ENGINEERING OPPORTUNITIES IN FOSS

FOSS modules provide students with opportunities to engage in engineering experiences to develop solutions to problems, construct and evaluate models, and use systems thinking. The FOSS engineering icon indicates opportunities for addressing the core ideas of Engineering, Technology, and Applications of Science as described in A Framework for K–12 Science Education. The core ideas are listed below with the grade K-2 and 3–5 grade band expectations from the framework and associated NGSS.

Core idea ETS1: Engineering design—How do engineers solve problems?

• ETS1.A Defining and Delimiting an Engineering Problem. What is a design for? What are the criteria and constraints of a successful solution?

• ETS1.B: Developing Possible Solutions. What is the process for developing potential design solutions?

• ETS1.C: Optimizing the Design Solution. How can the various proposed design solutions be compared and improved?

NGSS Performance Expectations

K–2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.

Materials in Our World; Balance and Motion

K–2-ETS1-2. Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

Materials in Our World; Plants and Animals; Air and Weather; Balance and Motion; Solids and Liquids

K–2-ETS1-3. Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.

Materials in Our World; Air and Weather; Balance and Motion; Solids and Liquids

NOTE

This list of engineering opportunities in FOSS Third Edition Modules (highlighted with the engineering icon) is available on FOSSweb (see Standards Alignment).
3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.

*Water; Measuring Matter; Energy and Electromagnetism; Motion, Force, and Models*

3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.

*Water; Energy and Electromagnetism; Motion, Force, and Models; Living Systems*

3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

*Water; Energy and Electromagnetism; Motion, Force, and Models, Environments; Weather on Earth*

**NOTE**

*A Framework for K–12 Science Education* has two core ideas in engineering, technology, and applications of science but only the first one is associated with K–5 NGSS.

