




Preparation Guide


Level 3 Module 1

EARTH CHANGES

with Spotlight Lessons on Changes in Matter

Materials: This section lists the quantity of each material necessary for the lesson. Lesson materials may be from a *PhD Science® Texas* materials kit, or the materials may be school-supplied items. In addition to having the listed materials, teachers should have access to the following common classroom items: sticky notes, chart paper, pencils, a whiteboard, and markers.

Resources: This section lists module resources (from the Module Resources section in the Teacher Edition) and core texts used in the lesson. Classrooms also need daily access to the module's Teacher Edition, Science Logbooks, and, if applicable, digital slides. A symbol () identifies resources that appear in the digital slides. Additional supports and Spanish resources are available in the Implementation Resources and Level Overview sections of the digital platform.

Preparation: This section identifies preparation teachers should complete before the lesson, including media teachers must cue before the lesson and activities that require setup. This section also describes advance preparation for upcoming lessons. For example, if teachers need to prepare 1 day in advance for an activity in Lesson 11, an advance preparation note appears in the Preparation section for Lesson 10. A symbol () identifies lessons with advance preparation notes.




Earth Changes | Advance Preparation

Some activities in this module require advance preparation. A version of this list appears in the Module Overview of the Teacher Edition. The expanded version in this guide identifies all lessons for which preparation may take longer than a planning period. A symbol (†) identifies preparation that can be done earlier than the suggested time.




Lesson	Time in Advance	Investigation	Description
3	3–4 days†	Soil Column Observation	Prepare soil column. (See Lesson 3 Resource A.)
3	1–2 days†	Local Land Samples Observation	Give each student a resealable plastic bag. Ask students to collect and bring to school a land sample from an area close to their home, an area near the school, or another approved area nearby. Collect extra local land samples to share with students who do not bring their own.
8, 10	2 days†	Water and Wind Models	Place 14 cups of potting soil in an even layer in a pan to dry out.
15	1 day†	Shoreline Models	Prepare shoreline models (See Lesson 15 Resource A.)

Earth Changes | Lesson Preparation



Lesson 1

Materials	Kit Items <input type="checkbox"/> Globe, inflatable (1) School-Supplied Items <input type="checkbox"/> Stickers, small (2) Item Reuse <input type="checkbox"/> Lesson 5 requires the prepared land features class list. <input type="checkbox"/> (Optional) The inflated globe can be used again in Lessons 3, 4, and 8.
Resources	<input type="checkbox"/> Lesson 1 Resource A: Surtsey Photographs  <input type="checkbox"/> Lesson 1 Resource B: Surtsey Photographs by Year 
Preparation 	<input type="checkbox"/> Inflate the globe. <input type="checkbox"/> Identify a nearby outdoor location where students can describe the features of their local area. Advance Preparation for Lesson 3 <input type="checkbox"/> 3 to 4 Days Before: Prepare soil column. (See Lesson 3 Resource A.) <input type="checkbox"/> 1 to 2 Days Before: Give each student a resealable plastic bag. Ask students to collect and bring to school a land sample from an area close to their home, an area near the school, or another approved area nearby. Collect extra local land samples to share with students who do not bring their own.


Lesson 2

Materials	Kit Items None School-Supplied Items None
Resources	<input type="checkbox"/> Lesson 1 Resource B: Surtsey Photographs by Year  <input type="checkbox"/> <i>Life on Surtsey: Iceland's Upstart Island</i> (Burns 2017) <input type="checkbox"/> <i>An Island Grows</i> (Schaefer and Felstead 2006)
Preparation	<input type="checkbox"/> Access Google Earth™ mapping service (http://phdsci.link/1310). <input type="checkbox"/> Cue volcano erupting video (http://phdsci.link/2395).  <input type="checkbox"/> Cue lava cooling video (http://phdsci.link/2396).  <input type="checkbox"/> Access Surtsey three-dimensional interactive model from the Icelandic Institute of Natural History (http://phdsci.link/1584).


