




Preparation Guide


Level 4 Module 2

ENERGY

with Spotlight Lessons on Earth and Space

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.





Energy | 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
4	1 day†	Energy Stations	Test the radio batteries and the heat lamp bulbs. (See Lesson 4 Resource.)
12	1 day†	Energy in Systems Stations	Prepare materials for Energy in Systems Stations. (See Lesson 12 Resource B.)
16	1 week†	Build a Generator	Begin to collect paper towel tubes (2) or toilet paper tubes (6).

Energy | Lesson Preparation





Lesson 1

Materials	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Pushpins (24) <p>Module 1 Kit</p> <ul style="list-style-type: none"> <input type="checkbox"/> Balloon pumps, handheld (6) <input type="checkbox"/> Plates, paper (24) <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"/> Pencils (24) <input type="checkbox"/> Scissors (24) <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 2 requires the balloon pumps. <input type="checkbox"/> Lesson 22 requires 6 of the pinwheels created by students.
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 1 Resource A: Windmill Paintings  <input type="checkbox"/> Lesson 1 Resource B: Windmill Gears Photograph  <input type="checkbox"/> Lesson 1 Resource C: Windmill Grinding Photograph 
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Cue windmill gears video (http://phdsci.link/2425). 

Lesson 2

Materials	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Snap Circuits® Green kits by Elenco® (<i>PhD Science</i> exclusive) <ul style="list-style-type: none"> ○ Base grids, 10" × 12" (6) ○ Generators (6) ○ Jumper wires, black, red (6 of each) ○ LEDs, red (6) ○ Pivot posts, stand bases, tops (6 of each) ○ Wind fans (6) <p>Module 1 Kit</p> <ul style="list-style-type: none"> <input type="checkbox"/> Balloon pumps, handheld (6) <p>School-Supplied Items</p> <p>None</p> <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 4 requires 2 of the prepared Snap Circuits® windmills and 2 of the balloon pumps. Save the remaining balloon pumps for use in Lesson 22. <input type="checkbox"/> All items from the Snap Circuits® Green kits by Elenco® are needed for the Engineering Challenge.
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 2 Resource: Windmill Model Setup Instructions <input type="checkbox"/> <i>The Boy Who Harnessed the Wind</i> (Kamkwamba and Mealer 2012)
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Prepare materials for the windmill model investigation. (See Lesson 2 Resource.)

Lesson 3

Materials	<p>Kit Items</p> <p>None</p> <p>School-Supplied Items</p> <p>None</p>
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 3 Resource A: Modern Wind Turbine Photograph  <input type="checkbox"/> Lesson 3 Resource B: Wind Farm Photograph  <input type="checkbox"/> Lesson 3 Resource C: Wind Farm Diagram 
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Cue wind turbine video (http://phdsci.link/2426).  <p>Advance Preparation for Lesson 4</p> <ul style="list-style-type: none"> <input type="checkbox"/> 1 Day Before: Test the radio batteries and the heat lamp bulbs. (See Lesson 4 Resource.)

Lesson 4

Materials	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Blocks, wooden, small (2) <input type="checkbox"/> Cutting boards, thin plastic, 5" × 5" (2) <input type="checkbox"/> Flashlights, hand-crank (2) <input type="checkbox"/> Heat lamps with reflectors (2) <input type="checkbox"/> Heat light bulbs (2) <input type="checkbox"/> Radios, handheld, with batteries (2) <input type="checkbox"/> Sandpaper, 4" × 5" (2) <input type="checkbox"/> Toy boats (2) <input type="checkbox"/> Toy cars, pull back (2) <p>Module 1 Kit</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"/> 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"/> Snap Circuits® windmills from Lesson 2 (2) <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 5 requires the prepared energy stations.
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 4 Resource: Energy Stations Setup Instructions
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Set up energy stations. (See Lesson 4 Resource.)

Lesson 5

Materials	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Sentence strips (at least 7) <p>School-Supplied Items</p> <p>None</p> <p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Energy stations from Lesson 4 (7) <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 6 requires the prepared Snap Circuits® windmills, the balloon pumps, and the toy cars. <input type="checkbox"/> Lesson 12 requires 1 of the hand-crank flashlights and the heat lamps with bulbs.
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 4 Resource: Energy Stations Setup Instructions
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Set up energy stations. (See Lesson 4 Resource.)