ETS1: Engineering Design

ETS2: Links among Engineering, Technology, Science, and Society
<table>
<thead>
<tr>
<th>Module</th>
<th>Investigation/Part</th>
<th>Where?</th>
<th>Page Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Materials in Our World</td>
<td>3.2</td>
<td>Getting Ready (GR)</td>
<td>147</td>
<td><strong>Step 2 -- Preview Part 2</strong> Students use crayons, pencils, and marking pens to explore and compare the properties of paper that make it suitable or unsuitable for writing and drawing. Students fold paper and compare the properties of paper that allow it to be folded. The focus questions are <em>What makes paper good for writing? What makes paper easy to fold?</em></td>
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<tr>
<td></td>
<td>3.2</td>
<td>Guiding</td>
<td>149</td>
<td><strong>Step 7 -- Discuss findings about paper and writing</strong> Students explore the different papers as they try to write on it and discuss their discoveries.</td>
</tr>
<tr>
<td></td>
<td>3.2</td>
<td>Guiding</td>
<td>150</td>
<td><strong>Step 14 -- Discuss the folding experience</strong> Students explore the different papers as they try to fold them and discuss their discoveries.</td>
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<tr>
<td></td>
<td>3.4</td>
<td>GR</td>
<td>161</td>
<td><strong>Step 2 -- Preview Part 4</strong> Students are introduced to papermaking and recycling. They shake toilet tissue and water in a bottle to make a pulp and then form it into a new sheet of paper. Students discover that the new paper has many of the properties of the original paper and also has some very different properties. The focus question is <em>How can new paper be made from old paper?</em></td>
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<td></td>
<td>3.4</td>
<td>Guiding</td>
<td>165</td>
<td><strong>Step 6 -- Ask questions to guide discussion</strong> As students explore making pulp and new paper, the teacher monitors progress and asks probing questions</td>
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<tr>
<td>Materials in Our World (cont)</td>
<td>3.5</td>
<td>GR</td>
<td>169</td>
<td></td>
</tr>
<tr>
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<td><strong>Step 2 -- Preview Part 5</strong></td>
<td>Students use wheat paste (flour and water) to mold strips of newspaper over a small container. They use this papier-mâché technique to change the paper from flexible to stiff and strong so it will keep a shape. The focus question is <strong>How can paper be made strong to form a bowl?</strong></td>
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<tr>
<td>3.5</td>
<td>Guiding</td>
<td>172</td>
<td></td>
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</tr>
<tr>
<td><strong>Step 6 -- Ask questions to guide discussion</strong></td>
<td>As students work on their papier-mâché bowls, teacher monitors progress and asks probing questions.</td>
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<tr>
<td>3.5</td>
<td>Guiding</td>
<td>173</td>
<td></td>
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<tr>
<td><strong>Step 11 -- Discuss the dried bowls</strong></td>
<td>After the bowls have dried, hold a discussion on how the paper has changed.</td>
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</tr>
<tr>
<td>Inv. 3</td>
<td>Extensions</td>
<td>175</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inv. 3</td>
<td>Extensions</td>
<td>176–177</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| **Math and Engineering Extensions** | * Take apart and reassemble paper boxes  
    * Make a paper box or paper envelope  
    *Weave a paper mat |
<p>| Inv. 3 | Extensions | 175 |
| 4.2 | GR | 196 |
| <strong>Step 2 -- Preview Part 2</strong> | Students investigate the structure of waven fabrics by disassembling and comparing loosely woven burlap and tightly woven wool plaid. The focus question is <strong>How is fabric made?</strong> |
| 4.2 | Guiding | 198 |
| <strong>Step 7 -- Take apart the plaid</strong> | Students take apart a sample of the plaid and compare to the burlap. |
| 4.2 | Guiding | 199 |
| <strong>Step 12 -- Make a summary chart (optional)</strong> | Students summarize the reading by making a chart of the resources used to make different fabrics. |</p>
<table>
<thead>
<tr>
<th>Materials in Our World (cont)</th>
<th>4.4</th>
<th>GR</th>
<th>206</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 2 -- Preview Part 4</strong></td>
<td>Students go outdoors and soil a piece of muslin with dirt and plant materials. They attempt to clean the cloth, first by washing with plain water, then with detergent and a scrub brush. Students find that some substances make permanent stains. The focus question is <em>What are some things that stain fabric?</em></td>
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<thead>
<tr>
<th>4.4</th>
<th>Guiding</th>
<th>209</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 9 -- Discuss the washing process</strong></td>
<td>As students work at basins to try to wash their fabric pieces, teacher guides their observations with probing questions.</td>
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<table>
<thead>
<tr>
<th>4.5</th>
<th>GR</th>
<th>213</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 2 -- Preview Part 5</strong></td>
<td>Students think about the kinds of fabric that would make a good pair of pants and other items of clothing. They prepare picture graphs that represent their decisions regarding the kinds of fabric they would use for different clothing applications. The focus question is <em>How are different kinds of fabric used?</em></td>
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<thead>
<tr>
<th>4.5</th>
<th>Guiding</th>
<th>214</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 2 -- Choose a cloth for making pants</strong></td>
<td>After a discussion of the different kinds of fabric, students must choose which one they think will make the best pair of long pants and why.</td>
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<table>
<thead>
<tr>
<th>4.5</th>
<th>Guiding</th>
<th>215</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 6 -- Focus question: How are different kinds of fabric used?</strong></td>
<td>Students answer the FQ and will make additional graphs for other clothing choices.</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Inv. 4</th>
<th>Extensions</th>
<th>218</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Science and Engineering Extensions</strong></td>
<td><em>Show how knit fabric is made</em></td>
<td></td>
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<tr>
<td>Materials in Our World (cont)</td>
<td>5.5</td>
<td>GR</td>
</tr>
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<tr>
<td>Step 2 -- Preview Part 5</td>
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<td>Students fashion a sculpture,</td>
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<td>using wood, paper, fabric,</td>
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<td>glue, and natural materials.</td>
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<td>Students use the knowledge</td>
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<td>they have gained in the</td>
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<td>previous parts of the module</td>
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<td>to make their own creations.</td>
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<td>The focus question is **What</td>
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<td>can we make from different</td>
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<td>materials?**</td>
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<thead>
<tr>
<th>5.5</th>
<th>Guiding</th>
<th>253</th>
</tr>
</thead>
<tbody>
<tr>
<td>Step 5 -- Start designing</td>
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<td>Students begin designing and</td>
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<tr>
<td>constructing their sculptures.</td>
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| Trees and Weather               |     |     |
| There are no engineering        |     |     |
| opportunities called out in     |     |     |
| Trees and Weather               |     |     |

