

# Preparation Guide

## Level 1 Module 1

### Survival with Spotlight Lessons on Forces and Motion

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

**Preparation:** This section identifies preparation teachers should complete before the lesson, including resources teachers should gather or cue. This section has two subsections:

- **Resources:** This subsection lists module resources (from Appendix A 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, PhD Projected. A symbol (☐) identifies resources that appear in PhD Projected.
- **Setup:** This subsection lists media teachers must cue before the lesson, activities that require setup, and items in the current lesson that are reused in future lessons. Note that items found in a typical elementary classroom (e.g., glue, tape, scissors) are not listed for reuse. This subsection also describes advance preparation for upcoming lesson. For example, if teachers need to prepare one day in advance for an activity in Lesson 11, an advance preparation note appears in the Setup subsection for Lesson 10. A symbol (📅) identifies lessons with advance preparation notes.

## Advance Materials Preparation




Several 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
5	10 days†	Classroom Crayfish	Order crayfish. (See Lesson 5 Resource A.) Note that some states require permits or have additional restrictions that may prolong ordering times.
5	4 days†	Crayfish Tanks	Prepare crayfish and tanks. (See Lesson 5 Resource A.)
8	8 days	Radish Plant Observation	Prepare radish plants in Cup A and Cup B. (See Lesson 8 Resource A.)


8	1 day	Radish Plant Observation	Cut plant roots in Cup B. (See Lesson 8 Resource A.)
8	1 day†	Plant Models	Prepare plant models. (See Lesson 8 Resource B steps 1–9.)
20	5 days	Light Investigation	Prepare radish plants and two boxes with an opening on top for light investigation. (See Lesson 20 Resource B.)

## Survival Lesson Materials and Preparation

### Lesson 1

Materials	Kit Items	School Supplied Items
	None	None
<b>Preparation</b> 	<b>Resources</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Lesson 1 Resource A: Pond Environment Photograph </li> <li><input type="checkbox"/> Lesson 1 Resource B: <i>Fish Magic</i> </li> <li><input type="checkbox"/> <i>Over and Under the Pond</i> (Messner and Neal 2017)</li> </ul>	
	<b>Setup</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Identify a large, open outdoor area (e.g., sports field, school lawn) to take students to during the Lesson 1 Launch.</li> </ul> <p><b>Advance Preparation for Lesson 5</b>  <b>4 Days Before:</b> Prepare crayfish and tanks. (See Lesson 5 Resource A.)</p> <p><b>Advance Preparation for Lesson 8</b>  <b>8 Days Before:</b> Prepare radish plants in Cup A and Cup B. (See Lesson 8 Resource A.)</p>	


### Lesson 2

Materials	Kit Items	School Supplied Items
	<input type="checkbox"/> Sticky note arrows (144)	<input type="checkbox"/> Glue stick (1)
<b>Preparation</b>	<b>Resources</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Lesson 2 Resource A: Photographs of Living Things</li> <li><input type="checkbox"/> Lesson 2 Resource B: Class Photographs of Living Things Cards</li> <li><input type="checkbox"/> <i>Over and Under the Pond</i> (Messner and Neal 2017)</li> </ul>	
	<b>Setup</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Cue turtle video (<a href="http://phdsci.link/1725">http://phdsci.link/1725</a>) </li> <li><input type="checkbox"/> Prepare photographs of living things. (See Lesson 2 Resource A.)</li> <li><input type="checkbox"/> Prepare class photographs of living things cards. (See Lesson 2 Resource B.)</li> </ul>	

### Lesson 3



<b>Materials</b>	<b>Kit Items</b> <input type="checkbox"/> Sentence strips (2)	<b>School Supplied Items</b> <input type="checkbox"/> Glue stick (1) <input type="checkbox"/> Pocket chart (1) <input type="checkbox"/> Scissors (1)
	<b>Preparation</b>	
<b>Preparation</b>	<b>Resources</b> <input type="checkbox"/> Lesson 3 Resource A: Class Living Things Chart Setup Instructions <input type="checkbox"/> Lesson 3 Resource B: Body Part Cards	
	<b>Setup</b> <input type="checkbox"/> Prepare class living things chart. (See Lesson 3 Resource A.) <input type="checkbox"/> Prepare body part cards. (See Lesson 3 Resource B.)	

### Lesson 4


<b>Materials</b>	<b>Kit Items</b> None	<b>School Supplied Items</b> None
<b>Preparation</b>	<b>Resources</b> <input type="checkbox"/> Lesson 4 Resource: Leaf Drawing 	
	<b>Setup</b> None	

### Lesson 5


<b>Materials</b>	<b>Kit Items</b> <input type="checkbox"/> Clay, modeling, nonhardening (1 lb) <input type="checkbox"/> Plastic eggs (2) <input type="checkbox"/> Safety goggles, student (8) <input type="checkbox"/> Safety goggles, teacher (1) <input type="checkbox"/> Sentence strip (1) <input type="checkbox"/> Sequin ribbon (2 ft) <input type="checkbox"/> Toothpicks, pointed (100)	<b>School Supplied Items</b> <input type="checkbox"/> Computers or tablets with internet access (2) <input type="checkbox"/> Pencil, sharpened (1) <input type="checkbox"/> Scissors (1) <input type="checkbox"/> Tape (partial roll) <input type="checkbox"/> Water (access)
	<b>Crayfish Items</b> <input type="checkbox"/> Airline tubing (8 ft) <input type="checkbox"/> Air pumps (2) <input type="checkbox"/> Antisiphon valves (2) <input type="checkbox"/> Aquarium shelters (2) <input type="checkbox"/> Bacteria starter (4 oz)	