Lesson 3

<p>Materials</p>	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Bags, resealable plastic, 1 qt (40) <input type="checkbox"/> Clay powder, natural (3 tbsp) <input type="checkbox"/> Dish soap (1 tsp) <input type="checkbox"/> Globe, inflatable (1, optional) <input type="checkbox"/> Gravel (3 tbsp) <input type="checkbox"/> Jars with lids, clear plastic, 4 oz (19) <input type="checkbox"/> Magnifiers, handheld, plastic (24) <input type="checkbox"/> Plates, paper, 10" (50) <input type="checkbox"/> Rock samples: basalt, gneiss, granite, pumice, sandstone, tuff (3 each type) <input type="checkbox"/> Safety goggles, student (24) <input type="checkbox"/> Safety goggles, teacher (1) <input type="checkbox"/> Sand, coarse (3 tbsp) <input type="checkbox"/> Sifting screens, plastic (6) <input type="checkbox"/> Silt (3 tbsp) <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Local soil sample (2 oz) <input type="checkbox"/> Local land sample <input type="checkbox"/> Local land samples brought by students (at least 6) <input type="checkbox"/> Marker, permanent (1) <input type="checkbox"/> Tape (partial roll) <input type="checkbox"/> Topsoil (3 tbsp) <input type="checkbox"/> Water (access) <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 4 requires 1 of the prepared local land samples, the handheld magnifiers, 38 of the paper plates, and the prepared rock samples. If the local land sample has been sifted, pour all the components back into the plastic bag.
<p>Resources</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 3 Resource A: Soil Column Setup Instructions <input type="checkbox"/> Lesson 3 Resource B: Common Land Samples Setup Instructions <input type="checkbox"/> Lesson 3 Resource C: “Diggin’ Dirt” (Braaf 2004)  <input type="checkbox"/> Lesson 3 Resource D: “Sand, Silt, and Clay” (<i>CLICK® Magazine</i> 2009)  <input type="checkbox"/> <i>Life on Surtsey</i>
<p>Preparation</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Prepare materials for common land samples observation. (See Lesson 3 Resource B.)


Lesson 4

<p>Materials</p>	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Globe, inflatable (1, optional) <input type="checkbox"/> Jar with lid, clear plastic, 4 oz (1) <input type="checkbox"/> Magnifiers, handheld, plastic (24) <input type="checkbox"/> Plates, paper, 10" (38) <input type="checkbox"/> Ruler (1) <input type="checkbox"/> Safety goggles, student (24) <input type="checkbox"/> Safety goggles, teacher (1) <input type="checkbox"/> Sandpaper, 3" x 3" (19) <input type="checkbox"/> Sugar cubes (2) <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Marker, permanent (1) <input type="checkbox"/> Scissors (1) <p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Local land sample from Lesson 3 (1) <input type="checkbox"/> Rock samples from Lesson 3 (18) <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 21 requires 1 of the paper plates.
<p>Resources</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 4 Resource A: Devils Tower National Monument Photograph  <input type="checkbox"/> Lesson 4 Resource B: Rock Tests Demonstration Setup Instructions
<p>Preparation</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Prepare materials for rock tests demonstration. (See Lesson 4 Resource B.) <input type="checkbox"/> Prepare materials for rock tests. Use scissors to cut the sandpaper sheets into three 3" squares per group.




Lesson 5

Materials	<p>Kit Items None</p> <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Glue stick (1) <input type="checkbox"/> Marker, permanent (1) <input type="checkbox"/> Scissors (1) <p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Land features class list started in Lesson 1 <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 6 requires the prepared land features class list.
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 5 Resource A: National Parks and Lands Poster Setup Instructions <input type="checkbox"/> Lesson 5 Resource B: Elevation Diagram 
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Open Google Earth™ mapping service (http://phdsci.link/2394). Select the Search icon near the top left of the panel. In the Search box, enter Hawai'i Volcanoes National Park. The program will zoom in to that location. If necessary, select the 3D button in the bottom right corner of the screen to enable a three-dimensional view. Use the zoom and tilt controls to customize the view until elevation differences in the land are visible. <input type="checkbox"/> Prepare national parks and lands posters. (See Lesson 5 Resource A.)




Lesson 6

Materials	<p>Kit Items None</p> <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Pencil, sharpened, short, used (1) <input type="checkbox"/> Pencil, unsharpened, unused (1) <p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Land features class list started in Lesson 1 <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 19 requires the sharpened and unsharpened pencils.
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 6 Resource A: South Core Banks Photographs  <input type="checkbox"/> Lesson 6 Resource B: Landform Photographs
Preparation	None



Lesson 7

Materials	Kit Items <input type="checkbox"/> Rock sample, tuff (1, optional) School-Supplied Items None
Resources	<input type="checkbox"/> Lesson 1 Resource B: Surtsey Photographs by Year  <input type="checkbox"/> Lesson 7 Resource A: Surtsey Diagram A  <input type="checkbox"/> Lesson 7 Resource B: Conceptual Checkpoint 
Preparation	<input type="checkbox"/> Prepare to distribute a color copy of Lesson 7 Resource A to each student. <input type="checkbox"/> Prepare to distribute a copy of Lesson 7 Resource B to each student.