<p>| Animals Two by Two              | Inv. 2 | Extensions | 125–126 |
| Science Extensions               |       |            |        |
| * Test for surface preferences  |       |            |        |
| * Are snails attracted to direct light? |     |            |        |</p>
<table>
<thead>
<tr>
<th>Module</th>
<th>Investigation /Part</th>
<th>Where?</th>
<th>Page Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balance and Motion</td>
<td>1.3</td>
<td>Getting Ready (GR)</td>
<td>66</td>
<td><strong>Step 2 -- Preview Part 3</strong> Students balance one more tagboard shape and apply their knowledge of counterweighting to a new challenge. They use a piece of soft wire and clothespins to balance a pencil on its point in a stable position. After reading &quot;Make It Balance!,&quot; students go outdoors to explore balance with their bodies. The focus question is <em>How can a pencil balance on its point?</em></td>
</tr>
<tr>
<td></td>
<td>1.3</td>
<td>Guiding</td>
<td>68</td>
<td><strong>Step 9 -- Begin the engineering</strong> Students begin investigating how to balance a pencil on its point.</td>
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<tr>
<td></td>
<td>1.4</td>
<td>GR</td>
<td>74</td>
<td><strong>Step 2 -- Preview Part 4</strong> Students design a particular balancing system called a mobile. They make mobiles to apply concepts of balance, counterbalance, and stability. The focus question is <em>How do the parts of a mobile go together to make a stable system?</em></td>
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<td></td>
<td>1.4</td>
<td>Guiding</td>
<td>76</td>
<td><strong>Step 3 -- Discuss building mobiles</strong> Discuss the model mobile and demonstrate some design techniques prior to students designing their own mobiles.</td>
</tr>
</tbody>
</table>
|                          | Inv. 1               | Extensions      | 81–82       | **Science and Engineering Extensions:**  
* Balance new creations  
* Balance on strings  
* Make a double balance  
* Balance other objects on strings and sticks  
* Set up a mobile center  
* Make big mobiles  
* Balancing sculptures outdoors  

**Step 2 -- Preview Part 1** Students make tops from plastic disks and shafts, and spin them by applying a torque force to the shaft. After finding the arrangement of parts that produces the best top, they make tops from other materials. The focus question is *How can spinning motion be changed?* |
<table>
<thead>
<tr>
<th>Balance and Motion (cont)</th>
<th>2.1 Guiding</th>
<th>93</th>
<th><strong>Step 4 -- Visit students as they work</strong>  While students are working on creating their tops, the teacher is circulating among the groups to provide encouragement and acknowledge progress.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inv. 2</td>
<td>Extensions</td>
<td>116</td>
<td><strong>Science Extensions</strong>  Students construct different sized tops and try to get them spinning. Students construct singing zoomers and traditional twirly birds.</td>
</tr>
<tr>
<td>3.3 GR</td>
<td>141</td>
<td><strong>Step 2 -- Preview Part 3</strong>  Students roll marbles in cups and down runways to observe spheres as rollers. They work with the flexible runways to control the motion of the marbles. As a culminating experience, students work together as a class to make one long runway through which a marble can roll nonstop. The focus question is <em>How can we make a runway system that will let a marble roll its entire length?</em></td>
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</tr>
<tr>
<td>3.3 Guiding</td>
<td>142</td>
<td><strong>Step 4 -- Introduce the first runway challenge</strong>  Students investigate how marbles roll in the runways and plan how to a cup or tape to keep spheres from escaping.</td>
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</tr>
<tr>
<td>3.3 Guiding</td>
<td>145</td>
<td><strong>Step 12 -- Start construction</strong>  Students collaborate to design and build a long runway in which a marble will be able to travel the entire length without stopping.</td>
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</tr>
<tr>
<td>Inv. 3</td>
<td>Extensions</td>
<td>156</td>
<td><strong>Science Extensions</strong>  Students construct a giant wheel-and-axle system using hula hoops, cardboard, and a broomstick.</td>
</tr>
<tr>
<td>Air and Weather</td>
<td>1.4 GR</td>
<td>81</td>
<td><strong>Step 2 -- Preview Part 4</strong>  Students put together tubes, a bottle, water, a rubber stopper, and two syringes to create a system. They add water and use air pressure to push the water around the system. The focus question is <em>How can water be used to show that air takes up space?</em></td>
</tr>
<tr>
<td>1.4 Guiding</td>
<td>86</td>
<td><strong>Step 12 -- Monitor the investigation</strong>  Teachers monitor student progress on their investigations and encourage students to explain what they are doing and observing.</td>
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<tr>
<td>Air and Weather (cont)</td>
<td>1.5</td>
<td>GR</td>
<td>90</td>
</tr>
<tr>
<td>------------------------</td>
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<tr>
<td><strong>Step 2 -- Preview Part 5</strong></td>
<td>Students set up a balloon-rocket system and find out how far the air in the balloon will propel the system along a flight line. The focus question is How can compressed air be used to make a balloon rocket?</td>
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</tbody>
</table>

