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Section: \_\_\_\_\_

**Chapter 11 Practice Worksheet:  
Gases: Their Properties and Behavior**

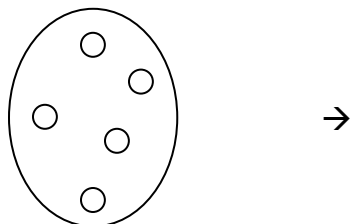
1) Describe the differences between atoms' behaviors in solids, liquids, and gases. Describe atomic motion and relative speed/energy in each. Draw a picture of a sample of each.

2) Convert 755 torr to atm and mmHg.

3) Define atmospheric pressure. How is it measured?

4) Write the formulas for a) Boyle's Law, b) Charles' Law, c) the Combined Gas Law, and d) the Ideal Gas Equation.

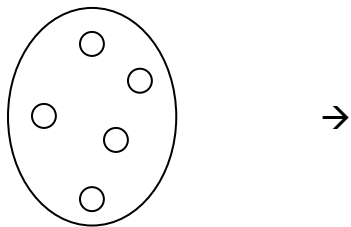
5) Consider the **closed** system (a balloon) below at a temperature of 200 K. Draw what will happen to the gas in the balloon if the balloon is heated to 400 K and pressure remains the same. Which gas law is being used in this example?



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6) Consider the **closed** system below at atmospheric pressure (1.00 atm) and constant temperature. Draw what will happen to the gas in the balloon if the pressure on the balloon is increased to 2.00 atm and temperature remains the same. Which gas law is being used in this example?



7) A certain gas has a volume of 19.7 L at a pressure of 745 mm Hg. If the volume is increased to 22.5 L, what is the pressure of the system?

8) A sample of helium occupies 30.0 mL at a temperature of 25°C. If the temperature is increased to 75°C, what is the new volume of helium?

9) An inflated balloon has a volume of 6.0 L at sea level (1.0 atm) and is allowed to ascend in altitude until the pressure is 0.45 atm. During the ascent the temperature of the gas falls from 22°C to -21°C. Calculate the volume of the balloon at its final altitude.

10) What is the pressure of 0.75 moles of an ideal gas at exactly 100°C that occupies 11.5 L of space?

11) What is the volume of 2.00 moles of gas at STP?

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12) Calculate the density (in g/L) of octane ( $C_8H_{18}$ ) vapor at  $125.0^\circ C$  and 720.0 torr.

13) An organic chemist isolates a colorless liquid from a petroleum sample. She places the liquid in a flask and puts the flask in a boiling water bath, which vaporizes the liquid and fills the flask with gas. She closes the flask, reweighs it, and obtains the data below. Using this information, calculate the molar mass of the organic liquid.

Volume of flask: 213 mL

Temperature:  $100^\circ C$

Pressure: 754 torr

Mass of flask + gas: 78.416 g

Mass of empty flask: 77.834 g

14) A sample of calcium carbonate,  $CaCO_3$ , is decomposed to give  $CaO$  and  $CO_2$ . The carbon dioxide is collected in a 0.500 L flask. After the reaction is complete, the gas has a pressure of 1.3 atm and a temperature of  $31^\circ C$ . How many grams of  $CO_2$  were generated in the reaction?

15) 5.77 g of  $H_2CO_3$  are heated in a test tube. A gas is produced in this decomposition reaction. What is the volume of the gas given off if the final temperature of the reaction is  $25^\circ C$  and the final pressure is 0.785 atm? (Hint: write a balanced equation for this reaction first.)

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16) The safety air bags in automobiles are inflated by nitrogen gas generated by the rapid decomposition of sodium azide,  $\text{NaN}_3$  according to the equation:  $2\text{NaN}_3(\text{s}) \rightarrow 2\text{Na}(\text{s}) + 3\text{N}_2(\text{g})$ . If an air bag has a volume of 36 L and is to be filled with nitrogen gas at a pressure of 1.15 atm at a temperature of  $26.0^\circ\text{C}$ , how many grams of  $\text{NaN}_3$  must be decomposed?

17) A container holds 4.0 mol of  $\text{CO}_2$  and 3.0 mol of  $\text{N}_2$ . The container has a total pressure of 9.5 atm at  $25^\circ\text{C}$ . Calculate the partial pressure of  $\text{N}_2$ .

18) A mixture of gases contains 0.75 mol  $\text{N}_2$ , 0.30 mol  $\text{O}_2$ , and 0.15 mol  $\text{CO}_2$ . If the total pressure of the mixture is 1.56 atm, what is the partial pressure of each component? (Hint: Find the mol fraction of each gas first.)

19) List the postulates of the Kinetic Molecular Theory of gases.

20) Place the following gases in order of increasing molecular speed at 300 K:  $\text{CO}_2$ ,  $\text{H}_2$ ,  $\text{F}_2$ ,  $\text{N}_2\text{O}_4$ ,  $\text{HF}$ .