Question #47931, Chemistry, Inorganic Chemistry

Dry ice is solid carbon dioxide; it vaporizes at room temperature and normal pressures to the gas. Suppose you put 26.6 g of dry ice in a vessel fitted with a piston, and it vaporizes completely to the gas, pushing the piston upward until its pressure and temperature equal those of the surrounding atmosphere at 21.7 °C and 751 mm Hg. Calculate the work done by the gas in expanding against the atmosphere. Neglect the volume of the solid carbon dioxide, which is very small in comparison to the volume of the gas phase.

Solvation

The work done by the system against external forces is equal:

$$A = p\Delta V$$

p is pressure;

ΔV is volume change.

According to the condition of the problem, *ΔV* is equal to volume of gaseous carbon dioxide. According to Mendeleev-Clapeyron equation:

$$p\Delta V = \frac{m(CO_2)RT}{M(CO_2)}$$

Also:

$$A = \frac{m(CO_2)RT}{M(CO_2)} = \frac{26.6 * 10^{-3} * 8.314 * (273.15 + 21.7)}{44} = 1.48J$$

Answer: Work, done by the gas is 1,148 joules