| 1.5 | Guiding | 92 |
| **Step 6 -- Discuss results** | Students use the knowledge they gained from working on the balloon-rocket-system challenge to a zip-bag-rocket system. |

| 3.4 | GR | 161 |
| **Step 2 -- Preview Part 4** | Students learn about wind vanes, instruments used to indicate wind direction. Students compare the movement of the wind vanes to that of bubbles and clouds. The focus question is What does a wind vane tell us about the wind? |

| 3.4 | Guiding | 164 |
| **Step 4 -- Make wind vanes** | Students construct wind vanes and test them out using fans or hair dryers prior to going taking them outdoors to find the direction the wind is coming from. |

| Inv. 3 | Extensions | 174–175 |
| **Science Extensions** | Students use different materials to construct and test new (different) kite designs. Students construct wind chimes for various materials. |

| Plants and Animals | Inv. 1 | Extensions | 93–94 |
| **Science Extensions:** | *Grow plants in the dark |
| *Try growing plants without water |

| 3.1 | GR | 137 |
| **Step 2 -- Preview Part 1** | Students build a terrarium with soil and the seeds and plants from Investigations 1 and 2. They construct a map showing the location of the seeds and plants. Students review what plants need to live, and think about what animals need. The focus question is What do plants need to live and grow in a terrarium? |

| 3.1 | Guiding | 140 |
| **Step 9 -- Distribute terrarium maps** | Students design their group terrarium and map its contents. |

