Name Answer Key Hour ____

$$P_1 \times V_1 = P_2 \times V_2$$

1.0 kPa = 7.5 torr
1.0 torr = 1.0 mmHg
STP = 0 °C, 101.3 kPa

1.0 atm = 101.3 kPa
1.0 atm = 760 mmHg
K = °C + 273

Boyle's Law

Honors Chemistry

Solve the following <u>assuming constant temperature and mass</u>. (All answers should be in atm or in Liters!)

1. A sample of oxygen gas occupies a volume of 250.0 mL at 7.31 kPa. What volume will it occupy at 800.3 torr?

$P_1 = .072\text{ atm}$ $P_2 = 1.053\text{ atm}$
$V_1 = .25\text{ L}$ $V_2 = ?$

$$V_2 = \frac{P_1 \times V_1}{P_2} = \frac{(.072\text{ atm})(.25\text{ L})}{1.053\text{ atm}} = .017\text{ L}$$

2. A sample of CO_2 occupies a volume of 3.50 L at 1.23 atm. What pressure would the gas exert if the volume were decreased to 2.0 L?

$P_1 = 1.23\text{ atm}$ $P_2 = ?$
$V_1 = 3.50\text{ L}$ $V_2 = 2.0\text{ L}$

$$P_2 = \frac{P_1 \times V_1}{V_2} = \frac{(1.23\text{ atm})(3.50\text{ L})}{2.0\text{ L}} = 2.15\text{ atm}$$

3. A 2.0 L container of N_2 had a pressure of 324.16 kPa. What volume would be necessary to decrease the pressure to 1.0 atm?

$P_1 = 3.2\text{ atm}$ $P_2 = 1.0\text{ atm}$
$V_1 = 2.0\text{ L}$ $V_2 = ?$

$$V_2 = \frac{P_1 \times V_1}{P_2} = \frac{(3.2\text{ atm})(2.0\text{ L})}{1.0\text{ atm}} = 6.4\text{ L}$$

4. Ammonia gas occupies a volume of 450.0-mL at a pressure of 0.95 atm. What volume will it occupy at standard pressure?

$P_1 = .95\text{ atm}$ $P_2 = 1.0\text{ atm}$
$V_1 = .45\text{ L}$ $V_2 = ?$

$$V_2 = \frac{P_1 \times V_1}{P_2} = \frac{(0.95\text{ atm})(0.45\text{ L})}{1.0\text{ atm}} = .43\text{ L}$$

5. A 175-mL sample of neon had its pressure changed from 75.0 kPa to 150.0 kPa. What is its new volume?

$P_1 = .740\text{ atm}$ $P_2 = 1.48\text{ atm}$
$V_1 = .175\text{ L}$ $V_2 = ?$

$$V_2 = \frac{P_1 \times V_1}{P_2} = \frac{(.740\text{ atm})(.175\text{ L})}{1.48\text{ atm}} = .088\text{ L}$$

6. A sample of H_2 at 1.5-atm had its pressure decreased to 380.0-torr producing a new volume of 750.0 mL. What was its original volume?

$P_1 = 1.5\text{ atm}$ $P_2 = 0.5\text{ atm}$
$V_1 = ?$ $V_2 = .75\text{ L}$

$$V_1 = \frac{P_2 \times V_2}{P_1} = \frac{(0.5\text{ atm})(0.75\text{ L})}{1.5\text{ atm}} = 0.2500\text{ L}$$

7. Chlorine gas occupies a volume of 1.2 L at 0.95-atm. What volume will it occupy at 1.0 atm?

$P_1 = 0.95\text{ atm}$ $P_2 = 1.0\text{ atm}$
$V_1 = 1.2\text{ L}$ $V_2 = ?$

$$V_2 = \frac{P_1 \times V_1}{P_2} = \frac{(0.95\text{ atm})(1.2\text{ L})}{1.0\text{ atm}} = 1.1\text{ L}$$

8. Fluorine gas exerts a pressure of 1.185-atm. When the pressure is changed to 1.5-atm, its volume is 250 mL. What was the original volume?