Lesson 6

Materials	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Toy cars, pull back (2) <p>Module 1 Kit</p> <ul style="list-style-type: none"> <input type="checkbox"/> Balloon pumps, handheld (2) <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Balls (e.g., soccer balls, kickballs) or other class-suggested objects (2) <p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Snap Circuits® windmills from Lesson 2 (2) <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 14 requires 1 of the prepared Snap Circuits® windmills. <input type="checkbox"/> Lesson 22 requires the balloon pumps.
Resources	None
Preparation	None

Lesson 7

Materials	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Ball bearings, 1" (6) <input type="checkbox"/> Meter sticks (6) <input type="checkbox"/> Rulers, grooved (6) <input type="checkbox"/> Stopwatches (6) <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Tape (partial roll) <input type="checkbox"/> Textbooks, same type or size for each group, at least 1" thick (6) <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 8 requires the ball bearings, grooved rulers, textbooks, and prepared class investigation plan. <input type="checkbox"/> Lesson 10 requires the meter sticks. <input type="checkbox"/> Lesson 22 requires the stopwatches.
Resources	None
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Ensure that all stopwatches work properly.



Lesson 8

Materials	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Ball bearings, 1" (6) <input type="checkbox"/> Ball-bearing catches (6) <input type="checkbox"/> Rulers, grooved (12) <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Tape, masking (partial roll) <input type="checkbox"/> Textbooks, same type or size for each group, at least 1" thick (6) <p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Class investigation plan started in Lesson 7 <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 10 requires 6 of the grooved rulers.
Resources	None
Preparation	None







Lesson 9

No materials or preparation required.

Lesson 10

Materials	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Blocks, wooden, 1" × 2" × 0.5" (6) <input type="checkbox"/> Burlap, 12" × 24" (6) <input type="checkbox"/> Foam rubber padding, 12" × 24" (6) <input type="checkbox"/> Grass, artificial, 12" × 24" (6) <input type="checkbox"/> Marbles, $\frac{5}{8}$" diameter (6) <input type="checkbox"/> Meter sticks (6) <input type="checkbox"/> Rulers, grooved (6) <p>Module 1 Kit</p> <ul style="list-style-type: none"> <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"/> Tape (partial roll)
Resources	None
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Cue golfer hitting golf ball video (http://phdsci.link/1396).  <input type="checkbox"/> Cue video "Trouble at the Postage Stamp" (Golf Channel 2016) (http://phdsci.link/2434). 

Lesson 11

Materials	Kit Items None School-Supplied Items None
Resources	<input type="checkbox"/> Lesson 11 Resource A: Golf Course Photograph  <input type="checkbox"/> Lesson 11 Resource B: Conceptual Checkpoint 
Preparation 	<input type="checkbox"/> Cue <ul style="list-style-type: none"> ○ golfer hitting golf ball video (http://phdsci.link/1396),  ○ motorboat on a river video (http://phdsci.link/2435),  and ○ water wave and shoreline video (http://phdsci.link/2436),  <input type="checkbox"/> Prepare to distribute a copy of Lesson 11 Resource B to each student. Advance Preparation for Lesson 16 <input type="checkbox"/> Begin to collect paper towel tubes (2) or toilet paper tubes (6).



