

1. Show for the body-centered cubic (BCC) crystal structure that the unit cell edge length a and the atomic radius R are related through $a=4R/\sqrt{3}$
(10%)
2. Please explain why HCP (hexagonal closed-packed) metals are typically more brittle than FCC (face-centered cubic) and BCC (body-centered cubic) metals.
(10%)
3. Would you expect iron to corrode in water of high purity? Why or Why not?
(10%)
4. Please explain what is meant by the drift velocity and mobility of a free electron.
(10%)
5. What is shape memory alloy? Please explain the possibility of shape memory alloy is used in the medical application.
(10%)
6. Briefly explain (a) Miller indices (b) Lever rule (c) Hardness (d) Tempered martensite (e) Superconductivity.
(10%)
7. Please explain how to improve the fatigue strength of metal.
(10%)
8. Please describe the features to form the solid solution. Why the solute atoms could prevent the movement of the dislocation.
(10%)
9. Please describe the mechanism of crack propagation for the ductile and brittle modes of fracture.
(10%)
10. Please describe eight different ionic point defects that are found in ceramic compounds.
(10%)