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## Period:

## **Material Science Webquest**

Link #1: Materials and their Properties: <u>http://www.explainthatstuff.com/materials-science.html</u>

1. Give two examples of the types of questions that material scientists and engineers might try to address.

2. The site describes the difference between science (scientific research) and technology (engineering). In your own words, describe the relationship between material science and technology.

3. List 2-3 examples of mechanical properties that might be important when choosing a material.

4. Choosing the right material for an application often involves trade-offs or compromise. What are the pros and cons of using gasoline to fuel a car?

5. In your own words, why can you only bend a paperclip a few times before it breaks?

6. Explain the difference between materials with elastic versus plastic properties.

7. Why are metals better conductors than plastics?

#### **Types of Materials**

## Link #2: Alloys: <a href="http://www.explainthatstuff.com/alloys.html">http://www.explainthatstuff.com/alloys.html</a>

- 1. What properties make aluminum difficult to use by itself? (Think of aluminum foil.)
- 2. What is the best definition for an alloy?
- 3. Why do engineers use alloys? How do they compare to pure metals?

#### Link #3: Plastics and Polymers: http://www.nobelprize.org/educational/chemistry/plastics/readmore.html

- 1. In your own words, what are plastics?
- 2. Define a monomer vs. a polymer.

3. The site states that all "plastics are polymers, but polymers don't have to be plastics." Give 3 examples of naturally occurring polymers.

#### Link #4: Structure and Properties of Polymers:

http://www.bbc.co.uk/schools/gcsebitesize/science/ocr\_gateway\_pre\_2011/carbon\_chem/6\_designer\_poly mers4.shtml

1. What kind of chemical bonds are in a polymer chain?

2. What two factors determine the physical properties of the polymers?

3. Describe the differences between polymer chains (thermoplastics) and cross-linked polymers (thermosets)

# Shape Memory Alloys & Polymers

- Link #5: How shape memory works: <u>http://www.explainthatstuff.com/how-shape-memory-works.html</u>
- 1. How are shape memory alloys different from regular alloys and metals (i.e. in a spoon)?
- 2. Explain the difference between elastic and plastic deformations.

- 3. What is superelasticity?
- 4. Give 2-3 examples of how shape memory alloys are used.
- 5. What are the benefits of shape memory polymers and shape-changing polymers?

Extra Resources on Polymers, Elastomers, and Shape Memory:

- Video from Science 101: What are Polymers? (2 minutes): https://www.youtube.com/watch?v=bJi8x7bKHqQ
- Video from MIT on Shape Memory Materials (5 minutes): https://www.youtube.com/watch?v=s62PL5vmfNw
- Muscle Wires (application of shape memory): http://www.jameco.com/Jameco/workshop/ProductNews/musclewire.html
- Explanation connecting Lewis Dot Structures, intra- and intermolecular forces to polymers: <u>http://www.uwosh.edu/faculty\_staff/mihalick/materials/Chapter5.pdf</u>
- How Rubber Works: <u>http://science.howstuffworks.com/rubber2.htm</u>