SciQuest 200: Addy's Adventure

Sample Packet

The following sample packet includes excerpts of the *SciQuest 200: Addy's Adventure* materials. You will see:

- ✓ The Novel (*beginning on p. 6*)
- ✓ The Instructor's Guide (*beginning on p. 11*)
- ✓ The Lab Journal (*beginning on p. 30*)

You can get more information and purchase this story-based program here:

https://elementalscience.com/collections/sciquest-200-addys-adventure

Teacher Notes At-A-Glance

The teacher guide is your go-to resource for guiding your students through science!

1. Two Scheduling Options

Provide guidance to the students with these two grid-style scheduling options. There are two-day-a-week and five-day-a-week schedules. These schedules break down the essential work and the optional activities into manageable chunks so that you can help them proceed with confidence.

2. Notes

Get key information and further explanations of the topics when necessary after the schedules. These notes will assist you as you teach science to your students and are described below.

READ SCIENCE

3. Reading Assignments

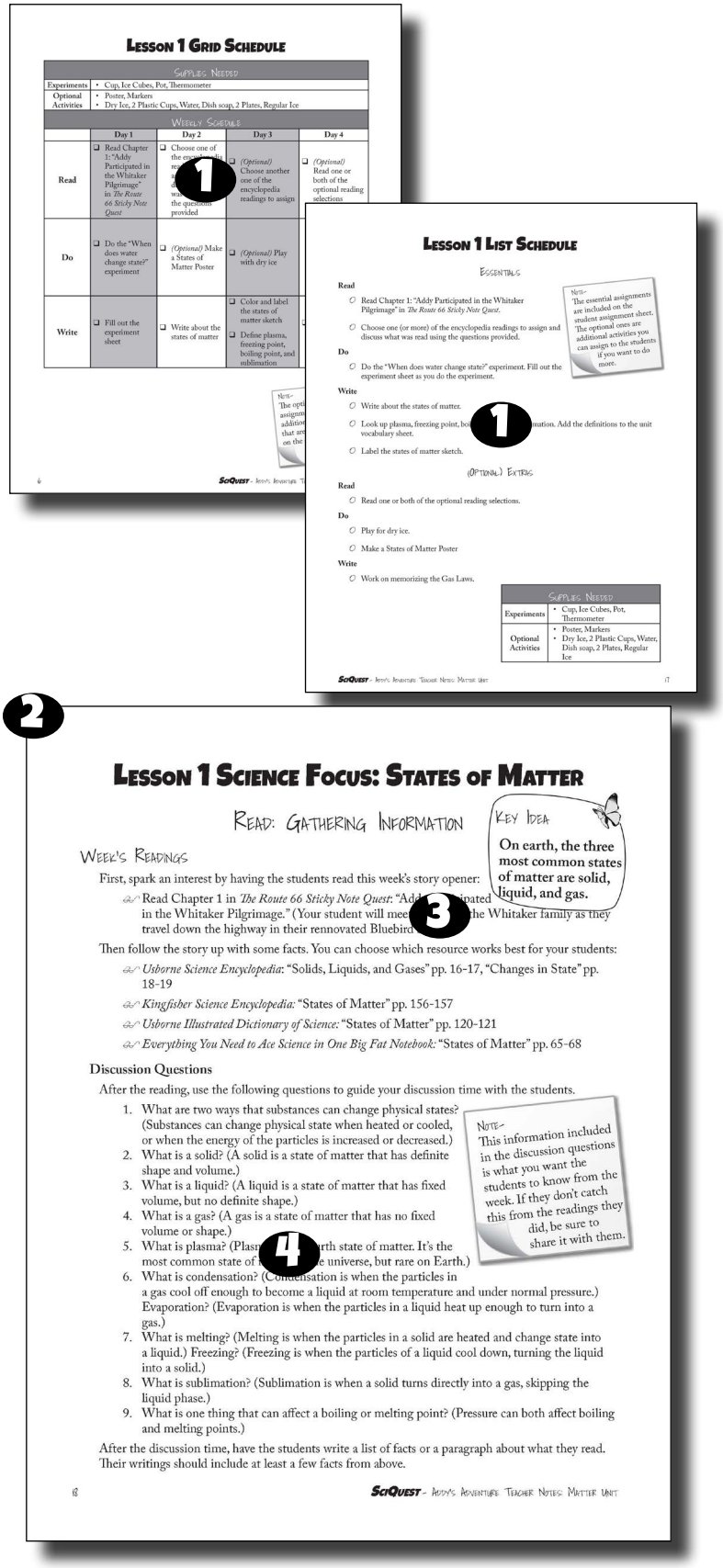
See the week's reading assignments. First, you will find the chapter from the springboard novel. After that, you will find the encyclopedia pages, which contain the core of the information for the week.

4. Discussion Questions with Answers

Get discussion questions with the answers so you have the tools necessary to lead an effective discussion time without having to read the selection.

5. Optional Readings

Find optional books you can check out from your local library.



Lesson 1 Grid Schedule

Supplies Needed	
Experiments	• Cup, Ice Cubes, Pot, Thermometer
Optional Activities	• Poster, Markers • Dry Ice, 2 Plastic Cups, Water, Dish soap, 2 Plates, Regular Ice

Weekly Schedule

	Day 1	Day 2	Day 3	Day 4
Read	❑ Read Chapter 1: "Addy Participated in the Whitaker Pilgrimage" in *The Route 66 Sticky Note Quest*	❑ Choose one of the encyclopedia … the questions provided	❑ *(Optional)* Choose another one of the encyclopedia readings to assign	❑ *(Optional)* Read one or both of the optional reading selections
Do	❑ Do the "When does water change state?" experiment	❑ *(Optional)* Make a States of Matter Poster	❑ *(Optional)* Play with dry ice	
Write	❑ Fill out the experiment sheet	❑ Write about the states of matter	❑ Color and label the states of matter sketch ❑ Define plasma, freezing point, boiling point, and sublimation	

1

Lesson 1 List Schedule

Essentials

Read

- ○ Read Chapter 1: "Addy Participated in the Whitaker Pilgrimage" in *The Route 66 Sticky Note Quest*.
- ○ Choose one (or more) of the encyclopedia readings to assign and discuss what was read using the questions provided.

Note- The essential assignments are included on the student assignment sheet. The optional ones are additional activities you can assign to the students if you want to do more.

Do

- ○ Do the "When does water change state?" experiment. Fill out the experiment sheet as you do the experiment.

Write

- ○ Write about the states of matter.
- ○ Look up plasma, freezing point, bo… mation. Add the definitions to the unit vocabulary sheet.
- ○ Label the states of matter sketch.

1

(Optional) Extras

Read

- ○ Read one or both of the optional reading selections.

Do

- ○ Play for dry ice.
- ○ Make a States of Matter Poster

Write

- ○ Work on memorizing the Gas Laws.

Supplies Needed	
Experiments	• Cup, Ice Cubes, Pot, Thermometer
Optional Activities	• Poster, Markers • Dry Ice, 2 Plastic Cups, Water, Dish soap, 2 Plates, Regular Ice

SciQuest - Addy's Adventure Teacher Notes: Matter Unit 17

2

Lesson 1 Science Focus: States of Matter

Read: Gathering Information

Key Idea

On earth, the three most common states of matter are solid, liquid, and gas.

Week's Readings

First, spark an interest by having the students read this week's story opener:

- Read Chapter 1 in *The Route 66 Sticky Note Quest*: "Add… inated in the Whitaker Pilgrimage." (Your student will mee… the Whitaker family as they travel down the highway in their rennovated Bluebird.)

3

Then follow the story up with some facts. You can choose which resource works best for your students:

- *Usborne Science Encyclopedia*: "Solids, Liquids, and Gases" pp. 16-17, "Changes in State" pp. 18-19
- *Kingfisher Science Encyclopedia:* "States of Matter" pp. 156-157
- *Usborne Illustrated Dictionary of Science:* "States of Matter" pp. 120-121
- *Everything You Need to Ace Science in One Big Fat Notebook:* "States of Matter" pp. 65-68

Discussion Questions

After the reading, use the following questions to guide your discussion time with the students.

1. What are two ways that substances can change physical states? (Substances can change physical state when heated or cooled, or when the energy of the particles is increased or decreased.)
2. What is a solid? (A solid is a state of matter that has definite shape and volume.)
3. What is a liquid? (A liquid is a state of matter that has fixed volume, but no definite shape.)
4. What is a gas? (A gas is a state of matter that has no fixed volume or shape.)
5. What is plasma? (Plasm… rth state of matter. It's the most common state of … e universe, but rare on Earth.)
6. What is condensation? (Condensation is when the particles in a gas cool off enough to become a liquid at room temperature and under normal pressure.) Evaporation? (Evaporation is when the particles in a liquid heat up enough to turn into a gas.)
7. What is melting? (Melting is when the particles in a solid are heated and change state into a liquid.) Freezing? (Freezing is when the particles of a liquid cool down, turning the liquid into a solid.)
8. What is sublimation? (Sublimation is when a solid turns directly into a gas, skipping the liquid phase.)
9. What is one thing that can affect a boiling or melting point? (Pressure can both affect boiling and melting points.)