Lesson 12

Materials	<p>Kit Items</p> <ul style="list-style-type: none"><input type="checkbox"/> Alligator clip cords (4)<input type="checkbox"/> Binder clips, small (4)<input type="checkbox"/> Buzzers (2)<input type="checkbox"/> Flashlights with batteries (2)<input type="checkbox"/> Flashlight, hand crank (1)<input type="checkbox"/> Heat lamps with reflectors (2)<input type="checkbox"/> Heat light bulbs (2)<input type="checkbox"/> Rice, dry (2 tbsp)<input type="checkbox"/> Rubber bands (2)<input type="checkbox"/> Snap Circuits® Green kit by Elenco®<input type="checkbox"/> Solar cells (2)<input type="checkbox"/> Thermometers, Celsius (4) <p>Module 1 Kit</p> <ul style="list-style-type: none"><input type="checkbox"/> Cups, clear plastic, 9 oz (6)<input type="checkbox"/> Plastic wrap (partial roll) <p>School-Supplied Items</p> <ul style="list-style-type: none"><input type="checkbox"/> Scissors (1)<input type="checkbox"/> Speakers and audio sources (2 of each, optional) <p>Optional Energy in Systems Stations Extension Items</p> <ul style="list-style-type: none"><input type="checkbox"/> Alcohol pads (24)<input type="checkbox"/> Aluminum foil (1 roll)<input type="checkbox"/> Construction paper, black (at least 2 sheets)<input type="checkbox"/> Kazoos (24)<input type="checkbox"/> Newspapers (about 4 sheets)<input type="checkbox"/> Pencils (2)<input type="checkbox"/> Pizza box, cardboard (1)<input type="checkbox"/> Plastic wrap (or a heavy-duty resealable freezer bag) (1 roll)<input type="checkbox"/> Rubber bands, large, varying widths (at least 8)<input type="checkbox"/> Ruler or wooden spoon (1)<input type="checkbox"/> Shoeboxes (2)<input type="checkbox"/> Tape, clear (1 roll)<input type="checkbox"/> Thermometer (1)<input type="checkbox"/> Tuning forks (2)<input type="checkbox"/> Utility knife or scissors (1) <p>Item Reuse</p> <ul style="list-style-type: none"><input type="checkbox"/> Lesson 13 requires 1 of the heat lamps with bulb and 1 of the Celsius thermometers.<input type="checkbox"/> Lesson 17 requires the alligator clip cords.
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Lesson 12 *continued*

Resources	<input type="checkbox"/> Lesson 12 Resource A: Energy in Systems Stations Setup Instructions <input type="checkbox"/> Lesson 12 Resource B: Energy in Systems Stations Procedure Sheets <input type="checkbox"/> Lesson 12 Resource C: Extension: Energy in Systems Stations Setup Instructions <input type="checkbox"/> Lesson 12 Resource D: Extension: Energy in Systems Stations Guidance <input type="checkbox"/> Lesson 12 Resource E: Extension: Energy in Systems Stations Procedure Sheets <input type="checkbox"/> Lesson 12 Resource F: Extension: Energy in Systems Observations
Preparation	<input type="checkbox"/> Prepare energy in systems stations. (See Lesson 12 Resources A and B.) <input type="checkbox"/> (Optional) Prepare extension stations. (See Lesson 12 Resources C, D, E, and F.)

Lesson 13

Materials	<p>Kit Items</p> <input type="checkbox"/> Heat lamp with reflector (1) <input type="checkbox"/> Heat light bulb (1) <input type="checkbox"/> Thermometer, Celsius (1)
Resources	<input type="checkbox"/> Lesson 13 Resource: Heat Lamp Components Diagram
Preparation	<input type="checkbox"/> Cue electric kettle video (http://phdsci.link/2437).  <input type="checkbox"/> Cue power lines video (http://phdsci.link/2438). 


Lesson 14

Materials	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Batteries, D (6) <input type="checkbox"/> Flashlight bulbs, incandescent (6) <input type="checkbox"/> Tape, electrical (6 rolls) <p>Module 1 Kit</p> <ul style="list-style-type: none"> <input type="checkbox"/> Aluminum foil, 12" x 18" (6) <input type="checkbox"/> Ruler, metric (1) <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Scissors (6) <p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Snap Circuits® windmill from Lesson 2 (1) <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 15 requires the electrical circuits created by students and 1 roll of electrical tape. <input type="checkbox"/> Lesson 16 requires the prepared Snap Circuits® windmill.
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 14 Resource: Electrical Circuit Investigation Setup Instructions and Procedure
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Prepare aluminum foil strips for electrical circuit investigation. (See Lesson 14 Resource.)