Lesson 8

<p>Materials</p>	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Bin, clear plastic, 34.88" × 16.63" × 6.13" (1) <input type="checkbox"/> Bins with lids, clear plastic, 6 qt (6) <input type="checkbox"/> Bucket, plastic, 10 qt (1) <input type="checkbox"/> Cups, paper, 8 oz (14) <input type="checkbox"/> Globe, inflatable (1, optional) <input type="checkbox"/> Gravel (3 cups) <input type="checkbox"/> Hook and loop fastener, 1" strips (3) <input type="checkbox"/> Knife, putty (1) <input type="checkbox"/> Rulers, metric (6) <input type="checkbox"/> Safety goggles, student (24) <input type="checkbox"/> Safety goggles, teacher (1) <input type="checkbox"/> Tape measure, metric (1) <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Markers, dry erase, 2 colors (6 each color) <input type="checkbox"/> Newspaper (6 sheets) <input type="checkbox"/> Pencil, sharpened (1) <input type="checkbox"/> Potting soil (12 cups) <input type="checkbox"/> Sand, fine (8 $\frac{1}{2}$ cups) <input type="checkbox"/> Scissors (1) <input type="checkbox"/> Stickers, small (10, optional) <input type="checkbox"/> Water (access) <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 10 requires the 6 qt clear plastic bins. <input type="checkbox"/> Lesson 15 requires the putty knife. <input type="checkbox"/> Lesson 19 requires the tape measure.
<p>Resources</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 8 Resource A: Olympic National Park Shoreline Photograph  <input type="checkbox"/> Lesson 8 Resource B: Wave Model Demonstration Setup Instructions and Procedure <input type="checkbox"/> Lesson 8 Resource C: Water Investigation Setup Instructions <input type="checkbox"/> Lesson 8 Resource D: Rain Model and River Model Procedure Sheets
<p>Preparation</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Cue Olympic National Park waves video (http://phdsci.link/1591).  <input type="checkbox"/> Prepare materials for wave model demonstration. (See Lesson 8 Resource B.) <input type="checkbox"/> Prepare materials for water investigation. (See Lesson 8 Resources C and D.) <input type="checkbox"/> Cue waves interacting with land underwater video (http://phdsci.link/2399). 



Lesson 9

Materials	<p>Kit Items</p> <p>None</p> <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Glue stick (1) <input type="checkbox"/> Scissors (1)
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 9 Resource A: Landslide Photograph  <input type="checkbox"/> Lesson 9 Resource B: Landslide Solution Poster Setup Instructions <input type="checkbox"/> Lesson 9 Resource C: Landslide Illustration 
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Prepare landslide solution posters. (See Lesson 9 Resource B.)




Lesson 10

Materials	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Balloon pump, handheld (1) <input type="checkbox"/> Bins with lids, clear plastic, 6 qt (6) <input type="checkbox"/> Gravel (2 cups) <input type="checkbox"/> Objects, small (e.g., rocks, shells) (6) <input type="checkbox"/> Paintbrush, medium (1) <input type="checkbox"/> Rock sample, limestone (1) <input type="checkbox"/> Safety goggles, teacher (1) <input type="checkbox"/> Shower caps, clear plastic (6) <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Drill with $\frac{3}{8}$" bit (1) <input type="checkbox"/> Markers, dry erase, 2 colors (1 each color) <input type="checkbox"/> Sand, fine (2 cups) <input type="checkbox"/> Topsoil (2 cups) <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 11 requires the balloon pump, paintbrush, and prepared wind models with procedure sheets. <input type="checkbox"/> Lesson 15 requires the 6 qt clear plastic bins. <input type="checkbox"/> Lesson 21 requires the limestone rock sample.
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 10 Resource A: Great Sphinx of Giza Photographs  <input type="checkbox"/> Lesson 10 Resource B: Wind Investigation Setup Instructions <input type="checkbox"/> Lesson 10 Resource C: Wind Investigation Data Table  <input type="checkbox"/> Lesson 11 Resource: Wind Model Procedure Sheet <input type="checkbox"/> <i>World Traveler: The Sphinx</i> (Schmidt and O'Halloran 2018) (13 copies)
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Prepare materials for wind investigation. (See Lesson 10 Resource B and Lesson 11 Resource.)




