Names:

**Size Dependent Properties Activity Packet**

In this activity you will explore how nano particles affect the properties of different items. There are directions and questions for each station included in this packet. Be sure to jot down your observations and answer all questions as you move from each station.

**T-Shirt Station**

**Directions:** You are given 2 shirts. On one, half of the shirt has been treated with a nano protectant spray and the other half has not been treated at all. They are labeled with “nano” and “not nano”. The other shirt has been embedded with nanoparticles.

Play around with the shirts and the liquids provided. Please play over the buckets provided. Make observations.

Try to develop an explanation for your observations.

**Observations:**

**Questions to Consider:**

1. How does this activity relate to size-dependent properties?
2. How does this concept relate to electromagnetic forces?

**References:**

http://www.nisenet.org/catalog/programs/exploring\_products\_-\_nano\_fabrics\_nanodays\_10\_11

<http://silicshirts.com/about-silic-waterproof-shirts/>

<http://www.theguardian.com/science/small-world/2014/feb/14/nanotechnology-clothes-nanoparticles>

<https://www.teachengineering.org/view_lesson.php?url=collection/duk_/lessons/duk_surfacetensionunit_lessons/duk_surfacetensionunit_less4.xml>

**Sand Station**

**Directions:**

Make observations about how the regular sand and magic sand interact with water and oil provided.

Develop an explanation for your observations.

**Observations:**

**Questions to Consider:**

1. How do you think the magic sand would help to clean up oil spills?
2. How does this activity show size-dependent properties?
3. What does this activity have to do with the concept of electromagnetic forces that we learned about yesterday?

**References:**

http://www.nisenet.org/catalog/programs/magic\_sand\_nanosurfaces

http://ice.chem.wisc.edu/Oil/On\_The\_Surface,\_Its\_All\_About\_Nano/Magic\_Sand.html

<http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0103-97332005000400018> (picture)

**Crystal Sheets Station**

**Directions:**

Use your hand and the heating pad to make observations about the differences between the 3 sheets.

*What observations did you make?*

*Develop an explanation to explain these observations.*

**Observations:**

**Questions to Consider:**

1. How does this activity show size-dependent properties?

**References:**

<http://www.nisenet.org/sites/default/files/catalog/uploads/1989/materialslc_sign_15nov10.pdf>

<http://nanoyou.eu/en/component/content/article/87-hands-on-activities/500-experiment-with-liquid-crystals.html?directory=4&Itemid=4> (background information, student synthesis procedure and video)

**Sunscreen Station**

**Directions:**

Use the pieces of black construction paper and Q-tips to observe how the 2 different sunblocks absorb.

(You can rub a small amount on your arm as well.)

**Observations:**

**Questions to Consider:**

1. How does this activity show size-dependent properties?
2. How does this activity connect to the other concepts we have learned in the workshop?

**References:**

http://www.nisenet.org/catalog/programs/invisible\_sunblock

<http://www.badgerbalm.com/s-33-zinc-oxide-sunscreen-nanoparticles.aspx>

Stevens, S. Y., Sutherland, L. M., & Krajcik, J. S. (2009). *The big ideas of nanoscience and engineering: A guidebook for secondary teachers*. Arlington, VA: National Science Teachers Association Press. (pg.41)