Teacher's Preparatory Guide

Exploring Nanotechnology through Consumer Products

Purpose
Students are provided an introduction to nanotechnology via a PowerPoint presentation *An Introduction to Nanotechnology – What's all the hype about*? Topics covered include scale, what is different about the nanoscale world, tools of nanotechnology, and education and career information. Students extend their understanding of how nanotechnology is being used today by examining currently available consumer products.

Time required
1-2 hours depending on number of products used and time used for student presentations.

Advance Preparation
Download a copy of the PowerPoint *An Introduction to Nanotechnology – What's all the hype about*? for use in the introduction. The presentation has speaker notes to help explain the slides. Choose which nanoproducts will be used to explore current applications of nanotechnology. A list of these is included at the end of this preparatory guide. Teachers may purchase the products, request samples (some manufacturers are willing to provide free samples for educational purposes), or they may choose to use only pictures of the products. Download a copy of the product description information sheet. It is best to laminate these to allow for extended use.

Place each product and its description in a bag, folder, or box. It is best to store all of the products in their respective bags in a larger bag or storage box to allow for easy distribution of the materials to the students.

Directions for the Activity
1. Begin activity by introducing nanotechnology by way of the PowerPoint presentation *An Introduction to Nanotechnology – What's all the hype about*?
2. Stop the PowerPoint presentation at "Directions for the Activity" and have students read over the directions. Leave this slide up during the activity.
3. Pass out the products and product description sheets to groups of students.
4. Direct students to read the material and study the product.
5. After students complete their presentations, return to the PowerPoint to explore additional applications of nanotechnology as well as education and career options.

Safety Information
There are no safety precautions for the products used in this activity.

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Teaching Strategies

- This activity works best when students work in groups of 2-3.
- Encourage the students to divide up the presentation to ensure that each group member participates.
- Allow students to explore the products such as providing water in a squirt bottle to test nanofabric or trying fog eliminator on glass or a mirror.
- Question students during their presentation on how they might test the product's claim. What type of experiment would they design to determine if the product lives up to its advertising?
- After the products activity and PowerPoint are completed, have a general discussion with the students to determine their level of understanding about what nanotechnology is
    - Can they define nano?
    - Do they know in what size range this field is occurring?
    - Do they understand that special and precise tools are needed?
    - Do they understand that nano is not new and why not?
    - Do they understand education and career choices are available? What are these?
- An extension is to have students explore via the Internet career and or education information. Have students create a PowerPoint presentation regarding the career in nanotechnology that they explored. Types of questions they should answer include:
    - What is the chosen career area?
    - What education is needed to do this job?
    - How would you prepare in high school to get ready to seek this career?
    - What type of job is it? (What do you do?)
    - What are the job opportunities? (Are there jobs? Is the job market growing?)
    - What is the average salary?
    - What is exciting about this career?
    - Would you like to do this job? Why or why not?

Listed below are potential sources that students can be directed to:

http://www.nano.gov
http://www.cneu.psu.edu
http://tinytechjobs.com
http://www.smalltimes.com
http://www.dctc.edu/prospStudents/programs/nanoTech.cfm

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http://www.workingin-nanotechnology.com
http://www.nanovip.com
http://www.foresight.org
http://www.nanotech-marketplace.com
http://nano.cancer.gov
http://www.nanoforum.org/
http://www.nsti.org
http://www.nanotech-now.com
http://ipt.arc.nasa.gov/nanotechnology.htm

- An alternative to having the students report out on the products is to have them create a commercial for the products. Students are allowed 1 minute of "air time" to sell the product by including such information as what is nano about the products and why it is better than its non-nano counterpart.

National Science Education Standards

Middle School Content Standards

- Standard A
  - Identify questions that can be answered through scientific investigations
  - Recognize and analyze alternative explanations and predictions
  - Communicate procedures and explanations
- Standard B
  - Properties and changes of properties in matter
- Standard E
  - Understandings about science and technology
- Standard F
  - Science and technology in society
- Standard G
  - Science as a human endeavor
  - Nature of Science

High School Science Standards

- Standard A
  - Identify questions and concepts that guide scientific investigations
  - Understanding about scientific inquiry
- Standard B
  - Structure and properties of matter
  - Chemical reactions
- Standard E

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    - Understandings about science and technology
- Standard F
    - Science and technology in local, national, and global challenges
- Standard G
    - Science as a human endeavor
    - Nature of scientific inquiry

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Assessment of student understanding

1. The student was able to accurately explain what is nano about the product in his or her own terms (not those written on the product description sheet).

Strongly agree	Disagree	Neither agree or disagree	Agree	Strongly agree
1	2	3	4	5

2. The student was able to clearly explain how the product works and how it differs from other non-nano enhanced counterparts.

Strongly agree	Disagree	Neither agree or disagree	Agree	Strongly agree
1	2	3	4	5

3. The student is able to define what nanotechnology is.

Strongly agree	Disagree	Neither agree or disagree	Agree	Strongly agree
1	2	3	4	5

4. The student is able to explain in clear and accurate terms what the nanoscale is.

Strongly agree	Disagree	Neither agree or disagree	Agree	Strongly agree
1	2	3	4	5

5. The student can provide examples of the type of tools used to see objects beyond our visible range.

Strongly agree	Disagree	Neither agree or disagree	Agree	Strongly agree
1	2	3	4	5

6. The student can articulate that nanotechnology is not new and provide an example to support this.

Strongly agree	Disagree	Neither agree or disagree	Agree	Strongly agree
1	2	3	4	5

7. The student can articulate that there are a variety of education and career paths for those interested in working in nanotechnology.

Strongly agree	Disagree	Neither agree or disagree	Agree	Strongly agree
1	2	3	4	5