Mystery science

# Anchor Layer Teacher Guide

A curriculum companion for Anchor Layer users

## Grade 2

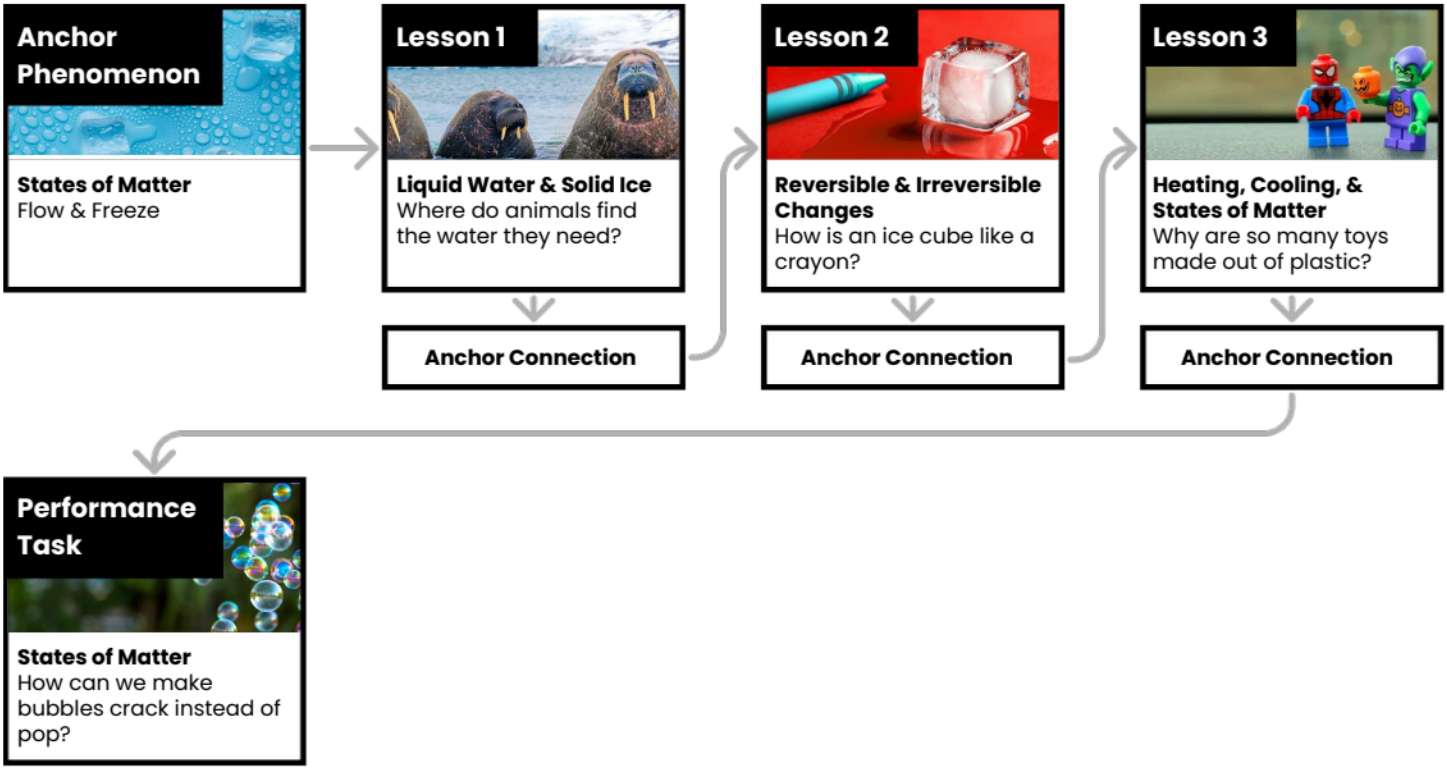
# States of Matter

Unit Web Link • Pacing Guide • Other Units

## Unit Summary

In this unit, students explore solid and liquid states of matter! They explore how water is found around the world and can be frozen solid into ice. Students also investigate other materials besides water and observe their properties to construct an explanation that some changes are reversible, while others are not.

| Performance Expectations | Science & Engineering Practices | Disciplinary Core Ideas | Crosscutting Concepts |
|---|---|---|---|
| • 2-ESS2-3. Obtain information to identify where water is found on Earth and that it can be solid or liquid.<br>• 2-PS1-2. Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose.<br>• 2-PS1-4. Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot. | • Obtaining, Evaluating, and Communicating Information<br>• Analyzing and Interpreting Data<br>• Engaging in Argument from Evidence | • PS1.A: Structure and Properties of Matter<br>• PS1.B: Chemical Reactions<br>• ESS2.C: The Roles of Water in Earth's Surface Processes | • Patterns<br>• Cause and Effect |



## Anchor Phenomenon Background

What do the three phenomena have in common?

Solids and liquids are all around us, whether we're walking through a forest, playing on a playground, or even just having lunch. Solids are things that keep their shape, like rocks, trees, and crackers. Liquids are things that flow and take the shape of their container, like water or milk. Students have opportunities to observe states of matter every day, often without realizing it.