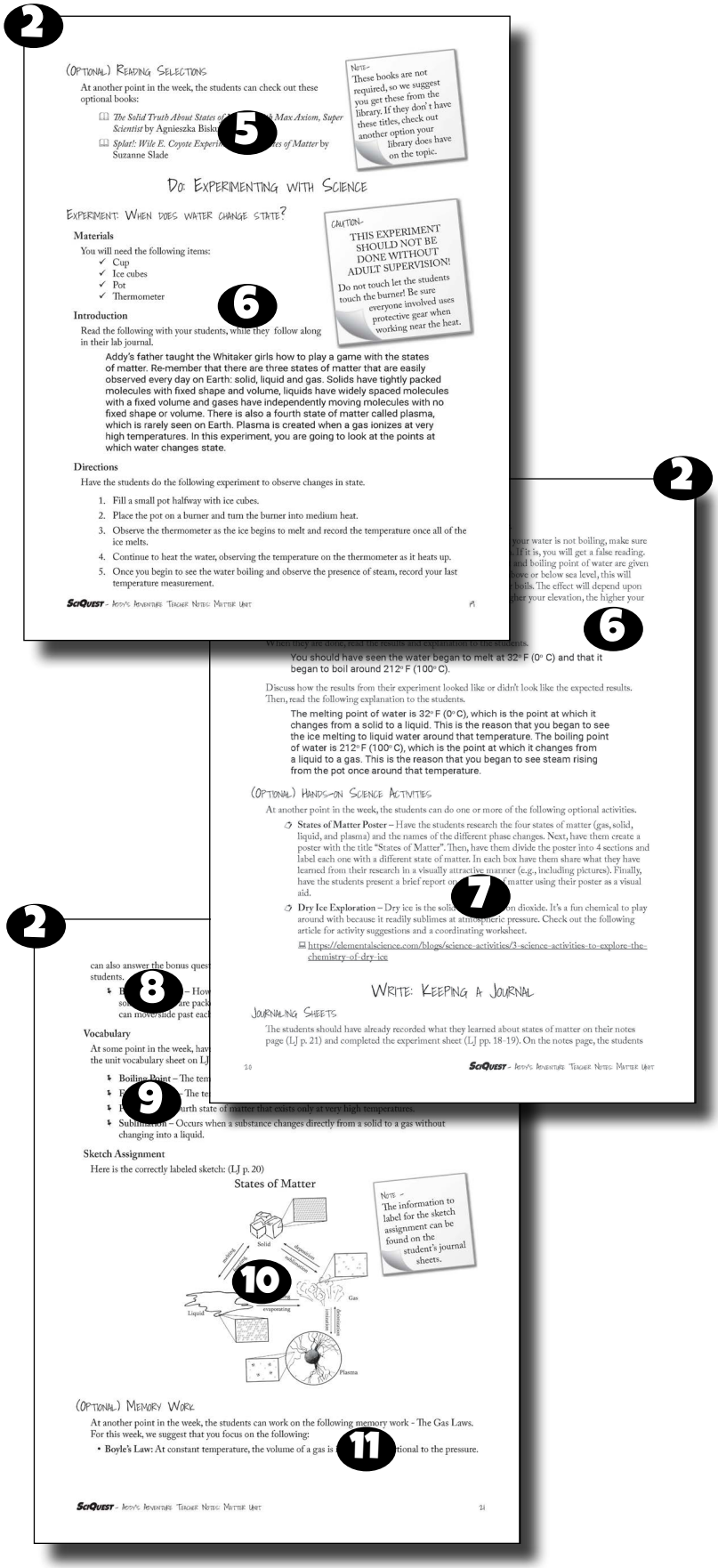
4

Note- This information included in the discussion questions is what you want the students to know from the week. If they don't catch this from the readings they did, be sure to share it with them.

After the discussion time, have the students write a list of facts or a paragraph about what they read. Their writings should include at least a few facts from above.

18 SciQuest - Addy's Adventure Teacher Notes: Matter Unit

Teacher Notes At-A-Glance



Do Science

6. Experiment Information

Know what you need to know about the weekly experiment, which will coordinate with the topic. This section includes the introduction and procedure, which are also included in the student materials. It also lists the expected results, an explanation, and ideas to take the hands-on science fun further.

7. Optional Hands-on Activities

Add a bit of fun with these optional research projects and hands-on science project ideas. These relate to and reinforce what the students are learning about the week's subject.

Write Science

8. Journal Sheets

Understand what the students will be writing down for the week, along with a bonus question. These are deeper inquiries designed to make the students think about the subject matter.

9. Vocabulary

Enhance your students' science vocabulary by introducing words that are relevant to the weekly topic.

10. Sketch Answers

Know how and where the students should label the pre-drawn sketches with the completed images.

11. Optional Memory Work

Have the students memorize key facts about the unit's topics with these optional memory work selections.

Lab Journal At-A-Glance

Go on a scientific quest to learn about matter, solutions, and forces.

1. Unit Memory Work

Memorize key facts about the unit's topics with these optional memory work selections.

2. Unit Glossary

Keep all the unit vocabulary in one place. The glossary gives space to write the definitions for each vocabulary word.

3. Student Assignment Sheet

See the plan for the week on the student assignment sheets, broken into reading, doing, and writing sections. This sheet has all the tasks for the week with checkboxes for you to use as you complete the work.

4. Experiment Sheet

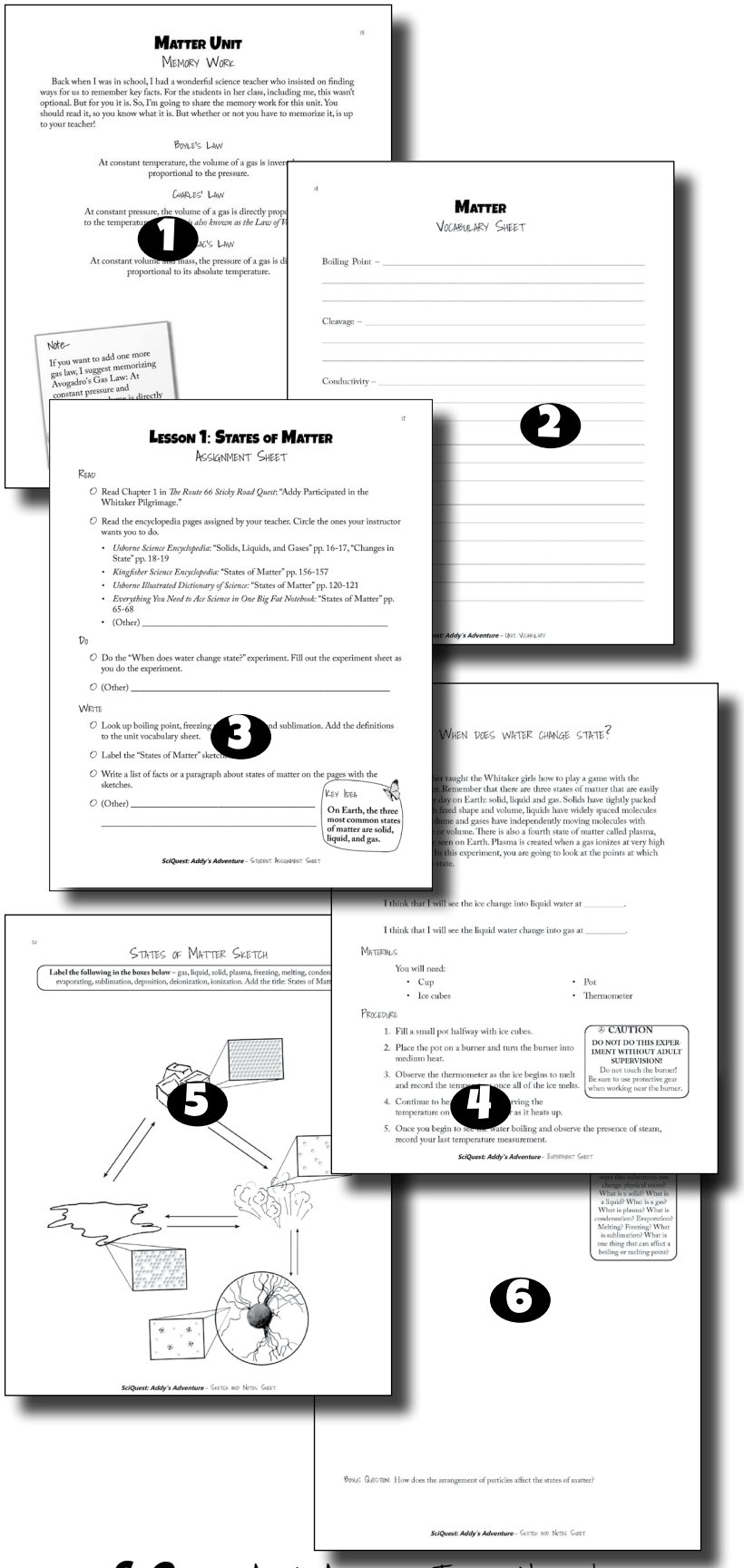
Do an experiment related to the topic for the week. The Experiment Sheet contains the introduction and the procedure for the experiment. It also has space to record the hypothesis, materials, observations, results, and conclusion.

