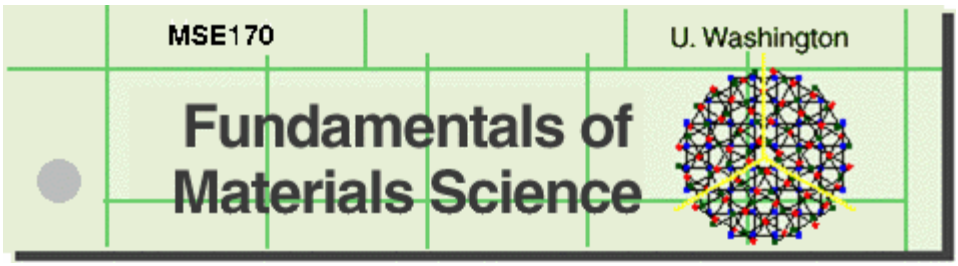

LAB I
WHAT IS IN IT AND WHY?

Study Questions:

1. Make a list of 3 examples for each of the 5 following material properties:
    - Mechanical properties
    - Electrical properties
    - Optical properties
    - Magnetic properties
    - Thermal properties
2. Define these 5 properties in engineering terms, using descriptive text and / or equations. Use the glossary and index of your text book for help, but use your own words.
3. List the most important properties, and why they are important, for the material of a stair railing used in the following environments:
    - A residential home
    - An outside environment
    - An industrial business

Engineers are involved in the design and construction of structures and devices that are fabricated with a wide variety of materials. Each of these structures is constrained by the properties of its component materials. During the design process, many factors must be considered and many questions related to materials must be answered, such as, “Can a particular material be fabricated for the design accurately and economically while maintaining its required durability?” and “Is the variety of materials in the design compatible so that corrosion or mechanical vibrations will not become an issue?” As engineers, simply creating a design is not enough; you must also be aware of the material issues of the final product and its individual components.

Materials can be broadly categorized into five basic groups: metals, ceramics, polymers, semiconductors, and composites. The purpose of this lab is to explore how and why different materials are chosen for specific applications. This lab should help you develop a more complete understanding of the engineering decisions that must go into a design.

Lab:

In this lab you will be examining and disassembling a toaster. Over the course of this process, examine each component to determine its function, material, properties, and fabrication method. You should work together in groups with one toaster per group. You should work cooperatively in your team in this lab; doing so will enhance your enjoyment and learning. The work in your lab notebook, however, should be your own.

1. Always wear your safety glasses when you or anyone near you is working to disassemble a toaster.
2. First, make a sketch of the assembled toaster in your notebook clearly numbering each component. Compose a table listing the following information for each of the components: number, name, material, properties, processing method, and function. You should have a minimum of 10 components in this table.
3. Begin to disassemble your team's toaster. As you do this, make an exploded-view sketch, making it clear how each component fits into the toaster. Number each component in your sketch; some of these will be duplicates from step 2. Compose a second table of each of the toaster's components: number, name, material, properties, processing method, and function. You should have a minimum of 25 components in this table. Don't worry if you accidentally break some components in this process. You will dispose of the toaster upon completion of this lab.
4. Compose a paragraph less than 150 words detailing your observations in this lab. Include specific structure-property relationships as well as statements about what properties of metals, ceramics, and polymers make them good choices for different general types of toaster components.
5. Your write-up for this lab should consist of:
    - 1 paragraph
    - 2 separate typed tables, one each from steps 2 and 3 where each object is numbered, named, with material, properties, and processing method.
    - Copies of the 2 groups of sketches from the assembled toaster and the disassembled toaster.

*Your sketches should be photocopies from your lab note book drawings; DO NOT hand in redrawn sketches.

If you are unclear about processing methods, discuss this in your group and use your text book for definitions such as rolling, forging, casting. You should be specific in your material descriptions, rather than "metal" is it stainless steel, some other steel, or aluminum, or… Rather than "plastic" is it nylon, or rubber, or… Be specific about your material properties such as electrical, thermal and mechanical, each of those covers a very wide range of specific properties. Again, work together, and your textbook may also be able to help you.