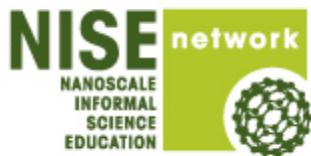


Summer Camp Framework – Materials List



Organization: Sciencenter
Contact person: Michelle Kortenaar
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Session 1: Intro to Nano

A nanometer is one-billionth of a meter. Things on this scale are too small to see, even with very powerful light microscopes. Some materials behave in a different way at a small scale than they do at a larger scale.

Materials

See detailed materials lists, sources and set-up in the lesson plans and activity guides that can be downloaded from www.nisenet.org

Intro to Nano Cart Demonstration

Exploring Materials: Nano Gold (NanoDays 2012)

- Vial of gold flakes
- Vial of red nano gold (20 nm)
- Vial of orange nano gold (80 nm)
- Samples of stained glass made with gold
- Mini-light (very bright white LED)
- Sheet of white paper
- Image of stained glass window

Exploring Forces: Static (NanoDays 2011)

- Tube of large balls
- Tube of small balls
- Polar fleece

Exploring Structure: Butterfly (NanoDays 2012)

- Butterflies in protective case
- Mini-light
- Images of butterfly and wing structures

Exploring Materials: Graphene (NanoDays 2012)

- Soft drawing pencils (6B is best)
- Pencil sharpener
- Battery and bulb circuit (alkaline 9v battery, 9v snap connectors, 5mm LED bulb, 330 Ohm ½ watt 5% tolerance carbon-film resistor, 2 alligator clips)
- Photocopy master for activity cards

Exploring Size: Ball Sorter (NanoDays 2012)

- Nesting sieves with three screen sizes
- Small balls in three sizes
- Container for balls

Exploring Products: Sunblock (NanoDays 2011)

- Sunblock with nanoparticles of zinc oxide
- Zinc oxide ointment
- Black construction paper
- Cotton swabs

Exploring Size: Measure Yourself

- “How Tall Are You?” height chart
- “How Big Is Your Hand?” worksheets
- Pencils

Exploring Size: Scented Balloons

- Round balloons in different colors
- Variety of flavored extracts
- Balloon pump
- “Match the Scent” poster
- “Key” sheet
- Wet- or dry-erase marker
- Latex warning sign

Smell the Difference

- 1 orange (or orange peel)
- 1 lemon (or lemon peel)
- 1 grater
- 2 small bowls

Exploring Properties: Surface Area

- 100 ml graduated cylinders (2)
- Small plastic measuring cups (2)
- Pitcher
- Effervescent antacid tablets
- Food coloring

Exploring Forces: Gravity

- Regular teacup
- Miniature teacup
- Container for water

Exploring Materials: Ferrofluid

- Ferrofluid display cell
- Vial of magnetic black sand
- Magnets
- Ferro fluid Material Safety Data Sheet (MSDS)

Exploring Products: NanoSand

- Ordinary, colored sand (green, or another color)
- Hydrophobic sand (purple, or another color)
- Trays (2)
- Dropper bottles (2)
- Small portion cups (2)
- Drinking cups (2)
- Spoons (2)

- “Nano Sand” sheet

Exploring Size: Memory Game

- “Macro, Micro, Nano” playing cards
- “Making a Match” sheet
- “Macroscale Objects,” “Microscale Objects,” and “Nanoscale Objects” sheets

Exploring Size: Memory Game

- Cards

Exploring Size: Powers of Ten Game

- Cards

Session 2: Nanoscale science in nature.

Nanotechnology and materials can be inspired by nature. Investigate pants and plants that repel dirt and water, and find out how nano-sized "whiskers" on fabric can keep your clothes stain-free. Explore the beautiful iridescent color of the Blue Morpho butterfly, and learn about new display technologies that mimic the butterfly's wings. Find out how nanoscale materials are built by nature.

Materials

See detailed materials lists, sources and set-up in the lesson plans and activity guides that can be downloaded from www.nisenet.org

Video: Nanotechnology What’s the Big Deal?

