Gas Law Practice Name ANSWER KEY

Directions: Answer the following questions. Show your work, include the units and use the correct number of significant figures.

1. A gas at constant temperature occupies a volume of 2.40 L and exerts a pressure of 710 mm Hg What volume will the gas occupy at a pressure of 75 mm Hg? BOYLES $V_1 P_1 = V_2 P_2$

$(2.40L)(710mmHg) = V_2(75mmHg)$ $V_2 = 22.7L$

2. What is the pressure of a gas that originally occupied 3.5 L at a pressure of 248 mm Hg, if the volume is increased to 6.43 L Assume that temperature remains constant. BOYLES $V_1 P_1 = V_2 P_2$

$(3.5L)(248mmHg) = (6.43L)P_2$ $P_2 = 140\ mmHg$ 135.9 ROUNDED TO 2 SIG FIGS

3. At constant temperature, a gas that exerted a pressure of 1.44 atm and that occupied 1.58 L is compressed until its pressure is 6.29 atm. What is its final volume? BOYLES $V_1 P_1 = V_2 P_2$

$(1.58L)(1.44atm) = V_2(6.29atm)$ $V_2 = 0.362\ L$

4. A gas at constant pressure occupies 0.400 L at 50°C. What volume will it have at 300°C? (Hint: Remember to convert temperature to Kelvin.) CHARLES $V_1 T_2 = V_2 T_1$ $50°C \rightarrow 323K$ $300 \rightarrow 573K$

$(0.400L)(573K) = V_2(323K)$ $V_2 = 0.710\ L$

5. A gas occupies 0.105 L at 105 K. At what Celsius temperature will its volume be 0.140 L? Assume that pressure remains constant. CHARLES $V_1 T_2 = V_2 T_1$

$(0.105L)(T_2) = (0.140L)(105K)$ $T_2 = 140K$ -273 $T_2 = -133°C$

6. At 75°C, a gas has a volume of 3.22 L. What volume will it occupy at 75 K? CHARLES $V_1 T_2 = V_2 T_1$ $75°C \rightarrow 348K$

$(3.22L)(75K) = V_2(348K)$ $V_2 = 0.69\ L$

7. A gas at 300 K occupies 6.50 L at a pressure of 355 mm Hg What will its pressure be at 250 K if its volume is reduced to 4.80 L? COMBINED $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ or $P_1V_1T_2 = P_2V_2T_1$

$\frac{(355mmHg)(6.50L)}{(300K)} = \frac{P_2(4.80L)}{(250K)}$ $P_2 = 401\ mm\ Hg$

8. At 120°C, a gas exerts a pressure of 212 mm Hg when its volume is 0.496 L. if the temperature is raised to 240°.C, at what volume will the gas exert a pressure of 183 mm Hg? COMBINED $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$ or $P_1V_1T_2 = P_2V_2T_1$

$120 \rightarrow 393K$ $240°C \rightarrow 513K$

$(212mmHg)(0.496L)(513K) = (183mmHg)(V_2)(393K)$ $V_2 = 0.750\ L$

9. A gas confined in a 515-mL container exerts a pressure of 107 mm Hg at 38.6°C. At what Celsius temperature will it exert a pressure of 635.7 mm Hg if it is placed into a 644 mL container? COMBINED $V_1P_1T_2 = V_2P_2T_1$

$(515mL)(107mmHg)T_2 = (644mL)(635.7mmHg)(311.6K)$ $38.6°C \rightarrow 311.6$ $2315.0K - 273$ $T_2 = 2040°C$ 3 sig figs

10. A gas sample that has a mass of 7.02 g occupies 31 mL at 64.3°C and a pressure of 87 mm Hg Calculate the gas density at STP (273 K and 760 mm Hg). COMBINED $V_1P_1T_2 = V_2P_2T_1$ DENSITY $= \frac{m}{V}$

① $(31mL)(87mmHg)(273K) = V_2(760mmHg)(337.3K)$ $V_2 = 2.9mL$ ② $\frac{7.02g}{2.9mL}$ $D = 2.42\ g/mL$

11. At 226 K, a 1.00g gas sample in a 1.88-L container exerts a pressure of 108.8 mm Hg What would the gas sample's density be at 346 K in another container at a pressure of 68.3 mm Hg? COMBINED $P_1V_1T_2 = P_2V_2T_1$ DENSITY $= \frac{m}{V}$

$(1.88L)(108.8mmHg)(346K) = V_2(68.3mmHg)(226K)$ $V_2 = 4.58L$ DENSITY $\frac{1.00g}{4580mL}$ $D = 2.18 \times 10^{-4}\ g/mL$

12. Use the kinetic molecular theory to explain why on a cold autumn morning a camper's air mattress may appear to be somewhat flatter than it was when blown up the afternoon before. Assume no leaks.

