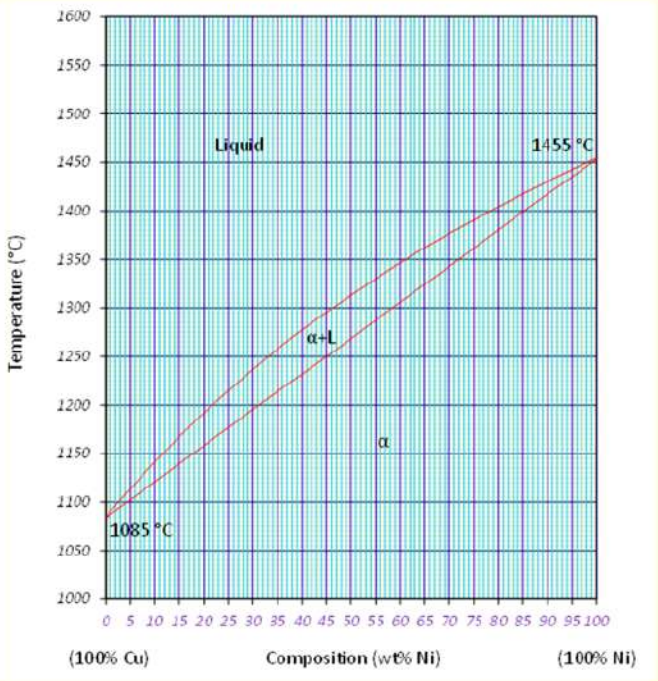
Explain the following strengthening mechanisms with suitable diagrams: (a) Solid solution strengthening and (b) Grain size reduction.

Draw and describe the stress-strain curves for a typical ductile and brittle material. Wherever applicable in the figures, mark the following properties: (a) Yield strength, (b) Tensile strength, (c) Ductility (d) Young's modulus, (g) Elastic and Plastic deformation.

A copper-nickel alloy having a composition 70 wt% Ni-30 wt% Cu is slowly heated from a temperature of 1300°C. **(Phase Diagram given below)**

a. Determine the temperature at which the first liquid phase forms and also the composition of this liquid phase.
b. Determine the temperature at which the complete melting of the alloy occurs and also the composition of the last solid remaining prior to complete melting.
c. Determine the amount of phases at 1360°C.



Draw and describe the following types of defects in crystals?

(a) Vacancy

(b) Impurity atoms

(c) Edge dislocation

An alloy specimen having the initial dimension 10 mm diameter and 10 cm length is subjected to an axial force of 20 kN. The loading elastically stretches the specimen to 10.04 cm and the diameter contracts to 9.987 mm. Calculate the modulus of elasticity and Poisson's ratio of the material.

Two cylindrical specimens are made out of a Copper alloy and are to be equally strain hardened by reducing their cross-sectional area while maintaining their circular cross-section. For the first specimen, the initial diameter is reduced from 32 mm to 22 mm. If the second specimen has 24 mm diameter, then how much reduction in diameter need to be made to have the properties similar to that of first specimen.