Lesson 11

Materials	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Balloon pumps, handheld (6) <input type="checkbox"/> Paintbrushes, medium (6) <input type="checkbox"/> Safety goggles, student (24) <input type="checkbox"/> Safety goggles, teacher (1) <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Markers, dry erase, 2 colors (6 each color) <p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Wind models with procedure sheets from Lesson 10 (6)
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 10 Resource A: Great Sphinx of Giza Photographs  <input type="checkbox"/> Lesson 10 Resource B: Wind Investigation Setup Instructions <input type="checkbox"/> Lesson 10 Resource C: Wind Investigation Data Table <input type="checkbox"/> Lesson 11 Resource: Wind Model Procedure Sheet  <input type="checkbox"/> <i>World Traveler: The Sphinx</i>
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Prepare materials for wind investigation. (See Lesson 10 Resource B and Lesson 11 Resource.)




Lesson 12

Materials	<p>Kit Items</p> <p>None</p> <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Equity sticks (class set)
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 12 Resource A: Effects of Wind Changing Land Photographs  <input type="checkbox"/> Lesson 12 Resource B: Solutions to Wind Problems Photographs 
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Cue time-lapse dust storm video (http://phdsci.link/1597).  <input type="checkbox"/> Prepare 4 color copies of each photograph of wind changing land. (See Lesson 12 Resource A.)




Lesson 13

Materials	<p>Kit Items None</p> <p>School-Supplied Items <input type="checkbox"/> Equity sticks (class set, optional)</p>
Resources	<p><input type="checkbox"/> Lesson 13 Resource A: Surtsey Diagram B </p> <p><input type="checkbox"/> Lesson 13 Resource B: Conceptual Checkpoint </p> <p><input type="checkbox"/> <i>Life on Surtsey</i></p>
Preparation	<p><input type="checkbox"/> Prepare to distribute a color copy of Lesson 13 Resource B to each student.</p> <p><input type="checkbox"/> Cue clip from “Surtsey, the Birth of an Island” (http://phdsci.link/1599). </p>



Lesson 14

Materials	<p>Kit Items None</p> <p>School-Supplied Items None</p>
Resources	<p><input type="checkbox"/> Lesson 14 Resource A: Engineering Challenge Rubric</p> <p><input type="checkbox"/> Lesson 14 Resource B: Blank Engineering Design Process Chart </p> <p><input type="checkbox"/> Lesson 14 Resource C: Engineering Design Process Visual </p> <p><input type="checkbox"/> Lesson 14 Resource D: Montauk Point Lighthouse Photographs </p> <p><input type="checkbox"/> <i>Marvelous Mattie: How Margaret E. Knight Became an Inventor</i> (McCully 2006)</p>
Preparation	<p><input type="checkbox"/> Cue “Saving the Montauk Lighthouse” (PBS 2016) video (http://phdsci.link/1604).</p>

Lesson 15

<p>Materials</p>	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Bins with lids, clear plastic, 6 qt (8) <input type="checkbox"/> Building blocks, plastic, (16) <input type="checkbox"/> Knife, putty (1) <input type="checkbox"/> Rubber stoppers (6) <input type="checkbox"/> Ruler (1) <input type="checkbox"/> Safety goggles, teacher (1) <input type="checkbox"/> Straw, 1 cm diameter, 2" pieces (8) <input type="checkbox"/> String, 4" pieces (8) <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Marker, dry erase (1) <input type="checkbox"/> Marker, permanent (1) <input type="checkbox"/> Sand, fine (20 cups) <input type="checkbox"/> Scissors (1) <input type="checkbox"/> Tape (partial roll) <input type="checkbox"/> Water (access) <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 16 requires the prepared class criteria and constraints chart, the putty knife, and the prepared shoreline models. Students will not use the lighthouses with the models in Lesson 16, but save the lighthouses for Lesson 17. <input type="checkbox"/> Lesson 21 requires the plastic building blocks.
<p>Resources</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 14 Resource A: Engineering Challenge Rubric <input type="checkbox"/> Lesson 14 Resource C: Engineering Design Process Visual  <input type="checkbox"/> Lesson 15 Resource A: Shoreline Model Setup Instructions <input type="checkbox"/> Lesson 15 Resource B: Shoreline Protection System Cards <input type="checkbox"/> Lesson 15 Resource C: Bulkhead Photograph  <input type="checkbox"/> Lesson 15 Resource D: Tree Data
<p>Preparation</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Prepare shoreline models. (See Lesson 15 Resource A.) <input type="checkbox"/> Prepare shoreline protection system cards. (See Lesson 15 Resource B.) <input type="checkbox"/> Cue preparation of concrete video (http://phdsci.link/1791).  <input type="checkbox"/> Prepare to distribute a tree data set to each group. (See Lesson 15 Resource D.)