<p>| Inv. 3 | Extensions | 171 |
| <strong>Science Extensions:</strong> | *Make a pitfall trap |
| *Make a worm bin |</p>
<table>
<thead>
<tr>
<th>Module</th>
<th>Investigation/Part</th>
<th>Where?</th>
<th>Page Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Solids and Liquids</strong></td>
<td>1.4</td>
<td>Getting Ready (GR)</td>
<td>76</td>
<td><strong>Step 2 -- Preview Part 4</strong> Students use solid materials to build towers, finding the best objects and the best materials for building tall structures and providing stability. The focus question is <strong>What objects are useful for building towers?</strong></td>
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<td></td>
<td>1.4</td>
<td>Guiding</td>
<td>77</td>
<td><strong>Step 3 -- Focus questions:</strong> What objects are useful for building towers? Students are presented with the building challenge.</td>
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<td></td>
<td>1.4</td>
<td>Guiding</td>
<td>79</td>
<td><strong>Step 8 -- Discuss towers</strong> Students describe their towers and include their reasoning for choosing the different objects.</td>
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<tr>
<td><strong>Inv. 1</strong></td>
<td>Extensions</td>
<td></td>
<td>89</td>
<td><strong>Science and Engineering Extensions</strong> <em>Provide for ongoing construction</em> <em>Build a paper bridge</em></td>
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<td></td>
<td>3.2</td>
<td>GR</td>
<td>150</td>
<td><strong>Step 2 -- Preview Part 2</strong> Students use screens of three sizes to separate a mixture of five particulate materials: cornmeal, rice, mung beans, pinto beans, and lima beans. The focus question is <strong>How can mixtures of particles be separated?</strong></td>
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<td>3.2</td>
<td>Guiding</td>
<td>153</td>
<td><strong>Step 7 -- Monitor the center</strong> Students devise their own methods for separating the soup mix.</td>
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<td></td>
<td>Inv. 3</td>
<td>Extensions</td>
<td>175–176</td>
<td><strong>Science and Engineering Extensions:</strong> <em>Separate mixtures with magnets</em> <em>Separate mixtures with sieves</em> <em>Mix solids to make layers</em></td>
</tr>
<tr>
<td>Pebbles, Sand, and Silt</td>
<td>3.1</td>
<td>GR</td>
<td>139</td>
<td></td>
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<td>------------------------</td>
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| **Step 2 -- Preview Part 1** Students learn how people use rocks as natural resources to construct objects and to make useful materials. They start by looking outside the school building for places where earth materials can be found naturally or as building materials. The focus question is *How do people use earth materials?*
| 3.1 | Guiding | 140 |
| **Step 2 -- Focus Question: How do people use earth materials?** Get students thinking about the varied materials that are used for building prior to going outdoors and finding examples.
| 3.5 | GR | 158 |
| **Step 2 -- Preview Part 5** Students make adobe clay bricks with a mixture of clay soil, dry grass or weeds, and water. After the bricks dry, they can be used to build a class wall. The focus question is *How are bricks made?*
| 3.5 | Guiding | 160 |
| **Step 2 -- Focus Question: How are bricks made?** Brainstorm ideas on how bricks are made prior to going outdoors for students to construct their bricks.
<p>| Inv. 3 | Extensions | 165 |
| <strong>Engineering Extension:</strong> Look at construction materials |</p>
<table>
<thead>
<tr>
<th>Insects and Plants</th>
<th>3.2</th>
<th>GR</th>
<th>148</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 2 -- Preview Part 2</strong></td>
<td>Students prepare milkweed bug habitats for the numphs and outfit them with food (sunflower seeds), water, air, and space with shelter. They hang up the habitat in the classroom. They use a thermometer to measure the air temperature near the habitats. The focus question is <em>What do milkweed bugs need in their habitat?</em></td>
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<thead>
<tr>
<th>3.2</th>
<th>Guiding</th>
<th>152</th>
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</thead>
<tbody>
<tr>
<td><strong>Step 5 -- Demonstrate assembling a habitat</strong></td>
<td>Teacher demonstrates how to set up a milkweed bug habitat prior to students constructing one for their group.</td>
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<tr>
<td>Module</td>
<td>Investigation/Part</td>
<td>Where?</td>
</tr>
<tr>
<td>---------------------</td>
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<td>---------------</td>
</tr>
<tr>
<td>Measuring Matter</td>
<td>2.3</td>
<td>Getting Ready (GR)</td>
</tr>
<tr>
<td></td>
<td>2.3</td>
<td>Guiding</td>
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<td>4.1</td>
<td>Guiding</td>
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<tr>
<td>Inv. 4</td>
<td>Extensions</td>
<td>238–239</td>
</tr>
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<td></td>
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<tr>
<td>Water</td>
<td>4.2</td>
<td>GR</td>
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<td>4.2</td>
<td>Guiding</td>
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<tr>
<td>Structures of Life</td>
<td>1.4</td>
<td>Guiding</td>
</tr>
<tr>
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<td>4.3</td>
<td>Guiding</td>
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<tr>
<td>Module</td>
<td>Investigation/Part</td>
<td>Where?</td>
</tr>
<tr>
<td>------------------------------</td>
<td>--------------------</td>
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</tr>
<tr>
<td>Energy and Electromagnetism</td>
<td>1.2</td>
<td>Getting Ready (GR)</td>
</tr>
<tr>
<td></td>
<td>1.2</td>
<td>Guiding</td>
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<td>Inv. 1</td>
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<tr>
<td>Energy and Electromagnetism (cont)</td>
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<td>GR</td>
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<tr>