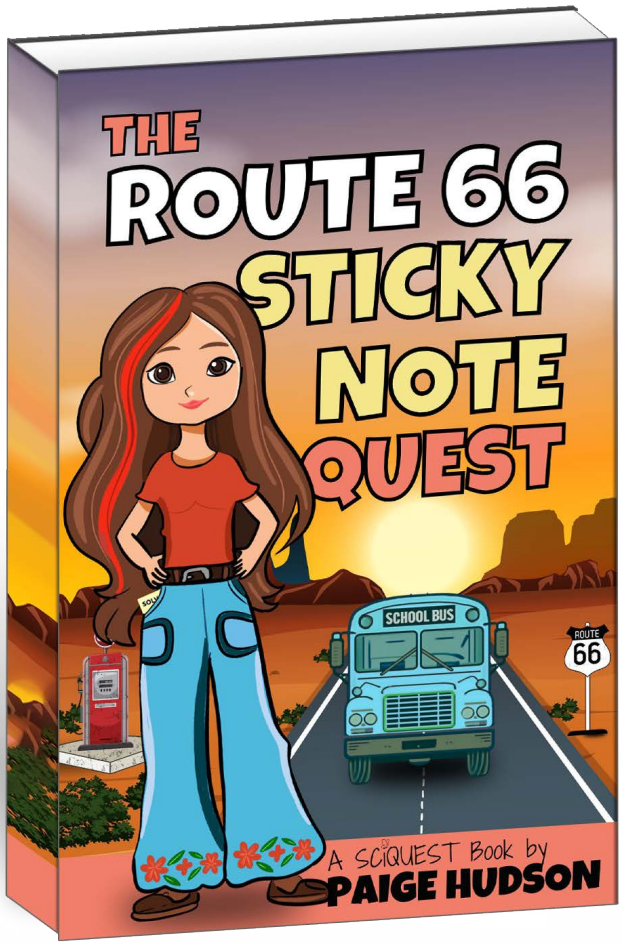
5. Pre-drawn Sketch

Color the pre-drawn sketch relating to the week's topic. Then, label it with the information given on the page.

6. Written Assignment

Know the questions for discussion time, and have plenty of space to write either a list of facts, an outline, or a summary.





The Route 66 Sticky Note Quest Excerpt

After seventy-three days in a renovated Bluebird bus, Addy discovers a sticky note on a restroom mirror in her dead grandmother's unmistakable shaky cursive.

The yellow square holds the first clue in a scientific scavenger hunt down Route 66.

At first, Addy keeps the note to herself. But once she shares it with her sisters, their RV-school journey takes a wild detour into roadside mysteries, clue-filled challenges, and one unforgettable trip down America's Mother Road.

Perfect for fans of *From the Mixed-Up Files of Mrs. Basil E. Frankweiler* and *The Vanderbeekers*, this lighthearted mystery celebrates adventure, sisterhood, and curiosity on the open road.

COPYRIGHT

For rights and permissions, please contact:
Elemental Science
PO Box 4583
Maryville, TN 37802
support@elementalscience.com

DEDICATION

To our kids, who enjoyed—or rather endured—more than one cross-country road trip during their homeschooling years. We all know far too well that George should never get curious enough to sell licked lemonade.

Author's Note

Route 66 is known as the Mother Road thanks to John Steinbeck, who called it that in his novel, *The Grapes of Wrath*.

It's a cultural icon of the American spirit of freedom and adventure. In its heyday, hundreds of thousands of people traveled this road. Nowadays, the road is a glimpse into a different era of American history.

My plan with Addy's story was to give you a snapshot of the slice of Americana found on Route 66. If you want to undertake your own trip down the Mother Road, I highly suggest checking out the following website:

https://www.route66roadtrip.com/

Whether you travel down Route 66 or not, I hope you'll see that every bend has a story!

11

Addy Participated in the Whitaker Pilgrimage

The gas station hot dog turned out to be a terrible idea. Addy groaned. Her back sank deeper into the homemade couch.

Seventy-three days. That's how long she had survived in this renovated Blue Bird bus with her whole family.

Up front, her father belted out Elvis's "Hound Dog" as if he were on stage. Behind him, the rest of the family sat seat-belted in the open living room, half of them pretending to work on schoolwork.

Addy was supposed to be doing her English assignment. But every bounce down the highway to Arkansas hammered in her head. Her stomach churned, threatening to release the service station lunch.

She leaned against the back of the banquette, letting the vibrations of the road jostle the back of her head with the type of massage no one asked for.

Her mother cleared her throat. Their father stopped singing mid-song.

"As the two sat there, bouncing around on the hot and shaky bus, they were definitely sorry they hadn't worked harder in science class." Their mother read from the first *Sassafras Science* book.

Addy rolled her eyes.

This marked the third time the Sassafras Twins had made their way to Uncle Cecil's for the summer during the Whitaker Pilgrimage— "road trip" had sounded too

dull for their author mother.

She had insisted on naming their six-month RV trip across America. The girls thought calling it a "crusade" was too violent. And their father thought the word "mission" was too critical. So Whitaker Pilgrimage it was.

The bus drove up the East Coast, watching whales and visiting almost every beach. The family toured what felt like thousands of battlefields—the actual number less than twenty. As the renovated bus turned back south, the number of parks exceeded all the girls' fingers and half their toes.

The shining star of the educational expedition was the drive down the famous Route 66. It would serve as the period on their road-schooling-bus journey. Addy was just thankful she hadn't had to diagram the plan or parse it into parts of speech.

In reality, it didn't matter what they called it. No

amount of hard work in her science class, or any other class, had prevented their family adventure.

At least this version was climate-controlled with hints of diesel fumes and last night's spaghetti.

She sighed, relaxing further into the couch her sisters had stuffed. The edge of a sheet of plywood pinched her neck—the foam woefully inadequate in that spot.

"Gladys strikes again," Addy mumbled under her breath, and shifted her head to the left.

Her sister Hazel wasn't as bad as Gladys in *The Best Christmas Pageant Ever*. She was a modern-day contender. At five years younger, the pint-sized Whitaker had a history of getting away with far more than the other sisters.

Their mother glanced up and asked, "What did you say, Addison?"

Without words, the twins, Willow and Charlotte, swiveled their heads. The steady thrum of the tires pulsed through the open space.

Addy swallowed. "I said, 'I can't believe they fell for the gravity sticky note again.'" She shrugged and lifted her palms.

Willow's short brown hair shook as she giggled.

Charlotte's ponytail swung when she turned. "That's the best part! Keep reading, Mom."

Addy ignored the drone of her mother's voice reading the familiar words. She counted the rivets up the eggshell-blue walls on the other side of the bus. Her eyes followed the tracks until they met the wooden-planked ceiling.

Then, they skipped to the next casing.

This was the only room in the house on wheels that

SciQuest: Addy's Adventure Introduction

Welcome to a quest to learn about science, or should I say a SciQuest! This is a journey that your students are going to embark on with a bit of independence.

In *SciQuest 200: Addy's Adventure*, you'll be learning about matter, solutions, reactions, forces, and energy. Addison (Addy) Whitaker will serve as an introduction for your students for the week. They will learn about the topics in chemistry and physics by reading, doing, and writing about science.

The Broad-Brush-Stroke View

In a nutshell, your students will enjoy learning about science as they do three things each week. These three things are based on the *Three Keys to Teaching Science* by Paige Hudson. Check them out here: https://elementalscience.com/blogs/news/3-keys. Here is what they are:

Read: Gathering Information

In this section of the lesson notes, you will find the assigned readings and discussion questions. Check out this podcast to understand the importance of discussion time:

💻 Don't skip that discussion time - https://elementalscience.com/blogs/podcast/53

You'll also find a few optional assignments for those students who want to dig deeper.

Do: Experimenting with Science

In this section of the lesson notes, we will be employing those inquiry-based methods. In other words, the students are going to do science. You will find an experiment introduction and directions – don't worry, these are in the student's journal, too. You will also find the expected results, an explanation, and any troubleshooting tips for the experiment in this section. Read this article to understand how your role is shifting from presenter-of-hands-on-science to mentor-of-a-budding-scientist:

💻 Scientific demonstrations vs. experiments - https://elementalscience.com/blogs/podcast/94

Plus, we added a few optional activities for those students who love to play with science.

Write: Keeping a Journal

In this section of the lesson notes, we are helping our students to organize what they have learned and to think analytically about it. This is where you will find the written assignments, vocabulary, and memory work for the lesson. The written assignments include a customizable writing assignment (either a list of facts, an outline, or a paragraph) and the sketch for the lesson. Watch this series of videos to learn about the progression of writing skills as they pertain to science:

💻 Writing in Homeschool Science: The Elementary Years - https://youtu.be/BrunFyeHhlQ
💻 Writing in Homeschool Science: Middle School and Beyond - https://youtu.be/B96DKXriCng

Also, with the written work, we have included a bonus question to help the students start to make those all-important connections.

The Nitty-Gritty Details of the Lesson Notes

Week's Readings

First, spark an interest by having the students read this week's story opener. These chapters come from the middle-grade novel, *The Route 66 Sticky Note Quest*. Your students will read about Addy and her family as they travel down America's Mother Road, Route 66. Each chapter has a hint of science and is designed to be read by the students on their own.

Later in the week, the students will follow up the story with facts. The following encyclopedias have pages detailed in this guide. You can choose which resources work best for your student. They will be used in subsequent levels of this program. If you can only purchase one or two of these, we recommend getting the ones with an *.

