



Drexel-SDP GK-12 ACTIVITY

Activity

Subject Area(s): Solar, Energy, Metals, Chemistry
Associated Unit: SolarWorks
Activity Title: Muscle Wires



copyright: flexinol

Grade Level: 6-8
Time Required: 30-45 minutes
Group Size: Classroom
Cost per Group: \$20-30

Summary: *Students learn the basics of materials, and how the building blocks called atoms can move into different positions, giving it different strengths though it “looks” the same..*

Engineering Connection: *Students learn that though a material may appear the same, that on a much smaller scale the material is very different.*

Keywords: *Atoms, Metal, Sun, Energy, Heat*

Educational Standards

- Science: [PA] 3.1.7BE, 3.2.7ABCD, 3.4.7B, 3.5.7C, 3.7.7AB
- Math: [PA] 2.4.8ABCDEF

Learning Objectives

After this lesson, students should be able to identify what an atom is, the building block of materials. They should realize that the wire adjusts the atom positions to yield different shapes..

Materials List

Each group needs: One piece of flexinol, two craft sticks, two thumbtacks, heat source

Introduction / Motivation: *Ideally this activity should be done after solar heating, as the solar furnace may be used to heat the wires up. This can take awhile with a whole class however, so anything from a lighter/Bunsen burner to even hairdryer will work. The wire needs a certain amount of heat to change shape. Though complex, the students can be told that the positions of atoms are called phases. Perhaps a good analogy is when teachers ask students to move their desks into groups, or individually for exams and quizzes, if each desk were an atom, the students would be a phase collectively.*

Vocabulary / Definitions

Word	Definition
Phase	A specific, collective position of a group of atoms within a material
Atom	The building block of materials

Procedure

Before the Activity

- Students should be asked some of the following questions to put in their notebook while forming a hypothesis
 - What do you think happens to the wire when it's cool?
When it's hot?
 - What will happen when the wire is heated then cooled again? Do you think it can break? Why?

With the Students

1. I bought 1 meter of flexinol 375 (the number is the diameter of the wire, really thin wires are harder to handle so I bought the thicker kind) from www.jameco.com This wire can be cut into smaller pieces so each student may have their own. This should cost in the 20 dollar range.
2. Students may shape the wire as they choose. One of the more fun ways to do this is the bend it 90 degrees like an elbow. When it is cool it will go straight, and hot it will flex and be able to pick up an object weighing much more than itself.

3. Once setup, students may take their wire to the teacher or adult to be heated. Students should write down what they see in their notebooks under observations.
4. If the student chose to make the “arm”, attach a weight with string at the end (not too heavy, about 30g max). Record what the heaviest object the wire could lift.
5. Compare what happened during the cooling and heating of the wire, write down what you saw in your conclusions.

Assessment: Ask the students creative thinking questions such as what possible applications could this wire be used for? Robotic arms? Clothing?

Safety Issues: Heat, don't let children heat the wires themselves.

References: mondotronics.com

Owner

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