ENGINEERING OPPORTUNITITES 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

Module	Investigation/Part	Where?	Page Number	Description
Materials in Our World	3.2	Getting Ready (GR)	147	**Step 2 -- Preview Part 2** 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 poperties of paper that allow it to be folded. The focus questions are **What makes paper good for writing? What makes paper easy to fold?**
	3.2	Guiding	149	**Step 7 -- Discuss findings about paper and writing** Students explore the different papers as they try to write on it and discuss their discoveries.
	3.2	Guiding	150	**Step 14 -- Discuss the folding experience** Students explore the different papers as they try to fold them and discuss their discoveries.
	3.4	GR	161	**Step 2 -- Preview Part 4** Students are introduced to papermaking and recylcing. 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 tha the new paper has many of the properties of the original paper and also has some very different properties. The focus question is **How can new paper be made from old paper?**
	3.4	Guiding	165	**Step 6 -- Ask questions to guide discussion** As students explore making pulp and new paper, teacher monitors progress and asks probing questions

Materials in Our World (cont)	3.5	GR	169	**Step 2 -- Preview Part 5** 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 **How can paper be made strong to form a bowl?**
	3.5	Guiding	172	**Step 6 -- Ask questions to guide discussion** As students work on their papier-mâché bowls, teacher monitors progress and asks probing questions.
	3.5	Guiding	173	**Step 11 -- Discuss the dried bowls** After the bowls have dried, hold a discussion on how the paper has changed.
	Inv. 3	Extensions	175	**Math and Engineering Extensions** * Take apart and reassemble paper boxes * Make a paper box or paper envelope
	Inv. 3	Extensions	176–177	**Art and Engineering Extensions** *Weave a paper mat
	4.2	GR	196	**Step 2 -- Preview Part 2** Students investigate the structure of waven fabrics by disassembling and comparing loosely woven burlap and tightly woven wool plaid. The focus question is **How is fabric made?**
	4.2	Guiding	198	**Step 7 -- Take apart the plaid** Students take apart a sample of the plaid and compare to the burlap.
	4.2	Guiding	199	**Step 12 -- Make a summary chart (optional)** Students summarize the reading by making a chart of the resources used to make different fabrics.

Materials in Our World (cont)	4.4	GR	206	**Step 2 -- Preview Part 4** 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 **What are some things that stain fabric?**
	4.4	Guiding	209	**Step 9 -- Discuss the washing process** As students work at basins to try to wash their fabric pieces, teacher guides their observations with probing questions.
	4.5	GR	213	**Step 2 -- Preview Part 5** 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 **How are different kinds of fabric used?**
	4.5	Guiding	214	**Step 2 -- Choose a cloth for making pants** 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.
	4.5	Guiding	215	**Step 6 -- Focus question: How are different kinds of fabric used?** Students answer the FQ and will make additional graphs for other clothing choices.
	Inv. 4	Extensions	218	**Science and Engineering Extensions** *Show how knit fabric is made

Materials in Our World (cont)	5.5	GR	250	**Step 2 -- Preview Part 5** Students fashion a sculpture, using wood, paper, fabric, glue, and natural materials. Students use the knowledge they have gained in the previous parts of the module to make their own creations. The focus question is **What can we make from different materials?**
	5.5	Guiding	253	**Step 5 -- Start designing** Students begin designing and constructing their sculptures.
Trees and Weather				There are no engineering opportunities called out in Trees and Weather
Animals Two by Two	Inv. 2	Extensions	125–126	**Science Extensions** * Test for surface preferences *Are snails atttracted to direct light?

Module	Investigation /Part	Where?	Page Number	Description
Balance and Motion	1.3	Getting Ready (GR)	66	**Step 2 -- Preview Part 3** 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 "Make It Balance!," students go outdoors to explore balance with their bodies. The focus question is How can a pencil balance on its point?
	1.3	Guiding	68	**Step 9 -- Begin the engineering** Students begin investigating how to balance a pencil on its point.
	1.4	GR	74	**Step 2 -- Preview Part 4** Students design a particular balancing system called a mobile. They make mobiles to apply concepts of balance, counterbalance, and stability. The focus question is How do the parts of a mobile go together to make a stable system?
	1.4	Guiding	76	**Step 3 -- Discuss building mobiles** Discuss the model mobile and demonstrate some design techniques prior to students designing their own mobiles.
	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*
	2.1	GR	91	**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?

