

# ENGR 240 Science of Materials

## Homework 7

### 12 points

1. [1 point] Open the BIPMAP program, using the link at the course "lecture" homepage.

Place the cursor at the left edge of the diagram (0% Sb), and use the click-buttons to move it up and down. Find as precisely as possible the melting temperature of Bi. Note the changes in the "results" windows to the right of the diagram as you move through the melting region. What is the melting temperature? (note: an answer of "none of your bismuth" is not acceptable.)

Similarly, move the cursor and use the program to find answers to the following:

2. [1 point] At 500 °C, a mixture containing 20 wt% Sb exists as a single phase liquid. If more antimony is added to this system, at what concentration would the solubility be exceeded (indicated by the presence of a second phase)?
3. A mixture of antimony and bismuth (70 wt% Sb) is heated to 650 °C to form a well mixed liquid. This liquid is slowly cooled to room temperature.
  - a) [2 points] At what temperature does the first solid form, and what is the composition of this solid?
  - b) [2 points] At what temperature will the mixture contain equal amounts of liquid and solid and what are the compositions of each phase at this temperature?
  - c) [2 points] At what temperature will the mixture contain 10 wt% liquid, and what are the compositions of each phase at this temperature?
  - d) [1 point] At what temperature will the last amount of liquid disappear?
  - e) [3 points] Collect information from the program, and then make a plot of the liquid composition (wt% Sb) as a function of temperature in the range of 300 – 650 °C.