

Growing Food

Lesson 2: Exploring Grapes
Lesson 3: Making Grape Juice

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LIFE LINKING FOOD AND THE ENVIRONMENT
AN INQUIRY-BASED SCIENCE AND NUTRITION PROGRAM

Exploring Grapes

AIM

To demonstrate the first three phases of QuESTA through observing and experimenting with grapes.

SCIENTIFIC PROCESSES

- question, observe, investigate, hypothesize

OBJECTIVES

Students will be able to:

- describe new things they learned about grapes through carefully observing them;
 - outline the steps of a procedure to turn grapes into grape juice;
 - define the phases of the QuESTA Learning Cycle in their own words;
 - express, in writing, what they have learned about grapes.
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OVERVIEW

Students are introduced to another key feature of LiFE — the QuESTA Learning Cycle. QuESTA has five phases: Questioning, Experimenting, Searching, Theorizing, and Applying to Life. This lesson covers the first three phases; Lesson 3 covers the remaining two. To gain an understanding of the way QuESTA guides the learning process, students participate in activities that take them through Questioning, Experimenting, and Searching. Students conduct detailed observations of grapes. Based on their observations, they pose questions to help them learn even more about grapes. They work in small groups to develop a procedure to change grapes into grape juice. Then they come together as scientists to discuss and debate their experiment procedures and reach consensus on a class procedure for making grape juice in the next lesson. Students experience the Searching phase as they read more about QuESTA. In their LiFE Logs, they summarize what they learned about grapes.

MATERIALS

For the teacher:

- *QuESTA!* lesson resource
- *Six Steps to an Experiment* lesson resource
- *Grapes and Grape Juice* teacher note
- *Scientific Inquiry* teacher note

For the class:

- Chart paper
- Markers

For each student:

- 3–4 grapes
- Napkins or paper towels
- *QuESTA Learning Cycle* student reading
- *Grape Explorations* activity sheet
- *Grape Experiment* activity sheet
- LiFE Log

PROCEDURE

Before You Begin:

- Review the background information in the *Grapes and Grape Juice* and *Scientific Inquiry* teacher notes.
- Detach and wash grapes, 3–4 per student
- Make copies of the *QuESTA Learning Cycle* student reading and the *Grape Explorations* and *Grape Experiment* activity sheets for each student.
- Review the questions on the *Grape Explorations* and *Grape Experiment* activity sheets.
- Post the *Six Steps to an Experiment* lesson resource at the front of the class.
- Review the *QuESTA!* lesson resource.
- If you have not already done so, post the Module Question and Unit 1 Question at the front of the classroom.

MODULE QUESTION

How does nature provide us with food?

UNIT QUESTION

What is a food scientist?



QUESTIONING

1. Review Module and Unit Questions

Explain that in this lesson students will investigate grapes. As food scientists, students will explore ways to turn grapes into grape juice.

2. Explore Grapes

Pass out 3–4 grapes to each student. Have students share what they already know about grapes. Record their ideas on the board. Ask students to think about some ways that food scientists might investigate grapes. Brainstorm

different ways to make observations about the grapes. Encourage students to break the grapes in half and to use all of their senses, including taste, to learn more about this fruit. Challenge students to discover something they did not know about grapes before. Have students record their findings on the *Grape Explorations* activity sheet.

Ask volunteers to share their observations. Accept all answers. Encourage discussion, questions, and debate among the students.



EXPERIMENTING

3. Develop Experiment Procedure

Have students work in groups of 3–4 students to develop an experimental procedure to answer the question: *How is grape juice made from grapes?* Students in each group can record the methods and materials on their *Grape Explorations* activity sheet. Encourage students to include as much detail as possible.

4. Have Groups Share Their Methods

Have each group write its method on the board or on chart paper. Invite groups to present their methods to the class. Encourage student groups to ask questions of their classmates. Explore similarities and differences among the groups' methods. *What steps did all the groups include? What steps did only some groups include? What steps seem to be very important to turn grapes into grape juice? Do you think any steps listed are not important? Why?* Most likely, all the groups included smashing the grapes as part of their method. Investigate each group's grape-smashing method. Be sure to discuss how to handle the seeds and skins. *How would you guess the grape juice might turn out using these different mashing methods? What ideas do you have for handling the seeds and skin of the grapes?*

5. Plan Whole-Class Experimental Procedure

Consider all of the groups' experimental procedures. Then, as a whole class, develop one method to use in Lesson 3 when you will make grape juice from grapes. This is an excellent opportunity to model how to plan a complete, detailed procedure for an experiment. Write your methods on chart paper so they can be posted when you do Lesson 3. If you wish to have students record the class experiment, they can copy it into their LiFE Logs. See the *Grapes and Grape Juice* teacher note for a description of how grape juice is made.