<td><strong>Step 2 -- Preview Part 1</strong></td>
<td>Students find ways to operate more than one lightbulb in a circuit. They devise a series circuit and discover that they can operate two bulbs with one D-cell, but the lights are dim. By adding a second D-cell in series with the first, students can get both bulbs to shine brightly. The focus question is How can you get two bulbs to light at the same time?</td>
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<tr>
<td>2.1</td>
<td>Guiding</td>
<td>125</td>
</tr>
<tr>
<td><strong>Step 8 -- Begin solving the low-light problem</strong></td>
<td>Students discuss the low-light problem and then design and implement ways to solve it.</td>
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<tr>
<td>2.2</td>
<td>GR</td>
<td>129</td>
</tr>
<tr>
<td><strong>Step 2 -- Preview Part 2</strong></td>
<td>Students learn that they can connect two bulbs in a way that allows both to shine brightly using a single D-cell. They wire two bulbs in parallel and find that many bulbs can be made to shine brightly on a single D-cell when they are wired in parallel. The focus question is How can you light two bulbs brightly with one D-cell?</td>
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<tr>
<td>2.2</td>
<td>Guiding</td>
<td>130</td>
</tr>
<tr>
<td><strong>Step 3 -- Build circuits</strong></td>
<td>Students construct their circuits in various ways to discover which pathways allow for brightly lit bulbs using only one D-cell. Students record their successes as scientific drawings in their notebooks.</td>
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<tr>
<td>2.3</td>
<td>GR</td>
<td>136</td>
</tr>
<tr>
<td><strong>Step 2 -- Preview Part 3</strong></td>
<td>Students investigate which type of circuit would be the best design for a string of lights. They analyze the designs and make a recommendation based on their knowledge of circuitry. The focus question is Which design is better for manufacturing long strings of lights—series or parallel?</td>
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<td>2.3</td>
<td>Guiding</td>
<td>137</td>
</tr>
<tr>
<td><strong>Step 1 -- Set the scene</strong></td>
<td>Students are introduced to their challenge and then collaborate in their groups to investigate it.</td>
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<tr>
<td>Energy and Electromagnetism (cont)</td>
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<td>GR</td>
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<tr>
<td><strong>Step 2 -- Preview Part 4</strong></td>
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<tr>
<td>Students design series and parallel solar cell circuits and observe the effect on the speed of a motor. They observe that cells in series make the motor run faster, but cells in parallel do not deliver additional power to the motor. The focus question is How can you make a motor run faster using solar cells?</td>
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<tr>
<th>2.4</th>
<th>Guiding</th>
<th>144</th>
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<tbody>
<tr>
<td><strong>Step 6 -- Generate electricity</strong></td>
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<tr>
<td>Students test their designs outdoors.</td>
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<tr>
<th>Inv. 2</th>
<th>Extensions</th>
<th>149–150</th>
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<tbody>
<tr>
<td><strong>Science and Engineering Extensions:</strong></td>
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<tr>
<td><em>Make a single-pole-double-throw switch</em></td>
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<td><em>Build a flashlight</em></td>
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<td><em>Make a silent alarm</em></td>
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<th>Inv. 3</th>
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<th>203</th>
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<tr>
<td><strong>Science and Engineering Extensions:</strong></td>
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<tr>
<td><em>Make a compass</em></td>
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<td><em>Conduct more force investigations</em></td>
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<tr>
<td><em>Explore different magnets</em></td>
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<td><em>Detecting hidden magnets</em></td>
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<th>4.3</th>
<th>GR</th>
<th>234</th>
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<tbody>
<tr>
<td><strong>Step 2 -- Preview Part 3</strong></td>
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<tr>
<td>Students apply their knowledge of circuitry and electromagnetism to build a telegraph. They invent a code and use their telegraphs to send messages to each other. Finally, they take on the long-distance challenge by wiring two telegraph units together using long wires. The focus question is How can you reinvent the telegraph using your knowledge of energy and electromagnetism?</td>
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<tr>
<th>4.3</th>
<th>Guiding</th>
<th>237</th>
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<tbody>
<tr>
<td><strong>Step 5 -- Monitor telegraph assembly</strong></td>
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<tr>
<td>Teacher monitors progress and provides troubleshooting hints if necessary.</td>
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<th>4.3</th>
<th>Guiding</th>
<th>241</th>
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<tbody>
<tr>
<td><strong>Step 18 -- Troubleshoot problems</strong></td>
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<tr>
<td>Students make minor adjustments to their designs if necessary.</td>
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<tr>
<td>Energy and Electromagnetism (cont)</td>
<td>Inv. 4</td>
<td>Extensions</td>
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</table>
| **Science and Engineering Extensions:** | * Make a rheostat  
* Compare magnets to electromagnets  
* Make a model motor  
* Build a cardboard telegraph  
* Change the electromagnet |

