Minor-1

EPL 206 (Solid State Physics)

Time: 50 min **Max. Marks: 20**

1. Two identical pieces of nickel are heated to 900 K. One of them, **sample 'A'**, is quenched by dropping it in water at room temperature (300K) and the other, **sample 'B'**, is slowly cooled to 300 K. Calculate the vacancy-concentrations
   (given that formation energy per vacancy in nickel is 1.74 eV)
   (i) in sample 'A' at 900 K
   (ii) in sample 'A' at room temperature, and
   (iii) in sample 'B' at room temperature.

   .....**(4)**

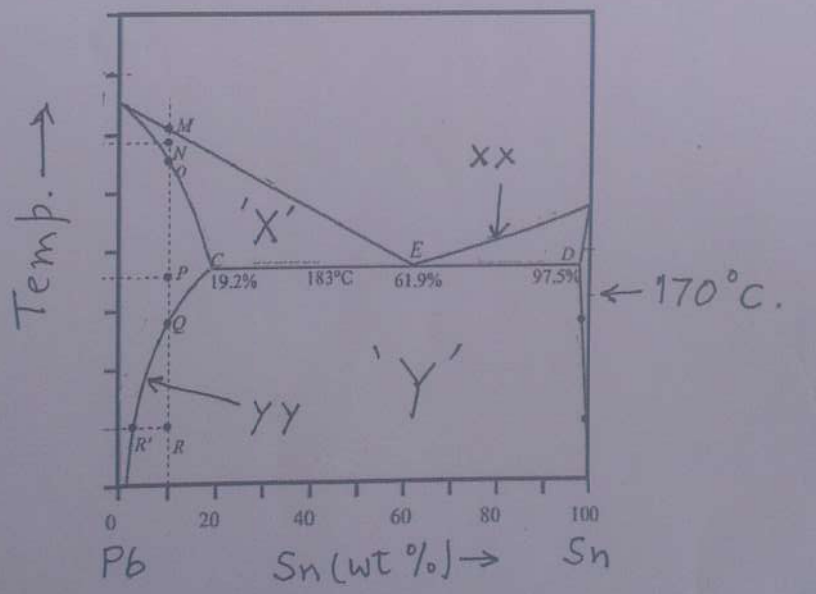
2. List the four basic differences between (a) edge dislocations and (b) screw dislocations.

   .....**(4)**

3. Taking f_{Na} and f_{Cl} as atomic structure factors of sodium and chlorine ions, obtain the **expression of the $|F^2|$** where F is the structure factor of the NaCl unit cell. Using $|F^2|$, obtain the conditions for **allowed** and **forbidden** reflections from *(hkl)* planes.

   .....**(6)**

4. (a) A schematic plot of equilibrium phase diagram of binary Pb-Sn system is shown below.
   (i) Label the regions X and Y (as shown) with the phases that exist therein this diagram .....**(1)**
   (ii) Label the phase boundaries xx and yy. .....**(1)**
   (iii) Schematically show the **alloy's microstructure at two temperatures** corresponding to points P and R. .....**(1)**
   (iv) What is a Eutectic transformation in terms of all the phases involved? .....**(1)**



(b) Draw a schematic plot showing the variation of resistivity (near 170°C) as a function of alloy composition in the entire range (i.e., 0-100% Sn). .....**(2)**