Liquids and Solids Pacing Guide[1]

Use the information below to assist you in determining the amount of time needed to complete the entire unit. These recommendations assume the average science class period is 45-60 minutes in length. We recommend teaching science a minimum of three sessions per week in order to maintain consistency and keep students engaged. Many teachers accomplish this by rotating a science unit with a social studies unit, enabling you to teach more science sessions in one week and finish the unit in fewer weeks. While we highly recommend that all teachers participate in the Expository Writing and Science Notebook Program in order to more fully develop students' science understandings and writing skills, the below recommendations do not include time for implementing the science writing curriculum.

Lesson and Common Assessments (See corresponding lesson in Instructional Guide for lesson planning)	**Recommended Number of Periods**	**GLEs Addressed/Big Idea(s) of Lesson**	**Considerations for Planning**	**Recommended Applications and Extensions**
Liquids Lesson 1: Liquids Around Us. Students make a web of their knowledge of liquids.	1	There is no big idea or concept developed in this lesson.	• The teacher Background information on pages 253-262 in the teacher's manual is very helpful. • Begin collecting clear, unbreakable jars with lids and a number of objects that can be used for the float and sink investigations.	• Note: Wait to read the book *Solids and Liquids*, included in the kit, until the point in the unit when the extra solids lessons have been taught. • Ask students to bring empty jars and one jar containing a safe liquid. Observe the safe liquid and use for 20 Questions game. This game can be played throughout the unit.
Liquids Lesson 2: Find Out What You Can. Students observe three liquids and compare properties of different liquids.	2	**GLE 1.1.1:** Understand simple properties of common natural and manufactured materials and objects. *Students will identify and describe a property of an object or [substance].* **Big Idea***:* Water, corn oil, and corn syrup can be distinguished by their properties of color, texture, smell, viscosity (runniness), and the way they behave when moved (shaken, tipped, swirled, etc). Fresh water is clear, colorless, slightly slippery, odorless, and runnier than oil or corn syrup. Corn oil is clear, yellow, slippery, has a slight odor, and thicker than water. Corn syrup is clear, colorless, sticky, sweet-smelling, and thicker than water and oil, oozing rather than running.	• Lessons 2-5 will involve doing a series of investigations with water, corn syrup and corn oil. • Plastic tubes have been replaced with jars and lids in the kit. • At the beginning of the lesson, tell students that they will **not** be opening the jars. • Explain safety rules.	• Students can use liquids brought from home, in addition to the liquids included in the kit, and observe how they behave. • Have a feeling and smelling station set up in the classroom. Small groups of students can visit the station while the other students are doing the investigation at their seats.
Liquids Lesson 3: What Do We Know? Students review, explore and create a definition of ALL liquids.	1	**GLE 1.1.1:** Understand simple properties of common natural and manufactured materials and objects. **GLE 2.1.1:** Understand how to ask a question about objects (and substances). **Big Ideas:** A liquid is a substance that flows freely. It takes the shape of the container that it is in.	• In order to organize the information from the "Descriptions of Liquids" chart, construct a class grid where the properties can be listed according to category. Do this instead of making the "Special characteristics of …" chart shown in the teacher's manual on p. 77.	• Use the containers that you and the students have brought from home to pour liquids from one container to another to demonstrate how liquids take the shape of the container they are in.

[1] Pacing Guide for use with the *LIQUIDS* Teacher's Manual, Kendall/Hunt Publishing Company (1997)