Lesson 16

<p>Materials</p>	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Bags, resealable plastic, 1 gal (8) <input type="checkbox"/> Cheesecloth, 12" x 12" (6) <input type="checkbox"/> Chenille stems (120) <input type="checkbox"/> Knives, putty (8) <input type="checkbox"/> Moss (4 cups) <input type="checkbox"/> Rocks (160) <input type="checkbox"/> Ruler (1) <input type="checkbox"/> Safety goggles, student (24) <input type="checkbox"/> Safety goggles, teacher (1) <input type="checkbox"/> Toothpicks (400) <input type="checkbox"/> Twig garland (1) or twigs, 6" (80) <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Markers, dry erase (8) <input type="checkbox"/> Scissors (1) <input type="checkbox"/> Scissors, blunt tip (8) <input type="checkbox"/> Water (access) <p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Shoreline models from Lesson 15 without lighthouses (8) <input type="checkbox"/> Class criteria and constraints chart started in Lesson 15 <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 17 requires the prepared class criteria and constraints chart, the putty knives, the prepared Engineering Challenge test materials, and the prepared shoreline models.
<p>Resources</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 14 Resource A: Engineering Challenge Rubric <input type="checkbox"/> Lesson 14 Resource C: Engineering Design Process Visual <input type="checkbox"/> Lesson 16 Resource A: Bulkhead Diagram  <input type="checkbox"/> Lesson 16 Resource B: Engineering Challenge Test Materials Preparation Instructions <input type="checkbox"/> Lesson 16 Resource C: Natural Resources Photographs 
<p>Preparation</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Prepare Engineering Challenge test materials. (See Lesson 16 Resource B.)


Lesson 17

Materials	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Knives, putty (8) <input type="checkbox"/> Safety goggles, student (24) <input type="checkbox"/> Safety goggles, teacher (1) <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Markers, dry erase (8) <input type="checkbox"/> Scissors, blunt tip (8) <input type="checkbox"/> Water (access) <p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Class criteria and constraints chart started in Lesson 15 <input type="checkbox"/> Engineering Challenge test materials from Lesson 16 (8 sets) <input type="checkbox"/> Shoreline models from Lesson 15 with lighthouses (8) <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 18 requires the shoreline protection systems created by students.
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 14 Resource A: Engineering Challenge Rubric <input type="checkbox"/> Lesson 14 Resource C: Engineering Design Process Visual
Preparation	None

Lesson 18

Materials	<p>Kit Items</p> None
Resources	<p>School-Supplied Items</p> None
Preparation	<p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Shoreline protection systems from Lesson 17 (8) <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 14 Resource A: Engineering Challenge Rubric <input type="checkbox"/> Lesson 14 Resource C: Engineering Design Process Visual
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Cue “Saving the Montauk Lighthouse” video (http://phdsci.link/1604).

Lesson 19

Materials	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Clothespins (6) <input type="checkbox"/> String (6 ft) <input type="checkbox"/> Tape measure (1) <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Paper, 11" × 17" (6 sheets) <input type="checkbox"/> Scissors (1) <input type="checkbox"/> Tape (partial roll) <p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Unused, unsharpened pencil from Lesson 6 (1) <input type="checkbox"/> Used, short, sharpened, pencil from Lesson 6 (1) <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 20 requires the sharpened and unsharpened pencils, the prepared Earth event display, and the Earth event card order sheets created by students. <input type="checkbox"/> Lesson 21 requires the tape measure.
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 19 Resource A: Mount St. Helens Photographs  <input type="checkbox"/> Lesson 19 Resource B: Earth Event Cards <input type="checkbox"/> Lesson 19 Resource C: Earth Event Photographs
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Prepare Earth event cards. (See Lesson 19 Resource B.) <input type="checkbox"/> Prepare Earth event photographs. (See Lesson 19 Resource C.) <input type="checkbox"/> Prepare materials for the Earth event display. Measure and cut a 6 ft piece of string. Hang the string horizontally across an area of the classroom at a height students can reach.



