Experiment 13 Determination of the molar entropy of fusion of camphor

Objectives:

1. To study the molar entropy of fusion of camphor
2. To determine the molar entropy of fusion (ΔS_f) of camphor

Apparatus and Material:

test tube, 250 cm^3 beaker, Bunsen burner, 0 – 200°C thermometer, tripod and gauge, retort stand, clamp and boss head, camphor (M = 152 g/mol) and naphthalene (M = 128g/mol)

Results and calculation:

Wt. of Naphthalene (g)	No. of moles of naphthalene	Wt. of camphor (g)	No. of moles of camphor	X	Freezing point (K)	ΔT	K_f
0.00	0	2.0054	0.0132	0	445	0	-
0.05	3.906×10^{-4}	2.0054	0.0132	0.0287	435	10	348.43
0.10	7.813×10^{-4}	2.0054	0.0132	0.0558	418	17	304.66
0.15	1.172×10^{-3}	2.0054	0.0132	0.0815	411	7	85.89
0.20	1.5625×10^{-3}	2.0054	0.0132	0.1058	403	8	75.61

$$\Delta T = K_f X$$

$K_f = \Delta T / X$
$= 10 / 0.0287$
$= 348.43$

$K_f = \Delta T / X$
$= 17 / 0.0558$
$= 304.66$

$K_f = \Delta T / X$
$= 7 / 0.0815$
$= 85.89$

$K_f = \Delta T / X$
$= 8 / 0.1058$
$= 75.61$

Since $\Delta S_f = \frac{\Delta H_f}{T_0}$

thus = $\ln K_f = \frac{-\Delta H_f}{RT_0} X$

When X = 0, K_f= 425 K^{-1}

425 = (8.314*445)/ ΔS_f

ΔS_f = 8.705 $JK^{-1}mol^{-1}$

$\Delta S_f = \Delta H_f/T_0$

ΔH_f = 8.705 x 445

= 3873.83$Jmol^{-1}$

Conclusion:

The molar entropy of fusion of camphor in this experiment is 8.705$JK^{-1}mol^{-1}$.