	<ul style="list-style-type: none"> <li><input type="checkbox"/> Bucket, plastic, 10 qt (1)</li> <li><input type="checkbox"/> Crayfish, small, live (2)</li> <li><input type="checkbox"/> Fish food tablets (1.69 oz)</li> <li><input type="checkbox"/> Fish net (1)</li> <li><input type="checkbox"/> Gravel (5 lb)</li> <li><input type="checkbox"/> Gravel vacuum (1)</li> <li><input type="checkbox"/> Measuring cup, 1 L (1)</li> <li><input type="checkbox"/> Pipette, disposable (1, optional)</li> <li><input type="checkbox"/> Scrubbing pad (1)</li> <li><input type="checkbox"/> Sponge filters (2)</li> <li><input type="checkbox"/> Tanks, plastic, 3–4 gallons (2)</li> <li><input type="checkbox"/> Thermometers, adhesive (2)</li> <li><input type="checkbox"/> Water conditioner (4 oz)</li> </ul>	
<b>Preparation</b>	<p><b>Resources</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Lesson 5 Resource A: Using Crayfish in the Classroom</li> <li><input type="checkbox"/> Lesson 5 Resource B: Animal Body Part Stations Setup Instructions</li> <li><input type="checkbox"/> Lesson 5 Resource C: Animal Body Part Stations Procedure Sheets and Photographs</li> </ul> <hr/> <p><b>Setup</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> If not done in advance, prepare crayfish and tanks. (See Lesson 5 Resource A.) Temporarily remove the aquarium shelter from each tank before introducing crayfish to students for observation.</li> <li><input type="checkbox"/> Set up animal body part stations. (See Lesson 5 Resource B.)</li> <li><input type="checkbox"/> Cue heron video, minnow video, and porcupine video: <a href="http://phdsci.link/1456">http://phdsci.link/1456</a>, <a href="http://phdsci.link/1457">http://phdsci.link/1457</a>, and <a href="http://phdsci.link/1458">http://phdsci.link/1458</a>. </li> <li><input type="checkbox"/> Cue crayfish video (optional): <a href="http://phdsci.link/1507">http://phdsci.link/1507</a>. </li> </ul> <p><b>Item Reuse</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Lesson 6 requires the Quills, Shell, and Scales Station models.</li> <li><input type="checkbox"/> Lesson 7 requires the prepared crayfish tanks.</li> <li><input type="checkbox"/> Lesson 17 requires the computers or tablets with internet access.</li> </ul>	


### Lesson 6

<b>Materials</b>	<b>Kit Items</b> None	<b>School Supplied Items</b> None
	<b>Prepared Items from Previous Lessons</b> <input type="checkbox"/> Quills, Shell, and Scales Station models from Lesson 5	
<b>Preparation</b>	<b>Resources</b> <input type="checkbox"/> Lesson 6 Resource: Painted Turtle Photograph 	
	<b>Setup</b> <input type="checkbox"/> Use materials from the Quills, Shell, and Scales Station to set up the protective animal body part stations before Lesson 6. Each model in the Quills, Shell, and Scales Station will form one of the protective animal body part stations: Porcupine Quills Station, Mussel Shell Station, and Minnow Scales Station. For most class sizes, set up two of each station.	




### Lesson 7

<b>Materials</b>	<b>Kit Items</b> <input type="checkbox"/> Binder rings, 1" (24) <input type="checkbox"/> Sentence strip (1) <input type="checkbox"/> Knowledge Deck™ cards, Crayfish Body Parts (24) <input type="checkbox"/> Knowledge Deck poster, Crayfish Body Parts (1)	<b>School Supplied Items</b> None
	<b>Prepared Items from Previous Lessons</b> <input type="checkbox"/> Prepared crayfish tanks from Lesson 5 (2)	
<b>Preparation</b> 	<b>Resources</b> <input type="checkbox"/> Lesson 7 Resource: Porcupine Puzzle	
	<b>Setup</b> <input type="checkbox"/> Prepare porcupine puzzles. (See Lesson 7 Resource.)	
	<p><b>Advance Preparation for Lesson 8</b></p> <p><b>1 Day Before:</b> Cut plant roots in Cup B. (See Lesson 8 Resource A.)</p> <p><b>1 Day Before:</b> Prepare plant models. (See Lesson 8 Resource B steps 1–9.)</p> <p><b>Item Reuse</b></p> <input type="checkbox"/> Lesson 18 requires the prepared crayfish tanks.	