<table>
<thead>
<tr>
<th>Motion, Force, and Models</th>
<th>2.1</th>
<th>Guiding</th>
<th>108</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 9 -- Introduce the work of engineers</strong></td>
<td>Students are introduced to the work of engineers and the design process. They then begin designing their investigations.</td>
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<tr>
<th>2.4</th>
<th>Guiding</th>
<th>134</th>
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<tbody>
<tr>
<td><strong>Step 3 -- Design an investigation</strong></td>
<td>Students design their ramp systems to roll a ball down a ramp and over a hill.</td>
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<tr>
<th>Inv. 2</th>
<th>Extensions</th>
<th>144</th>
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<tbody>
<tr>
<td><strong>Science Extension</strong></td>
<td>Students roll balls down slopes outdoors and design their own investigations.</td>
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<thead>
<tr>
<th>Inv. 3</th>
<th>Extensions</th>
<th>177</th>
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</table>
| **Science and Engineering Extensions:** | * Design a coin sorter  
* Test consumer products |
<table>
<thead>
<tr>
<th>Topic</th>
<th>Step</th>
<th>Activity</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motion, Force, and Models (cont)</td>
<td>4.3</td>
<td>Getting Ready (GR)</td>
<td>208</td>
</tr>
<tr>
<td></td>
<td></td>
<td><strong>Step 2 -- Preview Part 3</strong></td>
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<td>Student groups select from one of three engineering challenges. Challenges include designing a catapult to launch a marshmallow over a wall, landing within 60 cm of a target; a device to keep a bean-filled egg from cracking open when dropped; a boat that can safely transport a marshmallow across a pool of water. Students use engineering practices to construct one of these devices that meets certain parameters. The focus question is <em>What do engineers do when they create a product to solve a problem?</em></td>
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<td>Guiding</td>
<td>210</td>
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<td></td>
<td></td>
<td><strong>Step 2 -- Focus question:</strong> What do engineers do when they create a product to solve a problem? Students are introduced to the challenges they can choose to solve.</td>
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<td>Guiding</td>
<td>213</td>
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<td></td>
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<td><strong>Step 17 -- Review the work of engineers</strong> Students review what engineers do and complete their design plans.</td>
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<td>Inv. 4</td>
<td>Extensions</td>
<td>218</td>
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<td></td>
<td></td>
<td><strong>Science and Engineering Extensions:</strong> <em>Develop a soft-drink dispensing machine model</em></td>
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<tr>
<td>Soils, Rocks, and Landforms</td>
<td>4.2</td>
<td>GR</td>
<td>215</td>
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<td><strong>Step 2 -- Preview Part 2</strong></td>
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<td>Students focus on the earth resources that make up a very important material used for walkways, buildings and bridges–concrete. The class uses local natural resources to make one concrete stepping stone. The focus question for this part is <em>How are natural resources used to make concrete?</em></td>
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<td>4.2</td>
<td>Guiding</td>
<td>217</td>
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<td></td>
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<td><strong>Step 3 -- Focus question:</strong> How are natural resources used to make concrete? Students begin exploring the different ingredients in concrete and investigate the properties that make it so strong.</td>
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<tr>
<td>Soils, Rocks, and Landforms (cont)</td>
<td>4.3</td>
<td>GR</td>
<td>222</td>
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<td>GR</td>
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<td></td>
<td>1.1</td>
<td>Guiding</td>
<td>92</td>
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</table>
| Environments (cont) | Inv. 1 | Extensions | 108–109 | **Science and Engineering Extensions:**  
|                    |       |           |        | *Make a terrarium of local organisms  
|                    |       |           |        | *Build a compost pile  
| Inv. 2 | Extensions | 159–162 | **Science and Engineering Extensions:**  
|        |       |           |        | *Design and build another class aquarium  
|        |       |           |        | *Investigate water holes to mini-ponds  
| Inv. 4 | Extensions | 257–258 | **Science Extensions:**  
|        |       |           |        | *Make terrariums from around the world  