Lesson 15

Materials	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Battery, D (1) <input type="checkbox"/> Clay, modeling, nonhardening (3 oz) <input type="checkbox"/> Flashlight bulb, incandescent (1) <input type="checkbox"/> Steel wool (3 oz) <input type="checkbox"/> Tape, electrical (partial roll) <p>Module 1 Kit</p> <ul style="list-style-type: none"> <input type="checkbox"/> Craft sticks (6) <input type="checkbox"/> Ruler, metric (1) <input type="checkbox"/> String (18") <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Coins (6) <input type="checkbox"/> Paper clips, metal (6) <input type="checkbox"/> Scissors (1) <p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Electrical circuits from Lesson 14 (6)
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Lesson 15 continued

Resources	<input type="checkbox"/> Lesson 14 Resource: Electrical Circuit Investigation Setup Instructions and Procedure <input type="checkbox"/> Lesson 15 Resource: Thermal Conductors and Insulators Photographs 
Preparation	<input type="checkbox"/> Prepare groups' circuits according to the instructions in Lesson 14 Resource, but skip step 3 (i.e., do not tape an aluminum foil strip to the light bulb's metal base). Fold sticky notes to one-quarter size. <input type="checkbox"/> Prepare a modified circuit according to the instructions in Lesson 14 Resource, but use pieces of string in place of aluminum foil strips.

Lesson 16

Materials	<p>Kit Items</p> <input type="checkbox"/> Copper wire, enamel coated, 32 m spool (1) <input type="checkbox"/> LED (1) <input type="checkbox"/> Magnets, disc, neodymium (2) <input type="checkbox"/> Nail, 4" long (1) <input type="checkbox"/> Sandpaper, 4" × 5" (6)
	<p>Module 1 Kit</p> <input type="checkbox"/> Ruler, metric (1)
	<p>School-Supplied Items</p> <input type="checkbox"/> Scissors (1) <input type="checkbox"/> Toilet paper tubes (6) or prepared paper towel tube sections (6)
	<p>Prepared Items from Previous Lessons</p> <input type="checkbox"/> Snap Circuits® windmill from Lesson 2 (1)
	<p>Item Reuse</p> <input type="checkbox"/> Lesson 17 requires the copper wire, LED, magnets, nail, ruler, prepared sandpaper, and cardboard tubes. <input type="checkbox"/> Lesson 17 requires the prepared procedure sheets.
Resources	<input type="checkbox"/> Lesson 16 Resource A: Generator Photograph  <input type="checkbox"/> Lesson 16 Resource B: Build a Generator Procedure Sheet
Preparation	<input type="checkbox"/> Prepare materials for the generator investigation. Cut one 4" × 5" sheet of sandpaper for each group. If using paper towel tubes, cut tubes into thirds, about 9.5 cm long. Prepare to display one set of materials during the Lesson 16 Learn. <input type="checkbox"/> Prepare procedure sheets for students. (See Lesson 16 Resource B.)


Lesson 17

<p>Materials</p>	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Alligator clip cords (12) <input type="checkbox"/> Copper wire, enamel coated, 32 m spools (6) <input type="checkbox"/> LEDs (6) <input type="checkbox"/> Magnets, disc, neodymium (24) <input type="checkbox"/> Nails, 4" long (6) <input type="checkbox"/> Nuts, metal (12) <input type="checkbox"/> Sandpaper, 4" × 5" (6) <input type="checkbox"/> Wire cutters (1) <p>Module 1 Kit</p> <ul style="list-style-type: none"> <input type="checkbox"/> Rulers, metric (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"/> Toilet paper tubes (6) or prepared paper towel tube sections (6) <p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Procedure sheets from Lesson 16 <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 18 requires the prepared generator building materials and the wire cutters.
<p>Resources</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 16 Resource B: Build a Generator Procedure Sheet <input type="checkbox"/> Lesson 17 Resource: Build a Generator Group Roles 
<p>Preparation</p>	<ul style="list-style-type: none"> <input type="checkbox"/> Prepare to distribute a copy of Lesson 17 Resource to each group.



