Boyles' Law

Use Boyles' Law to answer the following questions:

1) 1.00 L of a gas at standard temperature and pressure is compressed to 473 mL. What is the new pressure of the gas?

$P_1 = 1\ atm$

$V_1 = 1.00\ L$

$P_2 = ?$

$V_2 = .473\ L$

$$\frac{(1\ atm)(1.00\ L)}{.473\ L} = 2.11\ atm$$

2) In a thermonuclear device, the pressure of 0.050 liters of gas within the bomb casing reaches 4.0×10^6 atm. When the bomb casing is destroyed by the explosion, the gas is released into the atmosphere where it reaches a pressure of 1.00 atm. What is the volume of the gas after the explosion?

$P_1 = 4 \times 10^6\ atm$

$V_1 = 0.050\ L$

$P_2 = 1\ atm$

$V_2 = ?$

$$\frac{(4. \times 10^6\ atm)(0.050\ L)}{1\ atm} = 200{,}000\ L$$

3) Synthetic diamonds can be manufactured at pressures of 6.00×10^4 atm. If we took 2.00 liters of gas at 1.00 atm and compressed it to a pressure of 6.00×10^4 atm, what would the volume of that gas be?

$P_1 = 1.00\ atm$

$V_1 = 2.00\ L$

$P_2 = 6.00 \times 10^4\ atm$

$V_2 = ?$

$P_1V_1 = P_2V_2$

$$\frac{(1.00\ atm)(2.00\ L)}{6.00 \times 10^4\ atm} = 3.33 \times 10^{-5}\ L$$

4) The highest pressure ever produced in a laboratory setting was about 2.0×10^6 atm. If we have a 1.0×10^{-5} liter sample of a gas at that pressure, then release the pressure until it is equal to 0.275 atm, what would the new volume of that gas be?

$P_1 = 2.0 \times 10^6\ atm$

$V_1 = 1.0 \times 10^{-5}\ L$

$P_2 = 0.275\ atm$

$V_2 = ?$

$$\frac{(2.0 \times 10^6\ atm)(1.0 \times 10^{-5}\ L)}{0.275\ atm} = 72.73\ L$$