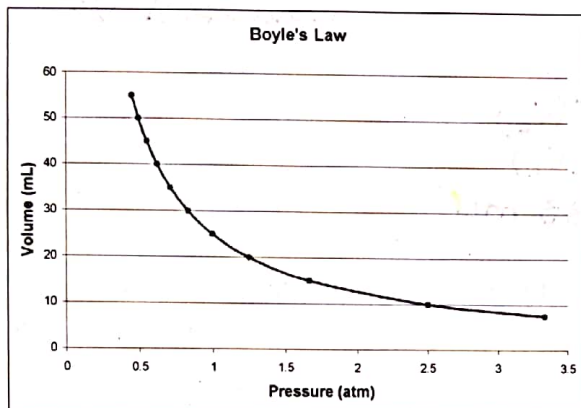


Boyle's Law Worksheet

Name KEY Per _____

Robert Boyle observed the relationship between the pressure and volume for a gas sample. These two variables are **inversely proportional**. This means that when the pressure goes up the volume goes down. This is expressed in the equation $P_1 \times V_1 = P_2 \times V_2$, which is known as **Boyle's Law**. The relationship between pressure and volume is only observed when the temperature and amount of gas particles do not change. The graph below shows this relationship.



BOYLE'S LAW EQUATION

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

PRESSURE UNITS/CONVERSIONS

1.00 atm = 760 mmHg 1.00 atm = 14.7 psi
 1.00 atm = 101300 Pa 1.00 atm = 760 torr
 1.00 atm = 101.3 kPa

example

A gas occupies a volume of 5.4 L at a pressure of 1.06 atm. What volume will the gas occupy if when the pressure is increased to 1.52 atm? Assume the temperature does not change.

-list the variables

$$P_1 = 1.06 \text{ atm}$$

$$V_1 = 5.4 \text{ L}$$

$$P_2 = 1.52 \text{ atm}$$

$$V_2 = ?$$

-substitute into the equation and solve

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

$$1.06 (5.4) = 1.52 (V_2)$$

$$5.724 = 1.52 (V_2)$$

$$V_2 = 3.8 \text{ L}$$

Solve the following problems.

1. According to the graph, when the pressure of a gas sample is decreased what happens to the volume?

P + V have inverse relationship, so if pressure decreases, volume increases

2. The gas in a 600 mL balloon has a pressure of 1.20 atm. If the temperature remains constant, what will be the pressure of the gas in the balloon when it is compressed to 400 mL?

would expect P ↑

$$P_1 = 1.20 \text{ atm}$$

$$V_1 = 600 \text{ mL}$$

$$P_2 = ?$$

$$V_2 = 400 \text{ mL}$$

$$P_1 V_1 = P_2 V_2$$

$$1.2 (600) = P_2 (400)$$

$$720 = P_2 (400)$$

$$P_2 = 1.8 \text{ atm}$$

3. An oxygen container has a volume of 48 mL and a pressure of 420 kPa. What is the volume of this gas when the pressure is 105 kPa? would expect V ↑

$$P_1 = 420 \text{ kPa}$$

$$V_1 = 48 \text{ mL}$$

$$P_2 = 105 \text{ kPa}$$

$$V_2 = ?$$

$$P_1 V_1 = P_2 V_2$$

$$420(48) = 105(V_2)$$

$$20160 = 105(V_2)$$

$$V_2 = 192 \text{ mL}$$

4. A tank of compressed CO₂ has a pressure of 850 psi and a volume of 150 mL. What is the volume of this gas when the pressure is 45 psi? would expect V ↑

$$P_1 = 850 \text{ psi}$$

$$V_1 = 150 \text{ mL}$$

$$P_2 = 45 \text{ psi}$$

$$V_2 = ?$$

$$P_1 V_1 = P_2 V_2$$

$$850(150) = 45(V_2)$$

$$127,500 = 45(V_2)$$

$$V_2 = 2,833 \text{ mL}$$

5. A scuba tank has a pressure of 19,300 kPa and a volume of 10.3 L. What would be the pressure of the gas if it were transferred to a 50.0 L container?

6. Air fills a room with a volume of 5600 L. Atmospheric pressure is 740 torr. What will be the pressure if all of the gas is pumped into an 80 L tank?

7. A sample of 24 L of helium gas is stored in a cylinder at a pressure of 110 lb/in². The helium is transferred to a container with a volume of 15 L. Assuming the temperature has not changed what will be the pressure?

8. An air compressor has a volume of 110 L. What volume of gas is pumped into the tank if the pressure goes from 14.5 psi torr to a pressure of 145 psi?