**Heat Treating Steel—Annealing Quenching Tempering**

**Applications:**

The properties of metals can be altered by processing.

Since the properties of a material are dependent upon its structure on the atomic level, altering its structure should alter its properties.

Common treatments include cold-working and heat treating.

**Procedure:**

1. Obtain 4 samples **each** of bobby pins and paper clips.

Repeat for the paper clip.

2. Heat the **2nd** bobby pin in the middle until it is red hot.

 Let it cool slowly in air.

 Repeat for the **2nd** paper clip.

3. Fill the beaker with cold water and ice.

4. Heat the **3rd** bobby pin in the flame until it is red hot and immediately plunge it into the water.

 Repeat for the **3rd** paper clip.

5. Heat the **4th** bobby pin in the flame until it is red hot and immediately plunge into the water.

Heat the **4th** bobby pin again but cool it slowly in air.

 Repeat for the **4th** paper clip.

In front of you should be the 1st untreated bobby pin and the 3 treated bobby pins.

The same for the paper clips.

Bend one of the wires until it breaks.

Count and record the number of bends needed to break the wire.

Repeat for all the pins and clips.

**Observations:**

**Questions:**

1. What was the purpose of the 1st bobby pin and paper clip?

2. Briefly describe the mechanical properties of the 1st bobby pin and the 1st paper clip.

3. a) What term describes heating with slow cooling? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 b) Describe the mechanical properties of these samples.

4. a) What term describes cooling hot metal rapidly? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 b) Describe the mechanical properties of these samples.

5. a) What did the final treatment of the metals entail?

 b) What is this method called? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 c) Describe the mechanical properties of these samples.