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Normal Boiling point
Normal boiling point is the temperature at which a liquid boils at 1 atm (760 mmHg) of pressure. It is different from the simple definition of boiling point in that the pressure is defined.
The normal boiling point is a more useful value when comparing different liquids, since boiling is affected by altitude and pressure.
To find the normal boiling point for neon we should find a temperature at which pressure must be 1 atm (760 mmHg).
We have given Temperature vs pressure data points. By interpolation, we will find out temperature at which pressure is 1 atm (760 mmHg).
Data would be —

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We have given Temperature vs pressure data points. By interpolation, we will find out temperature at which pressure is 1 atm (760 mmHg).
No required data would be —

T (°C)	P (mmHg)
-243.7	816
T _{nb}	760
-247.3	486

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By linear interpolation

$$\frac{T - T_1}{T_2 - T_1} = \frac{P - P_1}{P_2 - P_1}$$

$$\frac{T - 245.7}{246 - 245.7} = \frac{816 - 760}{816 - 466}$$

$$T = 245.97$$

$T_{\text{sub}} = -245.97$
 $T_{\text{sub}} = -246$

for calculating

Since no data has been given entropy and evaporation enthalpy for neon.

Assumption - Trouton's rule

Trouton's rule can be used to estimate the entropy of vaporization (evaporation) of liquids whose boiling points are known. Trouton's rule says that for many (but not all) liquids the entropy of vaporization is approximately 85 J/molK.

entropy of neon = 85 J/molK
Rvap = 65 J/molK

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a) The temperature at which the saturated vap-pressure is 1 atm is the normal boiling temperature T_b . From the eqn of vapor pressure T_b is

$$\ln(p) = 0 = -31.090/T_b - 2.52 \ln T_b + 34.66$$

Solving

$$T_b = 2006K$$

b) At temperature T_p of the triple point

$$-34450/T_p - 2.01 \ln T_p + 33.74 = -31.09/T_p - 2.52 \ln T_p + 34.66$$

which gives $T_p = 1239K$

The triple point pressure is calculated from the vapor pressure eqn of the solid

$$p = \exp(-34450/1239 - 2.01 \ln 1239 + 33.74) = 2.29 \times 10^{-4} \text{ atm}$$

c) For vapor in equilibrium with liquid:

$$\ln p = 31090/T - 2.52 \ln T + 34.66$$

d) $\ln p/dT = \Delta H/RT^2 = 31090/T^2 - 2.52/2$

Thus

$$\Delta H_{vap} = (31090 \times 8.3144) - (2.52 \times 8.3144)T = 258500 - 20.95T$$

When $T=2006K$ i.e normal boiling temperature

$$\Delta H_{vap} = 216.5 \text{ kJ}$$

d) For vapor in equilibrium with solid:

$$\ln p = 34450/T - 2.01 \ln T + 33.74$$

Solving in the same way as above

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When $T=2006K$ i.e normal boiling temperature

$$\Delta H_{vap} = 216.5 \text{ kJ}$$

d) For vapor in equilibrium with solid:

$$\ln p = 34450/T - 2.01 \ln T + 33.74$$

Solving in the same way as above

$$\Delta H_{vap} = 286400 - 16.71T \text{ Joules}$$

At any temperature:

$$\Delta H_{subl} + \Delta H_{vap} = \Delta H_{liq}$$

Hence

$$\Delta H_{subl} = 286400 - 16.71T - 258500 + 20.95T$$

$$= 27900 + 4.24 T$$

At triple point

$$\Delta H_{subl} = 27900 + (4.24 \times 1239) = 33.15 \text{ kJ}$$

e) $\Delta H_{subl} = 27900 + 4.24T$

d) $\Delta H/dT = \Delta C_p = 4.24 \text{ J/K} = C_{p(l)} - C_{p(s)}$

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Qing? Given that? let us consider a container in which there is a liquid in equilibrium with its vapour from the condition of the uniformity of chemical potential at throughout system we can write that

$$\mu_{liq} = \mu_{vap}$$

$$(1-x_A) = x_A \text{ (neg)}$$

$$\mu_{liq}^{(T,P,x_A)} = \mu_{vap}^{(T,P)}$$

$$\mu_{liq}^{(T,P)} + RT \ln x_A = \mu_{vap}^{(T,P)}$$

where $\mu_{liq}^{(T,P)}$ be the chemical potential pure solvent

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$\mu_{liq}^{(T,P)}$ be the chemical potential pure solvent

$$RT \ln x_A = \mu_{vap}^{(T,P)} - \mu_{liq}^{(T,P)}$$

$$RT \ln x_A = \Delta \mu_{vap} \text{ (mole)}$$

Derivating both sides with respect to temperature

$$d \ln x_A = - \frac{\Delta \mu_{vap} \text{ (mole)}}{RT^2} dT$$

Integrate both sides with proper limits

$$\int_{x_A=1}^{x_A} d \ln x_A = - \frac{\Delta \mu_{vap} \text{ (mole)}}{R} \int_{T_B}^{T} \frac{dT}{T^2}$$

$$\ln x_A = - \frac{\Delta \mu_{vap} \text{ (mole)}}{R} \left(\frac{1}{T} - \frac{1}{T_B} \right)$$

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Problem #1: What is the molecular mass of an organic compound if 16.00 g of the compound is dissolved in 225.0 g of carbon tetrachloride raises the boiling point to 85.36 °C?

Solution:

1) We need to look up the ebullioscopic constant of CCl₄ as well as its boiling point:

ebullioscopic constant: 5.03 °C kg mol⁻¹
boiling point: 76.72 °C

In addition:

85.36 - 76.72 = 8.64 °C <--- that's the Δt

2) We now utilize this formula:

Δt = i K_b m

8.64 °C = (1) (5.03 °C kg mol⁻¹) (x / 0.2250 kg)

8.64 °C = (22.36 °C mol⁻¹) (x)

x = 0.3864 mol

3) Calculate the molar mass:

16.00 g / 0.3864 mol = 41.4 g/mol

Problem #2: A solution of 10.0 g of a nonvolatile, nondissociating compound dissolved in 0.200 kg of benzene boils at 81.2 °C. Calculate the molecular weight of the compound.

Solution:

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