

**Lesson Topic:** Solids**Objective:**

Students will be able to:

1. Identify solids.
2. Identify and describe the properties of solids.
3. Observe and discuss crystalline structure.

**Time Required:** 90 minutes**Materials Needed:**

- Teacher computer with internet access
- Projector/Smartboard
- 1 computer/laptop/iPad per student with internet access
- Solids handout (attached)
- Statement Sheets (attached)
- Signs to label either side of the room (attached)
- For teacher reference: Crystals Video: [How to Grow Crystals Overnight](#)
- 1 cup of Epsom salt (one for prep the night before, and one for in-class demonstration)
- 1 cup of Hot water (one for prep the night before, and one for in-class demonstration)
- Stirring spoon (one for prep the night before, and one for in-class demonstration)
- Jar (one for prep the night before, and one for in-class demonstration)
- Food coloring (one for prep the night before, and one for in-class demonstration)
- Access to a refrigerator

**Teacher Preparation:**

- Assign a Legends of Learning Instructional [Quick Play](#) playlist for the day(s) you will be teaching the lesson.
  - Instructional - Middle School - Solids
- Assign a Legends of Learning Content Review [Quick Play](#) playlist for the day(s) you will be teaching the lesson.
  - Content Review - Middle School - Solids
- Make copies of Solids Worksheet (1 per student)
- Suggestion: Complete the beginning of the lesson outside.
- Prep the Crystals Activity by completing all the steps and keeping it in the refrigerator overnight (Follow the steps in this video): [How to Grow Crystals Overnight](#)
  - 1 cup of Epsom salts
  - 1 cup of Hot water
  - Stirring spoon
  - Jar
  - Food coloring
  - Access to a refrigerator
- Cut out Statement sheets (attached)

**Engage (15 minutes):**

1. Pass out the Solids handout.

2. Take students outside or have them walk around the classroom and have them write down examples of “solids” on Part 1 of the handout.
  - a. Tell students “as you walk around, write down any examples that you believe to be examples of ‘solids.’”
3. After students have had enough time to compile a decent sized list, take them back into the classroom/or have them take a seat.
4. Make a T chart on the board: On one side of the chart, write down a list of student examples on the board.
5. Ask students “Looking at the examples you wrote down, what made you believe these objects are solids?”
6. On the other side of the T chart, write down “Why do you think it’s a solid?” and make a list of all the reasons students came up with.
7. Tell students “Today we will be exploring what makes an item a “solid” and we will refer back to this list to see if we need to make any adjustments after our explorations.”

**Explore (20 minutes):**

1. Have your students [sign in to Legends of Learning](#). Instruct students to complete the Instructional playlist.
2. Assist students as needed during game play, pause playlist if you need to address content or questions to the entire class.

**Explain (30 minutes):**

1. Tell students “Let’s talk about solids. Be sure you have your handout in front of you to add to your notes.”
2. Write the qualities of solids on the board:
  - a. “**Solids maintain their shape and volume.** If you think about any of the solids listed here on the board. None of them are going to randomly drip onto the floor like a liquid, or float into the air like a gas. They keep their shape and volume.”
  - b. “How are the particles of a solid spaced?” (**very close together**)
  - c. “Solids have a **very low kinetic energy**. This means they do not move around very much.”
  - d. “They are **quite rigid, held tightly together.**”
  - e. “They do have motion. How do solids move?” (**vibrate in a fixed position**)
    - i. “Everybody pretend you are a molecule of a solid.” (All students should move very slightly but quickly).
3. Tell students, “Now that we know more about solids, let’s look at the list we created at the beginning of class. Are there any on the list that are not actually solids that we should remove? If so, why is it not a solid?” (answers will vary based on the list that students produced at the beginning of class)
4. Explain to students, “There are two different types of solids: Crystalline and Amorphous
  - a. Crystalline - atoms and molecules are in a regular, specific, repeating pattern = crystals.
  - b. Amorphous - atoms and molecules are not in a regular, orderly pattern
    - i. Glass, rubber”

5. Label either side of the room as Crystalline or Amorphous.
6. Give each student a true statement about one of the types of solids. You will need to repeat statements for larger classes.
7. Tell students to go to the appropriate side of the room that their statement is talking about.
8. Have each student read their statement aloud (if any are incorrect allow them to move the correct side of the room).
9. Collect the statement sheets.

**Elaborate (15 minutes):**

1. Tell students “Now for a demonstration in solids.”
2. Pour 1 cup of Epsom salts into an empty jar.
3. Then, pour in 1 cup of hot water.
4. Stir for at least 1 minute.
5. Add the food coloring and stir that as well.
6. Then, tell the students that you would put this solution into the refrigerator overnight.
7. Ask students “What do you think is going to happen to the solution?”
  - a. Allow students to share out.
8. Pull out your already prepared crystal jar and explain to students you already completed the same steps with this jar but let it sit overnight.
9. Let the students come up and observe, or walk around with it for students to see.
10. Ask students “What happened to the solution?” (when it was cooled, it revealed its crystal structure).
  - a. Why did this occur? (When the epsom salts cooled, they became a solid. Salt is a crystalline solid.)

**Evaluate (10 minutes):**

1. Have your students [sign in to Legends of Learning](#). Instruct students to complete the Content Review playlist.
2. [Analyze student results](#) to determine what concepts need to be a focus for reteaching.

**Additional Lesson Strategies:**

- To use Legends for additional instruction, create a [custom playlist](#) with an [instructional game](#) and pre and post [assessment](#).
- To use Legends for a quick formative assessment, create a 5-question [assessment](#) in a [playlist](#).
- To use Legends for a student-directed experience, create a [targeted freeplay](#) playlist.
- Encourage students to play on their own at home in [Legends of Learning: Awakening](#) for a student-driven experience including avatars, battling, and quests all centered around topics they are covering in class.



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

## Solids

### Part 1:

Write down a list of items that you believe to be a solid.

### Part 2:

1. What are some characteristics of all solids?

2. What are the two different types of solids?



**Cut out these statements prior to class for Crystalline and Amorphous.**

## **CRYSTALLINE**

Atoms and molecules are in a regular pattern

Have a definite geometrical shape.

Have a sharp melting point.

When broken, smooth plain surfaces are made.

Examples of this solid are: salt, diamonds, and snowflakes.

## **AMORPHOUS**

Atoms and molecules are in an irregular pattern.

Have an irregular shape.

They melt over a wide range of temperatures.

When broken, the pieces have a random arrangement.

Examples of this solid are: glass and rubber

# CRYSTALLINE

# AMORPHOUS