Lesson 20

Materials	<p>Kit Items</p> <p>None</p> <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Pencil, sharpened, unused (1) <input type="checkbox"/> Scissors (1) <input type="checkbox"/> Tape (partial roll, optional) <p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Unused, unsharpened pencil from Lesson 19 (1) <input type="checkbox"/> Used, short, sharpened pencil from Lesson 19 (1) <input type="checkbox"/> Earth event display from Lesson 19 (1) <input type="checkbox"/> Earth event card order sheets from Lesson 19 (6) <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 21 requires the prepared Earth event display.
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 20 Resource: Earth Event Texts
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Prepare Earth event texts. (See Lesson 20 Resource.)


Lesson 21

Materials	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Building blocks, plastic (24) <input type="checkbox"/> Plate, paper, 10" (1) <input type="checkbox"/> Rock sample, limestone (1) <input type="checkbox"/> Ruler (1) <input type="checkbox"/> Sandpaper, 3" × 3" (1) <input type="checkbox"/> String (7 m) <input type="checkbox"/> Tape measure, metric (1) <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Scissors (1) <input type="checkbox"/> Tape (partial roll) <p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Earth event display from Lesson 20 (1) <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 22 requires the prepared Earth event display.
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> <i>World Traveler: The Sphinx</i> (13 copies)
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Choose a large, open area (e.g., hallway, gymnasium, playground) at least 7 m long to take students to during the lesson. <input type="checkbox"/> Prepare materials for the time span model by cutting string to create 1 cm, 10 cm, and 5 m pieces. <input type="checkbox"/> Prepare for the changes to limestone demonstration by cutting a 3" square from the sandpaper sheet.


Lesson 22

Materials	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Knowledge Deck™ cards, Yardangs (24) <input type="checkbox"/> Knowledge Deck poster, Yardangs (1) <p>School-Supplied Items</p> <p>None</p> <p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Earth event display from Lesson 21 (1)
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 1 Resource B: Surtsey Photographs by Year  <input type="checkbox"/> Lesson 22 Resource: Conceptual Checkpoint 
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Prepare to distribute a color copy of Lesson 22 Resource to each student.


Lesson 23

Materials	<p>Kit Items None</p> <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Glue sticks (24) <input type="checkbox"/> Scissors, blunt tip (24)
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 1 Resource B: Surtsey Photographs by Year  <input type="checkbox"/> <i>An Island Grows</i>
Preparation	None

Lesson 24

Materials	<p>Kit Items None</p> <p>School-Supplied Items None</p>
Resources	None
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Cue the video from Yellowstone National Park (http://phdsci.link/2373).  <input type="checkbox"/> Prepare to distribute a copy of the End-of-Module Assessment to each student.

Lesson 25

Materials	<p>Kit Items None</p> <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Scissors (1)
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> End of Module Assessment Rubric  <input type="checkbox"/> Lesson 25 Resource A: Module Concept Statements <input type="checkbox"/> Lesson 25 Resource B: Recurring Themes and Concepts
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Score End-of-Module Assessments and write individual feedback. <input type="checkbox"/> Select End-of-Module Assessment responses to share with students for additional support. If selecting student responses, remember to remove identifying information and to choose diverse student responses. <input type="checkbox"/> Prepare visual for student connections between module learning and content standards. (See Lesson 25 Resources A and B.)



Changes in Matter | Advance Preparation

An activity in these lessons requires advance preparation. A version of this list appears in the Spotlight Overview of the Teacher Edition. The expanded version in this guide identifies the lesson for which preparation may take longer than a planning period. A symbol (†) identifies preparation that can be done earlier than the suggested time.





Lesson	Time in Advance	Investigation	Description
3	1 day†	Melting Ice Demonstration and Properties of Ice Cubes Observation	Prepare clear ice cubes.

Changes in Matter | Lesson Preparation





Lesson 1

Materials	Kit Items None School-Supplied Items <input type="checkbox"/> Scissors (1)
Resources	<input type="checkbox"/> Lesson 1 Resource A: Recycling Bin Photograph  <input type="checkbox"/> Lesson 1 Resource B: Recycled Objects Photographs  <input type="checkbox"/> Lesson 1 Resource C: Conservation Cards
Preparation	<input type="checkbox"/> Print and cut out a set of 12 cards for each group to use for the conservation card sort activity and an additional set for class use (Lesson 1 Resource C).





