

Answer on Question #60393 - Chemistry - Other

Task:

A container holds 400 L of a gas at atm. If the pressure is increased to 5 atm, what will the volume of the gas be?

Solution:

According to the Boyle's Law, if the volume of a container is increased, the pressure that the gas exerts on the walls of the container decreases. Likewise, if the volume of a container is decreased, the pressure that that gas exerts on the walls of the container increases. In order for this relationship between pressure and volume to be reliable we have to keep all other variables constant, namely temperature and the number of gas particles present.

Boyle's law takes the form:

$$PV = k, \text{ where } P \text{ is pressure, } V \text{ is volume, and the value of } k \text{ is a constant.}$$

Therefore according to Boyle's law we can say that:

$$P_1V_1 = P_2V_2$$

This equation states that the product of the initial volume and pressure is equal to the product of the volume and pressure after a change in one of them under constant temperature.

Then,

$$P_1 = 1 \text{ atm}; \quad V_1 = 400 \text{ l};$$

$$P_2 = 5 \text{ atm}; \quad V_2 = ?;$$

$$T_1 = T_2 = \text{const}$$

$$\text{Since } P_1V_1 = P_2V_2,$$

$$V_2 = \frac{P_1V_1}{P_2} = \frac{1 \text{ atm} \times 400 \text{ l}}{5 \text{ atm}} = 80 \text{ l};$$

$$V_2 = 80 \text{ l}.$$

Answer: The volume of the gas will 80 l.