## Lesson 8

<b>Materials</b>	<b>Kit Items</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Cups, clear plastic, 3.5 oz (18)</li> <li><input type="checkbox"/> Flashlights with batteries (6)</li> <li><input type="checkbox"/> Food coloring, blue (1 oz)</li> <li><input type="checkbox"/> Gravel (2 cups)</li> <li><input type="checkbox"/> Grow lamp, two-headed (1)</li> <li><input type="checkbox"/> Radish seed packet (<math>\frac{1}{2}</math>)</li> <li><input type="checkbox"/> Straws, clear, 1 cm diameter (3)</li> </ul>	<b>School Supplied Items</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Cups, plastic, 9 oz (3)</li> <li><input type="checkbox"/> Marker, permanent (1)</li> <li><input type="checkbox"/> Paper towels, white, absorbent (6 sheets)</li> <li><input type="checkbox"/> Pipettes, disposable (6)</li> <li><input type="checkbox"/> Plate, disposable (1)</li> <li><input type="checkbox"/> Potting soil (2 cups)</li> <li><input type="checkbox"/> Ruler, metric (1)</li> <li><input type="checkbox"/> Scissors (1)</li> <li><input type="checkbox"/> Water (access)</li> </ul>
<b>Preparation</b>	<b>Resources</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Lesson 8 Resource A: Radish Plant Preparation Instructions</li> <li><input type="checkbox"/> Lesson 8 Resource B: Plant Model Setup Instructions and Classroom Procedure</li> <li><input type="checkbox"/> Lesson 8 Resource C: Plant Model Template</li> <li><input type="checkbox"/> Lesson 8 Resource D: Cattail Plants Photograph </li> </ul>	
	<b>Setup</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Prepare plant models. (See Lesson 8 Resource B Steps 10–12.)</li> </ul>	
	<b>Item Reuse</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Lesson 20 requires the two-headed grow lamp.</li> </ul>	





## Lesson 9

<b>Materials</b>	<b>Kit Items</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Acorns, artificial with seeds (5)</li> <li><input type="checkbox"/> Jars with lids, clear plastic, 8 oz (4)</li> <li><input type="checkbox"/> Magnifiers, handheld, plastic (12)</li> <li><input type="checkbox"/> Wood pieces with bark (4)</li> </ul>	<b>School Supplied Items</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Gloves, protective (1 pair for teacher)</li> <li><input type="checkbox"/> Nutcracker or pliers (1)</li> <li><input type="checkbox"/> Prickly stems (4)</li> <li><input type="checkbox"/> Scissors (1)</li> <li><input type="checkbox"/> Tape (partial roll)</li> </ul>
<b>Preparation</b>	<b>Resources</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Lesson 9 Resource A: Plant Body Part Photographs </li> <li><input type="checkbox"/> Lesson 9 Resource B: Acorn Demonstration Instructions</li> <li><input type="checkbox"/> Lesson 9 Resource C: Protective Plant Body Part Stations Setup Instructions</li> <li><input type="checkbox"/> Lesson 9 Resource D: Animal Body Part Photographs </li> </ul>	
	<b>Setup</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Set up protective plant body part stations. (See Lesson 9 Resource C.)</li> <li><input type="checkbox"/> Cue moose eating water lilies video: <a href="http://phdsci.link/1455">http://phdsci.link/1455</a>. </li> </ul>	
	<b>Item Reuse</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Lesson 11 requires the handheld magnifiers.</li> </ul>	





## Lesson 10

<b>Materials</b>	<b>Kit Items</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Erasers, wedge, medium (24)</li> <li><input type="checkbox"/> Safety goggles, student (24)</li> <li><input type="checkbox"/> Safety goggles, teacher (1)</li> <li><input type="checkbox"/> Sticky note arrows (24)</li> <li><input type="checkbox"/> Toothpicks, pointed (24)</li> </ul>	<b>School Supplied Items</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Craft sticks (24)</li> <li><input type="checkbox"/> Crayons (24)</li> <li><input type="checkbox"/> Index cards (5, optional)</li> <li><input type="checkbox"/> Pencils, unsharpened (24)</li> <li><input type="checkbox"/> Scissors (1, optional)</li> </ul>
<b>Preparation</b>	<b>Resources</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Lesson 10 Resource A: Yellowjacket Photographs </li> <li><input type="checkbox"/> Lesson 10 Resource B: Yellowjacket Body Parts Illustration </li> <li><input type="checkbox"/> Lesson 10 Resource C: Female Yellowjacket Photographs </li> <li><input type="checkbox"/> Lesson 10 Resource D: Conceptual Checkpoint</li> </ul>	
	<b>Setup</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Prepare a set of stinger modeling materials for each student. If not using sticky note arrows, cut out arrow shapes from index cards.</li> <li><input type="checkbox"/> Prepare to distribute a copy of Lesson 10 Resource D to each student.</li> <li><input type="checkbox"/> Cue yellowjacket video: <a href="http://phdsci.link/1459">http://phdsci.link/1459</a>. </li> </ul>	

## Lesson 11



<b>Materials</b>	<b>Kit Items</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Hook and loop fastener (18 cm)</li> <li><input type="checkbox"/> Magnifiers, handheld, plastic (12)</li> <li><input type="checkbox"/> Safety goggles, student (24)</li> <li><input type="checkbox"/> Safety goggles, teacher (1)</li> <li><input type="checkbox"/> Screws (6)</li> </ul>	<b>School Supplied Items</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Brads (6)</li> </ul>
<b>Preparation</b>	<b>Resources</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Lesson 11 Resource A: Da Vinci Drawing </li> <li><input type="checkbox"/> Lesson 11 Resource B: Red Kite Photograph </li> <li><input type="checkbox"/> Lesson 11 Resource C: Dog with Burr Photograph </li> <li><input type="checkbox"/> Lesson 11 Resource D: Burr Photograph </li> </ul>	
	<b>Setup</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Prepare to distribute a color copy of Lesson 11 Resource C to each group.</li> <li><input type="checkbox"/> Prepare to distribute a color copy of Lesson 11 Resource D to each group.</li> <li><input type="checkbox"/> Prepare a piece of hook and loop fastener for each group. Press both sides of the fastener together and then pull them apart. Repeat this several times so the hooks become more visible. Then cut the hook and loop fastener into 3 cm pieces.</li> </ul>	
	<b>Item Reuse</b> <ul style="list-style-type: none"> <li><input type="checkbox"/> Lesson 23 requires the handheld magnifiers.</li> </ul>	