Synthetic Gecko Tape Activity

In advance: For making the gecko “tape” –

- Silicone RTV Mold-Making System (<http://www.tapplastics.com/>) -
 - o Side A 1 lb, \$20.50
 - o Side B Fast Catalyst (Blue) 0.1 lb, \$3.95
- Polycarbonate Millipore Track etched Isopore membrane filter (<http://www.millipore.com/>) TMTPO4700, 5µm pore size, 47 mm diameter \$84.00 for pack of 100 filters)
- Wide double sided sticky tape
- Disposable mixing container (any smooth glass/plastic wide mouth container)
- Petri dishes (1 for each piece of tape)
- Stirrer sticks or plastic disposable knives
- Weighing scale

Activity:

- Small plastic fruit basket or plastic cup
- String
- Paper clips
- Weight (i.e., pennies or loose bolts and nuts)
- Live Gecko in transparent holding tank
- Hand held magnifying glasses

Exploring Products: Nano Fabric

- Pants made of nanotechnology stain-resistant fabric
- Pants made of ordinary fabric

- Dropper bottle
- Tray
- Assortment of hydrophobic plant leaves, such as lotus leaves, nasturtium leaves, mustard greens, leafy kale, broccoli, or Chinese cabbage and an assortment of non-hydrophobic plants (iceberg lettuce, etc.). At minimum, 4-5 TOTAL leaves (note that more leaves will extend the length of the program)
- Trays for plants
- Paper or regular Towels

Snowflakes: Nano at its Coolest

- Assembled ice crystal chamber (**see below and the online guide for materials and instructions to make it, and for instructions on preparing it for the presentation**)
- Projector, screen and computer for PowerPoint presentation
- Dry ice for the chamber (see below)
- Warm water for the chamber (see below)
- Molecular models of ice (available at www.indigo.com)
- Optional: tactile models of the basic shapes of snowflakes (see below for materials and instructions to make them)
- Optional: tactile models of different types of snowflakes (see below for materials and instructions to make two types)
- Optional: printout of the PowerPoint presentation to offer as a handout.

Materials and instructions to make the ice crystal chamber

- Bottle with monofilament
- One plastic bottle with cap, 16 oz or 1 quart (500 ml to 1 l). Choose a clear bottle with a smooth neck.
- Punch two holes in the bottom of the bottle using a dissecting pick or other sharp instrument that makes a small hole. Place the holes near the edge, opposite each other.
- Thread the monofilament through the bottle so that two loose ends come out the top of the bottle.
- Pull the ends tight and tape them to the side of the bottle. Place the tape near the bottom of the bottle.
- Make a sleeve of black construction paper to cover the body (cylindrical part) of the bottle. The sleeve should not cover the shoulder and neck of the bottle.
- Insulating container, such as a Dewar or Styrofoam cooler, to hold the bottle and a surrounding layer of dry ice. The container should be big enough so that the bottle fits into the container at least up to the neck, with a couple inches of space below it and all around it.
- Dry ice to pack into the container around the bottle. Choose pellet form if you can get it; otherwise, you'll need to break up the dry ice into small pieces with a hammer or other tool.
- Protective material, such as cloth or paper, to cover the exposed dry ice and prevent visitors from touching it.

See the guide, online, for detailed instructions to prepare the chamber for each program.

Exploring Materials: Thin Films

- Shallow pan
- Strips of black paper
- Clear nail polish
- Permanent markers in metallic color
- Peacock feather (optional)
- Thin film solar cell sample (optional)

Exploring Size: Memory Game

- Cards

Exploring Size: Powers of Ten Game

- Cards

Session 3: Manipulating Things at the Nanoscale

Scientists and engineers have formed the interdisciplinary field of nanotechnology by investigating properties and manipulating matter at the nanoscale. Nano researchers have developed new ways to manipulate matter at the nanoscale. These techniques fall into two broad categories, known as “bottom-up” and “top-down” approaches.

Materials

See detailed materials lists, sources and set-up in the lesson plans and activity guides that can be downloaded from www.nisenet.org

Exploring Fabrication: Self Assembly

- 12 blue gloves
- 12 red gloves

DNA Nanotechnology

- Prepared strips of paper and adhesive envelope labels
- Pea mixture in labeled squirt bottles
- Alcohol in labeled squirt bottles
- Glass vials (or test tubes and a holder)
- Eppendorf tubes (1.5 ml or 2 ml)
- String or yarn
- Scissors
- DNA extraction protocol handout
- Safety glasses
- Paper towels (for spills)
- Dried split peas
- Cold water
- Blender
- 1 c measuring cup
- Mixing bowl or other container
- Strainer that fits into the mixing bowl
- Labeled squirt bottles (~500 ml)
- Funnel (optional)
- Dishwashing liquid (detergent)
- Salt

