

Nano Interactions

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Date Created: April, 2014

Subject: Chemistry

Grade Level: Grades 6-9

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

MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-4 Develop a model to generate data for iterative testing and modification of a proposed object, tool, or process such that an optimal design can be achieved.

Schedule: 3 or 4-40 minutes lessons

CCMR Lending Library Follow Up Activities:
 Atomic Bonding



<p><u>Objectives:</u></p> <p>This unit will introduce students to nanoscale and show how manipulating tiny particles allow us to mix substances together and also hide them.</p>	<p><u>Vocabulary:</u></p> <table style="width: 100%; border: none;"> <tr> <td>Solution</td> <td>Filter</td> </tr> <tr> <td>Suspension</td> <td>Purification</td> </tr> <tr> <td>Colloid</td> <td>Zeolite</td> </tr> <tr> <td>Hardness</td> <td>Ion</td> </tr> </table>	Solution	Filter	Suspension	Purification	Colloid	Zeolite	Hardness	Ion
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Suspension	Purification								
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<p><u>Students Will:</u></p> <ul style="list-style-type: none"> * Understand the scale of a nano and how properties and behavior of materials can change. * Observe how we can manipulate molecules to mix them into or remove from substances. * Understand the scale of a nano. 	<p><u>Materials:</u></p> <table style="width: 100%; border: none;"> <tr> <td style="vertical-align: top;"> <p>For Class:</p> <ul style="list-style-type: none"> -3 Glass containers w/diff. sizes of iron -Magnet -Stained glass samples (pink, red, purple) - Flashlight -Tempered steel -Wood w/NeverWet spray -Eyedropper -Water samples -Dish soap </td> <td style="vertical-align: top; padding-left: 20px;"> <p>For Each Student:</p> <ul style="list-style-type: none"> -Nano Activity Sheet -Mixtures Reading -Water Hardness Lab -Hardness Reading <p>For Teacher:</p> <ul style="list-style-type: none"> - Nano Activies Explained Sheet - Google Presentation </td> </tr> </table> <p>For Each Group (3-5 students)</p> <ul style="list-style-type: none"> -Test tubes w/cap -Measuring cylinder -Eyedropper -Plastic cup - Funnel -Filter Paper -Carbon powder -Ion exchange resin <p>Provided by Teacher:</p> <ul style="list-style-type: none"> -Ruler -Test tube racks -Beakers 	<p>For Class:</p> <ul style="list-style-type: none"> -3 Glass containers w/diff. sizes of iron -Magnet -Stained glass samples (pink, red, purple) - Flashlight -Tempered steel -Wood w/NeverWet spray -Eyedropper -Water samples -Dish soap 	<p>For Each Student:</p> <ul style="list-style-type: none"> -Nano Activity Sheet -Mixtures Reading -Water Hardness Lab -Hardness Reading <p>For Teacher:</p> <ul style="list-style-type: none"> - Nano Activies Explained Sheet - Google Presentation 						
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<p>Safety</p>	<p>Do not let students open up containers with iron and ferrofluid.</p>								



Science Content for the Teacher:

Refer to reading handouts for students and websites listed in “other resources.”

A presentation has been prepared for teachers to use with the activities. You can access this at:

https://docs.google.com/presentation/d/1coADgTUHjBcQmAaZHRjoMXy9D_V7J92ixF_MV-SjX-j4/edit#slide=id.g371eee12a_04

Preparation:

Print off Activity Sheets for class

Wood has been sprayed. Check to make sure which side is sprayed

Set up stations (have one or two of each activity, depending on class size)

Set up Hardness lab materials for groups.

Classroom Procedure:

Explore:

Hand out Nano Activity sheet and assign groups to one of the activities. Give them 5-10 minutes to observe and write down what they notice. Have them rotate to the next activity and do the same. Once they have done all of the activities, give them some time as a group to come up with definitions and inferences. Discuss with the class their observations with the following guided questions. This is a great opportunity to help student push beyond initial observations (e.g. the wood is water-resistant/water-proofed) to infer fundamental phenomena that produce the behavior (e.g. hydrophobic vs. hydrophilic). Additionally, help student proposed experiments and evaluate how they would help them to verify their inferences.

Activity 1	How are the iron solutions different? What do you think is causing the difference? (Possible answers: size, weight, use of additive, etc.) What experiment(s) would help use verify our inference? (Answers: testing the behavior of known size of iron fillings, weight the amount of iron)
Activity 2	How are the pieces of glass different? Why do you think is causing the difference? (Answer: different types of glasses, additives/dyes). What experiment (s) would help us verify our inferences? (Answers: using the same kind of glass (which we are), research the effect of different additives on glass color)



Activity 3	How are the pieces of metal different? What do you think is causing the difference? (Possible answers: reaction within the metal, different thickness of metal, etc.) What experiment(s) would help us verify our inferences? (Answers: use different temperature to try to slow down/speed up the reaction, heat for different lengths of time, heat the same piece of steel for specific amount of time at a specific temperature)
Activity 4	How are the pieces of wood different? What do you think is causing the difference? (Possible answers: water proofing treatment, etc.) What experiment(s) would help us verify our inferences? (Answers: try to get the same behavior with commercial water proof techniques, etc.)

Engage:

Hand out the Mixtures Reading and have the class read and answer the questions (you can do this in class or assign it for homework).

Review homework questions with the students. Emphasize the first demo and what it showed. The smaller sized particles (nanoparticles in the ferrofluid) stay suspended in solution and are easier to grab.

Hand out Water Hardness Lab and have students perform the test for hardness on the samples. They will record their data and choose the sample with the most hardness. Hand out the Water Hardness Reading and have them students answer the questions. (in class or for homework).

Review the homework questions with the class and go over how to make water soft. Have the students do the second part of the lab. They will take their hard water and use the different filtering techniques to find out which is best at removing ions.

Explain:

Have groups present their evidence for which filtration technique worked best. Review how some of them worked (ion exchange).

Other Resources:

Nanozone (website for kids): http://nanozone.org/	Nanoscience Institute for Medical and Engineering Technology http://nimet.ufl.edu/nanoscale.asp
Nuffield Foundation http://www.nuffieldfoundation.org/teachers	National Nanotechnology Initiative http://www.nano.gov/
Video on Nanoscale:	



https://www.youtube.com/watch?v=eCpkq_AeX50	
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Assessment:

The following rubric can be used to assess students during each part of the activity. The term “expectations” here refers to the content, process and attitudinal goals for this activity. Evidence for understanding may be in the form of oral as well as written communication, both with the teacher as well as observed communication with other students. Specifics are listed in the table below.

- 1= exceeds expectations
- 2= meets expectations consistently
- 3= meets expectations occasionally
- 4= not meeting expectations

	Engage	Explore	Explain
1	Shows leadership in the discussions and activities. Displays a good understanding of Mixtures and Water Hardness.	Completes work accurately while providing an explanation for what is observed. Works very well with partners.	Provides an in-depth explanation of findings. Makes excellent and thoughtful comparisons to everyday life. Completes activity sheet and lab clearly.
2	Participates in the discussions and activities. shows an understanding of Mixtures and Water Hardness.	Completes work accurately and works cooperatively with partners.	Provides clear explanation of findings. Notes good correlations to everyday life. Completes activity sheet and lab clearly.
3	Contributes to the discussions and activities, but shows little understanding of Mixtures and Water Hardness.	Works cooperatively with partners, but makes some mistakes with the procedure.	Provides a limited explanation of findings. Struggles to make comparisons to everyday life. Completes some of the activity sheet and lab.

