Answer on Question #42486 - Chemistry - Organic Chemistry

Question:

A closed gas system initially has pressure and temperature of 641 mm Hg and 638.0 oC with the volume unknown. If the same closed system has values of 859 mm Hg, 3.20 L and 580 K, what was the initial volume in mL?

Answer:

The combined gas law must be used, which states that:
"The ratio between the pressure-volume product and the temperature of a system remains constant."
This mathematically can be stated as

$$\frac{PV}{T} = k$$

, where P is for pressure, V is for volume and T is for temperature.
For comparing the same substance under two different sets of conditions, the law can be written as:

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

The initial volume V_1 is unknown and can be calculated performing the following:
$V_1 = (P_2*V_2*T_1)/(T_2*P_1) = (859*3.2*911)/(580*641) = 6.7$ L = 6700 mL.