## Lesson 12


<p><b>Materials</b></p>	<p><b>Kit Items</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Clipboard (1)</li> </ul>	<p><b>School Supplied Items</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Carbon copy paper, 8.5" × 11" (1 sheet)</li> <li><input type="checkbox"/> Fork, plastic (1)</li> <li><input type="checkbox"/> Magnet (1, optional)</li> <li><input type="checkbox"/> Paper, 11" × 17" or larger (6 sheets)</li> <li><input type="checkbox"/> Paper, printer, 8.5" × 11" (1 sheet)</li> </ul>
<p><b>Preparation</b></p>	<p><b>Resources</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Lesson 9 Resource A: Plant Body Part Photographs </li> <li><input type="checkbox"/> Lesson 12 Resource A: Engineering Challenge Rubric</li> <li><input type="checkbox"/> Lesson 12 Resource B: Engineering Design Process Visual </li> <li><input type="checkbox"/> Lesson 12 Resource C: Scientists at a Pond Photograph </li> <li><input type="checkbox"/> Lesson 12 Resource D: Dormant Bramble Plant Photograph </li> </ul> <hr/> <p><b>Setup</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Prepare to demonstrate the Engineering Challenge testing procedure. Place a sheet of carbon copy paper shiny side down on top of a sheet of printer paper. Clip the carbon copy paper and printer paper onto the clipboard. During the lesson, use the plastic fork to demonstrate the testing procedure.</li> </ul> <p><b>Item Reuse</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Lesson 13 requires the prepared class problem and solution chart and protective body parts chart.</li> <li><input type="checkbox"/> Lesson 14 requires the clipboard, plastic fork, and prepared class problem and solution chart.</li> </ul>	





## Lesson 13

<b>Materials</b>	<p><b>Kit Items</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Hook and loop fastener (3 cm)</li> <li><input type="checkbox"/> Safety goggles, student (24)</li> <li><input type="checkbox"/> Safety goggles, teacher (1)</li> </ul>	<p><b>School Supplied Items</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Glue sticks (6)</li> <li><input type="checkbox"/> Magnet (1, optional)</li> <li><input type="checkbox"/> Scissors, blunt tip (6)</li> <li><input type="checkbox"/> Tape (6 rolls)</li> </ul> <p><b>Possible Engineering Challenge Items</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Aluminum foil</li> <li><input type="checkbox"/> Bags, plastic, sandwich or grocery</li> <li><input type="checkbox"/> Cardboard, thin</li> <li><input type="checkbox"/> Cellophane</li> <li><input type="checkbox"/> Chenille stems</li> <li><input type="checkbox"/> Construction paper</li> <li><input type="checkbox"/> Craft foam sheets</li> <li><input type="checkbox"/> Craft sticks</li> <li><input type="checkbox"/> Egg cartons, cardboard</li> <li><input type="checkbox"/> Folders, manila</li> <li><input type="checkbox"/> Paper clips</li> <li><input type="checkbox"/> Paper, printer, 8.5" × 11"</li> <li><input type="checkbox"/> Plates, paper, small</li> <li><input type="checkbox"/> Sequins</li> <li><input type="checkbox"/> Tissue paper</li> <li><input type="checkbox"/> Wax paper</li> </ul>
	<p><b>Prepared Items from Previous Lessons</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Class problem and solution chart from Lesson 12 (1)</li> <li><input type="checkbox"/> Class protective body parts chart from Lesson 12 (1)</li> </ul>	
<b>Preparation</b>	<p><b>Resources</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Lesson 12 Resource A: Engineering Challenge Rubric</li> <li><input type="checkbox"/> Lesson 12 Resource B: Engineering Design Process Visual </li> <li><input type="checkbox"/> Lesson 13 Resource: Protective Body Part Photographs </li> </ul>	
	<p><b>Setup</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Prepare materials for the Engineering Challenge and determine how students will retrieve materials. Either line up all materials by item on a counter or table for students to access when needed or gather each group's set of materials in a box or bag beforehand for ease of distribution and cleanup.</li> <li><input type="checkbox"/> Prepare to distribute a copy of Lesson 13 Resource to each group.</li> </ul> <p><b>Item Reuse</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Lesson 14 requires the prepared class problem and solution chart and the prepared Engineering Challenge materials and building tools.</li> </ul>	