- *Usborne Science Encyclopedia**
- *Kingfisher Science Encyclopedia**
- *Usborne Illustrated Dictionary of Science*
- *Everything You Need to Ace Science in One Big Fat Notebook*

Discussion Questions

After all that reading, we have provided questions, along with the answers, to guide your discussion time with the students.

(Optional) Reading Selections

In this section, you will find additional reading suggestions. These are not required, but these library books can be used to enhance what the students have learned.

Experiment Information

Materials

This section will detail the supplies you need for the experiment. As much as possible, we have attempted to make these household supplies. However, if you don't want to pull these items together, you can purchase an experiment kit from us that contains the supplies for level 100 and 200.

Introduction

This section shares a glimpse of the science behind the experiment. It is also included in the lab journal.

The paragraphs written in this font are meant to be read to the student.

Directions

This section will detail what to do for the experiment, step by step. It is also included in the lab journal.

Results and Explanation

When the students are done with the experiment, read the results and explanation to them. Discuss how the results from their experiment looked like or didn't look like the expected results.

As before, the paragraphs written in this font are meant to be read to the student.

(Optional) Hands-on Science Activities

In this section, you will find optional hands-on science activities to reinforce what the students are learning.

Write: Keeping a Journal

Journaling Sheets

This section will have the page numbers and bonus questions. The students should record what they learn about the subjects on notes pages and the experiment sheets in the lab journal. On the notes page, the students can also answer the bonus question. These questions are meant to challenge the students and cause them to think about the subject.

Vocabulary

The students will look up the vocabulary words and add the definitions to their unit vocabulary sheet in the lab journal. In this guide, you will find the definitions for the words they have to look up.

Sketch

In this section, you will find the labeled sketches to use as an answer key.

(Optional) Memory Work

Every unit has memory work, which you can choose to assign or not.

Additional Resources

We have put together a page containing quick links to the activities suggested in this guide along with several helpful downloads:

💻 https://elementalscience.com/blogs/resources/sq200

How to Schedule this Study

SciQuest 200: Addy's Adventure should take up to three hours per week to complete. You and your student can choose whether to complete the work over five days or over two days. Below are two options for scheduling to give you an idea of how you can schedule your week:

Two-days-a-week Schedule

Day 1

Define the vocabulary, do the experiment, and complete the experiment sheet.

Day 2

Read the assigned pages and discuss them together, take your notes, and complete the sketch.

Five-days-a-week Schedule

Day 1

Do the experiment and complete the experiment sheet.

Day 2

Record the dates and define the vocabulary.

Day 3

Read the assigned pages, discuss them, and complete the sketch.

Day 4

Prepare the science report or an outline.

Day 5

Complete one of the other activities assigned by your teacher and work on the memory work.

Final Thoughts

If you find that this program contains too much work, please tailor it to the needs of your students. With that said, I encourage you to contact us with any questions or problems that you might have concerning *SciQuest 200: Addy's Adventure* at support@elementalscience.com. Our team will be more than happy to answer them as soon as we are able. I hope that you and your students enjoy your quest to learn about science!

~ Paige Hudson

List of Topics

Matter Unit

- States of Matter
- Solid Structures
- Crystals
- Density
- Surface Tension
- Intermolecular Forces
- Gas Laws
- Diffusion
- Kinetic Theory

Solutions and Reactions Unit

- Molecules
- Compounds
- Mixtures
- Polarity
- Solutions
- Filtration
- Chromatography
- Electrolysis
- Chemical Bonding
- Chemical Reactions

Scientist Biography Unit

- The students will learn about a scientist of their choice.

Forces and Motion Unit

- Forces
- Kinetic Energy
- Potential Energy
- Work
- Air Resistance
- Friction
- Gravity
- Fluid Dynamics
- Pressure
- Inertia
- Mass
- Weight
- Motion
- Speed
- Acceleration
- Velocity
- Simple Machines

Demonstration Supplies

Matter Unit

Lesson	Materials Needed
1	Cup, Ice Cubes, Pot, Thermometer
2	Wide mouthed jar, String, Pencil, Pipe cleaner, Water, Borax, Scissors
3	4 Clear cups, Eye dropper, Table salt, Food coloring, Water
4	2 Cups, Apple juice, Timer, Partner

Reactions Unit

Lesson	Materials Needed
5	Bag of multi-colored marshmallows, Toothpicks
6	5 Clear cups (or beakers), 5 Plastic spoons, Sugar, Salt, Baking soda, Flour, Petroleum jelly, Water, Vegetable oil, Tablespoon
7	4 Coffee filters, Markers, Alcohol, Coffee can or a wide-mouthed jar, Rubber bands, Eye dropper
8	Distilled water, 2 Test tubes, Salt, Glass cup, 2 Alligator clips, Covered copper wire, 6v Lantern battery, Permanent marker
9	Cake frosting, Red and yellow bite-sized candies (such as regular sized M&M's)
10	Yeast, Hydrogen peroxide, Epsom salts, Water, 2 Cups, 2 Thermometers

Forces Unit

Lesson	Materials Needed
12	Thick, sturdy cardboard, 1 Brad fastener, Rubber band, Hole punch or nail, String – about 3 in (10 cm), 3 Jumbo paper clips, Pen, Objects of varying weight
13	Goldfish cracker, Small marshmallow, Piece of lettuce, Piece of bacon fat, Aluminum pan, Matches, Safety glasses, Bucket of water
14	Force Meter from Lesson 12, Small wooden block (aka. Jenga block), Eye-hook screw, Sandpaper, Felt, Foil, Spray oil, Tape measure
15	2 Tin cans (one large, one small), Screw, Water, Piece of clay, Cup measurer, Tape measurer
16	Jenga block with the eyehook from last week, String, 2 Toy cars, Egg
17	Cardboard or plastic track, Blocks or thick books, Toy car, Stopwatch
18	Materials will vary based on what you choose to build

SciQuest

Addy's Adventure Teacher Notes

Matter Unit

What you'll study in this unit–

- ○ 1: States of Matter (p. 16)
- ○ 2: Solid Structures (p. 22)
- ○ 3: Molecular Properties (p. 28)
- ○ 4: Gas Laws (p. 34)

Memory Work–

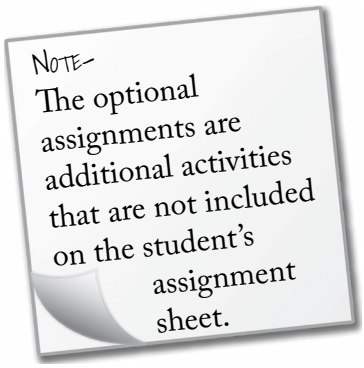
Three Gas Laws
(LJ* p. 13)

*LJ = Lab Journal

Lesson 1 Grid Schedule

Supplies Needed	
Experiments	• Cup, Ice Cubes, Pot, Thermometer
Optional Activities	• Poster, Markers • Dry Ice, 2 Plastic Cups, Water, Dish Soap, 2 Plates, Regular Ice

Weekly Schedule	**Day 1**	**Day 2**	**Day 3**	**Day 4**
Read	❑ Read Chapter 1: "Addy Participated in the Whitaker Pilgrimage" in *The Route 66 Sticky Note Quest*	❑ Choose one of the encyclopedia readings to assign and discuss what was read using the questions provided	❑ *(Optional)* Choose another one of the encyclopedia readings to assign	❑ *(Optional)* Read one or both of the optional reading selections
Do	❑ Do the "When does water change state?" experiment	❑ *(Optional)* Make a States of Matter poster	❑ *(Optional)* Play with dry ice	
Write	❑ Fill out the experiment sheet	❑ Write about the states of matter	❑ Color and label the states of matter sketch ❑ Define plasma, freezing point, boiling point, and sublimation	❑ *(Optional)* Work on memorizing the Gas Laws



Lesson 1 List Schedule

Essentials

Read

- ○ Read Chapter 1: "Addy Participated in the Whitaker Pilgrimage" in *The Route 66 Sticky Note Quest*.
- ○ Choose one (or more) of the encyclopedia readings to assign and discuss what was read using the questions provided.

Do

- ○ Do the "When does water change state?" experiment. Fill out the experiment sheet as you do the experiment.

Note-
The essential assignments are included on the student assignment sheet. The optional ones are additional activities you can assign to the students if you want to do more.

Write

- ○ Write about the states of matter.
- ○ Look up plasma, freezing point, boiling point, and sublimation. Add the definitions to the unit vocabulary sheet.
- ○ Label the states of matter sketch.

(Optional) Extras

Read

- ○ Read one or both of the optional reading selections.

Do

- ○ Play with dry ice.
- ○ Make a States of Matter poster.

Write

- ○ Work on memorizing the Gas Laws.

Supplies Needed	
Experiments	• Cup, Ice Cubes, Pot, Thermometer
Optional Activities	• Poster, Markers • Dry Ice, 2 Plastic Cups, Water, Dish Soap, 2 Plates, Regular Ice

Lesson 1 Science Focus: States of Matter

Read: Gathering Information

Key Idea

On earth, the three most common states of matter are solid, liquid, and gas.

