

Exploring Products—Nano Fabric

MAKE IT PERSONAL

- Invite visitors to **imagine** other places in their lives where nano fabric might be useful (such as a table cloth, on couches, or as carpet).

TELL A STORY

- Tell a **funny story** (real or made up) about a time when nano fabric could have saved you from staining your clothing, carpet, furniture, or similar. Be careful to use inclusive language and not give examples that reinforce stereotypical gender roles (i.e., a wife washing her husband's clothing).

Exploring Materials—Thin Films

ENCOURAGE CREATIVITY

- Participants may choose to **create** a greeting card, bookmark, or similar item out of the black paper. Encourage visitors to draw a design or write a special message and to cut their paper into a shape of their choosing.

Plan ahead: To promote creativity provide larger pieces of black paper. In addition to the activity materials, you'll also need to provide scissors for this extension. We suggest using Bristol paper as the dye in the paper doesn't bleed when it gets wet the way regular black construction paper does.

MAKE IT PERSONAL

- Encourage participants to **brainstorm** places they have seen iridescent colors before. Some examples are soap bubble, an oil slick on water, and even butterfly wings; all of which are examples of thin films.

HIGHLIGHT ALTRUISM

- **Oil spills** are a big problem for ocean life and the health of our planet. You saw how quickly one drop of nail polish could spread and create a nanofilm on the surface of water. How did the size and shape of the droplet change when it came in contact with the water's surface? Can you measure it? Imagine you were tasked with cleaning up

(continued on reverse)

an oil spill in the ocean. How would you use the iridescent properties of the oil film to detect where the affected areas were located? What tool would you invent to carefully remove nanofilms from the water's surface?

MAKE ACTIVITIES OPEN-ENDED WITH NO "RIGHT" ANSWERS

- Let visitors **experiment** with different colors of nail polish to see how the thin film changes.

Plan ahead: You'll have to provide various colors of nail polish for this extension.

Exploring Materials—Stained-Glass Window

ENCOURAGE CREATIVITY

- Encourage participants to **create layers** inside the contact paper using different colors. Have them **observe the difference** in the amount of light that comes through depending on the thickness and color of paper.
- Encourage visitors to **create different shapes and patterns** out of the contact paper to customize their project. They can **plan a design** for their stained glass such as a repetitive pattern, or a picture of a flower, animal, etc. Suggest they create a greeting card or bookmark out of their stained glass.

Plan ahead: Extra contact paper and scissors are necessary for this extension.

MAKE IT PERSONAL

- Tell the participants that researchers at the University of Michigan are putting **solar panels in stained glass windows**. Not only does it enhance the color of the windows, it also gives us another method to harvest clean energy! What would your house or school look like if windows were used like this to generate energy? Imagine if the windows of skyscrapers in big cities could be power plants that generate all the electricity needed for the city.

For more information, visit www.popsci.com/article/science/stained-glass-windows-double-solar-panels and www.nature.com/srep/2014/140228/srep04192/full/srep04192.html

Exploring Materials—Graphene

ENCOURAGE CREATIVITY

- Ask participants what **creative inventions** they could design with flexible circuits. Give examples such as using a flexible circuit on shoelaces that light up as you walk or using flexible circuits to create a foldable newspaper that displays the current news.

TELL A STORY

- Graphene is a material that is flexible, nearly transparent, conductive, and 100 times stronger than steel. **What problem in the world could you solve with graphene?** Tell a story of your solution.

MAKE ACTIVITIES OPEN-ENDED WITH NO “RIGHT” ANSWERS

- Encourage visitors to **keep exploring**. Can you short the circuit? What happens when you use an eraser to remove some of the graphene? Can you make the line connecting the circuit longer, shorter, thicker, or thinner?

Exploring Products—Kinetic Sand

ENCOURAGE CREATIVITY

- GeckSkin™ was inspired by geckos and their amazing ability to stick to walls and ceilings. Ask visitors what their **favorite animal trait** is (a snake shedding its skin, fish living underwater, or spiders spinning webs). Have them explain why they would want this animal “superpower” and what they would do with it. Encourage participants to draw themselves with their animal trait. Are there new technologies you could imagine using this animal trait?

Plan ahead: You’ll need paper and markers for this extension.

MAKE ACTIVITIES OPEN-ENDED WITH NO “RIGHT” ANSWERS

- Have participants **build** a tall tower or other structure with the play sand and the Kinetic Sand. Have them **hypothesize and observe** how the structures will change over the next few minutes. Which sand might create a taller tower?
- Encourage **free play** by asking visitors to test different ways of playing with the sand and seeing how it reacts. Try squeezing it, cutting it sharply, sprinkling it, or touching it softly. How do these ways of interacting with the sand change the effect?

Exploring Properties—Heat Transfer

MAKE ACTIVITIES OPEN-ENDED WITH NO “RIGHT” ANSWERS

- Encourage visitors to try cutting the ice with **other materials**, like a pen or dental floss. Have them test these materials out side-by-side with the graphene to compare how the ice behaves.
- Encourage visitors to try the thermal conductivity **experiment at home**. They can try the same set-up with other materials like a copper pot or Styrofoam to compare the thermal conductivity of these different materials.

Plan ahead: You’ll need extra materials such as pens, dental floss, or rocks for this extension at the museum.

TELL A STORY

- Tell visitors a story (real or made up) when you were **surprised by heat transfer**. Stories could include freezing at a sports game because of the metal bleachers or getting your tongue stuck on a metal pole. Ask visitors when they’ve experienced something similar, prompting them with examples from the “Notes to the Presenter” section of the Exploring Properties—Heat Transfer activity guide.

Exploring Tools—Transmission Electron Microscopes

FEATURE FEMALE ROLE MODELS

- Tell visitors about **Pratibha Gai**, a prominent female scientist using electron microscopy to develop nanomaterials to help aid pollution control, further medicine, and harvest clean energy. If possible, print a photo of Gai to show as you tell visitors about her work. To learn more about Gai and her research, visit www.discov-her.com/en/article/the-microscope-that-takes-science-further

ENGAGE THE SENSES

- **Print out pictures** taken from real transmission electron microscopes so visitors can see what common objects like sand or plants look like up close. Have visitors guess what they are looking at before you tell them what it is.

Plan ahead: You can use the images from the 2012 NanoDays activity “What am I?”. A printable version of the cards for this activity can be found here: www.nisenet.org/catalog/programs/what_am_i_nanodays_2012

MAKE IT SOCIAL

- Find a partner. You both should **create an object out of play dough** without your partner seeing what it is. Now take turns placing each object under the imaging tube and see if you can guess what it is! Rotate the object at different angles so your partner can get the most information. (You may want pencil and paper nearby so your partner can sketch the shapes they see each time.)