Balance and Motion (cont)	2.1	Guiding	93	**Step 4 -- Visit students as they work** While students are working on creating their tops, the teacher is circulating among the groups to provide encouragement and acknowledge progress.
	Inv. 2	Extensions	116	**Science Extensions** Students construct different sized tops and try to get them spinning. Students construct singing zoomers and traditional twirly birds.
	3.3	GR	141	**Step 2 -- Preview Part 3** 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 How can we make a runway system that will let a marble roll its entire length?
	3.3	Guidng	142	**Step 4 -- Introduce the first runway challenge** Students investigate how marbles roll in the runways and plan how to a cup or tape to keep spheres from escaping.
	3.3	Guiding	145	**Step 12 -- Start construction** Students collaborate to design and build a long runway in which a marble will be able to travel the entire length without stopping.
	Inv. 3	Extensions	156	**Science Extensions** Students construct a giant wheel-and-axle system using hula hoops, cardboard, and a broomstick.
Air and Weather	1.4	GR	81	**Step 2 -- Preview Part 4** 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 How can water be used to show that air takes up space?
	1.4	Guiding	86	**Step 12 -- Monitor the investigation** Teachers monitor student progress on their investigations and encourage students to explain what they are doing and observing.

Air and Weather (cont)	1.5	GR	90	**Step 2 -- Preview Part 5** 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?
	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.
	Inv. 3	Extensions	171	**Science Extensions:** *Make a pitfall trap *Make a worm bin

Module	Investigation/Part	Where?	Page Number	Description
Solids and Liquids	1.4	Getting Ready (GR)	76	**Step 2 -- Preview Part 4** 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 **What objects are useful for building towers?**
	1.4	Guiding	77	**Step 3 -- Focus questions: What objects are useful for building towers?** Students are presented with the building challenge.
	1.4	Guiding	79	**Step 8 -- Discuss towers** Students describe their towers and include their reasoning for choosing the different objects.
	Inv. 1	Extensions	89	**Science and Engineering Extensions** *Provide for ongoing construction *Build a paper bridge
	3.2	GR	150	**Step 2 -- Preview Part 2** 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 **How can mixtures of particles be separated?**
	3.2	Guiding	153	**Step 7 -- Monitor the center** Students devise their own methods for separating the soup mix.
	Inv. 3	Extensions	175–176	**Science and Engineering Extensions:** *Separate mixtures with magnets *Separate mixtures with sieves *Mix solids to make layers

Pebbles, Sand, and Silt	3.1	GR	139	**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.
	Inv. 3	Extensions	165	**Engineering Extension:** Look at construction materials

Insects and Plants	3.2	GR	148	**Step 2 -- Preview Part 2** Students prepare milkweed bug habitats for the numphs and outift 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 What do milkweed bugs need in their habitat?
	3.2	Guiding	152	**Step 5 -- Demonstrate assembling a habitat** Teacher demonstrates how to set up a milkweed bug habitat prior to students constructing one for their group.

Module	Investigation/Part	Where?	Page Number	Description
Measuring Matter	2.3	Getting Ready (GR)	122	**Step 8 -- Put gravel in cups** Pour the gravel from the storage container into ten plastic cups. Each cup should have about the same amount of gravel. Students will use the gravel to make 100 g masses in Step 19.
	2.3	Guiding	127	**Step 18 -- Introduce a problem to solve** Students are challenged to weight items when they insufficient mass pieces to balance against them.
	2.4	GR	131	**Step 3 -- Prepare for the introduction** The investigation introduces a challenge for students to measure the amount of water that a dry sponge can soak up. Before class, decide if you want to allow students to plan their own investigations or if you want them to use notebook sheet 10, *Soaking Sponges,* which prescirbes a plan.
	2.4	Guiding	132	**Step 2 -- Introduce the challenge** Students are introduced to the sponge challenge and begin designing their investigations.
	4.1	Guiding	210	**Step 7 -- Discuss the notebook sheet** Students design how separate a mixture of solid materials based on the properties of the materials.
	Inv. 4	Extensions	238–239	**Science and Engineering Extensions:** *Mixtures inquiry problem

