

Nanotechnology 5-E Lesson Plan Template

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Topic: Nanotechnology	
Title: Bubbles Characteristics	Grade Level: 3, 4, 5 and Gr. 6 Resource
Lesson Summary: When given bubbles the students will collect data on the bubbles' characteristics (bubble diameter or bubble color). Students will graph the bubbles' characteristics according to size, both by bubble diameter and by thickness of the bubble determined by its color.	

Arkansas Math and Science Frameworks SLEs:

NS 1.3.2 The learner will be able to develop questions that guide scientific inquiry.

NS 1.3.6 The learner will be able to collect and analyze measurable empirical evidence as a team/and or an individuals

PS 5.3.1 The learner will be able to develop questions that guide scientific inquiry

DAP 14.5.2 The learner will be able to collect numerical and categorical data using surveys, observations, and experiments that would result in bar graphs, line graphs, line plots, and stem-and-leaf plots.

DAP 15.5.1 The learner will be able to interpret graphs such as line graphs, double bar graphs, and circle graphs.

DAP 14.5.3 The learner will be able to construct and interpret frequency tables, charts line plots, stem-and-leaf plots, and bar graphs.

DAP 16.5.1 The learner will be able to make predictions and justify conclusions based on data.

DAP 14.6.1 The learner will be able to formulate questions, design studies, and collect data about a characteristic shared by two populations or different characteristics within one population.

DAP 14.6.2 The learner will be able to collect data and select appropriate graphical representations to display the data including Venn Diagrams.

DAP 15.6.1 The learner will be able to interpret graphs such as double line graphs and circle graphs.

DAP 16.6.1 The learner will be able to use observations about differences in data to make justifiable inferences.

NS 1.5.1 The learner will be able to make accurate observations

NS 1.5.4 The learner will be able to interpret scientific data using (1) data tables and charts, (2) bar graphs, (3) circle graphs, (4) line graphs, (5) stem and leaf plots, and (6) Venn Diagrams

NS 1.5.5 The learner will be able to communicate results and conclusions from scientific inquiry.

NS 1.5.6 The learner will be able to develop and implement strategies for long-term accurate data collection.

NS 1.6.4 The learner will be able to construct and interpret scientific data using (1) data tables/charts, (2) bar and double bar graphs, (3) line graphs, (4) stem and leaf plots

NS 1.6.5 The learner will be able to communicate results and conclusions from scientific inquiry,

Main SLE covered in this activity:

DAP 14.6.1 The learner will be able to formulate questions, design studies, and collect data about a characteristic shared by two populations or different characteristics within one population.

Objectives: The learner will:

1) be able to collect data and prepare graphs to display the findings

Essential Question:

How can we measure and compare bubbles? What determines the color of bubbles?

BACKGROUND INFORMATION

Timeline: 1 or 2 class periods (45 min. each)

Materials:

Bubbles, a white background (screen, wall, Whiteboard, etc), rulers, graph paper, video camera with stop action capability, paper drop cloth to catch bubbles to measure diameter, graphing calculator if desired

Teacher Preparation:

- **Collect materials**
- **Copy the lab sheet for the students**
- **Secure the appropriate technology equipment to make graphs**
- **Assign groups of 2 – 4 students**

PROCEDURE

Engage:

Teacher will blow bubbles and ask the students how they can compare and describe the bubbles. The students will brainstorm ways of comparing the bubbles. [These mainly include the diameter of the bubbles, the color of the bubbles, how long they last before they pop, and whether the bubbles are single, double, triple, or more.]

Explore:

The teacher will blow the bubbles. Working in groups, students will collect the bubbles data according to the characteristic their group is investigating. The students can use their frequencies at the website www.graphsforkids.com where they can develop graphs to compare the characteristics. A graphing calculator can also be used to make the graphs, which can be displayed for the class using a document camera, TI Emulator, or Smart Board.

Explain:

A reporter from each group will orally present their findings. The teacher will ask leading questions. The teacher will question the students about the units and precision of their measurements; and discuss how scientists measure to get accurate data. The students can keep their data in their science notebook to develop more charts and graphs.

Elaborate:

The teacher will explain that the color of the bubble depends on the thickness of the hollow bubble sphere, which is measured in nanometers. Explain that a nanometer is one-billionth of a meter. Soap bubbles reflect light from around them. They often show a "rainbow" of colors due to interference between the reflections from the very thin layers in the film around the bubble. The color depends on the nano-thickness of the surface film of the bubble (20 nm – 200 nm).

Expand:

- Take the class to the computer lab to explore the thickness of each color of bubble.
- While in the computer lab, do a nanotechnology Web Quest.

Evaluate:

The students' graphs can be printed and scored using a rubric.

CROSS CURRICULAR CONNECTIONS

Math: data collection, data analysis, graphs

Language Arts: terms, vocabulary, descriptive words

Social Studies: graphs

Art: color and wavelength

Parental Involvement: Parents can be surveyed for their use of nanotechnology in their careers, and invited to speak to the class about their nano application.

Technology Connections:
Internet

Resources:

www.graphsforkids.com

<http://www.seed.slb.com/v2/FAQView.cfm?ID=1089>

http://www.exploratorium.edu/ronh/bubbles/bubble_colors.html

<http://bubbles.org/html/questions/color.htm>

<http://science.howstuffworks.com/light13.htm>

<http://www.newton.dep.anl.gov/askasci/phy00/phy00191.htm>

[http://www.exo.net/~pauld/summer_institute/summer_day8interference/Soap%20 film Colors.html](http://www.exo.net/~pauld/summer_institute/summer_day8interference/Soap%20film_Colors.html)

Notes:

The bubbles can be compared by diameter size, or color. They can be videoed and the results put on the smart board and this can introduce colors and light spectrum

Credits:

This lesson: X_is original ___ was adapted from _____'s original lesson.