Lesson 18

Materials	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Wire cutters (1) <p>Module 1 Kit</p> <ul style="list-style-type: none"> <input type="checkbox"/> Safety goggles, student (24) <input type="checkbox"/> Safety goggles, teacher (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"/> Procedure sheets from Lesson 16 <input type="checkbox"/> Generator building materials from Lesson 17 <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 22 requires the cardboard generators created by students.
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 16 Resource B: Build a Generator Procedure Sheet <input type="checkbox"/> Lesson 17 Resource: Build a Generator Group Roles
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Prepare to distribute a copy of Lesson 17 Resource to each group. <input type="checkbox"/> Cue completed generator reference video (http://phdsci.link/2439). (optional)



Lesson 19

Materials	<p>Kit Items</p> <p>None</p> <p>School-Supplied Items</p> <p>None</p>
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 19 Resource: Hoover Dam Turbines Photograph 
Preparation	<p>None</p>

Lesson 20

Materials	<p>Kit Items</p> <p>None</p> <p>School-Supplied Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Highlighters (24)
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 20 Resource A: Bicycle with Dynamo Light System Illustration  <input type="checkbox"/> Lesson 20 Resource B: Conceptual Checkpoint  <input type="checkbox"/> <i>The Boy Who Harnessed the Wind</i>
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Prepare to distribute a copy of Lesson 20 Resource B to each student.

Lesson 21

Materials	<p>Kit Items None</p> <p>School-Supplied Items None</p>
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 21 Resource A: Engineering Challenge Rubric <input type="checkbox"/> Lesson 21 Resource B: Flooded Neighborhood Photograph  <input type="checkbox"/> Lesson 21 Resource C: Engineering Design Process  <input type="checkbox"/> <i>The Boy Who Harnessed the Wind</i>
Preparation	None

Lesson 22

Materials	<p>Kit Items</p> <ul style="list-style-type: none"> <input type="checkbox"/> Alligator clip cords (24) <input type="checkbox"/> LEDs (18) <input type="checkbox"/> Snap Circuits® Green kits by Elenco® (6) <input type="checkbox"/> Stopwatches (6) <p>Module 1 Kit</p> <ul style="list-style-type: none"> <input type="checkbox"/> Aluminum foil (remaining roll) <input type="checkbox"/> Balloon pumps, handheld (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"/> Highlighters in 2 different colors (24 of each color) <input type="checkbox"/> Various materials (e.g., aluminum foil, cardboard boxes or tubes, plastic cups or bottles, paper plates, straws, tape, string, wooden skewers, craft sticks) (6 sets) <p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Pinwheels from Lesson 1 (6) <input type="checkbox"/> Cardboard generators from Lesson 18 (6) <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 23 requires the prepared Engineering Challenge materials. <input type="checkbox"/> Lessons 22–26 require the Snap Circuits® Green kits by Elenco®.
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 21 Resource A: Engineering Challenge Rubric <input type="checkbox"/> Lesson 22 Resource: Researching Renewable Energy Engineers
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> Prepare for students to research renewable energy engineers. (See Lesson 22 Resource.) <input type="checkbox"/> The quantities of additional Engineering Challenge materials needed may vary according to group designs. Decide in advance what materials to make available so that students can include that information in their planning.

Lesson 23

Materials	<p>Kit Items None</p> <p>Module 1 Kit</p> <ul style="list-style-type: none"> <input type="checkbox"/> Safety goggles, student (24) <input type="checkbox"/> Safety goggles, teacher (1) <p>School-Supplied Items None</p> <p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Engineering Challenge materials from Lesson 22 <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 24 requires the prepared Engineering Challenge materials.
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 21 Resource A: Engineering Challenge Rubric
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> The quantities of additional Engineering Challenge materials needed may vary according to group designs. Decide in advance what materials to make available so that students can include that information in their planning.

Lesson 24

Materials	<p>Kit Items None</p> <p>Module 1 Kit</p> <ul style="list-style-type: none"> <input type="checkbox"/> Safety goggles, student (24) <input type="checkbox"/> Safety goggles, teacher (1) <p>School-Supplied Items None</p> <p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Engineering Challenge materials from Lesson 23 <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 25 requires the prepared Engineering Challenge materials.
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 21 Resource A: Engineering Challenge Rubric
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> The quantities of additional Engineering Challenge materials needed may vary according to group designs. Decide in advance what materials to make available so that students can include that information in their planning.

Lesson 25

Materials	<p>Kit Items None</p> <p>Module 1 Kit</p> <ul style="list-style-type: none"> <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"/> Highlighters in 2 different colors (24 of each color) <p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Engineering Challenge materials from Lesson 24 <p>Item Reuse</p> <ul style="list-style-type: none"> <input type="checkbox"/> Lesson 26 requires the Engineering Challenge devices created by students.
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 21 Resource A: Engineering Challenge Rubric
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> The quantities of additional Engineering Challenge materials needed may vary according to group designs. Decide in advance what materials to make available so that students can include that information in their planning.



