



## Student Guide

### Modeling Nanotechnology Project



**Introduction:** Nanotechnology is the science of the very small where scientists and engineers manipulate materials at the nanoscale to create new materials and devices. The nanoscale is defined as 1 to 100nm in one direction but many products use materials of several nanometers in diameter. Scientists have discovered that materials at the nanoscale can have very different properties than the same materials at the macro scale. For example, gold at the nanoscale interacts differently with light and may appear red or violet in color. They are utilizing these unique properties to create or enhance materials. The teacher may want to become familiar with basic information about nanotechnology by accessing materials on the internet in the resource section below.

The global nanotechnology market is expected to be more than \$125 billion industry by 2024<sup>1</sup>. The growth rate of nanotechnology products is forecast to be 17% through 2024<sup>2</sup>. There are numerous products made with nanotechnology that are currently available including many consumer products.

This activity has you select a nanoproduct to explore how it has been developed or improved using nanoscale science and engineering. While researching your product, keep in mind the cost, safety, reliability and aesthetics, as well as possible social, cultural and environmental impact of the product.

#### Directions:

1. Choose a product that has been developed with the use of nanotechnology. You may Google “nanotechnology + products” or visit the following website to choose a product: The Project on Emerging Nanotechnologies’ *Consumer Product Inventory* <https://www.nanotechproject.tech/>. Go to inventories to find one of more than 1800 products. The site also has important information on the environmental, health and safety issues associated with nanotechnology.
2. Research your product to understand what is nano about it and how nanotechnology has been used to develop or improve the product.
3. Create a model of the unique nano feature of your nanoproduct – showing how nanotechnology has improved the effectiveness of the product. This will be a three dimensional model that you will construct on your own.



4. In addition, design an experiment using all the steps of the scientific method that you believe were necessary to prove the effectiveness of nanoscience used with the product. The models must be 3-dimensional. The experimental design needs to be presented on a tri-fold poster board which includes:
  - a. title
  - b. purpose
  - c. hypothesis
  - d. materials
  - e. procedure
  - f. control and experiment groups
  - g. independent and dependent variables
  - h. data (use actual data from product website if available) and
  - i. conclusion
5. A compare and contrast that compares the nanoproduct to one that does not use nanotechnology. You must develop a cost analysis of the product and include safety, reliability and aesthetics, as well as possible social, cultural and environmental impact of the nano-based product.
6. Students will present their products, their model, and the research on the product to the class and any other invited guests.



Name: \_\_\_\_\_

Date: \_\_\_\_\_



### Part I

#### Proposal for Modeling Nanotechnology Project

- Nanotechnology product:
  
- Websites used to research your product:
  
- Purpose of the nanoproduct:
  
- How does the use of nanotechnology improve this product:
  
- What are the materials that you will use to model your nano product?



## Modeling Nanotechnology Project

Name: \_\_\_\_\_

Date: \_\_\_\_\_



### PART II

#### Experimental Design for your Nanotechnology Product

(You are acting as the actual creator of this product, so all parts of this design are based on a real experiment. You can use information from the product website.)

Purpose of the experiment:

Hypothesis:

Materials needed:

Procedure:

Control and Experiment groups:

Independent and Dependent variables:

Data/Results (use actual data if provided on the product website):

Conclusion:

Other items to include on your tri-fold poster will include:

- ✓ Cost analysis (how does the nano product compare to the “regular” product?)
- ✓ Compare and contrast of nano and regular product in terms of function
- ✓ Pros and cons of the nano product including safety
- ✓ Possible societal and environmental impacts

