MSE 2001: Exam #2

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<Printed Name>

October 12th, 2011

In taking this test, I agree that I will not participate in cheating or any other forms of academic fraud inconsistent of university policies. I understand that if I am caught participating in these types of actions, my exam grade will immediately default to 0% and I will be unable to retake the exam. _____

<initials> .

True/False: 40 points (4 point each)
(The answer to the following questions are either true or false)

(1) _____Electrons are responsible for the repulsive force between atoms that are bonded together in a solid.

(2) _____The yield strength of a material, σ_y, is independent of bar diameter or cross-sectional area.

(3) _____The ultimate tensile strength of a material correlates well with atomic bond strength.

(4) _____At the atomic scale, covalent bonds are typically stiffer than metallic bonds, which is also why ceramics are typically stiffer than metals.

(5) _____Young's modulus, E, is a measure of the mechanical strength of a material.

(6) _____Atoms that sit in substitutional defect sites are typically larger than atoms that sit in interstitial defect sites.

(7) _____A polycrystalline material always has more than one phase.

(8) _____Reducing grain size results in an increase in the yield strength of a metal.

(9) _____A thermoplastic polymer melts because it has weak covalent bonds in the chain backbone.

(10) _____Polymer chains undergo relatively easy conformational motion under applied load above their glass transition temperature.

Conceptual: 60 points (10 points each)

(1) In ONLY THREE sentences or less describe why metals are ductile and ceramics are brittle.

(2) In ONLY the space below describe one method used to strengthen a metal (out of several discussed in class); you can use drawings if necessary.

(3) In ONLY the space below describe why polymers are elastomeric (rubbery) at temperatures above their glass transition temperature and glassy (brittle) at temperature below their glass transition temperature; you can use drawings if necessary.

(4) Sketch the following directions in the unit cell (*label each direction*):

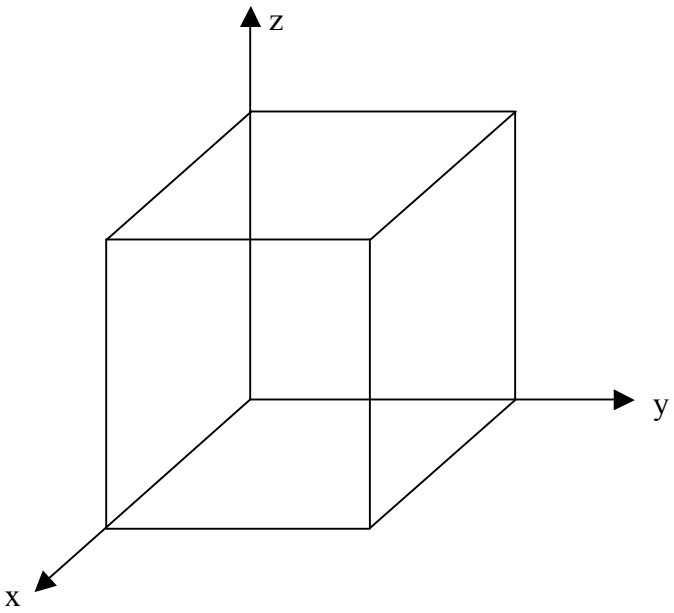
(2.5 pts each)

a. [0 1 0]

b. [0 1 1]

c. [1 2 1]

d. [0 $\bar{1}$ 0]



(5) Draw and shade the following planes in the unit cells: (5 pts each)