constant.**
- Charles's Law states that the volume of a fixed mass of gas is directly proportional to its Kelvin temperature if the pressure is kept constant.
- The mathematical expression of Charles' Law is: $\frac{V_1}{T_1} = \frac{V_2}{T_2}$
- The graph of temperate and volume is a straight line.
- **As the temperature of an enclosed as increases, the pressure increases, if the volume is constant**
- Gay-Lussac's Law states that the pressure of a gas is directly proportional to the Kelvin temperature if the volume remains constant.
- As the temperate (in Kelvin) of a gas increase the pressure increases.
- The mathematical expression of Gay-Lussac's Law is: $\frac{P_1}{T_1} = \frac{P_2}{T_2}$
- The combined gas law describes the relationship among the pressure, temperature, and volume of an enclosed gas. $\frac{P_1 \times V_1}{T_1} = \frac{P_2 \times V_2}{T_2}$
- **The combined gas law allows you to do calculations for situations in which only the amount of gas is constant.**

14.3 Ideal Gases

- **To calculate the number of moles of a contained gas requires an expression that contains the variable *n*.**
- **Ideal gas law can be used to calculate the number of moles of a contained gas.**
- The number of moles of gas is directly proportional to the number of particles
- Ideal gas law includes all for variables and is written as follows: PV=*n*RT
    - P = pressure in either kPa or atm
    - V = volume in L
    - T = Temperature in K
    - n = number of MOLES of a gas in an enclosed container
    - R = Ideal gas constant (R) = 8.31 $\frac{\text{L·kPa}}{\text{K·mol}}$ or 0.0821 $\frac{\text{L·atm}}{\text{K·mol}}$
        - ❖ If pressure is not in kPa or atm you must convert it using the Standard pressure values
        - ❖ If volume is not in Liter you must convert it, remember: 1 L =1000 mL or 1 L = 10^3 mL
        - ❖ If temperature is not in Kelvin you MUT convert it: K= °C + 273
        - ❖ For R pick the value that has the same unit of pressure as the one in your problem.
- Recall 1 mole of every gas occupies 22.4 L at STP (101.3 kPa and 273 K).
- And ideal gas is one that follows the gas laws at ALL conditions of pressure and temperature
- Ideal gases don't exist but real gases behave very much like an ideal gas
- **Real gases differ most from an ideal gas at LOW temperate and HIGH pressures**

14.4 Gases: mixtures and movements: will NOT be assessed on 03/30/12

You MUST have all equations, standard pressure and temperatures memorized for the assessment.
You WILL be give the R (ideal gas constant) values.