Answer on the question #55459 – Chemistry – Physical Chemistry

Question:

A tank with a capacity of 14 L contains helium gas at 24 °C under a gauge pressure of 2700 kPa

a) Determine the volume of a balloon filled with this gas if the helium expands to an internal absolute pressure of 1 atm and the temperature drops to −35 °C ?

b) Now suppose the system returns to its original temperature (24 °C). Calculate the final volume of the balloon.

Answer:

(a)

According to ideal gas law:

$$\frac{p_1 V_1}{T_1} = \frac{p_2 V_2}{T_2}$$

Taking T_1 equal to 273.15+24 = 297.15 and T_2 equal to 273.15 – 35 = 238.15,

$$V_2 = \frac{p_1 V_1}{T_1} \cdot \frac{T_2}{p_2} = \frac{2700 \times 14}{297.15} \cdot \frac{238.15}{101.325} = 299\ L$$

(b)

For the isobaric process (the pressure is constant), the following expression is valid:

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

Again converting the temperature from Celsius to Kelvin scale,

$$V_2 = \frac{V_1 \times T_2}{T_1} = \frac{299 \times 297.15}{238.15} = 373\ L$$