## Lesson 14

<b>Materials</b>	<p><b>Kit Items</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Clipboard (1)</li> <li><input type="checkbox"/> Safety goggles, student (24)</li> <li><input type="checkbox"/> Safety goggles, teacher (1)</li> </ul>	<p><b>School Supplied Items</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Carbon copy paper, 8.5" × 11" (18 sheets)</li> <li><input type="checkbox"/> Forks, plastic (8)</li> <li><input type="checkbox"/> Magnet (1, optional)</li> <li><input type="checkbox"/> Paper, printer, 8.5" × 11" (18 sheets)</li> </ul>
	<p><b>Prepared Items from Previous Lessons</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Class problem and solution chart from Lesson 12 (1)</li> <li><input type="checkbox"/> Engineering challenge materials and building tools from Lesson 13 (6 sets)</li> </ul>	
<b>Preparation</b>	<p><b>Resources</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Lesson 12 Resource A: Engineering Challenge Rubric</li> <li><input type="checkbox"/> Lesson 12 Resource B: Engineering Design Process Visual </li> </ul>	
	<p><b>Setup</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Prepare materials for the Engineering Challenge and determine how students will retrieve materials. Either line up all materials by item on a counter or table for students to access when needed or gather each group's set of materials in a box or bag beforehand for ease of distribution and cleanup.</li> <li><input type="checkbox"/> Prepare the Student Testing Station by placing a clipboard, plastic fork, sheets of carbon copy paper, and sheets of printer paper at a designated table or desk.</li> </ul> <p><b>Item Reuse</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> Lesson 15 requires the clipboard, 2 of the plastic forks, and the prepared Engineering Challenge materials and building tools.</li> </ul>	


## Lesson 15

<b>Materials</b>	<b>Kit Items</b>	<b>School Supplied Items</b>
	<input type="checkbox"/> Clipboard (1) <input type="checkbox"/> Safety goggles, student (24) <input type="checkbox"/> Safety goggles, teacher (1)	<input type="checkbox"/> Carbon copy paper, 8.5" × 11" (12 sheets) <input type="checkbox"/> Forks, plastic (2) <input type="checkbox"/> Magnet (1, optional) <input type="checkbox"/> Paper, printer, 8.5" × 11" (12 sheets)
<b>Prepared Items from Previous Lessons</b>		
<input type="checkbox"/> Engineering challenge materials and building tools from Lesson 13 (6 sets)		
<b>Preparation</b> 	<b>Resources</b>	
	<input type="checkbox"/> Lesson 12 Resource A: Engineering Challenge Rubric <input type="checkbox"/> Lesson 12 Resource B: Engineering Design Process Visual 	
	<b>Setup</b>	
<input type="checkbox"/> Prepare materials for the Engineering Challenge and determine how students will retrieve materials. Either line up all materials by item on a counter or table for students to access when needed or gather each group's set of materials in a box or bag beforehand for ease of distribution and cleanup.		
<input type="checkbox"/> Prepare the Student Testing Station by placing a clipboard, plastic fork, sheets of carbon copy paper, and sheets of printer paper at a designated table or desk.		
<b>Advance Preparation for Lesson 20</b>		
<b>5 Days Before:</b> Prepare radish plants and two cardboard boxes with an opening on top for light investigation. (See Lesson 20 Resource B.)		


## Lesson 16

<b>Materials</b>	<b>Kit Items</b>	<b>School Supplied Items</b>
	None	<input type="checkbox"/> Magnet (1, optional)
<b>Preparation</b>	<b>Resources</b>	
	<input type="checkbox"/> Lesson 12 Resource A: Engineering Challenge Rubric <input type="checkbox"/> Lesson 12 Resource B: Engineering Design Process Visual 	
	<b>Setup</b>	
None		





### Lesson 17

<b>Materials</b>	<b>Kit Items</b>	<b>School Supplied Items</b>
	<input type="checkbox"/> Sentence strips (3)	<input type="checkbox"/> Computers or tablets with internet access (6)
<b>Preparation</b>	<b>Resources</b>	
	None	
<b>Preparation</b>	<b>Setup</b>	
	<input type="checkbox"/> Cue heron video: <a href="http://phdsci.link/1460">http://phdsci.link/1460</a> .  <input type="checkbox"/> Cue squirrel video, monkey video, and hippopotamus video for video stations: <a href="http://phdsci.link/1764">http://phdsci.link/1764</a> , <a href="http://phdsci.link/1765">http://phdsci.link/1765</a> , and <a href="http://phdsci.link/1463">http://phdsci.link/1463</a> . If possible, cue each video on two computers or tablets.	


### Lesson 18

<b>Materials</b>	<b>Kit Items</b>	<b>School Supplied Items</b>
	<input type="checkbox"/> Knowledge Deck cards, Crayfish Sensing Body Parts (24)	<input type="checkbox"/> Paper, printer, 8.5" × 11" (4 sheets)
	<input type="checkbox"/> Knowledge Deck poster, Crayfish Sensing Body Parts (1)	<input type="checkbox"/> Tape (partial roll)
<b>Preparation</b>	<b>Prepared Items from Previous Lessons</b>	
	<input type="checkbox"/> Crayfish tanks from Lesson 5 (2)	
	<b>Resources</b>	
<b>Preparation</b>	None	
	<b>Setup</b>	
	<input type="checkbox"/> Cue squirrel video, monkey video, and hippopotamus video for video stations: <a href="http://phdsci.link/1764">http://phdsci.link/1764</a> , <a href="http://phdsci.link/1765">http://phdsci.link/1765</a> , and <a href="http://phdsci.link/1463">http://phdsci.link/1463</a> .  <input type="checkbox"/> Cue crayfish video (optional): <a href="http://phdsci.link/1507">http://phdsci.link/1507</a> .	
<b>Preparation</b>	<input type="checkbox"/> Cue crayfish sensing video (optional): <a href="http://phdsci.link/1508">http://phdsci.link/1508</a> .	