<table>
<thead>
<tr>
<th>Module</th>
<th>Investigation/Part</th>
<th>Where?</th>
<th>Page Number</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mixtures and Solutions</td>
<td>1.3</td>
<td>GR</td>
<td>77</td>
<td><strong>Step 2 -- Preview Part 3</strong> Students are given a dry mixture (gravel, powder, and salt) to separate. The mixture includes a new mystery material, magnetite. Students separate the mixture by using magnets, screens, fibers, and evaporation. The focus question is <strong>How can you separate a mixture of dry materials?</strong></td>
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<td>1.3</td>
<td>Guiding</td>
<td>79</td>
<td><strong>Step 5 -- Develop a plan for separation</strong> Students design their plans for separating the mixture</td>
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<td></td>
<td>4.3</td>
<td>GR</td>
<td>198</td>
<td><strong>Step 5 -- Plan to read Science Resources: &quot;Air Bags&quot;</strong> Students read the selection before exploring investigations of chemical reactions.</td>
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<td></td>
<td>4.3</td>
<td>Guiding</td>
<td>203</td>
<td><strong>Step 14 -- Read &quot;Air Bags&quot;</strong> Students think about the reaction in a bag in an application context (car air bags)</td>
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<td></td>
<td>Inv. 4</td>
<td>Extensions</td>
<td>216</td>
<td><strong>Science and Engineering Extensions:</strong> <em>Get involved with World Water Monitoring Day</em></td>
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<tr>
<td>Topic</td>
<td>Step</td>
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<td><strong>Weather on Earth</strong></td>
<td>2.4</td>
<td>GR</td>
<td>152</td>
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<td><strong>Step 2 -- Preview Part 4</strong></td>
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<tr>
<td>Students set up solar water</td>
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<td>heaters using black and white</td>
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<td>collectors to see if color</td>
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<td>affects temperature change</td>
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<td>in water. They also set up</td>
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<td>open and covered solar water</td>
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<td>heaters to find out if</td>
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<td>exposure to air affects</td>
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<td>temperature change in water.</td>
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<td>The focus question is</td>
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<td><strong>What is the best design for</strong></td>
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<td><strong>a solar water heater?</strong></td>
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<td><strong>Step 2 -- Focus question:</strong></td>
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<td>What is the best design for</td>
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<td>a solar water heater?</td>
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<td>Students are introduced to</td>
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<td>the challenge.</td>
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<td><strong>Science and Engineering Extensions:</strong></td>
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<tr>
<td>*Design other solar water</td>
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<td>heaters</td>
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<td>*Solar energy technology in</td>
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<td>your community</td>
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<td><strong>Inv. 2 Extensions</strong></td>
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<tr>
<td>*Make a rain gauge</td>
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<td><strong>Sun, Moon, and Planets</strong></td>
<td>Inv. 1</td>
<td>Extensions</td>
<td>91</td>
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<tr>
<td><strong>Science and Engineering Extensions</strong></td>
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<tr>
<td>Students research sundials in and consider ways to make one in the schoolyard.</td>
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<td><strong>Living Systems</strong></td>
<td>Inv. 2</td>
<td>Extensions</td>
<td>137</td>
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<td><strong>Science Extensions</strong></td>
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<tr>
<td>Students design an experiment to test the sugar content of breakfast cereals using yeast as an indicator.</td>
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<td><strong>Step 9 -- Construct the circulatory system model</strong></td>
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<tr>
<td>Students design and engineer a model of the circulatory system (heart/lung model).</td>
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