

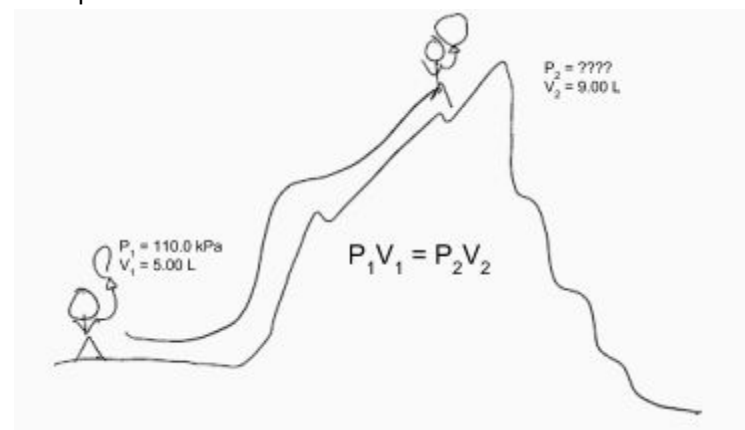
Boyle's Law (Scuba Diver's Law)

- Pressure on a gas is inversely proportional to its volume (at a constant temperature)
- UNITS MUST MATCH!

 $PV = \text{Constant}$

$$P_1V_1 = P_2V_2$$

Example 1



$$P_1V_1 = P_2V_2$$

$$(110.0 \text{ kPa})(5.00 \text{ L}) = P_2(9.00 \text{ L})$$

$$\frac{(110.0 \text{ kPa})(5.00 \text{ L})}{(9.00 \text{ L})} = \frac{P_2(9.00 \text{ L})}{(9.00 \text{ L})}$$

$$P_2 = 61.1 \text{ kPa}$$

$$P_2 = \frac{P_1V_1}{V_2}$$

$$P_2 = \frac{(110.0 \text{ kPa})(5.00 \text{ L})}{9.00 \text{ L}}$$

$$P_2 = 61.1 \text{ kPa}$$

Example 2

$$P_1 = 3040.00 \text{ Torr (mmHg)}$$

$$V_1 = 5000 \text{ mL}$$

$$P_2 = 2.000 \text{ atm}$$

$$V_2 = ?? \text{ (L)}$$

$$P_1 = 3040.00 \text{ Torr} \times \frac{1.0000 \text{ atm}}{760.00 \text{ Torr}} = 4.000 \text{ atm}$$

$$V_1 = 5000 \text{ mL} \times \frac{1 \text{ L}}{1000 \text{ mL}} = 5.000 \text{ L}$$

$$P_1V_1 = P_2V_2$$

$$V_2 = \frac{P_1V_1}{P_2}$$

$$V_2 = \frac{(4.000 \text{ atm})(5.000 \text{ L})}{2.000 \text{ atm}}$$

$$V_2 = 10.00 \text{ L}$$

$$\times \frac{\text{What you want}}{\text{What you have}}$$

UNIT CONVERSION

$$\frac{4}{7} \times \frac{7}{1} = \frac{28}{7} = 4$$

$$\frac{2}{5} \times \frac{5}{1} = \frac{10}{5} = 2$$

$$\frac{g}{mol} \times mol = g$$

$$\frac{mol}{L} \times L = mol$$

$$\frac{g}{mol} \times mol \times \frac{L}{g} \times \frac{g}{L} = g$$

Sea Level Standards

$$101.325 \text{ kPa} = 760.000 \text{ mmHg} = 1.00000 \text{ atm}$$

Eg.

$$1520.00 \text{ Torr} = \text{???? kPa}$$

$$1520.00 \text{ Torr} \times \frac{101.325 \text{ kPa}}{760.000 \text{ mmHg}} = 202.650 \text{ kPa}$$

Chemistry 20 - Unit 2 - Unit Conversions and Boyle's Law

Name: _____

Complete all of the following problems to the best of your ability. Ensure that you show all of your work, including the formula used and the substitution of numerical values. Write legibly, and make sure that your name is on this sheet. If you have any questions, please refer to your notes or chapter four of your textbook. Good luck!

You may find the following formulas and constants useful:

$$P_1V_1 = P_2V_2$$
$$760.000 \text{ mmHg} = 101.325 \text{ kPa} = 1.00000 \text{ atm}$$
$$1000 \text{ mL} = 1.000 \text{ L}$$

1. Complete the following table by making the necessary unit conversions.

Pressure (mmHg)	Pressure (kPa)	Pressure (atm)
1.10×10^{-5}		
	134.6	
		1.45×10^{-6}
9.82×10^{-6}		
	226.5	
		9.81×10^{-5}

2. A 2.5 L party balloon at a pressure of 98 kPa is taken to the top of a mountain where the pressure is 75 kPa. What is the new volume of the balloon in litres?

3. A small oxygen canister contains 110 mL of gas at a pressure of 3.0 atm. All of the oxygen is released into a balloon with a final pressure of 202.650 kPa. What is the new volume of the gas in litres?

4. A weather balloon containing 35.0 L of helium at 98.0 kPa is released and rises. Assuming that the temperature is constant, find the volume of the balloon when the atmospheric pressure is 15.0 kPa at a height of 25.0 km.

5. A 2.5 L party balloon at a pressure of 1.10 atm is taken to the bottom of a mountain where the pressure is 900 Torr. What is the new volume of the balloon in mL?

6. A small oxygen canister contains 215 mL of gas at a pressure of 765 mmHg. If the oxygen gas is allowed to expand to a volume of 0.350 L, what pressure *in kilopascals* must be exerted on the canister?