



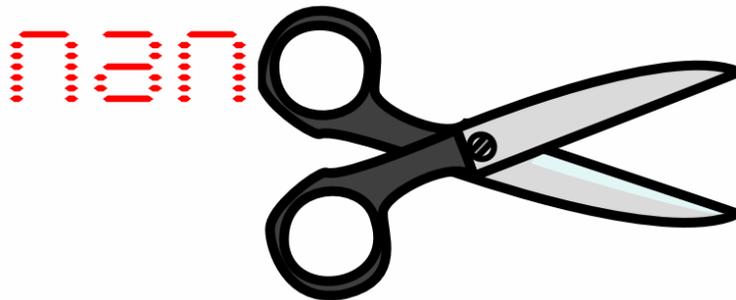
Drexel-SDP GK-12 ACTIVITY

Activity

Subject Area(s): Scales, Scientific Notation

Associated Unit: Nanotechnology

Activity Title: NanoScissors



Grade Level: 6-8

Time Required: 30-45 minutes

Group Size: Whole Class

Cost per Group: Minimal

Summary: *The class learns the concept of the nanometer, a unit of length much smaller than the eye can see. Students are asked how many times a 22 cm length of paper would need to be cut in half to be less than 10nm in length. Students also learn that special tools are needed to deal with such small objects.*

Engineering Connection: *It is important students learn the necessity of the lengthscale and specialty items needed for engineers to develop new technologies.*

Keywords: Scales, Scientific, Size, Nanotechnology

Educational Standards

- Science: [PA] 3.1.7D, 3.2.7ABCD, 3.7.7AB
- Math: [PA] 2.3.5ABCD, 2.4.5A

Learning Objectives

After this lesson, students should possess a better qualitative understanding of how small microscopic objects are, as well an understanding of the need for specialized tools to work with such small objects.

Materials List

Each group needs: A pair of scissors, a 216mmx5mm piece of paper, a ruler

Introduction / Motivation: *The students first need to realize that a nanometer is one billionth of a meter. It helps to either draw the decimal equivalent of this on the board as well as holding up what a meter stick looks like in comparison. Another comparison is to tell the students that finding one nanometer along the meter stick is equivalent of trying to find a single golf ball in the state of Maryland.*

Vocabulary / Definitions

Word	Definition
nanometer	one billionth of a meter

Procedure

Before the Activity

- Students should be asked some of the following questions to put in their notebook while forming a hypothesis
- How many times can you cut the paper in half to make a 10 nanometer long piece?
- How many times can you cut the paper in half before you can no longer cut the paper?

With the Students

1. Students may begin taking their strips of paper and counting how many times they cut the paper in half until they can no longer do so. It is easiest to have them keep hash marks in their notebooks so they do not forget.
2. It is important to keep the students cutting the paper in only the length direction, they will have a tendency to want to cut the width direction once the length is shorter than the width.
3. Once the students finished cutting their smallest pieces, they can measure how long they are (hopefully with a metric side ruler). The following questions may then be asked:

Assessment:

- How close were the predictions to the two questions above? (It takes 26 cuts to make a 10nm-long piece.)
- How many times were you able to cut the paper?
- What was the smallest piece compared to the nanoscale? [It can used to show how 10^{-2} is a cm while 10^{-9} is a nm, a good intro to scientific notation]
- Why did theyshe have to stop cutting?
- Can macroscale (i.e. bigger) objects, like scissors, be used on the nanoscale?
- How could one cut the paper any smaller?

Safety Issues: *Sharp scissors (if students pair up and use one set each that's ok)*

Activity Extensions: *This is a good lead-in for a microscope image activity.*

References: <http://mrsec.wisc.edu>

Owner

Drexel University GK-12 Program

Contributors: **Adapted by Stephen Nonnenmann**

Copyright

Copyright 2007 Drexel University GK12 Program. Reproduction permission is granted for non-profit educational use

Version: Mar 2007