 **NSF Sustainable Energy Grant RET Lesson** 

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| **Lesson Title:** How Crystals are Formed | **Grade Level/Subject:**  1st-5th Grade Science |
| **Maximum # of Students:** Students in Class | **Total Time Required:** 15 minutes/day for 5-10 days |
| **Prior Knowledge Needed:** Understanding of different types of rock. Understanding different rocks are made in different ways |

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| **Materials and Preparation:**

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| * Heat proof gloves
* Salt
* Distilled water
* Induction Heater
* Induction Pot
* Microscope with photo capability
* Slides
 | * Propellers
* Tubing
* Solar panels (2V 400mA)
* Multi-meters
* Assorted LEDs
* Solar motors
* Pairs of clamp wires
* Wire strippers
* Protractors
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| **Performance Objectives/Learning Targets:*** Students will learn rocks can be made of different structures
* Students will learn how salt crystals form
* Students will understand we can use heat and water to change the properties of a substance
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| **Standards:** |
| **Lesson Procedure** |
| **Before:** | * Lecture on crystal formation and rock types
* Set up all materials somewhere all students can see the process
* Describe the process that will be undertaken to the students
* Set aside an area to monitor crystal growth progress
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| **During:** | **Ask students what they think will happen to the salt when it is mixed into the water****Ask students what will happen when you boil away the water****Have students observe the salt crystal slides on their own****Have students check salt crystal growth daily****Procedure:****Steps to be taken as a demonstration for class. Younger students should not be allowed near burners**1. **Preparing the Solution:**
	* Put on heatproof gloves to protect your hands.
	* In a small pot, mix a concentrated solution of salt and distilled water. Stir until the salt is completely dissolved. The more salt you add, the more saturated the solution will be, resulting in larger crystals.
	* Note: Ensure that the pot is clean and free from any contaminants that could affect crystal growth.
2. **Heating the Solution:**
	* Place the pot containing the salt solution on the induction heater or alternative heat source.
	* Gradually heat the solution, stirring gently if needed, until it reaches a near-boiling point. Be cautious while handling hot objects and the heat source.
3. **Creating Seed Crystals:**
	* Once the solution is heated, remove it from the heat source and allow it to cool slightly.
	* Use a clean slide to dip into the solution and retrieve a small amount of liquid.
	* Place the slide in a clean area to allow the liquid to evaporate. As the water evaporates, salt crystals will form on the slide. These will act as "seed crystals" for further crystal growth.
4. **Growing Salt Crystals:**
	* Carefully pour the remaining salt solution into clean glass beakers.
	* Place the beakers in a location where they won't be disturbed.
	* Allow the beakers to sit undisturbed for several days to a week, depending on the desired size of the crystals. During this time, the water will continue to evaporate, leaving behind salt crystals.
5. **Observation and Documentation:**
	* After the allotted time, use the microscope with photo capability to examine the salt crystals.
	* Carefully transfer some of the crystals onto a clean slide for closer observation.
	* Take photos of the salt crystals at different magnifications, capturing their shapes, sizes, and any unique features.
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| **After:** | * Have students work through the salt crystal growth activity reflection
* Ask the same questions to the class as an open discussion
* Allow students to share their salt crystal pictures
* Encourage students to compare and contrast their salt crystals
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| **5E Model:** *Engage, Explore, Explain, Evaluate, Elaborate*Engage: Inquiries: How are crystals made? What are crystalsExplore: Probing questions about crystal expectationsExplain: Pre-activity lectureEvaluate: Sharing pictures of salt crystals. Completion of reflection sheetElaborate: Helping students grow salt crystals. Class discussion afterward |

*Worksheet attached below*

**Title: Salt Crystal Growth Activity Reflection**

**Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Date: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Instructions: Please answer the following questions based on your observations and experiences during the salt crystal growth activity.**

1. **Describe what you observed during the salt crystal growth activity. What did the salt solution look like before you started the activity?**
2. **What changes did you notice in the salt solution as it was heated and allowed to cool?**
3. **How did the salt crystals form in the pot? What did they look like?**
4. **Did you observe any differences in the size, shape, or color of the salt crystals? If so, describe them.**
5. **What do you think caused the salt crystals to form in the beaker?**
6. **How would you describe the texture of the salt crystals? Were they smooth, rough, shiny, etc.?**
7. **Did you notice any patterns or similarities among the salt crystals? If yes, describe them.**
8. **How do you think the salt crystal growth activity relates to what you have learned about materials and their properties in science class?**
9. **What was the most interesting or surprising thing you learned during the salt crystal growth activity?**
10. **If you could change one thing about the activity, what would it be and why?**