Quiz 4.1 – Chemical Potential and Phase Diagrams

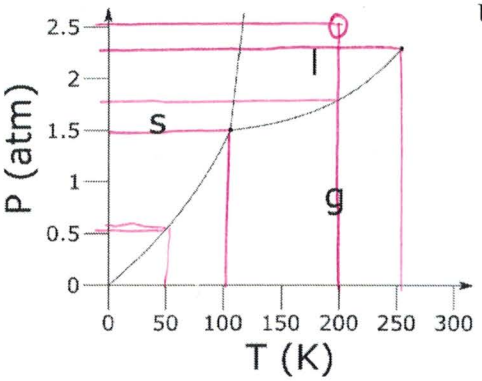
Name: Key

Chemical Potential

Chemical potential, μ, is related to G in a way that is sometimes hard to disentangle. What exactly is the relationship between μ and G?

$dG = -SdT + Vdp + \sum_i \mu_i dn_i \rightarrow G = \sum_i \mu_i n_i \rightarrow \left(\frac{\partial G}{\partial n_i}\right)_{T,p,n_j} = \mu_i$

Phase Diagrams



Use the phase diagram at left to answer the following questions:

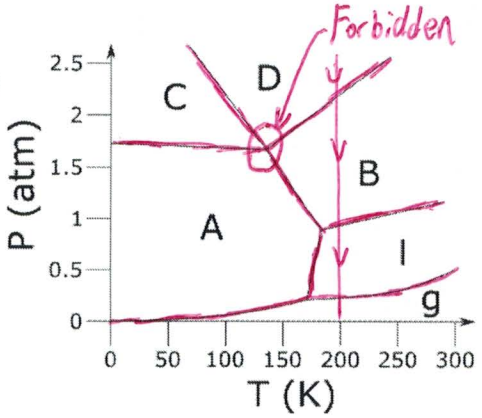
- What is the stable phase at 2.25 atm and 200 K? liquid
- Give T and p for the triple point and the critical point

triple: 1.5 atm and 100K critical: 2.25 atm and 250 K

- Estimate the vapor pressure at 50 K and at 200 K

50: 0.5 atm 200: 1.75 atm

Use the phase diagram at right to answer the following questions:



- How many solid phases are represented? 4
- Highlight all parts of the diagram where there is only 1 free variable (i.e. variance = 1) phase boundaries
- Indicate a forbidden point on the diagram
- List the solid phases from least dense to most dense

$A < (C, B) < D$

- Which solid phase has the greatest molar entropy?

$A < C < D < B$

- A sample begins at 2.5 atm and 200 K. What phase changes would occur as the pressure is isothermally reduced to 0 atm?

$D \rightarrow B \xrightarrow{\text{fusion}} l \xrightarrow{\text{vaporization}} g$