Gas Laws I – Boyle's Law   Name_____

Boyle's law is a gas law that relates the pressure and volume of a gas when the temperature if held constant. The relationship between pressure and volume at a constant temperature is an inverse relationship, which means if volume decreases, then the pressure must increase and if the pressure decreases the volume must have increased. The formula for Boyle's law is below. You can use any pressure and volume units as long as you use the same units on both sides of the equation.

$$P_1 V_1 = P_2 V_2$$

1. Measurements are taken in the lab to observe what happens to the volume (y) of a gas as the pressure (x) decreases. Using your knowledge of Boyle's law, draw a line on the coordinates to the right that predicts what you would observe as you decrease pressure.

2. Measurements are taken in the lab to observe what happens to the pressure (y) of a gas the volume (x) increases. Using your knowledge of Boyle's law, draw a line on the coordinates to the right that predicts what you would observe as you increase the volume.

3. Describe STP conditions?

4. An S.C.U.B.A tank holds 12.8 liters of air at 2,500 psi (pounds per square inch) which is equal to 170.1 atm. Do you predict that the pressure of the air in the tank is **more or less** if you double the size of the S.C.U.B.A. tank?
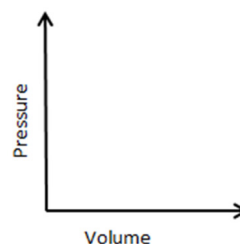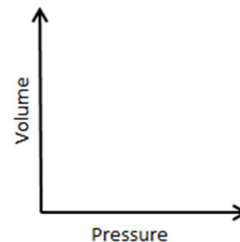
Solve the questions below and show your work to get full credit. *(Identify unknowns, plug into your equation, solve)*

5. Humans breathe air that is not pressurized. If the S.C.U.B.A. regulator lets you breathe the air from the tank at a pressure of 1.0 atm, what volume of unpressurized air can be stored in a 12.8 liter tank at the above mentioned 170.1 atm of pressure?

6. The average human takes breathes that are approximately 0.5 liters in volume. While S.C.U.B.A. diving, you take approximately 41 breaths in a minute. How long will the tank of air from questions # 4-5 last you?

7. A sample of oxygen (O_2) gas occupies a volume of 251 mL at 735 torr of pressure. What volume will the oxygen occupy if the pressure changes to 825 torr?

8. A sample of CO_2 occupies a volume of 3.50 liters at 125 kPa pressure. What new pressure will the gas exert if the volume was decreased to 2.00 liters?

9. A 2.0 liter container of nitrogen has a pressure of 3.2 atm. What volume should you change the container to if you want the gas to decrease to a pressure of 1.0 atm?

10. Ammonia gas (NH_3) occupies a volume of 455 mL at a pressure of 720. mmHg. What volume will it occupy at standard pressure? *(Hint: Remember STP conditions are standard temperature and pressure).*

11. A 175 mL sample of a neon gas had its pressure changed from 75 kPa to 150 kPa. What is the new volume of the neon gas?

12. A sample of hydrogen at 1.5 atm had its pressure decreased at 0.50 atm producing a new volume of 750 mL. What was its original volume?

13. Chlorine gas occupies a volume of 1.2 liters at 720 torr pressure. What volume will it occupy if the pressure is changed to 1.0 atm. (Hint: Before you solve, either convert torr → atm or atm → torr so they both match.)

14. Fluorine gas exerts a pressure of 918 torr. When the pressure is changed to 1.50 atm, its new volume is 255 mL. What was the original volume?

15. Atmospheric pressure on the peak of Mt. Everest can be as low as 150 mm Hg, which is why climbers need to bring oxygen tanks for the last part of the climb. If the climbers carry 10.0 liter tanks with an internal gas pressure of 3.04 x 10^4 mm Hg, what will be the volume of the gas when it is released from the tanks?