Make a materials list and determine where you will get the supplies. You may wish to have students bring in some of the kitchen supplies that are needed. Modify methods, as necessary, based on available materials.

Create a class hypothesis for the experiment. Or, you can have the students write their own hypotheses in their LiFE Logs.

Alternative method: Instead of creating one class experiment, let each group try the process as designed. This way the class can compare results and each group can learn what works and does not work in their experimental procedure. However, this will take more materials and more time.



SEARCHING

6. Introduce QuESTA Learning Cycle

Explain that LiFE uses the QuESTA Learning Cycle to help students understand the process of learning. *Have you ever thought about how you learn? What might be the steps involved in learning something new? Can you share with the class an example of how you learned something?*

Distribute the *QuESTA Learning Cycle* student reading. Have students read it individually or as a class. Discuss each phase and ask students to define each one using their own words. Encourage questions and discussion.



THEORIZING

7. LiFE Logs

Have students write a paragraph that begins with: "Today I learned some new things about grapes. Here's what I learned..." Ask students to include a description of the kind of observations they made. Prompt them to describe what they learned by using each of their senses. Remind them to include any questions they still have about grapes.

QuESTA!

How students learn is as important as what they learn. The Module and Unit questions ask students to think hard by challenging them to explore, question, investigate, analyze, synthesize, and act. QuESTA is a five-phase cycle that guides students through this process. Although the phases are presented linearly, they are dynamic. Once you get acquainted with QuESTA, you and your students will flow among the phases. Here are some sample questions to help you guide your students' learning.



QUESTIONING

- What do I already know about the topic?
- What don't I know about the topic but would like to learn?
- What am I curious about?
- How might I find answers to my questions?
- What if...?



EXPERIMENTING

- How can I set up my experiment?
- What are the steps in my experiment?
- What materials do I need for my experiment?
- What do I think will happen?
- Did my experiment work as well as I thought it would? Is there anything I would like to change about it?
- What data do I have?
- What are the results of my experiment?



SEARCHING

- What can I learn from reading or talking to people?
- Where can I find out more information?
- What do scientists already know about this topic?
- How can I find out if my results are accurate?
- How can I tell the difference between a fact and an opinion?



THEORIZING

- What have I learned?
- What evidence do I have to support my conclusion?
- Have my ideas changed?
- What are some different ways that I can analyze what I have learned from questioning, experimenting and searching?
- What conclusions can I draw?
- Has my thinking about this topic changed? Why or why not?



APPLYING TO LIFE

- How can I use what I have learned?
- How can I remember to think about what I have learned as I do my daily activities?
- What can I teach my family and friends?
- What new questions do I have about the topic now that I am using this new knowledge in the real world?

Six Steps to an Experiment

Step 1: Develop an experiment question. This is the question your experiment is trying to answer. To develop a question, think about what you want to learn.

Ask Yourself: What question do I want to answer with my experiment?

Step 2: Decide on a **hypothesis**. A hypothesis is a prediction, or a guess, about the results of the experiment.

Ask Yourself: What do I think will happen?

Step 3: Develop your **experimental design**. Write down the steps you will do to conduct the experiment. These are called your methods. If you are conducting an experiment to make comparisons, identify the **control group** and the **experimental group**. With the experimental group, be sure to identify the **variable** (the thing that will change). Include a list of the materials you will need for your experiment.

Ask Yourself: What are all the steps in my experiment? What materials do I need to conduct the experiment?

Step 4: Do the experiment following your methods.

Ask Yourself: Is my experiment working as planned? Does it need to be changed? How could I change it to make it better?

Step 5: Record your data in a table, a chart, or in your LiFE Log.

Ask Yourself: What are the results? How should I record my data? Should I use a chart, a graph, a table, or write a paragraph to describe my results?

Step 6: Examine your results and think about what you have learned. Use your answers to this question to make your conclusions.

Ask Yourself: What did my experiment teach me, and how can I use this?

Grapes and Grape Juice

Did you know that grapes are the most commonly grown fruit in the world? This fruit and its juice have been popular for a long time. Archaeologists have found evidence of fermented grape juice in pottery jars dated to Neolithic times, about 5400 to 5000 B.C. And even though wild grapes didn't grow in ancient Egypt, artwork on tomb walls depicts the wine-making process. Extracting juice from grapes has a long history!

