MEMT 201 Section 001

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HW #1 (Due: 3/27/19)

For the following questions, provide brief answers (1-2 sentences only).

1. Why the cooling rate (an important processing parameter) affects the hardness of steel?

2. What happens to the electrical resistivity of copper at higher temperatures (increases, decreases or remains the same?) And why?

3. What is the average density of ceramics? And how that compares to metals and polymers?

4. Among metals, ceramics and polymers, which material type exhibits the lowest thermal coefficient of expansion? And why?

5. Among metals, ceramics and polymers, which material type exhibits the highest tensile strength? And why?

6. Among metals, ceramics and polymers, which material type exhibits the lowest density? And why?

7. What is the unique advantage of using metal nanoparticles (an example of advanced materials) in catalysis?

8. How electron configuration affects properties?

9. Which type of bond requires electron transfer between the participating atoms?

10. How electronegativity affects the formation of ionic or covalent bonds?

11. Why metals are ductile and workable?

12. What is hydrogen bonding?

For the following questions, use engineering format (a sample format is posted in the moodle).

13. Calculate the force of attraction between a Ca^{2+} and an O^{2-} ion whose centers are separated by a distance of 1.25 nm. (Note: it forms an ionic bond and the force is coulombic in nature).

14. Molybdenum (Mo) has a BCC crystal structure, an atomic radius of 0.1363 nm, and an atomic weight of 95.94 g/mol. Compute its theoretical density in g/cm^3.

15. Calculate the radius of a palladium (Pd) atom, given that Pd has an FCC crystal structure, a density of 12.0 g/cm^3, and an atomic weight of 106.4 g/mol.