## Lesson 19

<b>Materials</b>	<b>Kit Items</b> None	<b>School Supplied Items</b> None
<b>Preparation</b>	<b>Resources</b>	
	<input type="checkbox"/> Lesson 19 Resource A: Vervet Monkey Photographs  <input type="checkbox"/> Lesson 19 Resource B: Predator Photographs  <input type="checkbox"/> Lesson 19 Resource C: Beaver Communication Photograph  and Text	
<b>Preparation</b>	<b>Setup</b>	
	<input type="checkbox"/> Cue crossing guard video, “Vervet Monkey’s Escape Plans” (BBC 2014) video, and beaver video: <a href="http://phdsci.link/1464">http://phdsci.link/1464</a> , <a href="http://phdsci.link/1465">http://phdsci.link/1465</a> , and <a href="http://phdsci.link/1466">http://phdsci.link/1466</a> . 	


## Lesson 20

<b>Materials</b>	<b>Kit Items</b>	<b>School Supplied Items</b>
<b>Preparation</b>	<input type="checkbox"/> Boxes, cardboard, 8" × 8" × 8", unassembled (7) <input type="checkbox"/> Grow lamp, two-headed (1) <input type="checkbox"/> Radish seed packet ( $\frac{1}{2}$ )	<input type="checkbox"/> Cups, plastic, 9 oz (8) <input type="checkbox"/> Potting soil (9 cups) <input type="checkbox"/> Tape (partial roll) <input type="checkbox"/> Water (access)
	<b>Resources</b>	
<b>Preparation</b>	<input type="checkbox"/> Lesson 20 Resource A: Plants Next to Window Photograph  <input type="checkbox"/> Lesson 20 Resource B: Light Investigation Preparation Instructions	
	<b>Setup</b>	
<b>Preparation</b>	<input type="checkbox"/> Set up students’ cardboard boxes for light investigation. Assemble a box for each group. Leave one side of each box open. Secure the closed sides with tape as necessary. If time permits and students are able, consider allowing the class to help assemble the boxes.	
	<b>Item Reuse</b>	
<b>Preparation</b>	<input type="checkbox"/> Lesson 21 requires the prepared light investigation boxes with radish plants.	



## Lesson 21

<b>Materials</b>	<b>Kit Items</b> None	<b>School Supplied Items</b> <input type="checkbox"/> Water (access)
	<b>Prepared Items from Previous Lessons</b> <input type="checkbox"/> Light investigation boxes with radish plants from Lesson 20 (7)	
<b>Preparation</b>	<b>Resources</b> <input type="checkbox"/> Lesson 21 Resource A: Plant Responses to Light Photographs  <input type="checkbox"/> Lesson 21 Resource B: Calla Lily Photograph 	
	<b>Setup</b> <input type="checkbox"/> Prepare a color copy of each photograph in Lesson 21 Resource A. During the lesson, post the photographs in different areas of the classroom.	
	<b>Item Reuse</b> <input type="checkbox"/> Lesson 22 requires 1 of the prepared cups with radish plants. Save all the prepared cups with radish plants for Lesson 24.	


## Lesson 22

<b>Materials</b>	<b>Kit Items</b> <input type="checkbox"/> Sentence strip (1)	<b>School Supplied Items</b> <input type="checkbox"/> Scissors (1)
	<b>Prepared Items from Previous Lessons</b> <input type="checkbox"/> Cup with radish plants from Lesson 20 (1)	
<b>Preparation</b>	<b>Resources</b> <input type="checkbox"/> Lesson 22 Resource A: Mimosa Plant Cards <input type="checkbox"/> Lesson 22 Resource B: Conceptual Checkpoint	
	<b>Setup</b> <input type="checkbox"/> Cue mimosa plant videos: <a href="http://phdsci.link/1467">http://phdsci.link/1467</a> and <a href="http://phdsci.link/1468">http://phdsci.link/1468</a> .  <input type="checkbox"/> Prepare mimosa plant cards. (See Lesson 22 Resource A.) <input type="checkbox"/> Prepare to distribute a copy of Lesson 22 Resource B to each student.	
	<b>Item Reuse</b> <input type="checkbox"/> Lesson 24 requires the prepared cup with radish plants.	



### Lesson 23

<b>Materials</b>	<b>Kit Items</b> <input type="checkbox"/> Magnifiers, handheld, plastic (12)	<b>School Supplied Items</b> <input type="checkbox"/> Markers, dry erase (24) <input type="checkbox"/> Paper towels (6 sheets) <input type="checkbox"/> Scissors (1)
	<b>Preparation</b>	
<b>Preparation</b>	<b>Resources</b> <input type="checkbox"/> Lesson 23 Resource A: Radish and Mimosa Plant Photographs  <input type="checkbox"/> Lesson 23 Resource B: Same Kind Cards <input type="checkbox"/> Lesson 23 Resource C: Mystery Animal Photograph 	
	<b>Setup</b> <input type="checkbox"/> Prepare same kind cards. (See Lesson 23 Resource B.)	
	<b>Item Reuse</b> <input type="checkbox"/> Lesson 24 requires the handheld magnifiers.	

