

## **MSE 2001: Exam #1**

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<Printed Name>

Feb 1<sup>st</sup>, 2012

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> .

## Part I: Conceptual

True/False: 30 points (3 point each)

(The answer to the following questions are either true or false)

- (1) \_\_\_\_\_ Young's modulus,  $E$ , is a measure of the mechanical strength of a material.
- (2) \_\_\_\_\_ The yield strength of a material,  $\sigma_y$ , is independent of bar diameter or cross-sectional area.
- (3) \_\_\_\_\_ The FDA approves materials for use in the human body.
- (4) \_\_\_\_\_ Polymers can be brittle or ductile, depending on testing temperature.
- (5) \_\_\_\_\_ At relatively low temperatures polymers behave in a rubberlike manner.
- (6) \_\_\_\_\_ Fatigue failures do not occur as long as you can keep applied stresses below the yield strength.
- (7) \_\_\_\_\_ Void nucleation, growth, and coalescence drives the brittle failure of a material.
- (8) \_\_\_\_\_ Resistivity does not depend on the cross sectional area of the wire with a current running through it.
- (9) \_\_\_\_\_ Metals typically contain a thin ceramic layer on their surface.
- (10) \_\_\_\_\_ The yield strength of a metal is typically close to that of a polymer when the polymer is tested at a temperature above it's glass transition temperature.

Short Answer: 40 points (20 points each)

- (1) In the space below only, describe the stress-strain of a polymer as a function of changing temperature.

- (2) In two sentences or less please describe the difference between stiffness and strength of a metallic material.

**Part II: Quantitative (30 points)**

You have the crazy idea that you want to swing from a steel cable you place between the earth and the moon. Lets assume you weigh 150 lbs (about 667 N) and that the distance from the moon to the earth is about 380,000,000 meters.

In addition, the properties of the steel cable are:

Properties of Steel cable:

$E = 200 \text{ GPa}$

Yield strength = 1000 MPa

Ultimate tensile strength = 1500 MPa

(1) What diameter wire would you need to assure the wire did not yield when you started to hang from it?

(2) Provided the wire had the diameter from part (1), how much would a wire extended from the moon to the earth elastically stretch when you hung from it?