

Lesson Plan

Description
 In this lesson, students will code an interactive animation using Scratch that shows how water molecules behave in each of the three states of matter: solid, liquid, and gas.

<p>Learning Outcomes Students will be able to:</p> <ul style="list-style-type: none"> • Describe how molecules behave in each of the three states of matter (solid, liquid, and gas) • Describe the effect temperature has on the state of matter for water. • Use if statements in their code to check if certain conditions have been met. • Use less than, greater to, and equal to operators to test the value of variables. • Code Scratch sprites to move around the screen in specific ways (e.g., fast vs. slow) • Use loops in their code. 	<p>Specific Expectations</p> <p>Science</p> <p>A2.1 write and execute code in investigations and when modelling concepts, with a focus on using different methods to store and process data for a variety of purposes.</p> <p>C2.2 identify the states of matter, and describe characteristics and properties of solids, liquids, and gases.</p> <p>C2.4 describe physical changes in matter as changes of the state, volume, or form of the matter that do not result in the formation of a different substance.</p> <p>C2.6 explain how changes of state can occur when matter absorbs or releases thermal energy.</p> <p>Math</p> <p>C3.1 solve problems and create computational representations of mathematical situations by writing and executing code, including code that involves conditional statements and other control structures</p>
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Introduction
 Prior Knowledge: Students having some experience with Scratch coding prior to this lesson is recommended. Students should also have some familiarity with the states of matter (solid, liquid, and gas).

After using the provided slides to go through a quick review of the states of matter and their properties, students will then "zoom in" and examine what is happening at the molecular level when matter is in different states.

Inform the students that their task today is to make a simulation like the one in the video on slide 6, but it will be interactive. This interactive simulation will be made using Scratch. Have students open the template on the Scratch website or use the Scratch Offline.

Action

The bulk of this lesson is divided into two parts as outlined below. These can be done all in one go or completed over a couple of class periods.

Part 1: Conditional Statements

The first thing that we will work on is determining whether our water molecule should be acting like a solid, liquid, or gas based on the temperature reading. This will be done using conditional statements. Use the slides provided to give an overview of how conditional statements work, and then work through state by state what the conditional statement should look like. The slides are set up in a way where students are first given a prompt with all the necessary code blocks on the screen, but the code blocks are scrambled. Give students time on this slide to experiment with their code before showing the solution and moving on to the next state of matter. Once they have created a conditional statement for each state of matter, have them test, debug (if necessary), and then save their code.

Part 2: Molecule Movement

Now that we know when each molecule should act as a solid, liquid, or gas, we must make them move like it! Working through the slides the same way as in Part 1, be sure to give students time to experiment with their code when prompted before showing the solution and moving on. Once they have programmed the sprites to move accordingly for each state of matter, have the students test, debug (if necessary), and then save their code.

Consolidation/Extension

Have a Student Showcase! Let students take turns playing with a partner's simulation and test it for bugs and provide feedback.

A suggested extension activity is to have students customize the look of the simulator. Add a background, sound effects, change the look of the sprites, whatever they think will take their project to the next level.

<p>Accommodations/Modifications The starter can be modified before being provided to students to provide scaffolding, depending on student needs.</p>	<p>Assessment Look at the students' code to determine whether they understand conditional statements and can create programs illustrating their use.</p>
<p>Additional Resources Scratch: https://scratch.mit.edu/ Scratch Offline Editor: https://scratch.mit.edu/download Water Molecule Simulation – Starter: https://scratch.mit.edu/projects/888301602/ Water Molecule Simulation – Solution: https://scratch.mit.edu/projects/888308269/</p>	