Lesson 26

Materials	<p>Kit Items None</p> <p>Module 1 Kit</p> <ul style="list-style-type: none"> <input type="checkbox"/> Safety goggles, student (24) <input type="checkbox"/> Safety goggles, teacher (1) <p>School-Supplied Items None</p> <p>Prepared Items from Previous Lessons</p> <ul style="list-style-type: none"> <input type="checkbox"/> Engineering Challenge devices from Lesson 25 (6)
Resources	<ul style="list-style-type: none"> <input type="checkbox"/> Lesson 21 Resource A: Engineering Challenge Rubric
Preparation	<ul style="list-style-type: none"> <input type="checkbox"/> The quantities of additional Engineering Challenge materials needed may vary according to group designs. Decide in advance what materials to make available so that students can include that information in their planning.


Lesson 27

No materials or preparation required.

Lesson 28



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 video “How Plug-In Vehicles Work” (EPA 2014) (http://phdsci.link/2445).  <input type="checkbox"/> Prepare to distribute a copy of the End-of-Module Assessment to each student. 

Lesson 29




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 29 Resource A: Module Concept Statements <input type="checkbox"/> Lesson 29 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. <input type="checkbox"/> Prepare visual for student connections between module learning and content standards. (See Lesson 29 Resources A and B.)

Earth and Space | Lesson Preparation



Lesson 1

Materials	<p>Kit Items None</p> <p>School-Supplied Items <input type="checkbox"/> Scissors (1)</p>
Resources	<p><input type="checkbox"/> Lesson 1 Resource A: Field Through a Year Photographs </p> <p><input type="checkbox"/> Lesson 1 Resource B: Gardener's Notes </p>
Preparation	<p><input type="checkbox"/> Prepare the field through a year photographs. (See Lesson 1 Resource A.)</p> <p><input type="checkbox"/> Prepare to distribute a copy of Lesson 1 Resource B to each group.</p>



Lesson 2

Materials	<p>Kit Items None</p> <p>School-Supplied Items <input type="checkbox"/> Glue or tape <input type="checkbox"/> Highlighters (24, optional) <input type="checkbox"/> Scissors (1)</p>
Resources	<p><input type="checkbox"/> Lesson 2 Resource A: Gardener Observations Data Table </p> <p><input type="checkbox"/> Lesson 2 Resource B: San Antonio Sunrise and Sunset Data </p> <p><input type="checkbox"/> Lesson 2 Resource C: Sunrise and Sunset Data Table Strips</p> <p><input type="checkbox"/> Lesson 2 Resource D: Day Length Chart Strips</p> <p><input type="checkbox"/> Lesson 2 Resource E: Class Day Length Chart (optional)</p>
Preparation	<p><input type="checkbox"/> Cue strawberry plant video (http://phdsci.link/1840). </p> <p><input type="checkbox"/> Prepare to distribute one sunrise and sunset data table strip and one day length chart strip to each student pair. (See Lesson 2 Resources C and D.)</p>



Lesson 3

Materials	<p>Kit Items None</p> <p>School-Supplied Items <input type="checkbox"/> Scissors (1)</p>
Resources	<p><input type="checkbox"/> Lesson 3 Resource A: San Antonio Day Length Graph </p> <p><input type="checkbox"/> Lesson 3 Resource B: Day Length and Fruiting Data Tables </p> <p><input type="checkbox"/> Lesson 3 Resource C: Day Length Data Tables</p> <p><input type="checkbox"/> Lesson 3 Resource D: Bar Graph Template</p> <p><input type="checkbox"/> Lesson 3 Resource E: Class Average Day Length Graph (optional)</p> <p><input type="checkbox"/> Lesson 3 Resource F: Class Strawberry Fruit Graph (optional)</p>
Preparation	<p><input type="checkbox"/> Prepare to distribute one day length data table and one bar graph template to each of 8 groups. (See Lesson 3 Resources C and D.)</p>