Week's Readings

First, spark an interest by having the students read this week's story opener:

- Read Chapter 1 in *The Route 66 Sticky Note Quest*: "Addy Participated in the Whitaker Pilgrimage." (Your student will meet Addy and the Whitaker family as they travel down the highway in their rennovated Bluebird bus.)

Then follow the story up with some facts. You can choose which resource works best for your students:

- *Usborne Science Encyclopedia*: "Solids, Liquids, and Gases" pp. 16-17, "Changes in State" pp. 18-19
- *Kingfisher Science Encyclopedia:* "States of Matter" pp. 156-157
- *Usborne Illustrated Dictionary of Science:* "States of Matter" pp. 120-121
- *Everything You Need to Ace Science in One Big Fat Notebook:* "States of Matter" pp. 65-68

Discussion Questions

After the reading, use the following questions to guide your discussion time with the students.

1. What are two ways that substances can change physical states? (Substances can change physical state when heated or cooled, or when the energy of the particles is increased or decreased.)
2. What is a solid? (A solid is a state of matter that has definite shape and volume.)
3. What is a liquid? (A liquid is a state of matter that has fixed volume, but no definite shape.)
4. What is a gas? (A gas is a state of matter that has no fixed volume or shape.)
5. What is plasma? (Plasma is the fourth state of matter. It's the most common state of matter in the universe, but rare on Earth.)
6. What is condensation? (Condensation is when the particles in a gas cool off enough to become a liquid at room temperature and under normal pressure.) Evaporation? (Evaporation is when the particles in a liquid heat up enough to turn into a gas.)
7. What is melting? (Melting is when the particles in a solid are heated and change state into a liquid.) Freezing? (Freezing is when the particles of a liquid cool down, turning the liquid into a solid.)
8. What is sublimation? (Sublimation is when a solid turns directly into a gas, skipping the liquid phase.)
9. What is one thing that can affect a boiling or melting point? (Pressure can both affect boiling and melting points.)

Note-
This information included in the discussion questions is what you want the students to know from the week. If they don't catch this from the readings they did, be sure to share it with them.

After the discussion time, have the students write a list of facts or a paragraph about what they read. Their writings should include at least a few facts from above.

(Optional) Reading Selections

At another point in the week, the students can check out these optional books:

- 🕮 *The Solid Truth About States of Matter With Max Axiom, Super Scientist* by Agnieszka Biskup
- 🕮 *Splat!: Wile E. Coyote Experiments with States of Matter* by Suzanne Slade

Note-
These books are not required, so we suggest you get these from the library. If they don't have these titles, check out another option your library does have on the topic.

Do: Experimenting with Science

Experiment: When does water change state?

Caution-
THIS EXPERIMENT SHOULD NOT BE DONE WITHOUT ADULT SUPERVISION!
Do not let the students touch the burner! Be sure everyone involved uses protective gear when working near the heat.

Materials

You will need the following items:

- ✓ Cup
- ✓ Ice cubes
- ✓ Pot
- ✓ Thermometer

Introduction

Read the following with your students, while they follow along in their lab journal.

> Addy's father taught the Whitaker girls how to play a game with the states of matter. Remember that there are three states of matter that are easily observed every day on Earth: solid, liquid and gas. Solids have tightly packed molecules with fixed shape and volume, liquids have widely spaced molecules with a fixed volume and gases have independently moving molecules with no fixed shape or volume. There is also a fourth state of matter called plasma, which is rarely seen on Earth. Plasma is created when a gas ionizes at very high temperatures. In this experiment, you are going to look at the points at which water changes state.

Directions

Have the students do the following experiment to observe changes in state.

1. Fill a small pot halfway with ice cubes.
2. Place the pot on a burner and turn the burner on to medium heat.
3. Observe the thermometer as the ice begins to melt and record the temperature once all of the ice melts.
4. Continue to heat the water, observing the temperature on the thermometer as it heats up.
5. Once you begin to see the water boiling and observe the presence of steam, record your last temperature measurement.

6. Turn the burner off and remove the pot from the burner.

Troubleshooting Tips – If the temperature goes way up, but your water is not boiling, make sure that your thermometer is not touching the bottom of the pan. If it is, you will get a false reading. Also, your elevation can affect your results. The melting point and boiling point of water are given at 1 atmosphere of pressure, which is at sea level. If you live above or below sea level, this will affect the temperature at which your ice melts and your water boils. The effect will depend upon how much you are above or below sea level. Generally, the higher your elevation, the higher your temperatures will be.

Results and Explanation

When they are done, read the results and explanation to the students.

> You should have seen the water began to melt at 32° F (0° C) and that it began to boil around 212° F (100° C).

Discuss how the results from their experiment looked like or didn't look like the expected results. Then, read the following explanation to the students.

> The melting point of water is 32° F (0° C), which is the point at which it changes from a solid to a liquid. This is the reason that you began to see the ice melting to liquid water around that temperature. The boiling point of water is 212° F (100° C), which is the point at which it changes from a liquid to a gas. This is the reason that you began to see steam rising from the pot once around that temperature.

(Optional) Hands-on Science Activities

At another point in the week, the students can do one or more of the following optional activities.

- **States of Matter Poster** – Have the students research the four states of matter (gas, solid, liquid, and plasma) and the names of the different phase changes. Next, have them create a poster with the title "States of Matter." Then, have them divide the poster into 4 sections and label each one with a different state of matter. In each box have them share what they have learned from their research in a visually attractive manner (e.g., including pictures). Finally, have the students present a brief report on the states of matter using their poster as a visual aid.
- **Dry Ice Exploration** – Dry ice is the solid form of carbon dioxide. It's a fun chemical to play around with because it readily sublimes at atmospheric pressure. Check out the following article for activity suggestions and a coordinating worksheet.

  https://elementalscience.com/blogs/science-activities/3-science-activities-to-explore-the-chemistry-of-dry-ice

Write: Keeping a Journal

Journaling Sheets

The students should have already recorded what they learned about states of matter on their notes page (LJ p. 21) and completed the experiment sheet (LJ pp. 18-19). On the notes page, the students

can also answer the bonus question. Here is an answer for your reference as you discuss this with your students.

- **Bonus Question** – How does the arrangement of particles affect the states of matter? (In solids, particles are packed closely in a fixed, ordered pattern. In liquids, particles are close but can move/slide past each other. In gas, particles are far apart and move in random directions.)

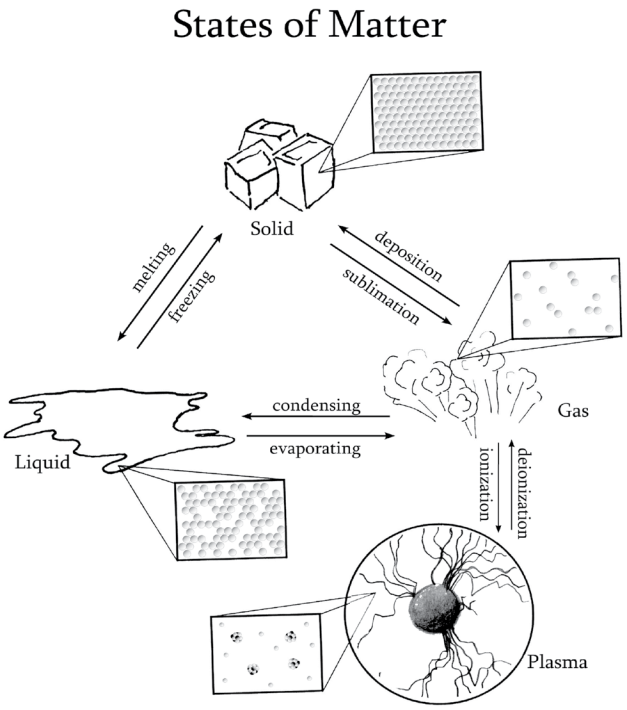
Vocabulary

At some point in the week, have the students look up the following words and add the definitions to the unit vocabulary sheet on LJ pp. 14-16:

- **Boiling Point** – The temperature at which a substance turns from a liquid into a gas.
- **Freezing Point** – The temperature at which a substance turns from a liquid into a solid.
- **Plasma** – The fourth state of matter that exists only at very high temperatures.
- **Sublimation** – Occurs when a substance changes directly from a solid to a gas without changing into a liquid.

Sketch Assignment

Here is the correctly labeled sketch: (LJ p. 20)



Note -
The information to label for the sketch assignment can be found on the student's journal sheets.

(Optional) Memory Work

At another point in the week, the students can work on the following memory work - The Gas Laws. For this week, we suggest that you focus on the following:

- **Boyle's Law:** At constant temperature, the volume of a gas is inversely proportional to the pressure.