What's the first thing you think of when you think about making grape juice? For most people, smashing grapes — whether with feet or food processor — is what first comes to mind. Undoubtedly, this will also be the first thing that comes to your students' minds as well. You can count on hearing some rather creative ideas for smashing the fruit! While smashing grapes is part of the process, a very important step occurs after the smashing. This is the step when the grape pulp is heated. The heating process brings out the sugar in the grapes and incorporates elements from the skins. If purple grapes are used, the juice takes on the purple color of the skin.

Grape-Juice Recipe

Most grape-juice recipes recommend mashing the grapes with a potato masher, then heating the grapes to boiling. Continue to mash the grapes during heating. After the grape pulp boils for about 3 minutes, reduce the heat and simmer for 20 minutes. The final step is straining the juice through a fine strainer or cheesecloth to remove any remaining skin fragments and seeds. If possible, try heating your grapes when your class makes grape juice. Even if you don't do it in class, perhaps you, or one of your students, could try adding the heating step at home and bringing in the juice for everyone to try. Commercial grape juice is heated at least one more time during the pasteurization process before it reaches store shelves.

Most commercial grape juice is made from Concord grapes, which have a deep purple skin but light green insides. Concord grapes are highly perishable and can be hard to find in stores. If they grow in your region, you may be able to find them in farmers' markets. Another popular variety to look for is Niagara.

Scientific Inquiry

With this lesson, LiFE introduces students to the scientific method. Your students will gain valuable experience recording and describing each step in the grape juice-making procedure.

It's important for students to understand that different kinds of investigations are used to answer different kinds of questions. Sometimes observation might be appropriate. *How does a starfish move?* Sometimes a question can be answered through research. *Are all grapes purple?* Sometimes a thought analysis can answer a question. *Could animals live if there were no plants?* Other times, a controlled experiment can be used to answer the question. *Does the amount of light affect how a plant grows?* In an experiment, scientists need to control the variables — the factors that can affect the results. For example, water, air, and temperature might also affect plant growth. To test just the effect of light, a scientist would control the other factors (water, temperature, and air).

While students are introduced to controlled experiments in this lesson, they do not conduct one until Lesson 4. You may choose to save your discussion of controls and variables until later in this unit.



Name

Date

QuESTA Learning Cycle

You have been learning science since you were born. Have you ever thought about how you learn? You will in the LiFE program!

In the LiFE program, you will use the QuESTA Learning Cycle. When you first begin to study a topic, you will question what you already know about the topic. For example, what do you already know about grapes? After you think about what you already know, you ask yourself what **questions** you still have about grapes.

How can you find answers to the questions you still have? One way is to conduct a scientific test called an **experiment**. When you conduct an experiment, you may make new discoveries or develop new ideas as you try to find answers to your questions. You may also **search** for more information by reading or talking to people.

What do you do with all of this new information you've learned from questioning, doing experiments, and searching? You can use it to develop new **theories**, or explanations of how things work.

You may be asking yourself how you can use what you have learned. Try using it in your daily life and sharing it with your family. For example, the next time you have a glass of grape juice, think about how it was made. You may even want to teach your family and friends what you've learned. When you do this, you'll be **applying to life** what you have learned.

Once you start applying what you learned, you may find you have more questions. This starts the learning cycle all over again.



QUESTIONING



EXPERIMENTING



SEARCHING



THEORIZING



APPLYING TO LIFE



Name

Date

Grape Explorations

Answer the following questions.

1. What do you already know about grapes?

2. Look at your grapes very closely and record some of your new observations.

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Name

Date

Grape Explorations

3. Make a drawing of the grape and what you observe.

4. Based on what you already know about grapes and what you have just learned from your observations, write down some ideas about how you think grapes are turned into grape juice.



Name

Date

Grape Experiment

2. List everything you will need for your grape juice-making procedure. Think through the entire process and try not to leave anything out.

3. What do you think your results will be?

Making Grape Juice

AIM

To continue to learn about grapes and QuESTA through making grape juice and synthesizing new ideas about grapes.

SCIENTIFIC PROCESSES

- experiment, gather data, infer, theorize, apply

OBJECTIVES

Students will be able to:

- describe their experiences of making grape juice from grapes;
 - develop theories on how commercial grape juice is made, based on what they have learned about grapes;
 - express in writing in their LiFE Logs what it will be like to learn using QuESTA.
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OVERVIEW

Students learn more about the QuESTA Learning Cycle. They continue with the Experimenting phase by conducting their class experiment for making grape juice, doing the experiment and variations on it as many times as they can. After the experiment they move to the Theorizing phase through speculating on how store-bought grape juice is made. They speculate on how much effort it took to make a small amount of juice and come up with ideas about how factories might make very large amounts of grape juice. This gives them the opportunity to process what they have learned in order to synthesize new knowledge constructs, something they will do throughout the LiFE Curriculum Series. Finally, they Apply the lesson to life by discussing what they will think, feel, and do differently in the future, based on what they have learned about grapes and grape juice.