Lesson 4

Materials	<p>Kit Items <input type="checkbox"/> Meter stick (1)</p> <p>Module 1 Kit <input type="checkbox"/> Rulers, metric (6)</p> <p>School-Supplied Items <input type="checkbox"/> Chart paper, graph (7 sheets) <input type="checkbox"/> Marker, black (1) <input type="checkbox"/> Scissors (1)</p>
Resources	<p><input type="checkbox"/> Lesson 2 Resource A: Gardener Observations Data Table </p> <p><input type="checkbox"/> Lesson 4 Resource A: San Antonio Temperature Data Tables</p> <p><input type="checkbox"/> Lesson 4 Resource B: Line Graph Template Preparation Instructions</p> <p><input type="checkbox"/> Lesson 4 Resource C: Class Average Temperature Graph (optional)</p> <p><input type="checkbox"/> Lesson 4 Resource D: San Antonio Temperature Graph </p> <p><input type="checkbox"/> Lesson 4 Resource E: Class Strawberry Data (optional)</p>
Preparation	<p><input type="checkbox"/> Prepare to distribute one San Antonio temperature data table to each group. (See Lesson 4 Resource A.)</p> <p><input type="checkbox"/> Prepare one line graph template for each group and one additional template for demonstration. (See Lesson 4 Resource B.)</p>


Lesson 5

<p>Materials</p>	<p>Kit Items None</p> <p>School-Supplied Items <input type="checkbox"/> Scissors (1)</p>
<p>Resources</p>	<p><input type="checkbox"/> Lesson 5 Resource A: Peruvian Apple Cactus Photographs </p> <p><input type="checkbox"/> Lesson 5 Resource B: Gardener’s Peruvian Apple Cactus and Moon Notes </p> <p><input type="checkbox"/> Lesson 5 Resource C: Moon Calendar Preparation Instructions</p>
<p>Preparation</p>	<p><input type="checkbox"/> Prepare Moon calendars. (See Lesson 5 Resource C.)</p>

Lesson 6

<p>Materials</p>	<p>Kit Items None</p> <p>School-Supplied Items <input type="checkbox"/> Glue sticks (24) <input type="checkbox"/> Scissors (24)</p>
<p>Resources</p>	<p><input type="checkbox"/> Lesson 6 Resource A: European Nightjar Photograph </p> <p><input type="checkbox"/> Lesson 6 Resource B: European Nightjar Migration Map </p> <p><input type="checkbox"/> Lesson 6 Resource C: Nightjar Activity Field Notes </p> <p><input type="checkbox"/> Lesson 6 Resource D: Day Length and Temperature Data </p>
<p>Preparation</p>	<p><input type="checkbox"/> Prepare to distribute a copy of Lesson 6 Resource D and the End-of-Spotlight Assessment to each student. </p>

Lesson 7

Materials	Kit Items None School-Supplied Items <input type="checkbox"/> Pens or pencils in 2 different colors (24 of each color) <input type="checkbox"/> Scissors (1)
Resources	<input type="checkbox"/> End-of-Spotlight Assessment Rubric  <input type="checkbox"/> Lesson 7 Resource A: Content Standards <input type="checkbox"/> Lesson 7 Resource B: Recurring Themes and Concepts
Preparation	<input type="checkbox"/> Prepare to distribute a copy of the End-of-Spotlight Assessment Rubric to each student. <input type="checkbox"/> Score End-of-Spotlight Assessment and write individual feedback. <input type="checkbox"/> Select End-of-Spotlight Assessment responses to share with students for additional support. If selecting student responses, remember to remove identifying information and choose diverse student responses. <input type="checkbox"/> Prepare visual for student connections between content standards and recurring themes and concepts. (See Lesson 7 Resources A and B.)

Energy | Works Cited

Golf Channel. 2016. "Trouble at the Postage Stamp." Video, 3:04.

<https://www.golfpass.com/travel-advisor/video/trouble-at-the-postage-stamp#>.

Kamkwamba, William, and Bryan Mealer. 2012. *The Boy Who Harnessed the Wind: Picture Book Edition*. New York: Puffin Books.

US Environmental Protection Agency (EPA). 2014. "How Plug-In Vehicles Work." Video, 3:00.

<https://www.epa.gov/greenvehicles/explaining-electric-plug-hybrid-electric-vehicles>.