

Answer on Question #72621-Chemistry-Organic Chemistry

1. A handbook lists the normal boiling point of an organic liquid as 42.6 Celsius and it's enthalpy of vaporization as 24.9 kJ/mol. Calculate the vapor pressure in torr of this compound at 25.0 Celsius

Solution

$$\ln \frac{p_1}{p_2} = \frac{H}{R} \left(\frac{1}{T_2} - \frac{1}{T_1} \right)$$
$$\ln \frac{760}{p_2} = \frac{24900}{8.31} \left(\frac{1}{214.1 + 25} - \frac{1}{214.1 + 42.6} \right)$$
$$p_2 = 322 \text{ torr.}$$

2. Hydrazine N₂H₄ has a normal boiling point of 113.5 Celsius and a critical point at 380.0 Celsius and 145.4 atm. Estimate the vapor pressure of hydrazine at 75.0 Celsius (treat the critical point as last point on the vapor pressure curve)

Solution

$$\ln \frac{p_1}{p_2} = \frac{H}{R} \left(\frac{1}{T_2} - \frac{1}{T_1} \right)$$
$$\ln \frac{145.4}{1} = \frac{H}{8.31} \left(\frac{1}{113.5 + 273.15} - \frac{1}{380 + 273.15} \right)$$
$$H = 39212 \frac{J}{mol}$$
$$\ln \frac{145.4}{p_2} = \frac{39212}{8.31} \left(\frac{1}{75 + 273.15} - \frac{1}{380 + 273.15} \right)$$
$$p_2 = 0.259 \text{ atm.}$$

3. The normal boiling point of a liquid is 214.1 Celsius and it's enthalpy of vaporization at the normal boiling point is 68.2 kJ/mol. At what temperature will the liquid have a vapor pressure of 475.0 torr?

Solution

$$\ln \frac{p_1}{p_2} = \frac{H}{R} \left(\frac{1}{T_2} - \frac{1}{T_1} \right)$$
$$\ln \frac{760}{475} = \frac{68200}{8.31} \left(\frac{1}{T_2} - \frac{1}{214.1 + 273.15} \right)$$
$$T_2 = 474.02 \text{ K} = 474.02 - 273.15 = 200.87^\circ\text{C}$$