King Saud University
College of Science, Physics department, Girls Section.

Final Examination, IST Semester 1427-28H
Date: 15-01-1428H (Saturday, 03-02-2007G)
Time: 8.00 am to 11.00 am (3 hours).

PHYS 474

Answer all the *Five* questions.

Question 1:

(a) Define & discuss Co-ordination number and number of atoms per unit cell for SCC, BCC and FCC cells. Obtain expressions of atomic radius for SCC, BCC and FCC Cells.

(b) Describe the various steps to determine the crystal structure (SCC) of a solid by X-ray powder diffraction.

(c) From a powder camera of radius 57.3 mm, using an X-ray beam of wavelength 1.542 Å, the following S values in mm are obtained for a material.
86, 100, 148, 180, 188, 232 and 272.
Determine the structure and lattice parameter of the material.

Question 2:

(a) Derive an expression for the concentration of Pair of vacancies (Schottky defects).

(b) Calculate the ratio of the number of vacancies in equilibrium at 300 K in aluminum to that produced by rapid quenching from 800 K. The formation energy of this defect in Al is 0.7 eV.

Question 3:

(a) Discuss briefly the various hardness tests.

(b) If the mean length of diagonal of impression is 150μm for an indenting load of 500 gm, determine the Vickers pyramid hardness(VPN) on a steel specimen.

(c) Calculate the Brinell number (BHN), given that the diameter of indentation is 190 μm, for a load of 1000 gm with 1mm diameter ball.

Question 4:

(a) Explain diffusion mechanisms and temperature dependence of the diffusion coefficient.

(b) The diffusion activation energy of C in γ- iron is 1.53 eV/atom. The temperature independent exponential $D_0 = 2.3 \times 10^{-5}$ m^2/s. Calculate the diffusion coefficient at 900 °C and 1100 °C.

Question 5:

(a) What is a phase rule? How do you classify phase diagrams? Briefly Explain TTT diagrams with a special reference to the various transformations in eutectoid carbon steel.

(b) Construct the phase diagram for a binary alloy AB, using the following data.

Wt% of B:	0	20	40	60	80	100
Liquidus T:	1080	1192	1272	1342	1407	1450
Solidus T :	1080	1132	1202	1287	1372	1450

Starting with a liquid of 60% of B and cooling it gradually, state the composition of the Solid that forms first.

Question 6:

Write short notes on any three: (1) Burgers Vector (2) Lever formula
(3) Low carbon steel (4) Transformation Reactions

Constants:

****