Lesson 2 Grid Schedule

Supplies Needed	
Experiments	• Wide mouthed jar, String, Pencil, Pipe cleaner, Water, Borax, Scissors
Optional Activities	• Vinegar, Baking soda • Magnifying glass or microscope, Sugar, Salt

Weekly Schedule				
	Day 1	**Day 2**	**Day 3**	**Day 4**
Read	❑ Read Chapter 2: "Addy Dug Up A Clue" in *The Route 66 Sticky Note Quest*	❑ Choose one of the encyclopedia readings to assign and discuss what was read using the questions provided	❑ *(Optional)* Choose another one of the encyclopedia readings to assign	❑ *(Optional)* Choose another one of the encyclopedia readings to assign
Do	❑ Do the "Can I make crystals?" experiment	❑ *(Optional)* Make Hot Ice		❑ *(Optional)* Look closer at crystals
Write	❑ Fill out the experiment sheet	❑ Write about solid structures	❑ Color and label the crystal shapes sketch ❑ Define cleavage, conductivity, and lattices	❑ *(Optional)* Work on memorizing the Gas Laws

Lesson 2 List Schedule

Essentials

Read

- ○ Read Chapter 2: "Addy Dug Up A Clue" in *The Route 66 Sticky Note Quest.*
- ○ Choose one of the encyclopedia readings to assign and discuss what was read using the questions provided.

Do

- ○ Do the "Can I make crystals?" experiment. Fill out the experiment sheet as you do the experiment.

Write

- ○ Write about solid structures.
- ○ Look up cleavage, conductivity, and lattices. Add the definitions to the unit vocabulary sheet.
- ○ Label the crystal shapes sketch.

(Optional) Extras

Read

- ○ Choose another one (or two) of the encyclopedia readings to assign.

Do

- ○ Make a Hot Ice.
- ○ Look closer at crystals.

Write

- ○ Work on memorizing the Gas Laws.

Supplies Needed	
Experiments	• Wide mouthed jar, String, Pencil, Pipe cleaner, Water, Borax, Scissors
Optional Activities	• Vinegar, Baking soda • Magnifying glass or microscope, Sugar, Salt

Lesson 2 Science Focus: Solid Structures

Read: Gathering Information

Key Idea

Crystals have atoms that are arranged in orderly, repeated patterns.

Week's Readings

First, spark an interest by having the students read this week's story opener:

- Read Chapter 2 in *The Route 66 Sticky Note Quest*: "Addy Dug Up A Clue." (Your student will join Addy and the Whitaker family as they go on a hunt at Craters of Diamonds State Park.)

Then follow the story up with some facts. You can choose which resource works best for your students:

- *Usborne Science Encyclopedia*: "Crystals" pp. 90-91
- *Kingfisher Science Encyclopedia:* "Crystals" pp. 168-169
- *Usborne Illustrated Dictionary of Science:* "Crystals" pp. 135-137
- *Everything You Need to Ace Science in One Big Fat Notebook:* "Minerals and Their Uses" pp. 228-230

Discussion Questions

After all that reading, use the following questions to guide your discussion time with the students.

1. What are crystals? (Crystals are solids with regular geometric shapes that can be formed from the regular arrangement of atoms, ions, or molecules.)
2. What are two methods of crystallization? (Two methods of crystallization are allowing a solvent to evaporate and placing a seed crystal in a supersaturated solution.)
3. What causes crystals to form a definite shape? (Crystals form a definite shape because of the arrangement of their atoms or ions.)
4. What are the main crystal shapes? (The five basic shapes of crystals are cubic, tetragonal, monoclinic, triclinic [or rhombohedral], and hexagonal.)
5. What is polymorphism in crystals? (Polymorphism in crystals is when a substance can have two or more different crystal shapes.)
6. What are the four main types of lattice structures? Describe each one. (The four main types of lattice structures are giant atomic, giant ionic, giant metallic, and molecular lattices. Giant atomic lattices are crystal lattices held together with covalent bonding. Giant ionic lattices are crystal lattices held together with ionic bonding. Giant metallic lattices are crystal lattices held together by metallic bonding with delocalized electrons. Molecular lattices are crystal lattices held together by weak intermolecular forces.)

After the discussion time, have the students write a list of facts or a paragraph about what they read. Their writings should include at least a few facts from above.

(Optional) Reading Selections

At another point in the week, the students can check out these optional books:

- 🕮 *Gems for Kids: A Junior Scientist's Guide to Mineral Crystals and Other Natural Treasures* by Ashley Hall and Lee Hall
- 🕮 *The Rock and Gem Book: And Other Treasures of the Natural World* by DK and Smithsonian Institution

Do: Experimenting with Science

Experiment: Can I make crystals?

Materials

You will need the following items:

- ✓ Wide mouthed jar
- ✓ String
- ✓ Pencil
- ✓ Pipe cleaner
- ✓ Water
- ✓ Borax
- ✓ Scissors

Note-

You can find Borax in the laundry aisle of the local grocery store. Be sure to buy the one labeled laundry booster, not the soap that includes Borax.

Introduction

Read the following with your students, while they follow along in their lab journal.

> Addy and her family learn about and dig up different minerals during their visit to a state park. Minerals have crystal structures in all shapes and sizes, but each is based on the regularly repeating pattern of the atoms, molecules, or ions that make it up. They are very hard, solid structures, and we use them in a variety of ways as we go about our daily lives. For example, the salt you use on your food and the lead in your pencil are both made up of crystals. In this experiment, you are going to make your own crystals.

Directions

Have the students do the following experiment to use a leaf to learn about a local tree under your supervision.

1. Fill your jar with water, pour that water into a pot, and set it on a burner to boil. Make sure to record how many cups (or mL) of water it takes to fill your jar.
2. Form a shape with the pipe cleaner—this can be as simple or as complex as you wish, but make sure it will fit through the opening of your jar.
3. Next, tie a string to the shape and then tie the other end of the string to a pencil.
4. Set your jar in the sink, put on safety glasses, and use a hot mitt to slowly add boiling water until it almost fills the jar.
5. Then, add the Borax one TBSP (25 g) at a time, stirring each time until the Borax is

Troubleshooting Tips-

You want the pencil to be able to rest on the edge of your jar without having your shape touch the sides or bottom of the jar.

dissolved. (**Note—**You want to add about 3 TBSP (75 g) of Borax for every cup (240 mL) of water you've added. Be sure to record how many tablespoons you added on your experiment sheet.)

6. Hang the shape in the jar so that it is completely covered by the liquid.
7. Allow the jar to sit undisturbed overnight.
8. In the morning, take out your shape and observe what has happened.

Results and Explanation

When they are done, read the results and explanation to the students.

> You should have seen the pipe cleaner creation is completely coated with crystals. The crystals should be white, making their shape look like it is covered in ice or snow.

Discuss how the results from their experiment looked like or didn't look like the expected results. Then, read the following explanation to the students.

> You super-saturated the water with Borax crystals because hot water can hold more crystals than cold water. This is due to the fact that the hot water molecules are spread farther apart, which creates more room into which the Borax molecules can dissolve. As the water cooled, the molecules came closer together, causing the Borax molecules to be forced out of the solution and form solid crystals once again. The pipe cleaner gave the molecules an easy place to attach, which is why it was coated with crystals.

(Optional) Hands-on Science Activities

At another point in the week, the students can do one or more of the following optional activities.

- **Hot Ice** – This experiment is very cool when it works, but it's a bit temperamental. You will need vinegar and baking soda for the experiment. Directions and troubleshooting tips can be found at:

  💻 https://frugalfun4boys.com/hot-ice-science-experiment/

- **Looking at Crystals** – Have the students use a magnifying glass or microscope to examine sugar and salt crystals. You can also have them examine one of their Borax crystals from the experiment. Talk about the different crystal systems (or shapes) that the students see. (Borax and sugar are both monoclinic, while salt is cubic.)

Write: Keeping a Journal

Journaling Sheets

The students should have already recorded what they learned about solid structures on their notes page (LJ p. 27) and completed the experiment sheet (LJ pp. 24-25). On the notes page, the students can also answer the bonus question. Here is an answer for your reference as you discuss this with your students.

- **Bonus Question** – Would the way a crystal is formed affect its shape? (Yes, the way a crystal forms does affect its shape. For example, if a crystal forms by a liquid cooling, it will typically yield smaller, more numerous crystals due to rapid saturation and decreased movement of the atoms. But if a crystal forms by a liquid evaporating, it can allow for larger, more orderly crystals because it increases concentration gradually without significantly lowering the temperature.)

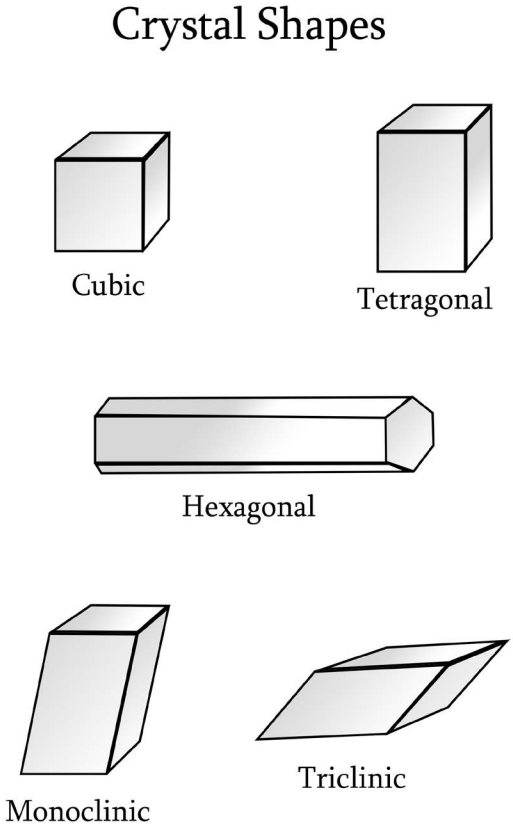
Vocabulary

At some point in the week, have the students look up the following words and add the definitions to the unit vocabulary sheet on LJ pp. 14-16:

- **Cleavage** – The splitting of a crystal along a certain plane.
- **Conductivity** – The measure of a substance's ability to conduct heat or electricity.
- **Lattices** – The regular arrangement of repeating patterns of atoms, molecules, or ions in a solid structure.

