# Chapter 5 - Homework

5.1 Consider the transition: S(s, rhombic) → S(s, monoclinic).

The standard molar entropy of rhombic sulfur is 31.80 J/mol-K, and that of monoclinic sulfur is 32.60 J/mol-K. The molar enthalpy change for this transition is ΔHm = 568 J/mol.

(a) Can an increase in temperature be expected to make monoclinic sulfur more stable than rhombic sulfur?

(b) If so, at what temperature will the transition occur at 1 bar pressure?

5.2 The vapor pressure of liquid benzene [M = 78] is 17.7 kPa at 30 oC and 37.7 kPa at 50 oC.
(a) Calculate the Enthalpy of Vaporization of benzene
(b) Estimate the vapor pressure at 10 oC [use your answer for part (a)].
(c) Estimate the normal boiling point of benzene (the temperature at which the vapor pressure is 1 bar = 100 kPa)
[use your answer for part (a)].

5.3 Use the data below to calculate q (= ΔH, since P = constant) when 120. grams of benzene gas at 120 oC is cooled (at constant pressure) to solid benzene at
at -20 °C.

Tb^o = 80 °C $\Delta_{vap}H^o$ =30.8 kJ/mol
$C_{P,m}(gas)$ = 81.7 J/mol-K T_m^o = 6 oC
$\Delta_{fus}H^o$ = 9.9 kJ/mol $C_{P,m}(liq)$ = 136.1 J/mol-K
$C_{P,m}(sol)$ = 61.2 J/mol-K

5.4 A solid has two crystalline phases, A(s) and B(s). For the transition A(s) → B(s), ΔGo= +6.0 kJ/mol (i.e. at 1 bar pressure). The molar volumes of the two phases are Vm(A) = 23.8 mL/mol and Vm(B) = 17.2 mL/mol. At what pressure (in bar) are the two phases in equilibrium?

5.5 Consider the phase diagram to the right.
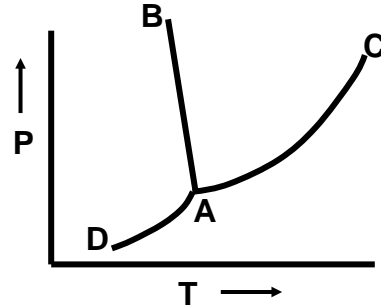
(a) The Triple Point in the diagram is represented by

(A) Point A   (B) Point B   (C) Point C   (D) Point D

(b) The slope of curve A-B is negative because

(A) Sm(liq)>Sm(sol)   (B) Sm(liq)<Sm(sol)   (C) Vm(liq)>Vm(sol)
(D) Vm(liq)<Vm(sol)

(c) The magnitude of the slope of curve A-B is greater than the magnitude of the slope of curve A-C because:

(A) $|\Delta V_{fus}| < |\Delta V_{vap}|$ (B) $|\Delta V_{fus}| > |\Delta V_{vap}|$
(C) $\Delta S_{fus} < \Delta S_{vap}$ (D) $\Delta S_{fus} > \Delta S_{vap}$

(d) The slope of curve A-D is greater than the slope of curve A-C because:

(A) $\Delta V_{sub} < \Delta V_{vap}$ (B) $\Delta V_{sub} > \Delta V_{vap}$
(C) $\Delta S_{sub} < \Delta S_{vap}$ (D) $\Delta S_{sub} > \Delta S_{vap}$

(e) If the pressure on this substance is increased from 1. bar to 10 bar, the boiling point temperature will

(A) Decrease   (B) Increase   (C) Remain the same

(D) Increase or decrease depending on the relative liquid and vapor entropies

(f) If the pressure on this substance is increased from 1. bar to 500 bar, the melting point temperature will

(A) Decrease   (B) Increase   (C) Remain the same

(D) Increase or decrease depending on the relative liquid and solid entropies