Assessment A: Definition of a Liquid.			• This assessment may be implemented at the end of Lesson 3.	
Liquids Lesson 4: How Are Liquids Different? Comparing Drops. Students explore drops of liquids and compare how they behave on waxed paper.	2	**GLE 1.1.1:** Understand simple properties of common natural and manufactured materials and objects. **Big Idea**: Drops of the 3 liquids behave differently because they have different thicknesses and are different in their ability to "stick together" (cohesion).	• Check the small dropper bottles to make sure that the bottles of water are full. It is important to make sure that the tops of the oil and syrup dropper bottles are not clogged. • You will need several laminated black pieces of construction paper.	
Liquids Lesson 5: How Are Liquids Different? Mixing Liquids. Students explore how liquids interact when added to a tumbler of water.	2	**GLE 1.1.1:** Understand simple properties of common natural and manufactured materials and objects. **Big Ideas**: Water and oil do not mix although, if shaken together, they will form an emulsion and then separate with oil floating on top of the water. Oil and corn syrup do not mix. If shaken together, they will separate with oil floating on top of the corn syrup. Water and corn syrup do mix. If equal amounts are shaken together, the corn syrup mixes completely with the water. The two liquids do not form layers.	• Make sure to have students make predictions during session 1. • Do not follow the teacher's manual for session 2. Follow the instructional guide instead. • Be sure to add food coloring to the dropper bottles of water.	• Have students make predictions about what will happen when you pour oil into a jar 1/3 full with water. Then mix these two liquids together in front of the class. Do the same for oil and syrup and then water and syrup. Then mix all three liquids together.
Assessment B: How Are Liquids Different?	Embedded in Lesson 5 Session 2		• Session 2 of Lesson 5 has been modified so that it can be used as formative assessment; therefore it is called Assessment B.	
Solids Lesson 1: Looking at Solid Objects. Students Observe and describe some solids and compare to definition of liquids.	1	**GLE 1.1.1:** Understand simple properties of common natural and manufactured materials and objects. **Big Ideas:** Solid objects can be distinguished by their properties of color, texture, size, shape. Some properties of solids are different than the properties of liquids.	• Solids lessons 1-5 are not in the teacher's manual. They have been added in order to address the new GLEs.	
Solids Lesson 2: Testing for Another Property of Solids: Magnetic or Not? Students observe magnetic properties of some solids.	2	**GLE 1.3.2.** Know that pushes and pulls can change the motion of common objects. Evidence of Learning: Students will observe and show that magnets can make some objects move without touching the objects. **Big Ideas:** Two magnets can be attracted to each other. Sometimes two magnets can push each other apart. A magnet can push another magnet away without touching it. Some solid objects are attracted to magnets. A magnet can make a magnetic object move without touching it. Solid objects that are magnetic are made of iron.	• If students need a longer time for exploration, this lesson should be divided into two periods.	• Have a set of other objects in a center where students first predict whether or not an object is magnetic, then test it using a magnet. • If students have magnets at home, ask them to find other things at home that are magnetic.
Solids Lesson 3: Solids: Does Size Make a Difference? Students observe particles of solids and compare the properties of these to liquids.	1	**GLE 1.1.1:** Understand simple properties of common natural and manufactured materials and objects. **Big Ideas:** Granular solids can pour and take the shape of their containers like liquids. But they distinguish themselves as solids in several ways. They can be scraped into piles or pushed into rows. They clump rather than flow. They are made of tiny particles that may need to be magnified in order to see their shape.	• You will need to freeze some ice cubes for the next lesson. You will need enough for each person in the class, as well as yourself.	• Place some other examples of small solids in a center where students can observe them inside tightly covered jars. • Have jars of various liquids available for students to observe and compare with the small solids.

Solids Lesson 4: Water: Solid and Liquid. Students investigate how to change solid water to liquid water and back again.	1-2	**GLE 1.1.5**: Understand physical properties of Earth materials. **Evidence of Learning**: Illustrate and tell about the properties of water as a solid and liquid. **GLE 1.3.3**: Know that water can exist in different states: solid and liquid. **Evidence of Learning**: Observe water changing from solid to liquid. Observe and describe how a substance is the same substance before and after heating and cooling. **Big Ideas:** Water can exist as a solid and as a liquid. Water, in solid form, ice, becomes a liquid when its temperature is increased or raised. Liquid water becomes a solid when its temperature is lowered. When water changes from a solid to a liquid and back to a solid again, it is still water.	• **Possible Misconception:** Some students think initially that their coats or shirts are warm and can provide heat to melt the ice cube. Make sure students understand that it is their body heat melting the ice cube.	• Bring out the ice cubes trays during the next science lesson and ask the students to observe what happened when liquid water was placed in the freezer. • You might consider making popsicles or juice cubes for the students making sure they watch you fill the trays with the liquid.
Solids Lesson 5: Mixing Solids With Water. Students observe what happens to solids when mixed in water-dissolve, swell, break down, etc.	2-3	**GLE 2.1.3:** Understand how to construct a reasonable explanation using evidence. **GLE 2.2.1**: Understand that all scientific observations are reported accurately even when the observations contradict expectations. **GLE 2.2.2:** Understand that observations and measurement are used by scientists to describe the world. **GLE 2.2.5:** Know that ideas in science change as new scientific evidence arises. **Big Ideas:** Some solids change, some remain unchanged when mixed with water. When scientists conduct a fair test they try to do everything exactly the same way except for the one thing they are testing. They record their observations and use them as evidence to support their answer to the question they are investigating.	• In this lesson students will be planning and conducting a fair test.	• You may decide to keep the tumblers on a back table for a few more days, until the water dries up. The salt will start to become visible on the sides and bottom of the cup. • Allow students to bring in other solids mixed with water in tightly sealed unbreakable jars. The jars should be labeled. Place these in a center for all to observe.
Liquids Lesson 6: What Solids Sink and What Ones Float? Students explore what a variety of objects do in water.	2	**GLE 1.1.1:** Understand simple properties of common natural and manufactured materials and objects. **Big Ideas:** Objects may float in water, which is to remain off the bottom of the water in a container. Objects may sink in water, which is to remain at the bottom of the water and resting on the container. Objects may float sometimes and sink at other times, depending on how they are placed in the water. Whether an object floats or sinks is influenced by the material of which it is made, the distribution of the mass (hollow/solid), and its shape. The weight and size of the object are not the sole determiners of whether it will float or sink.	• Lessons 6-11 all involve sinking and/or floating. • You will need to gather about 6 or more fruits and vegetables for a class demonstration on sinking and floating. Make sure to find a variety of fruits and vegetables that float and sink.	• Literacy integration: Read the book *Solids and Liquids,* included in the kit, at this point in the unit now that the extra solids lessons have been taught. You can choose to read this book aloud to the class or to use it as a guided reading book during your literacy time.
Liquids Lesson 7: Sinker and Floaters in Other Liquids. Students compare viscosity (thickness) of three liquids and how objects behave in these liquids.	2	**GLE 1.1.1:** Understand simple properties of common natural and manufactured materials and objects. **Big Ideas**: Objects may float, sink, or do both at different times, in different liquids. Whether an object floats or sinks is influenced by the material it is made of and by its shape, as well as the thickness of the liquid. The weight of the object is not the sole determiner of whether an object will float. A larger portion of an object will remain above the surface of a thick than a thin liquid.	• A modification is suggested. Each group should be given 3 bottles of the 3 different liquids and drop 2 different sets of objects in each liquid e.g., 3 rubber balls, 3 jacks. Different groups of students would have 2 sets of different objects. Then the groups could circulate around the room to observe the behavior of the objects that each group tested.	• Bring out the bottle containing water, oil, and syrup. Ask the students to predict what the objects will do when dropped into this bottle. You will only need to use the hot glue stick, plastic cube, plastic disc, and the nylon ball, since these are the only objects that most likely did different things in the different liquids. Test students' predictions.