MATERIALS

For the class:

- 3 bunches of grapes
- Chart paper with experiment recorded (from Lesson 2)
- Materials as listed for class experiment (from Lesson 2)

For each student:

- *Turning Grapes into Juice* activity sheet
- *Grape Juice Theories* activity sheet
- *Applying What I Have Learned* activity sheet
- LiFE Log

PROCEDURE

Before You Begin:

- Complete any setup needed for your experiment.
- Post the experiment recorded on chart paper in Lesson 2.
- Make enough copies of the *Turning Grapes into Juice*, *Grape Juice Theories*, and *Applying What I Have Learned* activity sheets for each student.
- If you have not already done so, post the Module Question and Unit 1 Question at the front of the classroom.

MODULE QUESTION

How does nature provide us with food?

UNIT QUESTION

What is a food scientist?



EXPERIMENTING

1. Review Module and Unit Questions

Explain that in this lesson the class is going to conduct an experiment. Conducting experiments is one way that food scientists learn more about food.

2. Conduct Grape Juice Experiment

As the experiment is being done, help the students see how you are following the methods just as they were written up in the last session. If you have the supplies and the time, conduct the experiment a second time to compare with the results from the first time. You may do the experiment in the exact same way or make modifications based on what you learned the first time. Explain to the students that scientists often do experiments more than once to determine if their results come out the same each time. If the results are different, scientists carefully look over what they did to determine why.

3. Record Results

Have students describe the results of the experiment on the *Turning Grapes into Juice* activity sheet. Review the questions on the activity sheet with students. Check for understanding. Have students answer the questions.



THEORIZING

4. Develop Grape Juice Theories

From what you learned in your experiment, how do you think the grape juice you buy in the store is made? Discuss as a whole class, then have students write their answers on the Grape Juice Theories activity sheet.

Encourage students to think about the factories that make grape juice in very large quantities. *How might what happens in a factory be similar to what we did in class? How might it be different? What do you think factories do with the seeds and skins of the grapes? How might the equipment used in a factory be like the equipment we used in class? How might it be different?* Use the teacher note in Lesson 2 to guide you through this discussion.

Remind students that the theorizing phase of QuESTA is particularly important. It is their opportunity to put together everything they have learned and to gain new knowledge about what they are studying that they will be able to use now and in the future.

5. Share Written Answers

Encourage questions, discussion, and debate among the students. Continue the conversation until you feel most students have developed a new understanding about making grape juice.



APPLYING TO LIFE

6. Discuss Applications

Ask students to describe how their thoughts and actions related to grapes and grape juice have changed as a result of this lesson. Have students complete the *Applying What I Have Learned* activity sheet.

Explain that in this final phase of the learning cycle, students will think about how they will apply what they learned to their daily decisions.

7. LiFE Logs

Have students define in their own words the five phases of QuESTA (Questioning, Experimenting, Searching, Theorizing, and Applying to Life) and describe what they think it will be like to learn using the QuESTA Learning Cycle.



Name	Date
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Turning Grapes into Juice

Use these questions to help you describe the results of your experiment.

1. Does what you made look like grape juice?

2. How is the juice you made similar to grape juice you have had before? How is it different?

3. Is the juice thick or thin? What is the texture?

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Name

Date

Turning Grapes into Juice

4. Does the juice have skin or seeds in it?

Four horizontal lines for writing the answer to question 4.

5. How does it smell? How does it taste?

Four horizontal lines for writing the answer to question 5.

6. Compare your results with your hypothesis. What was similar? What was different?

Five horizontal lines for writing the answer to question 6.

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Name

Date

Turning Grapes into Juice

7. What worked about your experiment? Why?

8. What didn't work about your experiment? Why?

9. What would you do differently next time? Why?



Name

Date

Grape Juice Theories

2. What evidence do you have for your ideas?

3. How have your ideas changed?



Name

Date

Applying What I Have Learned

2. Based on what you have learned about making grape juice in class, do you have any new questions about the grape juice you buy in the store?

3. How can you apply what you have learned to your daily life? Is there anything that you will do differently?
