$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

Key

Combined Gas Law Problems

Use the combined gas law to solve the following problems:

1) If I initially have a gas at a pressure of 12 atm, a volume of 23 liters, and a temperature of 200 K, and then I raise the pressure to 14 atm and increase the temperature to 300 K, what is the new volume of the gas?

$$V_2 = \frac{P_1V_1T_2}{T_1P_2} = \frac{(12\text{ atm})(23\text{L})(300\text{K})}{(200\text{K})(14\text{ atm})} = 29.57\text{ L}$$

2) A gas takes up a volume of 17 liters, has a pressure of 2.3 atm, and a temperature of 299 K. If I raise the temperature to 350 K and lower the pressure to 1.5 atm, what is the new volume of the gas?

$$V_2 = \frac{P_1V_1T_2}{T_1P_2} = \frac{(2.3\text{ atm})(17\text{ L})(350\text{K})}{(299\text{K})(1.5\text{ atm})} = 30.5\text{L}$$

3) A gas that has a volume of 28 liters, a temperature of 45 °C, and an unknown pressure has its volume increased to 34 liters and its temperature decreased to 35 °C. If I measure the pressure after the change to be 2.0 atm, what was the original pressure of the gas?

$$P_1 = \frac{P_2V_2T_1}{T_2V_1} = \frac{(2\text{ atm})(34\text{L})(318\text{K})}{(308\text{K})(28\text{ L})} = 2.51\text{ atm}$$

4) A gas has a temperature of 14 °C, and a volume of 4.5 liters. If the temperature is raised to 29 °C and the pressure is not changed, what is the new volume of the gas?

$$V_2 = \frac{P_1V_1T_2}{T_1P_2} = \frac{(4.5\text{L})(302\text{K})}{287\text{K}} = 4.74\text{L}$$

$$\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2} \qquad \frac{1(4.5\text{L})}{287} = \frac{1V_2}{302}$$