In the natural world, solids are easy to observe. Trees stand tall with strong trunks and branches. Animals are made up of solid parts like bones or shells. Cars, buildings, and bookcases are all made of solids. These solid objects help form the structure of our environment. They don't easily change shape on their own, which makes them reliable and easy for students to observe and describe.

Liquids in nature are just as fascinating. Rain, rivers, puddles, and ocean waves are all examples of liquids.

Students can see liquids in action when they watch how a stream moves around a rock or how juice spreads out when spilled on a table. These observations help students understand how liquids behave differently from solids.

Many substances can exist as either a solid or a liquid. For example, rock is almost always solid, and yet rock can be observed as a molten liquid inside and around volcanoes. Water is a special substance in that it is one of the few that students can observe in their daily lives as either a solid or a liquid. The Anchor Layer for this unit is centered around a group of phenomena that give students a chance to observe materials in their solid and liquid states.

By understanding the properties of solids and liquids, and how those properties can change in reversible and irreversible ways, students develop a foundation of understanding that prepares them for later studies in chemistry.

## Anchor Phenomenon: Flow & Freeze
States of Matter

**Anchor Phenomenon**
5 mins

**Guided Inquiry**
20 mins

### Anchor Phenomenon Lesson Overview

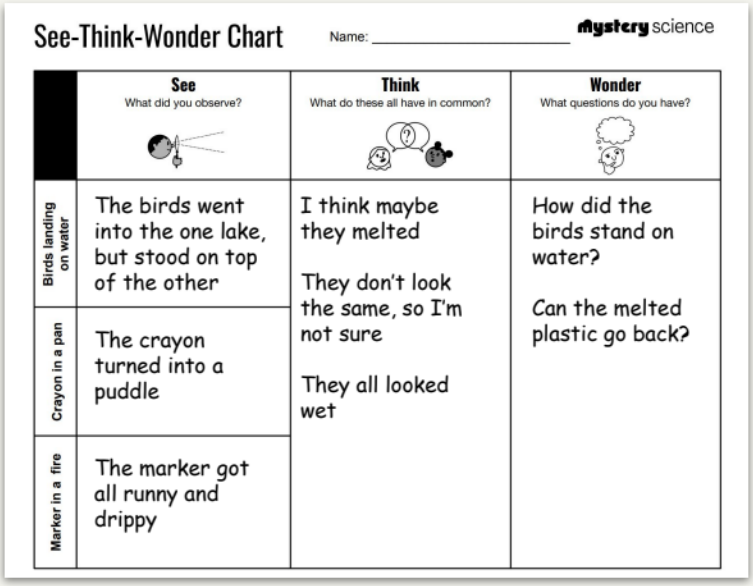
Note: This lesson is part of this unit's Anchor Layer. If you have the Anchor Layer turned on, we recommend teaching all lessons in the remainder of this unit in order.

The anchor phenomena for this unit are a collection of strange situations that seem completely unrelated. But what do they all have in common?

During the introduction, students generate observations and questions about the phenomena and create an initial explanation of how they are related.

### Student Work Samples & Notes

Students will gather clues during and after each lesson in this unit to help them improve their explanations. It is important to encourage students to recognize that even if they don't know the perfect answer yet, they are going to learn a lot throughout the unit and will have an opportunity to change or add to their first explanation.



See-Think-Wonder Chart

Name: _____

| | See<br>What did you observe? | Think<br>What do these all have in common? | Wonder<br>What questions do you have? |
|---|---|---|---|
| Birds landing on water | The birds went into the one lake, but stood on top of the other | I think maybe they melted<br><br>They don't look the same, so I'm not sure<br><br>They all looked wet | How did the birds stand on water?<br><br>Can the melted plastic go back? |
| Crayon in a pan | The crayon turned into a puddle | | |
| Marker in a fire | The marker got all runny and drippy | | |

## Lesson 1: Where do animals find the water they need?
Liquid Water & Solid Ice

**Exploration**
12 mins

**Hands-On Activity**
35 mins

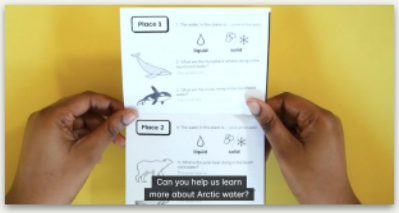
**Wrap-Up**
8 mins

**Anchor Connection**
5 mins

**Assessment**
20 mins

### Overview
In this lesson, students observe that different bodies of water can be found around the Earth, and that water can be liquid or solid.

In the activity, Arctic Adventure, students explore the Arctic and gather observations of how Arctic animals interact with water in many different ways.




**Activity Notes**
We suggest students work in pairs. Homeschool students can work on their own.

### Anchor Connection
Many substances can exist in either a liquid or a solid state, but water is one of the only substances that students can regularly observe in both of those states.

The fact that water exists in both a liquid and a solid state has a huge impact on life all around the globe. In the anchor phenomenon, students see an example of how birds respond to a lake that is or isn't frozen.

