Question 1:

Two previously undeformed cylindrical specimens of an alloy are to be strain hardened by reducing their cross-sectional areas (while maintaining their circular cross sections). For one specimen, the initial and deformed radii are 16 mm and 11 mm, respectively. The second specimen, with an initial radius of 12 mm, must have the same deformed hardness as the first specimen; compute the second specimen's radius after deformation.

Question 2:

The lower yield point for an iron that has an average grain diameter of 5×10^{-2} mm is 135 MPa. At a grain diameter of 8×10^{-3} mm, the yield point increases to 260 MPa. At what grain diameter will the lower yield point be 205 MPa?

Question 3:

The average grain diameter for a brass material was measured as a function of time at 650°C, which is tabulated below at two different times:

(a) What was the original grain diameter?
(b) What grain diameter would you predict after 150 min at 650°C?

Time (min)	Grain Diameter (mm)
30	3.9×10^{-2}
90	6.6×10^{-2}

Question 4:

We have a piece of aluminum- copper alloy with the composition of Al – 4 wt% Cu. The alloy is supposed to be strengthened via both precipitation hardening and strain hardening. Use the Al-Cu phase diagram and design the fabrication procedure for the alloy.

Question 5:

(a) List four major differences between deformation by twinning and deformation by slip relative to mechanism, conditions of occurrence, and final result.

(b) Briefly explain why HCP metals are typically more brittle than FCC and BCC metals.

(c) Briefly cite the differences between recovery and recrystallization processes.

(d) What is the driving force for recrystallization and grain growth?