### Lesson 24

<b>Materials</b>	<b>Kit Items</b> <input type="checkbox"/> Magnifiers, handheld, plastic (12) <input type="checkbox"/> Sentence strips (2)	<b>School Supplied Items</b> <input type="checkbox"/> Glue stick (1) <input type="checkbox"/> Scissors (1)
	<b>Prepared Items from Previous Lessons</b> <input type="checkbox"/> Cups with radish plants from Lesson 20 (6)	
<b>Preparation</b>	<b>Resources</b> <input type="checkbox"/> Lesson 24 Resource A: Mother Fox and Offspring Photograph  <input type="checkbox"/> Lesson 24 Resource B: Parent and Offspring Posters Setup Instructions <input type="checkbox"/> Lesson 24 Resource C: Plant Parent Cards <input type="checkbox"/> Lesson 24 Resource D: Plant Parent Photographs	
	<b>Setup</b> <input type="checkbox"/> Prepare parent and offspring posters. (See Lesson 24 Resource B.) <input type="checkbox"/> Prepare plant parent cards. (See Lesson 24 Resource C.) <input type="checkbox"/> Identify three corners or areas of the classroom to use for a modified Question Corners routine. Prepare a color copy of each photograph in Lesson 24 Resource D. Post one photograph in each corner.	


### Lesson 25

<b>Materials</b>	<b>Kit Items</b> None	<b>School Supplied Items</b> <input type="checkbox"/> Glue sticks (24) <input type="checkbox"/> Scissors (1) <input type="checkbox"/> Tape (partial roll)
<b>Preparation</b>	<b>Resources</b> <input type="checkbox"/> Lesson 25 Resource A: Offspring Photograph  <input type="checkbox"/> Lesson 25 Resource B: Offspring Sequence Cards <input type="checkbox"/> Lesson 25 Resource C: Pond Animal Life Cycle Models <input type="checkbox"/> Lesson 25 Resource D: Moose and Trout Life Cycle Cards	
	<b>Setup</b> <input type="checkbox"/> Cue tadpole video: <a href="http://phdsci.link/1763">http://phdsci.link/1763</a> .  <input type="checkbox"/> Prepare offspring sequence cards. (See Lesson 25 Resource B.) <input type="checkbox"/> Prepare trout and moose life cycle cards. (See Lesson 25 Resource D.)	

### Lesson 26



<b>Materials</b>	<b>Kit Items</b> <input type="checkbox"/> Sentence strip (1)	<b>School Supplied Items</b> <input type="checkbox"/> Scissors (1) <input type="checkbox"/> Tape (partial roll)
<b>Preparation</b>	<b>Resources</b> <input type="checkbox"/> Lesson 26 Resource A: Robin Offspring Photograph <input type="checkbox"/> Lesson 26 Resource B: Parent and Offspring Storyboards	
	<b>Setup</b> <input type="checkbox"/> Prepare parent and offspring storyboards. (See Lesson 26 Resource B.) <input type="checkbox"/> Prepare a sheet of chart paper for each group. Create two columns on each sheet. Title one column Parents Help and the other column Parents Do Not Help.	

### Lesson 27


<b>Materials</b>	<b>Kit Items</b> <input type="checkbox"/> Sentence strip (1)	<b>School Supplied Items</b> None
<b>Preparation</b>	<b>Resources</b> <input type="checkbox"/> Lesson 27 Resource: Parent and Offspring Behaviors Storyboards	
	<b>Setup</b> <input type="checkbox"/> Cue robin video: <a href="http://phdsci.link/1469">http://phdsci.link/1469</a> .  <input type="checkbox"/> Prepare parent and offspring behaviors storyboards. (See Lesson 27 Resource.)	




### Lesson 28

<b>Materials</b>	<b>Kit Items</b> None	<b>School Supplied Items</b> <input type="checkbox"/> Scissors (1)
<b>Preparation</b>	<b>Resources</b> <input type="checkbox"/> Lesson 28 Resource A: Parent and Offspring Cards <input type="checkbox"/> Lesson 28 Resource B: Response Cards  <input type="checkbox"/> Lesson 28 Resource C: Conceptual Checkpoint	
	<b>Setup</b> <input type="checkbox"/> Prepare parent and offspring cards. (See Lesson 28 Resource A.) <input type="checkbox"/> Prepare response cards. (See Lesson 28 Resource B.) <input type="checkbox"/> Prepare to distribute a copy of Lesson 28 Resource C to each student. <input type="checkbox"/> Cue swan video (pijnacker01 2016): <a href="http://phdsci.link/1525">http://phdsci.link/1525</a> . 	


### Lesson 29

<b>Materials</b>	<b>Kit Items</b> None	<b>School Supplied Items</b> <input type="checkbox"/> Scissors (1)
<b>Preparation</b>	<b>Resources</b> <input type="checkbox"/> Lesson 1 Resource A: Pond Environment Photograph  <input type="checkbox"/> Lesson 29 Resource: Key Term Cards	
	<b>Setup</b> <input type="checkbox"/> Prepare key term cards. (See Lesson 29 Resource.)	

### Lesson 30

<b>Materials</b>	<b>Kit Items</b> <input type="checkbox"/> Knowledge Deck cards, Koala and Eucalyptus (24) <input type="checkbox"/> Knowledge Deck poster, Koala and Eucalyptus (1)	<b>School Supplied Items</b> <input type="checkbox"/> Glue sticks (24) <input type="checkbox"/> Scissors (1)
<b>Preparation</b>	<b>Resources</b> <input type="checkbox"/> Lesson 30 Resource: Sense and Response Cards	
	<b>Setup</b> <input type="checkbox"/> Prepare sense and response cards. (See Lesson 30 Resource.) <input type="checkbox"/> Cue koala video: <a href="http://phdsci.link/1501">http://phdsci.link/1501</a> . 	

