

1) (2.5 points) Which member in each pair has the lower vapor pressure at a given temperature? Circle your choice.

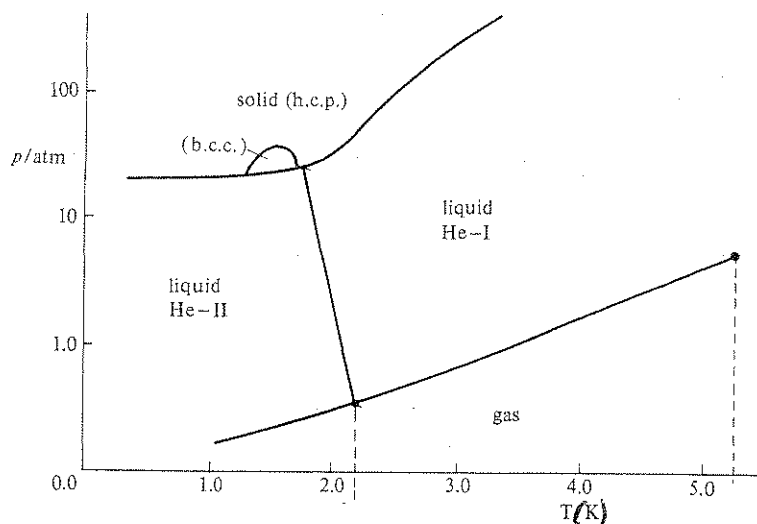
- a) K or Fe b) I₂ or Xe c) CsBr or KBr
 d) CH₃CH₂OH or CH₃CH₂F e) *trans*-C₂H₂F₂ or *cis*-C₂H₂F₂

2) (1.5 points) From the substances given in question 1, write the formula of one substance that forms

- a) an atomic solid b) a molecular solid c) an ionic solid

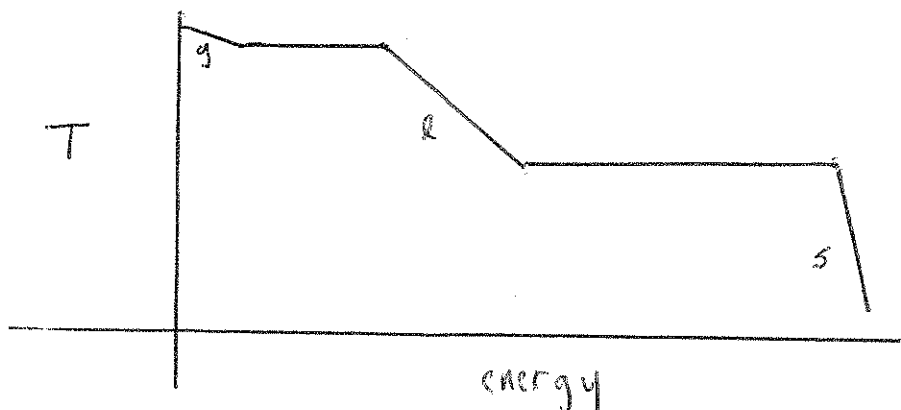
3) (4 points) Helium has two liquid forms, He I and He II. He II is a superfluid with no viscosity. Helium also has solids that are hcp and bcc depending on the conditions. On the given phase diagram for He

- a) Identify the triple points. Circle your choices. b) What forms exist at each triple point?
 c) Identify the critical point. Circle your choice.
 d) You have He II at 1.5 K. How would you produce solid He in bcc form?
 e) Why can't increased pressure beyond the critical point liquefy He?



4) (1.5 points) For the given cooling curve of a certain mass of material determine the larger quantity. Circle your choice.

- a) C_p of the solid or C_p of the liquid
 b) ΔH_{fusion} or $\Delta H_{\text{vaporization}}$
 c) total energy removed for certain mass or total energy removed for 1/2 the certain mass



5) (2.5 points) Which of the following will have the lowest total vapor pressure at 25 °C?

- a) $(P_{\text{vap}}(\text{H}_2\text{O}) = 23.8 \text{ torr at } 25 \text{ }^\circ\text{C})$
- b) a solution glucose in water with $\chi_{\text{C}_6\text{H}_{12}\text{O}_6} = 0.01$
- c) a solution of NaCl in water with $\chi_{\text{NaCl}} = 0.01$
- d) a solution of methanol and water with $\chi_{\text{CH}_3\text{OH}} = 0.2$, $(P_{\text{vap}}(\text{CH}_3\text{OH}) = 143 \text{ torr at } 25 \text{ }^\circ\text{C})$

6) (14 points) A solution containing a high molar mass biomolecule solute and CCl_4 solvent is 88.2₃₅₃ % CCl_4 by mass. The mass of CCl_4 is 15.0 g. The boiling point of this solution was 77.85 °C. The boiling point constant and the boiling point for pure CCl_4 are 5.03 °C/m and 76.50 °C, respectively.

- a) Calculate the molar mass of the biomolecule.
- b) Calculate the mole fraction of CCl_4 in the solution.
- c) Calculate the vapor pressure of the solution at 20 °C. The vapor pressure of pure CCl_4 at 20 °C is 91.3 torr.
- d) What would be the vapor pressure of CCl_4 at 76.50 °C?

Extra Credit: Calculate the actual vapor pressure at 76.50 °C using the Clausius-Clapeyron Equation. It may be different from 6d, that's ok.

7) (4 points) When pure methanol (CH_3OH) is mixed with water the resulting solution feels warm. Would you expect this solution to be ideal? Explain what must occur for the solution to form (consider both enthalpy and entropy) and why it is exothermic and why methanol is soluble in water. Both methanol and water are volatile.