

## Practice Questions

1. Dislocations are defects in crystal structures. Discuss how these defects allow a metal to plastically deform. What happens to the dislocation density as the material deforms and what is the process for reversing this process during annealing?
2. Aluminum as a pure material has very high formability. This changes for some of the alloys. Does the phase diagram suggest any indication of this change?
3. What is the meaning of the 2.0 value on the Fe-C phase diagram at 1130°C? What happens to the carbon above this value? Why is the value at 0.025 and 723°C different?
4. Why does wood have two bubbles on the stiffness versus density diagram in the text?
5. The shear modulus (G) of aluminum is about 27 GPa. If a T6 precipitation hardening is performed on a 6061 alloy, estimate the shear modulus of the material.
6. The corrosion of a steel spoke occurs with a loss of material at the anode. Describe the differences in the process that would occur if you galvanize the spoke versus chrome plating the spoke. Which spoke would be more likely to be reliable after long periods of neglect (also known as winter in Maine)? Why would the less reliable process be used?
7. Discuss the process that aluminum undergoes to create a precipitate in hardening (such as the T6 alloy). Suggest at least two reasons an engineer who is not a material specialist should know about precipitation hardened alloys.
8. Two materials are available for us in a furnace for the supports of the part. The furnace will be used for a long period of time at 800°C. Suggest a material you might use for this application.
9. Explain in general (the type of information contained in the number designation) what the 6061 means in an aluminum alloy designation.
10. What is the difference between a 6061-T6 aluminum alloy and a 6061-0 alloy?
11. Fracture toughness should be considered when designing a travel mug. Why?
12. Discuss the types of criteria that should be considered when selecting a material for use in a chisel. What issues other than cost are primary in the material selection?

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13. A cold worked alloy is chosen for a particular application because of the need to have the higher yield stresses possible with the alloy. However, the material needs to be machined to obtain the required shape. What issues need to be considered when machining a cold worked alloy?
14. Dislocation density \_\_\_\_\_ during annealing. Increases or decreases.
15. A precipitation hardened aluminum alloy has a higher \_\_\_\_\_ than the same alloy in the annealed condition. A) dislocation density b) yield c) modulus d) none of the above
16. On the phase diagram below the Greek letters indicate the \_\_\_\_\_.
17. Apply the tie line and the lever rule to the Al-Si phase diagram at 600C at 3% Si to find the a) composition of each phase and b) the amounts of the phases in weight percent.