Sketch Assignment

Here is the correctly labeled sketch: (LJ p. 26)



(Optional) Memory Work

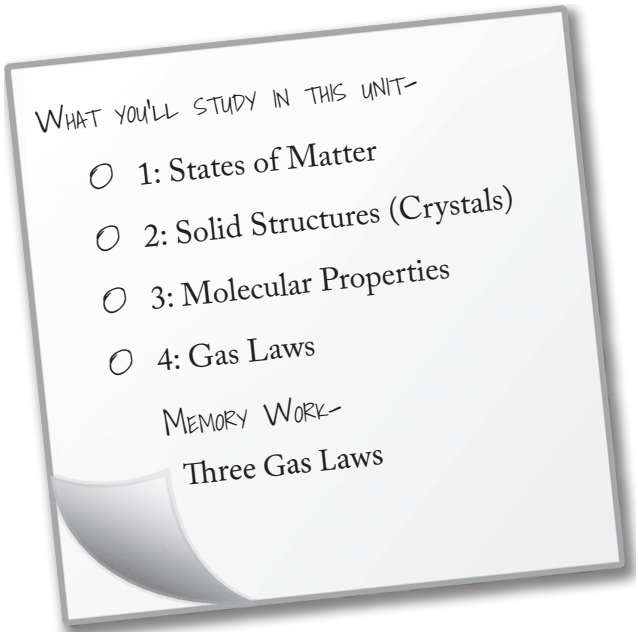
At another point in the week, the students can work on the following memory work - the Gas Laws. For this week, we suggest that you focus on the following:

- **Charles' Law:** At constant pressure, the volume of a gas is directly proportional to the temperature. (This law is also known as the Law of Volumes.)

SciQuest

Addy's Adventure Lab Journal

Matter Unit



Matter Unit

Memory Work

Back when I was in school, I had a wonderful science teacher who insisted on finding ways for us to remember key facts. For the students in her class, including me, this wasn't optional. But for you it is. So, I'm going to share the memory work for this unit. You should read it, so you know what it is. But whether or not you have to memorize it, is up to your teacher!

Boyle's Law

At constant temperature, the volume of a gas is inversely proportional to the pressure.

Charles' Law

At constant pressure, the volume of a gas is directly proportional to the temperature. (*This law is also known as the Law of Volumes*.)

Gay-Lussac's Law

At constant volume and mass, the pressure of a gas is directly proportional to its absolute temperature.

Note-

If you want to add one more gas law, I suggest memorizing Avogadro's Gas Law: At constant pressure and temperature, volume is directly proportional to the amount of gas (moles). Equal volumes of gases contain equal numbers of molecules.

Matter

Vocabulary Sheet

Boiling Point – _____

_____

_____

Cleavage – _____

_____

_____

Conductivity – _____

_____

_____

Density – _____

_____

_____

Diffusion – _____

_____

_____

Elasticity – _____

_____

_____

Freezing Point – _____

_____

_____

Intermolecular Forces – _____

_____

_____

Kinetic Theory – _____

_____

_____

Lattices–_____

_____

_____

Plasma – _____

_____

_____

Pressure – _____

_____

_____

Sublimation – _____

_____

_____

Temperature – _____

_____

_____

Volume–_____

_____

_____

Lesson 1: States of Matter

Assignment Sheet

Read

- ○ Read Chapter 1 in *The Route 66 Sticky Road Quest*: "Addy Participated in the Whitaker Pilgrimage."
- ○ Read the encyclopedia pages assigned by your teacher. Circle the ones your instructor wants you to do.
  - *Usborne Science Encyclopedia*: "Solids, Liquids, and Gases" pp. 16-17, "Changes in State" pp. 18-19
  - *Kingfisher Science Encyclopedia:* "States of Matter" pp. 156-157
  - *Usborne Illustrated Dictionary of Science:* "States of Matter" pp. 120-121
  - *Everything You Need to Ace Science in One Big Fat Notebook:* "States of Matter" pp. 65-68
  - (Other) _____

Do

- ○ Do the "When does water change state?" experiment. Fill out the experiment sheet as you do the experiment.
- ○ (Other) _____

Write

- ○ Look up boiling point, freezing point, plasma, and sublimation. Add the definitions to the unit vocabulary sheet.
- ○ Label the "States of Matter" sketches.
- ○ Write a list of facts or a paragraph about states of matter on the pages with the sketches.
- ○ (Other) _____

_____

Key Idea

On Earth, the three most common states of matter are solid, liquid, and gas.

When does water change state?

Introduction

Addy's father taught the Whitaker girls how to play a game with the states of matter. Remember that there are three states of matter that are easily observed every day on Earth: solid, liquid and gas. Solids have tightly packed molecules with fixed shape and volume, liquids have widely spaced molecules with a fixed volume and gases have independently moving molecules with no fixed shape or volume. There is also a fourth state of matter called plasma, which is rarely seen on Earth. Plasma is created when a gas ionizes at very high temperatures. In this experiment, you are going to look at the points at which water changes state.

Hypothesis

I think that I will see the ice change into liquid water at _____.

I think that I will see the liquid water change into gas at _____.

Materials

You will need:

- Cup
- Ice cubes
- Pot
- Thermometer

Procedure

1. Fill a small pot halfway with ice cubes.
2. Place the pot on a burner and turn the burner on to medium heat.
3. Observe the thermometer as the ice begins to melt and record the temperature once all of the ice melts.
4. Continue to heat the water, observing the temperature on the thermometer as it heats up.
5. Once you begin to see the water boiling and observe the presence of steam, record your last temperature measurement.

CAUTION

DO NOT DO THIS EXPERIMENT WITHOUT ADULT SUPERVISION!

Do not touch the burner! Be sure to use protective gear when working near the burner.

6. Turn the burner off and remove the pot from the burner.

Observations and Results

Phase Change	Temperature
solid to liquid	
liquid to gas	

_____

_____

_____

_____

Conclusion

_____

_____

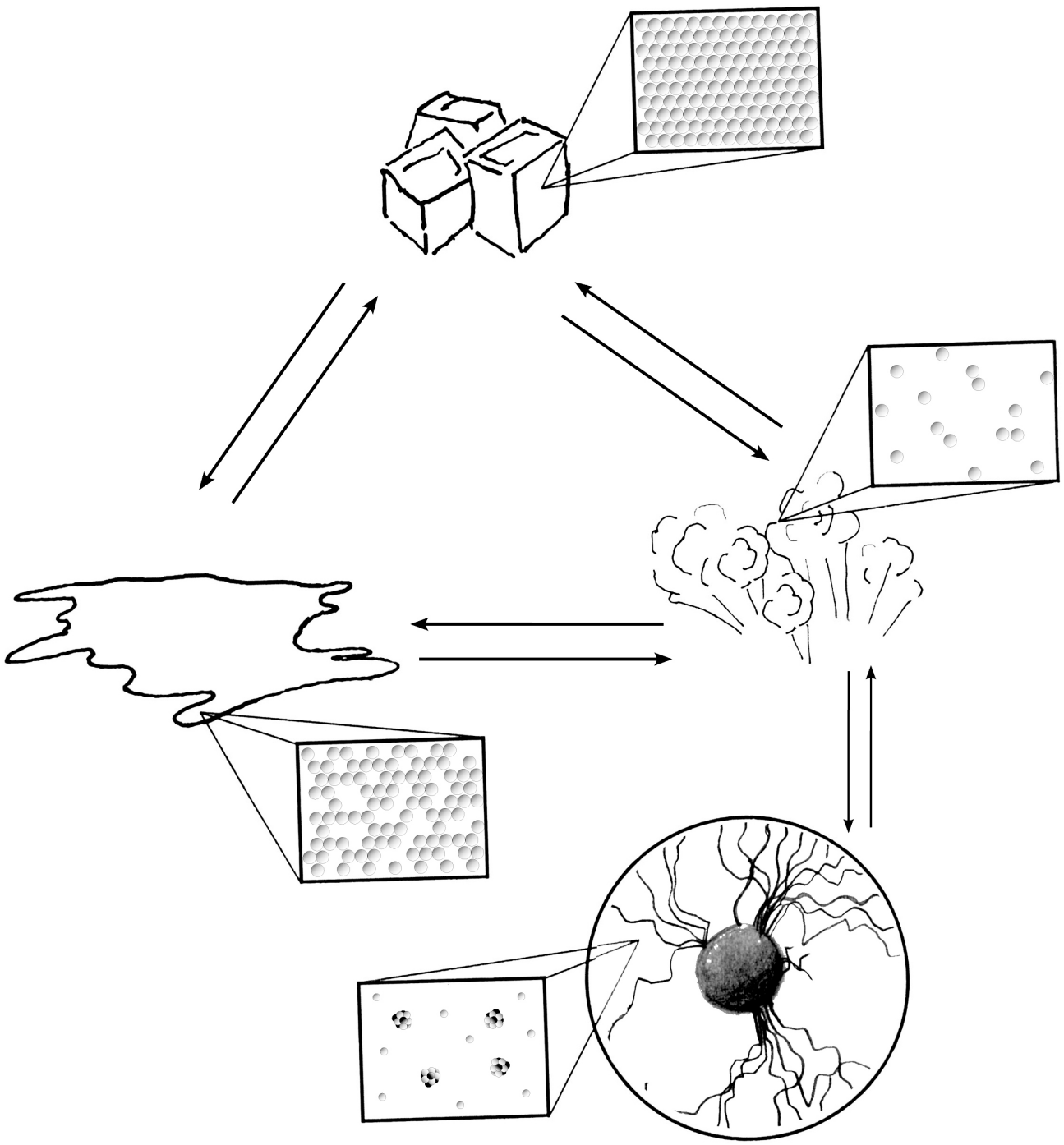
_____

_____

_____

States of Matter Sketch

Label the following in the boxes below – gas, liquid, solid, plasma, freezing, melting, condensing, evaporating, sublimation, deposition, deionization, ionization. Add the title: States of Matter



States of Matter Notes

Your turn: Write what you learned about states of matter.