When the camper blew up the mattress in the afternoon it was most likely warmer. IF there was no leaks then the amount would stay the same. Kinetic molecular theory says the colder temperature would cause the molecules to move slower than they were the prior afternoon. If they move slower the volume & pressure would decrease.

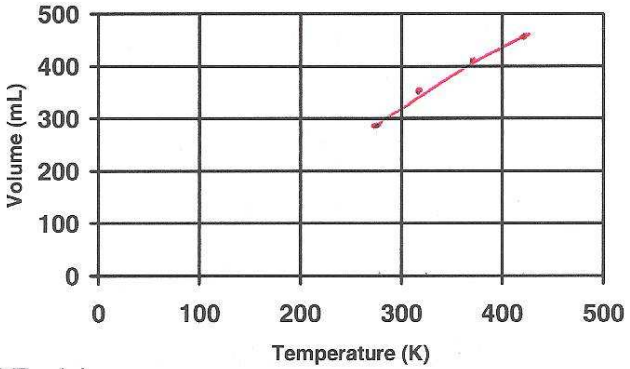
13 One of the cylinders in an automobile engine is heated and the piston moves, allowing the gas inside to expand. The original pressure was 1,85 atm, while its original volume was 175 mL, measured at 18°C. The final measured pressure was 0.86 atm and the temperature was measured at 382°C. Calculate the final volume of the cylinder

COMBINED $V_1P_1T_2 = V_2P_2T_1$ 18°C → 291K 382°C → 655K

$(175mL)(1.85atm)(655K) = V_2(0.86atm)(291K)$ $\quad V_2 = 847\ mL$

14. An expandable container is filled with a given volume of gas. While the pressure of the gas is kept constant, the container is heated. The temperature is recorded in degrees Celsius, and the volume of the contained gas is recorded as well. The data are shown in the following table. Convert °C into Kelvin. Then plot the data on the grid supplied.

Temp (°C)	Temp (K)	Volume (mL)
0°C	273	293
50°C	323	347
100°C	373	401
150°C	423	455



a. What type of proportion does this graph illustrate? Explain.

DIRECTLY PROPORTIONAL. AS ONE VARIABLE INCREASES THE OTHER INCREASES PROPORTIONALLY FORMS A LINE GRAPH

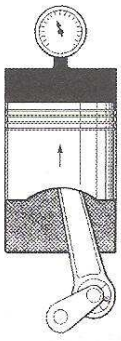
b. What gas law does the graph illustrate?

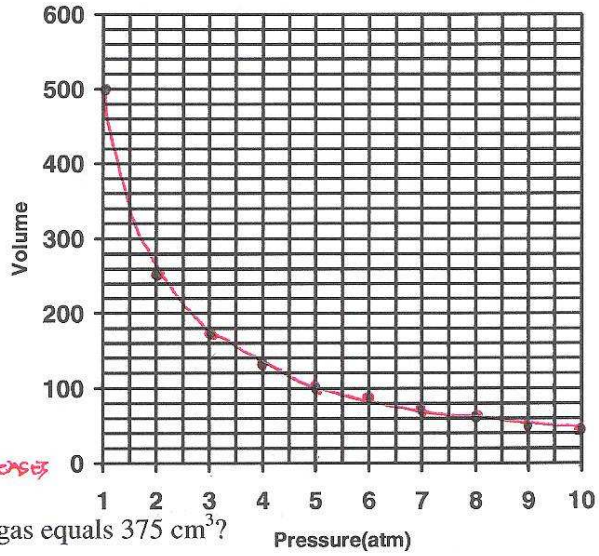
CHARLES

c. Express this relationship in the form of a mathematical equation. $V_1T_2 = V_2T_1$

13. The piston in the following figure is moving further into the cylinder. As it moves, both the pressure and volume of the contained gas are measured. The data are shown in the following table. Graph these data on the grid.

Volume	Pressure
500 cm^3	1 atm
250 cm^3	2 atm
167 cm^3	3 atm
125 cm^3	4 atm
100 cm^3	5 atm
83 cm^3	6 atm
71 cm^3	7 atm
63 cm^3	8 atm
56 cm^3	9 atm
50 cm^3	10 atm





a. What type of proportion does this graph illustrate? Explain.

INVERSELY PROPORTIONAL. AS ONE VARIABLE INCREASES THE OTHER DECREASES

b. What pressure will be observed if the volume of the contained gas equals 375 cm^3?

≈ 1.4 atm

c. Which gas law does the graph illustrate?

BOYLES

d. Express this relationship in the form of a mathematical equation.

$V_1P_1 = V_2P_2$