$P_1 = 1.185\text{ atm}$ $P_2 = 1.5\text{ atm}$
$V_1 = ?$ $V_2 = 0.25\text{ L}$

$$V_1 = \frac{P_2 \times V_2}{P_1} = \frac{(1.5\text{ atm})(0.25\text{ L})}{1.185\text{ atm}} = 0.32\text{ L}$$

Charles' Law

Honors Chemistry

$V_1 \times T_2 = V_2 \times T_1$ or $V_1/T_1 = V_2/T_2$

Solve the following <u>assuming constant pressure and mass</u>. (All answers should be in Kelvin or in Liters!)

1. A sample of nitrogen gas occupies a volume of 250.0 mL at 25 °C. What volume will it occupy at 95 °C?

$V_1 = .25\ L \quad V_2 = ?$

$T_1 = 298\ K \quad T_2 = 368\ K$

$V_2 = \frac{V_1 \times T_2}{T_1} = \frac{(0.25\ L)(368\ K)}{298\ K} = .3087\ L$

2. Oxygen gas is a temperature of 40 °C when it occupies a volume of 2.3 L. To what temperature should it be raised to occupy a volume of 6.5 L?

$V_1 = 2.3\ L \quad V_2 = 6.5\ L$

$T_1 = 313\ K \quad T_2 = ?$

$T_2 = \frac{V_2 \times T_1}{V_1} \qquad T_2 = \frac{(6.5\ L)(313\ K)}{2.3\ L} = 885\ K$

3. Hydrogen gas was cooled from 150 °C to 50 °C. Its new volume its 75.0 mL. What was its original volume?

$V_1 = ? \quad V_2 = .075\ L$

$T_1 = 423\ K \quad T_2 = 323\ K$

$V_1 = \frac{V_2 \times T_1}{T_2} = \frac{(.075\ L)(423\ K)}{323\ K} = .098\ L$

4. Chlorine gas occupies a volume of 25.0-mL at 300 K. What volume will it occupy at 600 K?

$V_1 = .025\ L \quad V_2 = ?$

$T_1 = 300\ K \quad T_2 = 600\ K$

$V_2 = \frac{V_1 \times T_2}{T_1} = \frac{(.025\ L)(600\ K)}{300\ K} = .050\ L$

5. A sample of neon gas at 50 °C and a volume of 2.5 L are cooled to 25 °C. What is the new volume?

$V_1 = 2.5\ L \quad V_2 = ?$

$T_1 = 323\ K \quad T_2 = 298\ K$

$V_2 = \frac{V_1 \times T_2}{T_1} = \frac{(2.5\ L)(298\ K)}{323\ K} = 2.3\ L$

6. Fluorine gas at 300 K occupies a volume of 500.0-mL. To what temperature should it be lowered to bring the volume to 300.0-mL?

$V_1 = 0.5\ L \quad V_2 = 0.3\ L$

$T_1 = 300\ K \quad T_2 = ?$

$T_2 = \frac{V_2 \times T_1}{V_1} = \frac{(0.3\ L)(300\ K)}{0.5\ L} = 180\ K$

7. Helium occupies a volume of 3.8 L at - 45 °C. What volume will it occupy at 45 °C?

$V_1 = 3.8\ L \quad V_2 = ?$

$T_1 = 228\ K \quad T_2 = 318\ K$

$V_2 = \frac{V_1 \times T_2}{T_1} = \frac{(3.8\ L)(318\ K)}{228\ K} = 5.3\ L$

8. A sample of argon gas is cooled and its volume went from 380.0-mL to 250-mL. If its final temperature was - 55 °C, what was its original temperature?

$V_1 = .38\ L \quad V_2 = .25\ L$

$T_1 = ? \quad T_2 = 218\ K$

$T_1 = \frac{V_1 \times T_2}{V_2} = \frac{(.38\ L)(218\ K)}{.25\ L} = 331\ K$