The fact that students have the opportunity to directly observe solid and liquid water in their daily lives provides a foundation for further studies. Specifically, it helps students to make sense of how other substances, such as plastics or various food items, will behave when they change states.

### Connecting Storyline Question
What other substances can change between liquid and solid?

## Lesson 2: How is an ice cube like a crayon? (pg 1 of 2)
Reversible & Irreversible Change

**Exploration**
15 mins

**Hands-On Activity**
30 mins

**Wrap-Up**
10 mins

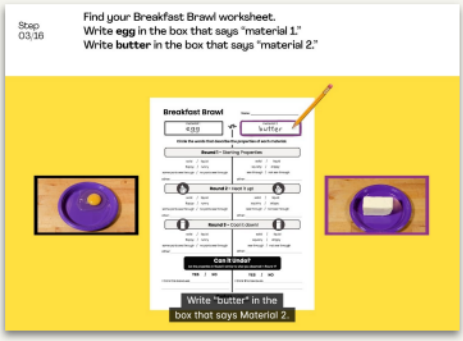
**Anchor Connection**
5 mins

**Assessment**
20 mins

### Overview

In this lesson, students explore the incredible ability of water to reverse back and forth between solid and liquid states depending on temperature.

In the activity, Ultimate Undo Showdown, students make observations of other materials and their properties after being heated up and then cooled down. They use these observations as evidence that some changes are reversible and some are not.




### Activity Notes

We suggest students work in pairs. Homeschool students can work on their own.

### Extend this Activity & Observe More Materials

In the extensions, we have a bonus matchup of the Ultimate Undo Showdown! You can find further instructions in the Extend This Lesson box found on this lesson page.

***Anchor Connection on Next Page***

## Lesson 2: How is an ice cube like a crayon? (pg 2 of 2)
Reversible & Irreversible Change

**Exploration**
16 mins

**Hands-On Activity**
30 mins

**Wrap-Up**
4 mins

**Anchor Connection**
5 mins

**Assessment**
20 mins

### Anchor Connection

Many substances change state when they are heated or cooled. In most cases, substances melt when they are heated adequately, and they solidify when cooled.

Water is an example of a substance that can change back and forth repeatedly between the liquid and solid states. In other words, these changes are reversible. Other substances, however, might only be able to change state a single time, and then be unable to reverse to the previous state. Changes of this nature are called irreversible.

### Connecting Storyline Question

When plastic melts, is it reversible or irreversible?

## Lesson 3: Why are so many toys made out of plastic?
Heating, Cooling, & States of Matter (pg 1 of 2)

**Exploration**
20 mins

**Hands-On Activity**
35 mins

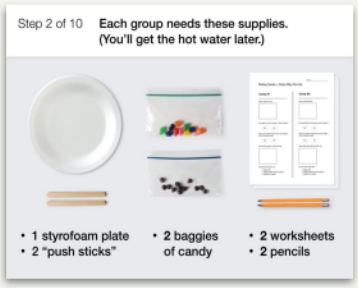
**Anchor Connection**
20 mins

**Assessment**
20 mins

### Overview

In this lesson, students learn about melting and the solid and liquid states of matter, and then discover why plastic was invented.

In the activity, Candy Melt, students conduct an investigation to determine which types of candy melt in hot water. Using their observations, they decide which candy is the best choice to bring to a hot summer camp.



### Activity Notes

We suggest students work in pairs for this activity.

You will need a source of hot water for this activity and a way to keep the containers of hot water warm. You can either use a cooler or create your own insulator using a cardboard box and bath towels.

You need to fill the Ziploc bags with candy and prepare the hot water bottles and results charts before class. This will take about 20 minutes. For more lesson prep details, see this lesson page.

***Anchor Connection on Next Page***

## Lesson 3: Why are so many toys made out of plastic?
Heating, Cooling, & States of Matter (pg 2 of 2)

**Exploration**
20 mins

**Hands-On Activity**
35 mins

**Anchor Connection**
20 mins

**Assessment**
20 mins

### Anchor Connection

Many plastics are materials that can melt and then resolidify into new shapes. This is very helpful for making many types of toys.

There are also many types of foods that can melt and solidify, which is helpful in making candies in a variety of fun shapes.

When a substance is able to melt into a liquid and resolidify into the solid state, that type of change is called reversible. Humans take advantage of reversible changes in a huge range of ways.

### Connecting Storyline Question

What do the three things we saw at the beginning of the unit all have in common?

## Performance Task: How can we make bubbles crack instead of pop?

State of Matter

**Unit Review**
10 mins

**Hands-On Activity**
20 mins

### Overview

In this performance task, students investigate what happens to bubbles that change from the liquid to solid state.

### Performance Task Notes

After a brief review of the unit, students make observations of bubbles and explain how to cause reversible changes to them.

### Crosscutting Concepts

*Cause and Effect*: DIfferent materials can change between the liquid and solid states when they are heated or cooled. The change in temperature is the cause that leads to the effect of a change of state. Some materials, such as water, can change back and forth reversibly. Other materials, such as eggs, change irreversibly.