

MSE 2001: Exam #3

<Printed Name>

March 28th, 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> .

True/False, 21 points (3 point each)

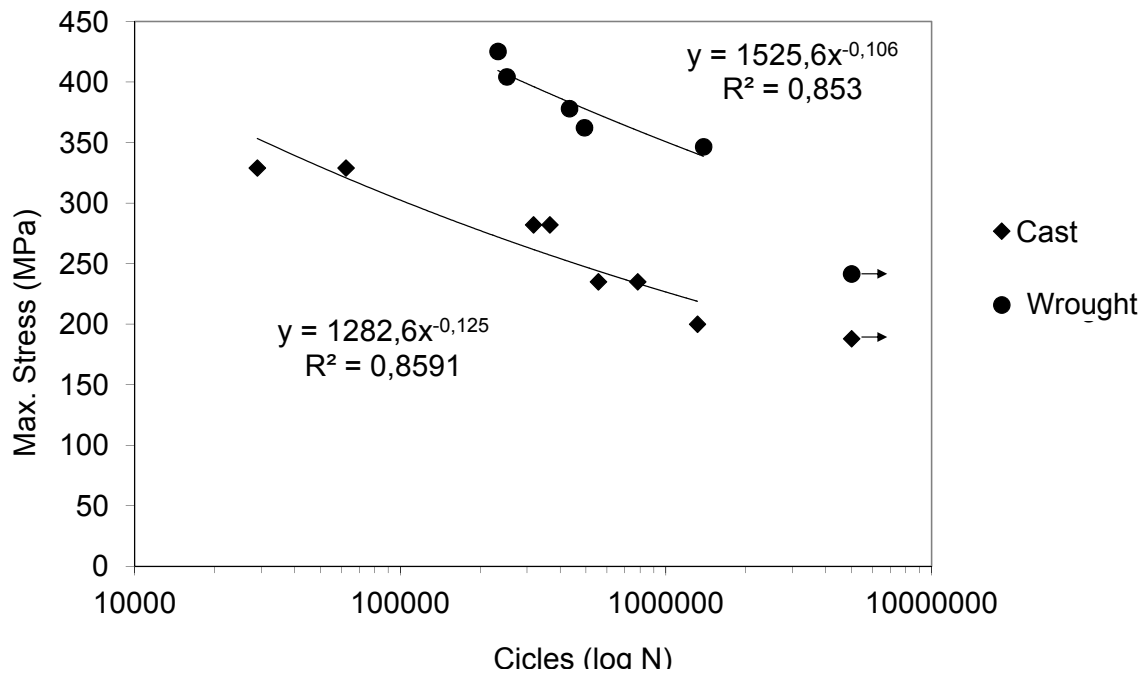
(The answer to the following questions are either true or false)

- (1)_____Interstitials typically diffuse slower than substitutionals in the same diffusion media.
- (2)_____The rate of diffusion depends strongly on temperature.
- (3)_____Diffusionless phase transformations often result in a change of composition, but not a change in crystal structure.
- (4)_____In order to achieve precipitation hardening you must be at a temperature in a region of the phase diagram where two phases co-exist.
- (5)_____Castings are typically weaker than their wrought material equivalents.
- (6)_____A functional group in an organic molecule is named so because its function is to remain stable and non-reactive.
- (7)_____To create a thermoset you need at least one of the molecules to have di-functionality.

Conceptual, 39 points (13 points each)

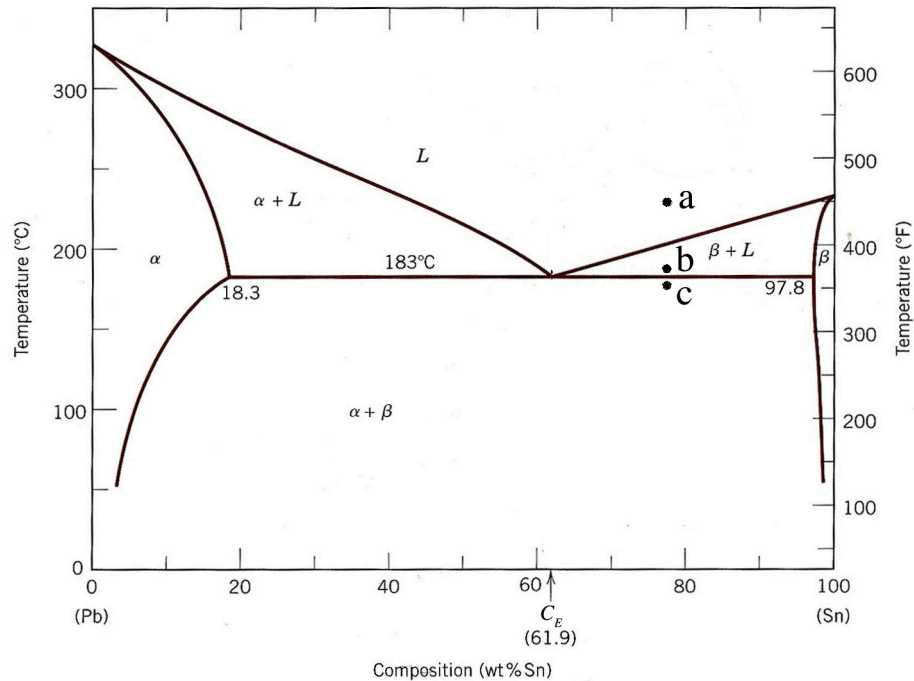
- (1) Describe in words only (5 sentences or less) the process of chain growth polymerization.
- (2) Very small diameter, cold drawn wires have extremely high yield strength. Please describe in the space below why these very small diameter wires have such large yield strength.

- (3) This month I received a paper to review about the failure of a total hip implant. They demonstrated that cast materials have much worse fatigue properties than wrought materials (this is taken directly from the paper). They didn't need to submit a paper on this – we already knew this!! Below the graph please explain why the fatigue properties of cast materials are worse than wrought materials.



Quantitative (40 points)

Please use the Pb-Sn diagram above to answer the following questions:



1. The eutectic composition of Pb-Sn solder (a substance that is melted and used to join metal ends of wires together) is 61.9% Sn. In one sentence please explain why this composition used?
2. When solder is at 100 °C what phases are present and what are the compositions of these phases?
3. What are the fractions of the solder phases present in question 2?