

Scaling down: Effects on Behavior

Author(s): Janice St.Pierre

Date Created: August, 2016

Subject: Chemistry and Physics

Grade Level: Middle School & High School

Standards: Next Generation Science Standards (www.nextgenscience.org)

HS-PS2-6 Why the molecular level structure is important in the functioning and design of materials

Schedule:

CCMR Lending Library Connected Activities:



<p><u>Objectives:</u></p> <ol style="list-style-type: none"> 1. To understand the magnitude of a billion. 2. To investigate how size effects the behavior of materials. 	<p><u>Vocabulary:</u></p> <p>Metric prefixes deca, hecto, kilo mega, giga deci, centi, milli, micro, nano volume of a cube, volume of a sphere surface area density billion</p>
<p><u>Students Will:</u></p> <ul style="list-style-type: none"> - Devise a method to determine the volume, mass and density of each of the Styrofoam balls, using the materials given. - Determine the volume of box then predict how many Styrofoam ball would fit into the box without actually filling the box up with Styrofoam balls. - Students will test their prediction by filling each box with the appropriate sized styrofoam balls. - At this point you may have student discuss or predict the mass and density of each box when filled with the different sized balls. - Students will calculate the number of balls that would be in 10 boxes, 100 boxes etc. Correlating the 10 fold increase(decrease) to the metric prefix. <p><u>Activity #2 Behavior:</u></p> <ul style="list-style-type: none"> - Predict which ball can be throw the furthest distance and explain their choice. Students will then test their prediction. - Predict and investigate the behavior of the largest and the smallest styrofoam ball's reaction to accumulated charge. 	<p><u>Materials:</u></p> <ul style="list-style-type: none"> ● 3 different size Styrofoam balls <ul style="list-style-type: none"> ○ 1 inch diameter up to 3 inch diameter ○ surfaces must be smooth ● rabbit fur/wool/silk/plastic wrap ● Length of string ● glass rod/ Plexiglas rod ● Container (box) ● scale ● metric ruler/meter stick
<p>Safety.</p>	<p>Hazards are minimal; Students will be throwing styrofoam balls</p>



Science Content for the Teacher:

This activity can be math centered or not. The integration of the the math adds to the validity of the student's predictions.

Activity #1

Students may need guidance in determining the volume of a styrofoam ball. Using the formula: (circumference) $C = 2\pi r$ Students can determine the circumference of the spheres by wrapping a string around the center of each size sphere, then measuring the length of the string.

$$\text{Volume of a sphere} = \frac{4}{3} \pi r^3$$

$$\text{Volume of a cube} = \text{length} * \text{width} * \text{height}$$

$$\text{Density} = \text{mass} / \text{volume}$$

Activity #2 Behavior

Have either the same student throw all three sizes or have all students throw their own from a mark on the floor.

Styrofoam accumulates electrons from wool silk or rabbit fur (give up electrons) . Rub the Styrofoam with the cloth or fur prior to charging the rod. This is best accomplished if you place the fur/cloth on a flat surface and briskly rub the styrofoam across.

The glass rod will lose electrons and obtain a + charge. You could rub the glass rod with sarah wrap (accumulates electrons making the rod +) or Plexiglas rod with the silk, wool or fur. See this link for further options:

http://www.school-for-champions.com/science/static_materials.htm#.V6j_QnpCjk8

Classroom Procedure:

Divide activities into 3 to 4 sessions if need be.
Follow directs as per student had out.

Preparations:

Gathering of materials



Assessment:

Correcting or discussing student's predictions, data analysis and summary questions on the answer sheet.

Resources:

Modified from Nanoscale Science NSTA