Need help getting started?

Answer the following questions: What are two ways that substances can change physical states? What is a solid? What is a liquid? What is a gas? What is plasma? What is condensation? Evaporation? Melting? Freezing? What is sublimation? What is one thing that can affect a boiling or melting point?

Bonus Question: How does the arrangement of particles affect the states of matter?

Lesson 2: Solid Structures

Assignment Sheet

Read

- ○ Read Chapter 2 in *The Route 66 Sticky Road Quest*: "Addy Dug Up A Clue."
- ○ Read the encyclopedia pages assigned by your teacher. Circle the ones your instructor wants you to do.
  - *Usborne Science Encyclopedia*: "Crystals" pp. 90-91
  - *Kingfisher Science Encyclopedia:* "Crystals" pp. 168-169
  - *Usborne Illustrated Dictionary of Science:* "Crystals" pp. 135-137
  - *Everything You Need to Ace Science in One Big Fat Notebook:* "Minerals and Their Uses" pp. 228-230
  - (Other) _____

Do

- ○ Do the "Can I make crystals?" experiment. Fill out the experiment sheet as you do the experiment.
- ○ (Other) _____

Write

- ○ Look up cleavage, conductivity, and lattices. Add the definitions to the unit vocabulary sheet.
- ○ Label the "Crystal Shapes" sketches.
- ○ Write a list of facts or a paragraph about solid structures and crystals on the pages with the sketches.
- ○ (Other) _____

_____

Key Idea

Crystals have atoms that are arranged in orderly, repeated patterns.

Can I make crystals?

Introduction

Addy and her family learn about and dig up different minerals during their visit to a state park. Minerals have crystal structures in all shapes and sizes, but each is based on the regularly repeating pattern of the atoms, molecules, or ions that make it up. They are very hard, solid structures, and we use them in a variety of ways as we go about our daily lives. For example, the salt you use on your food and the lead in your pencil are both made up of crystals. In this experiment, you are going to make your own crystals.

Materials

You will need:

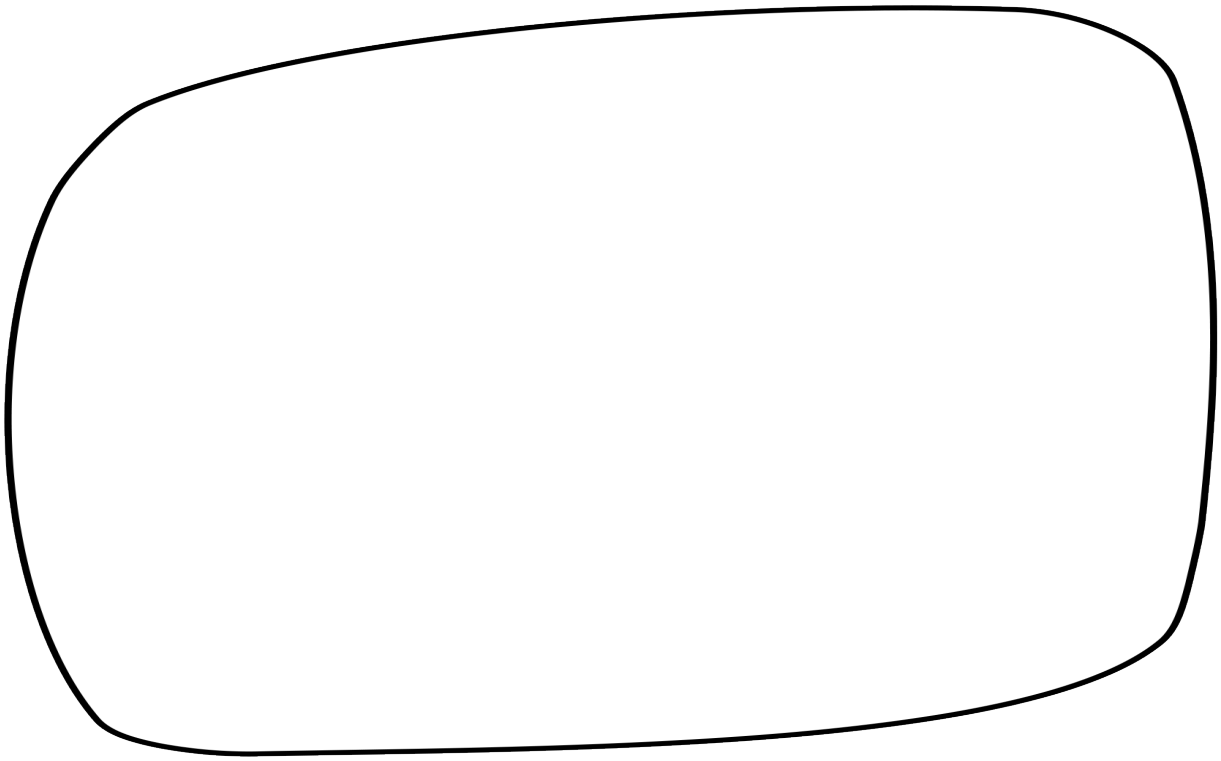
- Wide mouthed jar
- String
- Pencil
- Pipe cleaner
- Water
- Borax
- Scissors

Procedure

1. Fill your jar with water, pour that water into a pot, and set it on a burner to boil. (Make sure to record how many cups (or mL) of water it takes to fill your jar.)
2. Form a shape with the pipe cleaner—this can be as simple or as complex as you wish, but make sure it will fit through the opening of your jar.
3. Next, tie a string to the shape and then tie the other end of the string to a pencil. (Tip—You want the pencil to be able to rest on the edge of your jar without having your shape touch the sides or bottom of the jar.)
4. Set your jar in the sink, put on safety glasses, and use a hot mitt to slowly add boiling water until it almost fills the jar.
5. Then, add the Borax one TBSP (25 g) at a time, stirring each time until the Borax is dissolved. (Note—You want to add about 3 TBSP (75 g) of Borax for every cup (240 mL) of water you've added. Be sure to record how many tablespoons you added on your experiment sheet.)
6. Hang the shape in the jar so that it is completely covered by the liquid.

7. Allow the jar to sit undisturbed overnight.
8. In the morning, take out your shape and observe what has happened.

Drawing or Picture of the Crystals



Results

_____

_____

_____

_____

Conclusion

_____

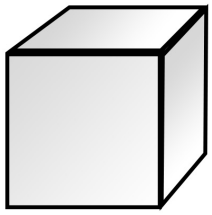
_____

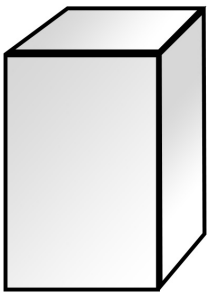
_____

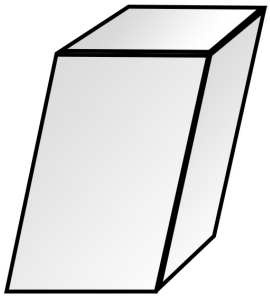
_____

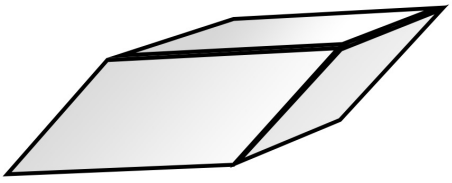
Solid Structures Sketch

Label the following crystals below – cubic, tetragonal, monoclinic, triclinic, hexagonal. Add the title: Crystal Shapes









Solid Structures Notes

Your turn: Write what you learned about solid structures and crystals.

Need help getting started?
Answer the following questions: What are crystals? What are two methods of crystallization? What causes crystals to form a definite shape? What are the main crystal shapes? What is polymorphism in crystals? What are the four main type of lattice structures? Describe each one.

Bonus Question: Would the way a crystal forms affect its shape?

elemental science

ARE YOU READY TO START?

Learn about matter, solutions, and forces by purchasing *SciQuest 200: Addy's Adventure* here:

https://elementalscience.com/collections/sciquest-200-addys-adventure

Or check out the rest of our story-based science programs here:

https://elementalscience.com/collections/story-based-science

STORY-BASED SCIENCE