Liquids Lesson 8: Can You Make a Sinker Float? Students try to make a piece of clay float by changing the shape. They discuss which design features make it float longer.	2-3	**GLE 2.1.3:** Understand how to construct a reasonable explanation using evidence. **GLE 2.2.1:** Understand that all scientific observations are reported accurately even when the observation contradict expectations. **GLE 3.1.1:** Know and understand problems that can be solved by using scientific design. **GLE 3.1.2:** Understand how to construct and test a solution to a problem. **GLE 3.1.3**: Understand how to evaluate how well a design or product solves a problem. **Big Ideas:** Changing the shape of an object that sinks can allow it to float. A shape that creates more air-filled space (volume) that is protected from being filled with water will enable an object to float higher and for a longer time than will a shape with less air-filled volume.	• In lessons 8 and 9 the effect of changing the shape of the clay is observed. Therefore, the size of the lump of clay should be uniform. Make sure the students are aware that you were very careful to give them equal amounts of clay. This will promote understanding of the idea of a fair test.	• Challenge students to sink floaters-things that normally float (foil, wood, paper towel and so forth)-by adding weight, changing shape, soaking the item with water, or any other means they can find.
Liquids Lesson 9: What Else Can You Make Float? Students use clay and aluminum foil to see how many weights they can float in water.	2	**GLE 3.1.1:** Know and understand problems that can be solved by using scientific design. **GLE 3.1.2:** Understand how to construct and test a solution to a problem. **GLE 3.1.3:** Understand how to evaluate how well a design or product solves a problem. **Big Ideas:** Changing the shape of an object that sinks or attaching material that floats can enable the object to float. A shape that creates more air-filled space (volume) that is protected from being filled with water will enable an object to float higher and for a longer time than will a shape with less air-filled volume. An object shaped like a boat with a larger surface area on the bottom is more stable than one with less surface area. An object shaped like a boat is more stable when a load is spread out evenly rather than piled up in one place.	• Math integration: Make a class line plot showing number of washers held by each pair.	
Assessment C: Identifying Features of Successful Clay Floaters.			• This assessment may be implemented at the end of Lesson 9.	
Liquids Lesson 10: Making Sinkers. Students explore some of the features that influence sinking.	1-2	**GLE 3.1.1**: Know and understand problems that can be solved by using scientific design. **GLE 3.1.2:** Understand how to construct and test a solution to a problem. **GLE 3.1.3:** Understand how to evaluate how well a design or product solves a problem. **Big Idea**: The rate at which an object sinks in water and the behavior while sinking are influenced by the material it is made of and the shape of the object, as well as how the object was released.	• You will need to collect a variety of small objects that will sink. Look for objects that will sink in interesting ways. You may also use the objects in the bags that you used in lesson 6.	• Students can observe the objects sinking in oil and syrup if you prepare jars of each liquid and place some objects inside. • You may also want to place some of the objects in the jars that are oil/syrup, oil/water, and oil/syrup/ water.
Liquids Lesson 11: Not recommended.				
Liquids Lesson 12: Fun With Liquids. Students apply concepts learned in the lessons to design and build a boat, toy or game. This creation is a system with parts that are interconnected.	2-3	**GLE 1.2.1**: Understand that things are made of parts that go together. **Big Idea:** A system can be designed with objects and liquids to be used as a boat, toy, or game.	• Most of the students will not want to take their boat, toy, or game apart, so do not use any objects that need to be returned in the kit. • This lesson has been modified to construct the understanding of a system with interrelated parts that must work together in order for the system to function properly.	