Lesson 2

<p>Materials</p>	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Beads, glass, flat (6) <input type="checkbox"/> Bins, clear plastic, 6 qt (6) <input type="checkbox"/> Caps, plastic, from large plastic bottles or jugs (6) <input type="checkbox"/> Cups, paper, small (6) <input type="checkbox"/> Fork, plastic (1) <input type="checkbox"/> Magnets (6) <input type="checkbox"/> Rubber stoppers (6, if needed) <input type="checkbox"/> Safety goggles, student (24) <input type="checkbox"/> Safety goggles, teacher (1) <input type="checkbox"/> Scales, digital (6) <input type="checkbox"/> Spoon, plastic (1) <input type="checkbox"/> Spoons, steel (6) <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Paper towels (1 roll) <input type="checkbox"/> Water (access) <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 3 requires 1 of the digital scales. <input type="checkbox"/> Lesson 7 requires 2 of the plastic bins with rubber stoppers and the prepared properties of matter class chart. Save the remaining plastic bins and rubber stoppers for Lesson 9.
<p>Resources</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 1 Resource A: Recycling Bin Photograph  <input type="checkbox"/> Lesson 1 Resource B: Recycled Objects Photographs  <input type="checkbox"/> Lesson 2 Resource: Truck Unloading Recyclable Objects Photograph 
<p>Preparation</p> 	<ul style="list-style-type: none"> <input type="checkbox"/> Fill clear plastic bins halfway with water for the explore additional properties activity. Use a rubber stopper to plug hole in the side of bins if necessary. Make sure the bottle cap's mass is at least 1 gram and the cap floats in water. Make sure steel spoons are attracted to the magnet. <p>Advance Preparation for Lesson 3</p> <ul style="list-style-type: none"> <input type="checkbox"/> 1 Day Before: Prepare clear ice cubes.




Lesson 3

Materials	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Beaker, glass, 250 mL (1) <input type="checkbox"/> Cooling pad (1) <input type="checkbox"/> Cups, clear plastic, 9 oz (6) <input type="checkbox"/> Hot plate (1) <input type="checkbox"/> Safety goggles, student (24) <input type="checkbox"/> Safety goggles, teacher (1) <input type="checkbox"/> Scale, digital (1) <input type="checkbox"/> Thermometers, Celsius (6) <input type="checkbox"/> Tongs (1) <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Glue sticks (24) <input type="checkbox"/> Ice cubes, clear (42) <input type="checkbox"/> Scissors, blunt tip (24) <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 5 requires the beaker, cooling pad, hot plate, tongs, and prepared states of matter chart.
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 3 Resource A: Glass Recyclables Photograph  <input type="checkbox"/> Lesson 3 Resource B: Glass Objects Photograph 
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Cue glass recycling introduction video (http://phdsci.link/2345).  <input type="checkbox"/> Cue heating glass video (http://phdsci.link/2348). 


Lesson 4

Materials	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Balloon (1) <input type="checkbox"/> Balloon pump, handheld (1) <p>School-Supplied Items</p> <p>None</p> <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 7 requires the balloon pump.
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 3 Resource B: Glass Objects Photograph  <input type="checkbox"/> Lesson 4 Resource: Liquid Glass Photograph 
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Cue glassblowing video (http://phdsci.link/2349).  <input type="checkbox"/> Cue balancing balloons video (http://phdsci.link/1834). 


Lesson 5

Materials	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Beaker, glass, 250 mL (1) <input type="checkbox"/> Cooling pad (1) <input type="checkbox"/> Graduated cylinder, 100 mL (1) <input type="checkbox"/> Hot plate (1) <input type="checkbox"/> Safety goggles, teacher (1) <input type="checkbox"/> Tongs (1) <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Glue stick (1) <input type="checkbox"/> Scissors (1) <input type="checkbox"/> Water (100 mL) <p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> States of matter chart started in Lesson 3 <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 9 requires the beaker, cooling pad, hot plate, tongs, and prepared states of matter chart.
Resources	None
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Cue glass shaping video (http://phdsci.link/2350).  <input type="checkbox"/> Cue glassblowing video (http://phdsci.link/2349).  <input type="checkbox"/> For the evaporation demonstration, use a graduated cylinder to add 100 mL of water to the 250 mL beaker. <input type="checkbox"/> Cue glass cooling video (http://phdsci.link/2339). 

Lesson 6

Materials	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Chenille stems, 12" (2) <input type="checkbox"/> Cups, clear, 9 oz (6) <input type="checkbox"/> Erasers, rectangular (30) <input type="checkbox"/> Ruler (1) <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Crayons, 1 cm length pieces (30) <input type="checkbox"/> Paper, 1 cm × 1 cm (30) <input type="checkbox"/> Paper clips, metal, small (30) <input type="checkbox"/> Scissors (1) <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 7 requires the prepared desk drawer samples.
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 6 Resource A: Desk Drawer Sample Setup Instructions <input type="checkbox"/> Lesson 6 Resource B: Engineering Design Process Visual 
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Prepare desk drawer sample materials. (See Lesson 6 Resource A.)


