

## Teacher's Preparatory Guide

### ***Bringing the Macro to the Nano in the Early Elementary School Classroom Lesson 4***

#### ***Big vs. Little – Micro to Nano***

**Overarching Question or Statement:** Why is nanoscience important?

**Purpose:** To introduce students to nanotechnology and demonstrate its importance and relevance to their lives.

**Time required:** 45 minute session for lesson, extension activities require additional time

**Level:** Early Elementary, grades 1-3

#### **Materials**

##### **For Lesson**

- Examples of nano engineered products- see resources section below for sources
  - Behr® Premium Plus Kitchen and Bath Paint
  - Clarity® Fog Eliminator
  - DERMAdoctor® Poutlandish
  - Eagle One® Nano Wax
  - Flex Power™ Joint and Muscle
  - Head® “Nano Titanium” Tennis Racket
  - Kodak® Ultima Picture Paper
  - L’Oreal™ Retivalift
  - NanoBreeze® car air filter from NanoTwin Technologies
  - Nano Mask®
  - NanoTex™ fabric
  - NDMX™ golf balls
  - Pilkington ACTIV™ Self Cleaning Glass
  - Shock Doctor Shoe insoles—Hotbed™ Aerogel Super Insulating Inserts
  - X-static™ Nano socks
  - Curad® Silver Bandages
    - Decorated Box to put products in
- Drawing paper
- product design sheet, a copy for each group ( at end of lesson)

#### **Advance Preparation:**

**National Nanotechnology Infrastructure Network**

[www.nnin.org](http://www.nnin.org)

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Gather materials and examples of nano engineered products (If possible, try to have actual examples for students to touch and see, and if not possible, at least have pictures of products for students to see.)

### **Teacher Background:**

#### **Important Vocabulary**

- Nanotechnology – Technology that involves working with particles at the nanometer scale. A nanometer is one billionth of a meter.

Story behind the development of Gecko tape:

<http://www.sfgate.com/cgi-bin/article.cgi?f=/c/a/2008/02/11/BUTPUU7DH.DTL&hw=Tom+Abate+geckos&sn=001&sc=1000>

Tablet experiment directions – To illustrate how “smaller works faster”, fill two clear glasses halfway with water. Have ready one dental cleaner tablet and another one ready to crush. Crush one tablet with the children, explaining that the experiment will show how smaller particles can work faster. Drop the crushed tablet and the whole tablet in each glass at the same time. Ask children for observations.

**Teaching strategy:** whole group and small group configurations

### **Resources:**

A good website for additional information and activities for children: [www.nanozone.org](http://www.nanozone.org)

Good websites for information about nano products are:

[http://www.nnin.org/nnin\\_k12nanotechproducts.html](http://www.nnin.org/nnin_k12nanotechproducts.html) This site contains information sheets on each product.

<http://www.nanotechproject.org/inventories/consumer/>

### **Instructional Procedure:**

*Introduction: (approx. 5min.)*

Gather children in a group, on the floor, and say, “We’ve been looking at pictures at the nano scale, why do you think scientists would spend so much time and energy studying such small things?” After some discussion, guide students to understand that when you work at such a small level, you can understand and change the way things works. Say, “Sometimes things work faster at this level, for instance let’s look at what happens with this experiment.” At this point, perform the tablet experiment. ( Other ideas for demos are short activities can be found at [http://www.nnin.org/doc/NNIN\\_Outreach\\_Demo\\_Guide-11\\_10.pdf](http://www.nnin.org/doc/NNIN_Outreach_Demo_Guide-11_10.pdf) or [http://www.nisenet.com/catalog/programs/exploring\\_properties\\_-\\_surface\\_area\\_nanodays\\_08\\_09\\_10](http://www.nisenet.com/catalog/programs/exploring_properties_-_surface_area_nanodays_08_09_10) )

*Part One: (approx. 10 min.)*

At this point, explain to students that you are now going to show them some products that have been developed for us to use in our every day life. From the decorated “nano” box, take out a product. The concluding thought from this activity would be that because scientists could

understand how nano structures work, they could engineer a product that could use these properties. From here continue sharing other examples of nano engineered products. Discuss the benefits of each.

*Part Two: (approx. 20 min.)*

Children will work in groups to design a possible product of the future. To do this, divide students into groups of 4 and explain to them that they are going to be scientists and engineers. Their task is to design a product for the future. It can be a product that already exists that they want to improve or it can be something completely new and unique. To facilitate this activity, provide a list of category choices such as: food, games, building materials, clothing, household machines, and electronics. Allow students to begin working on their projects. Additional time will be needed to complete the project. Pass out product design sheets to students.

*Conclusion: (approx. 2 min.)*

As the teacher moves from group to group collecting the planning sheets, ask each group to think of one new fact that they learned from today's lesson and share with the class.

*Extension: (approx. 20 min.)*

Center Work: Have students continue working on development of product.

Other center activity

*Additional Extension:* When product ideas are complete, children will design an advertisement for their product. See product design sheet at end of lesson

#### **National Science Education Standards K-4**

- Content Standard A Science as Inquiry
  - Abilities necessary to do scientific inquiry
  - Understanding about scientific inquiry
- Content Standard B Physical Science
  - Properties of objects and materials

## Product of the Future

**Task:** You are a scientist or an engineer and you are to design a product for the future. It may be a product that already exists and you are going to make it better, or it can be a completely new and unique product.

**Name of Product:** \_\_\_\_\_

**What is the product designed to do?** \_\_\_\_\_

\_\_\_\_\_

**Sketch your product below:**

**Explain how your product works:**

\_\_\_\_\_