**Tutorial Sheet**

**Crystal Imperfections**

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1. Prove that the radius (r) of an atom that will fit into octahedral site of a BCC structure is equal to 0.155 R, where R is the atomic radium of the corner atoms in a BCC structure.
2. Find the equilibrium concentration of vacancies in aluminium at 0 K, 300 K and 900 K. (ΔHf for Al = 68000 J/mol, and R = 8.314 J/mol·K)
3. Find the equilibrium concentration of vacancies in nickel at 300 K. (ΔHf for Ni = 168000 J/mol, and R = 8.314 J/mol·K)
4. Explain the Frenkel defect using a suitable example. What are the reasons which cause Frenkel's defect?
5. Explain the Schottky defect using a suitable example. What are the causes of Schottky's defect?
6. Draw the relative Burgers vector–dislocation line orientations for edge, screw, and mixed dislocations.
7. Briefly describe a twin boundary. Cite the difference between mechanical and annealing twins.
8. For each of the following stacking sequences found in FCC metals, cite the type of planar defect that exists:

(a) . . . A B C A B C B A C B A . . .

(b) . . . A B C A B C B C A B C . . .

1. Would you expect Frenkel defects for anions to exist in ionic ceramics in relatively large concentrations? Why or why not?
2. Calculate the fraction of lattice sites that are Schottky defects for sodium chloride at its melting temperature (801°C). Assume an energy for defect (Qs) formation of 2.3 eV and   
   Boltzmann constant (k) = 8.62 ×10**-5** eV/K.