

(#4-3b)
Chemistry
Combined Gas Law (a)

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2}$$

* T = Kelvin

1. A 1 Liter rigid gas cylinder with a pressure of 1.00 atm has its temperature increased from 298K to 398K. What is the new pressure?

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad V = \text{constant} \quad \frac{P_1 T_2}{T_1} = P_2 \quad \frac{1 \cdot 398}{298} = 1.33 \text{ atm}$$

2. A balloon with a volume of 1 liter at room temperature (25°C) is decreased to -175°C. What is the new volume?

$$\frac{P V_1}{T_1} = \frac{P V_2}{T_2} \quad P = \text{constant} \quad \frac{V_1 T_2}{T_1} = V_2 \quad \frac{1 \cdot 98}{298} = 0.328 \text{ L}$$

3. A 5L weather balloon rises up into the air where the pressure has dropped from 1 atm to .75 atm. What is the new volume?

T = constant $\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad \frac{P_1 V_1 T_2}{T_1 P_2} = V_2 \quad \frac{5 \text{ L} \cdot 1}{.75} = \boxed{6.67 \text{ L}}$

4. A 2L rigid container at 1 atm is heated from 25°C to 500°C what is the new pressure inside the container?

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad \frac{P_1 V_1 T_2}{T_1 V_2} = P_2 \quad \frac{1 \cdot 2 \text{ L} \cdot 773}{298 \cdot 2 \text{ L}} = 2.59 \text{ atm}$$

5. A rigid container has a temperature at 0°C is increased to 25°C. If the original pressure was 600 torr what is the new pressure?

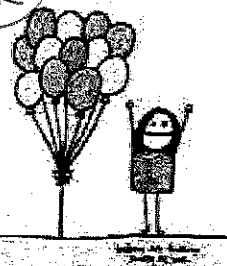
$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad \frac{P_1 T_2}{T_1} = P_2 \quad \frac{600 \cdot 298}{273} = 654 \text{ torr}$$

6. What temperature will cause a 1 gallon balloon, at STP, to be compressed to 1L. (STP = 1 atm & 0°C)

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad T_2 = \frac{T_1 P_2 V_2}{P_1 V_1} \quad \frac{273 \cdot 1 \text{ L}}{3.78} = \boxed{72 \text{ K}}$$

7. A balloon has a volume of 2L at STP. The balloon is released and floats up into the atmosphere causing the temperature drop by 35°C and the pressure to 620mmHg. What is the new volume?

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad \frac{P_1 V_1 T_2}{T_1 P_2} = V_2 \quad \frac{273 \cdot 2 \cdot 760}{273 \cdot 620} = \boxed{2.13 \text{ L}}$$



8. A .5L bottle of soda with a pressure of 1.5atm will explode at 8 atm. If the bottle starts at 23°C, what temperature will it explode at?

$$\frac{P_1 V_1}{T_1} = \frac{P_2 V_2}{T_2} \quad T_2 = \frac{P_2 V_2 T_1}{P_1 V_1} \quad V = \text{constant}$$

↑
solve

$$\frac{8 \cdot 0.5 \cdot 296}{0.5 \cdot 1.5} = \boxed{1578 \text{ K}} \\ \boxed{1305 \text{ °C}}$$