- 1/2 c measuring cup
- 1 t measuring spoon
- 1/8 t measuring spoon
- Mixing bowl or other container
- Spoon
- Labeled dropper bottles (~100 ml)
- Funnel (optional)
- Isopropyl alcohol (at least 70%)
- Labeled squirt bottles (~250 ml bottles)
- Funnel (optional)
- Strips of paper or register tape
- Self-adhesive envelope labels
- Marker

Sweet Self-Assembly

- Sodium Alginate (Food Grade, optional)
- Calcium Chloride (Food Grade, optional)
- Blender
- Flavoring (optional - Ice Cream Toppings, snow cone flavors, etc)
- Food Coloring (Optional – To intensify color)
- Strainers
- Eye Droppers or Needleless Syringes

Exploring Size: Memory Game

- Cards

Exploring Size: Powers of Ten Game

- Cards

Session 4: Scientists use special tools to work on the nanoscale

The dramatic growth of the fields of nanoscience and nanotechnology has been made possible by the recent development of specialized tools by scientists and engineers. Nanoscale structures can be observed by using specialized microscopes, like the Scanning Probe Microscopes (SPM) and Atomic Force Microscopes (AFM).

Materials

See detailed materials lists, sources and set-up in the lesson plans and activity guides that can be downloaded from www.nisenet.org

Exploring Tools: Special Microscopes

- Small magnets
- Large demonstration magnet (optional)
- “Magnetic Field” sheet

Exploring Tools: Mitten Challenge

- Oven mitts (2)
- Brick building set (Lego® Duplo® or similar)
- “Build a House” sheet

Tiny Particles Big Trouble

Dressing activity

- Shoe covers, universal size (LSS #966P)
- Hooded coverall with boots, size small (VWR #10844-420)
- Safety glasses
 - Children (Carolina #646713)
 - Adults (Carolina, LSS, VWR, and other suppliers)
- Nitrile gloves in two or more colors (LSS, VWR, and other suppliers)

Shrinking Robots

Stage presentation

- PowerPoint presentation
- Optional: Toy robots

Hands-on activity

- Recycled materials, such as:
 - Assorted containers and cups
 - Container lids and caps
 - Paper tubes and boxes
 - CDs, computer discs and other “tech” materials
 - Spools
 - Fabric scraps
 - Other clean, safe materials
- Craft materials, such as:
 - Craft foam
 - Construction paper
 - Straws
 - Craft sticks
 - Pipe cleaners
 - Pompoms
 - Yarn
 - Googly eyes
- Supplies:
 - Safety scissors
 - Nontoxic markers
 - White glue
 - Clear tape
 - Masking tape
 - Hole punches

Exploring Size: Memory Game

- Cards

Exploring Size: Powers of Ten Game

- Cards

Session 5: Nanotechnology leads to new knowledge and innovations

In the field of nanotechnology, researchers and engineers take advantage of the change in properties at the nanoscale to produce new and/or improved materials and devices in areas such as computing, medicine, energy, the environment, and manufacturing.

Through our choices as consumers and citizens, we affect the development of nanotechnologies. Government, companies, and individuals can all be involved in guiding the development and regulation of nanotechnologies. We can discuss some of these decisions from different viewpoints.

Materials

See detailed materials lists, sources and set-up in the lesson plans and activity guides that can be downloaded from www.nisenet.org

Wheel of the Future:

- Game wheel
- Sturdy table for the wheel
- Score Board (We've used a dry erase board, including dry erase markers and the eraser)
- Two Easels, one for Score Board and one for visuals
- Note cards with game questions on them
- PowerPoint or Posters with visual aids on them

Exploring Products - Sunblock:

- Sunblock with nanoparticles of zinc oxide
- Zinc oxide ointment
- Black construction paper
- Cotton swabs

Exploring Materials: Graphene

- Flakes of graphite
- Plastic tweezers with a pointed tip
- Scotch tape
- White activity cards (or index cards)
- Soft drawing pencils (6B is best)
- Pencil sharpener
- Battery and bulb circuit (alkaline 9v battery, 9v snap connectors, 5mm LED bulb, 330 Ohm ½ watt 5% tolerance carbon-film resistor, 2 alligator clips)
- Image of graphene sheet
- Photocopy master for activity cards

Exploring Size: Memory Game

- Cards

Exploring Size: Powers of Ten Game

- Cards



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