## Lesson 31

<b>Materials</b>	<b>Kit Items</b> None	<b>School Supplied Items</b> <input type="checkbox"/> Scissors (1)
<b>Preparation</b>	<b>Resources</b> <input type="checkbox"/> Lesson 31 Resource: Structure and Function Card	
	<b>Setup</b> <input type="checkbox"/> Cue koala video: <a href="http://phdsci.link/1501">http://phdsci.link/1501</a> .  <input type="checkbox"/> Score End-of-Module Assessment and write individual feedback. <input type="checkbox"/> Select at least one End-of-Module Assessment item for the class to debrief, and prepare a sample response for that item to share with students. <input type="checkbox"/> Prepare Structure and Function card. (See Lesson 31 Resource.) <input type="checkbox"/> Select student work products that show evidence of links between phenomena, ideas, concepts, and practices in science and engineering, and display them in different areas of the classroom. Student work products may include the anchor model, other class charts, selected Science Logbook pages, and Engineering Challenge designs.	

# Forces and Motion Lesson Materials and Preparation

## Lesson 1

<b>Materials</b>	<b>Kit Items</b> None	<b>School Supplied Items</b> <input type="checkbox"/> Computers or tablets with Internet access (5)
	<b>Preparation</b>	
	<b>Resources</b> None	
	<b>Setup</b> <input type="checkbox"/> Cue ice skater video: <a href="http://phdsci.link/1731">http://phdsci.link/1731</a> . <input type="checkbox"/> Cue merry-go-round video, skier video, swing video, trampoline video, and truck video for video stations: <a href="http://phdsci.link/1786">http://phdsci.link/1786</a> , <a href="http://phdsci.link/1787">http://phdsci.link/1787</a> , <a href="http://phdsci.link/1788">http://phdsci.link/1788</a> , <a href="http://phdsci.link/1789">http://phdsci.link/1789</a> , and <a href="http://phdsci.link/1790">http://phdsci.link/1790</a> .	

## Lesson 2

<b>Materials</b>	<b>Kit Items</b> <input type="checkbox"/> Toy cars (6)	<b>School Supplied Items</b> None
	<b>Preparation</b>	
	<b>Resources</b> None	
	<b>Setup</b> <input type="checkbox"/> Cue ice skater video: <a href="http://phdsci.link/1731">http://phdsci.link/1731</a> .	

## Lesson 3

<b>Materials</b>	<b>Kit Items</b> <input type="checkbox"/> Bingo chips (6) <input type="checkbox"/> Bottle caps, steel (6) <input type="checkbox"/> Building blocks, plastic, blue (6) <input type="checkbox"/> Craft sticks (6) <input type="checkbox"/> Erasers, wedge, medium (6) <input type="checkbox"/> Jar lids, steel (6) <input type="checkbox"/> Keys, aluminum or brass (6) <input type="checkbox"/> Magnets, bar, N/S labeled (6) <input type="checkbox"/> Paper clips, steel (6) <input type="checkbox"/> Safety goggles, student (24)	<b>School Supplied Items</b> <input type="checkbox"/> Bags, resealable plastic, 1 qt (6) <input type="checkbox"/> Dime coins (6) <input type="checkbox"/> Paper, pieces (6)
	<b>Preparation</b>	

	<input type="checkbox"/> Safety goggles, teacher (1) <input type="checkbox"/> Spoons, steel (6) <input type="checkbox"/> Washers, steel (6)	
<b>Preparation</b>	<b>Resources</b>	
	None	
<b>Preparation</b>	<b>Setup</b>	
	<input type="checkbox"/> Cue mystery magnet video: <a href="http://phdsci.link/1732">http://phdsci.link/1732</a> . <input type="checkbox"/> Prepare the magnet interactions with objects activity. Ensure that the bar magnet attracts the lid, spoon, paper clip, and bottle cap. Ensure that the magnet does not attract the key. Consider placing each group’s objects in a bag or other container for ease of distribution. Keep the bar magnet separate from the other objects. <input type="checkbox"/> Ensure that the bar magnets attract the washers for the predict magnet interactions activity.	

### Lesson 4

<b>Materials</b>	<b>Kit Items</b>	<b>School Supplied Items</b>
	<input type="checkbox"/> Magnets, bar, N/S labeled (18) <input type="checkbox"/> Safety goggles, student (24) <input type="checkbox"/> Safety goggles, teacher (1) <input type="checkbox"/> Toy cars (6)	<input type="checkbox"/> Tape, masking (partial roll)
<b>Preparation</b>	<b>Resources</b>	
	<input type="checkbox"/> Lesson 4 Resource: Use Magnets to Push Cars Setup Instructions	
<b>Preparation</b>	<b>Setup</b>	
	<input type="checkbox"/> Cue magnets picking up pins video: <a href="http://phdsci.link/1733">http://phdsci.link/1733</a> . <input type="checkbox"/> Prepare the use magnets to push cars activity. (See Lesson 4 Resource.) <input type="checkbox"/> Cue toy train video: <a href="http://phdsci.link/1734">http://phdsci.link/1734</a> .	

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