Lesson 7

<p>Materials</p>	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Balloon pumps, handheld (2) <input type="checkbox"/> Bins, clear plastic, 6 qt (2) <input type="checkbox"/> Magnetic wands (2) <input type="checkbox"/> Plastic mesh, 10" × 10" (2) <input type="checkbox"/> Rubber stoppers (2, if needed) <input type="checkbox"/> Ruler (1) <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Scissors (1) <input type="checkbox"/> Water (access) <p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Properties of matter class chart started in Lesson 2 <input type="checkbox"/> Desk drawer samples from Lesson 6 (6) <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 9 requires the balloon pumps, prepared plastic bins filled with water, magnetic wands, prepared plastic mesh pieces, prepared desk drawer samples, and prepared criteria and constraints table. <input type="checkbox"/> Lesson 10 requires the prepared properties of matter class chart.
<p>Resources</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 7 Resource A: Engineering Challenge Rubric <input type="checkbox"/> Lesson 7 Resource B: Tool Testing Procedure Sheets
<p>Preparation</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Prepare the crayon separation process research stations. Cut the plastic mesh into two 10" × 10" pieces. Fill two 6 qt clear plastic bins halfway with water. Place one of each tool at two separate stations. Prepare to distribute two different tool testing procedure sheets to each group. (See Lesson 7 Resource B.) The plastic mesh and the containers filled with water will also be used in Lesson 9. <input type="checkbox"/> Cue the recycling center machine video (http://phdsci.link/2344). 


Lesson 8

<p>Materials</p>	<p>Kit Items</p> <p>None</p> <p>School-Supplied Items</p> <p>None</p>
<p>Resources</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 7 Resource A: Engineering Challenge Rubric
<p>Preparation</p>	<p>None</p>

Lesson 9

<p>Materials</p>	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Balloon pumps, handheld (6) <input type="checkbox"/> Beaker, glass, 250 mL (1) <input type="checkbox"/> Bins, clear plastic, 6 qt (4) <input type="checkbox"/> Cooling pad (1) <input type="checkbox"/> Hot plate (1) <input type="checkbox"/> Magnetic wands (6) <input type="checkbox"/> Plastic mesh, 10" x 10" (4) <input type="checkbox"/> Rubber stoppers (4, if needed) <input type="checkbox"/> Ruler (1) <input type="checkbox"/> Safety goggles, teacher (1) <input type="checkbox"/> Timers, digital (6) <input type="checkbox"/> Tongs (1) <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Crayons, 2 cm pieces (7) <input type="checkbox"/> Scissors (1) <input type="checkbox"/> Water (access) <p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> States of matter chart started in Lesson 3 <input type="checkbox"/> Criteria and constraints table started in Lesson 7 <input type="checkbox"/> Desk drawer samples from Lesson 7 (6) <input type="checkbox"/> Plastic bins filled with water from Lesson 7 (2) <input type="checkbox"/> Plastic mesh, 10" x 10" from Lesson 7 (2) <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 10 requires the prepared states of matter chart and the prepared beaker with crayon sample. Also save the cooling pad, hot plate, and tongs to remove the crayon sample from the beaker after Lesson 10.
<p>Resources</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 6 Resource B: Engineering Design Process Visual  <input type="checkbox"/> Lesson 7 Resource A: Engineering Challenge Rubric <input type="checkbox"/> Lesson 9 Resource: Crayon Melting Demonstration Setup Instructions
<p>Preparation</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Prepare materials for crayon separation process test. Cut the plastic mesh into four 10" x 10" pieces. Fill four 6 qt clear plastic bins halfway with water. Gather the plastic mesh pieces and plastic bins filled with water from Lesson 7. <input type="checkbox"/> Set up materials for the crayon melting demonstration. (See Lesson 9 Resource.)

Lesson 10

Materials	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Cooling pad (1) <input type="checkbox"/> Hot plate (1) <input type="checkbox"/> Safety goggles, teacher (1) <input type="checkbox"/> Tongs (1) <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Markers, colored (6 sets) <input type="checkbox"/> Paper, 11" × 17" or larger (6 sheets) <p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Beaker with crayon sample from Lesson 9 <input type="checkbox"/> Properties of matter class chart started in Lesson 2 <input type="checkbox"/> States of matter chart started in Lesson 3
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 7 Resource A: Engineering Challenge Rubric
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Cue the recycling center machine video (http://phdsci.link/2344). 

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