Water	4.2	GR	186	**Step 2 -- Preview Part 2** Students design and construct simple waterwheels. They use water to power their waterwheels to lift or pull objects. They refine their designs with each trial and determine how many syringes of water it takes to move an object a specified distance. The focus question is **Does wataer have the power to do work?**
	4.2	Guiding	187	**Step 4 -- Introduce the challenge** Students are introduced to the waterwheel challenge and begin working on their designs.
	4.2	Guiding	189	**Step 10 -- Draw the designs** Students record their designs in their notebooks and will use them in their refinements.
Structures of Life	1.4	Guiding	95	**Step 9 - Modify seeds** Students mofidy seeds to the seeds can be dispersed in different ways and test the design.
	4.3	Guiding	239	**Step 29 - Introduce and leg model** Students work in pairs to build a model of a leg that shows how muscles move bones.

Module	Investigation/Part	Where?	Page Number	Description
Energy and Electromagnetism	1.2	Getting Ready (GR)	81	**Step 2 -- Preview Part 2** Students are introduced to a switch and a motor and make a circuit that they can turn on an off. Students then work with a different energy source, a solar cell. They determine the conditions needed to produce electricity using energy from sunlight to operate the motor. The focus question is What does energy do in a circuit with a motor?
	1.2	Guiding	84	**Step 3 -- Investigate motors** Students investigate what the motors do when connected to an energy source.
	1.2	Guiding	85	**Step 7 -- Explore switches** Students add a switch to their motor circuits and investigate how the switch affects the circuit.
	1.2	Guiding	87	**Step 13 --Use the solar cell to run the motor** Students replace the battery with a solar cell and investigate how energy from sunlight can be used to power the motor.
	1.3	GR	92	**Step 2 -- Preview Part 3** Students use a circuit and a collection of objects to determine which materials can complete the pathway (conductors) and which cannot (insulators). After developing the rule that metals are conductors, students consider foils and use evidence to confirm that foils are indeed metal. The focus question is What is needed to make a complete pathway for current to flow in a circuit?
	1.3	Guiding	95	**Step 7 -- Make a conductor detector** Students create a conductor detector to test various objects in the classroom to determine if it is conductor.
	Inv. 1	Extensions	111	**Science and Engineering Extensions** Students draw schematic diagrams of the circuits they have made. Students explore their circuits to see how a change in the flow of electricity can affect the motor's rotation.

Energy and Electromagnetism (cont)	2.1	GR	123	**Step 2 -- Preview Part 1** 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?
	2.1	Guiding	125	**Step 8 -- Begin solving the low-light problem** Students discuss the low-light problem and then design and implement ways to solve it.
	2.2	GR	129	**Step 2 -- Preview Part 2** 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 sh ine 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?
	2.2	Guiding	130	**Step 3 -- Build circuits** 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.
	2.3	GR	136	**Step 2 -- Preview Part 3** 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 paralle?
	2.3	Guiding	137	**Step 1 -- Set the scene** Students are introduced to their challenge and then collaborate in their groups to investigate it.

Energy and Electromagnetism (cont)	2.4	GR	141	**Step 2 -- Preview Part 4** 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 faste, 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?
	2.4	Guiding	144	**Step 6 -- Generate electricity** Students test their designs outdoors.
	Inv. 2	Extensions	149–150	**Science and Engineering Extensions:** *Make a single-pole-double-throw switch *Build a flashlight *Make a silent alarm
	Inv. 3	Extensions	203	**Science and Engineering Extensions:** *Make a compass *Conduct more force investigations *Explore different magnets *Detecting hidden magnets
	4.3	GR	234	**Step 2 -- Preview Part 3** 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?
	4.3	Guiding	237	**Step 5 -- Monitor telegraph assembly** Teacher monitors progress and provides troubleshooting hints if necessary.
	4.3	Guiding	241	**Step 18 -- Troubleshoot problems** Students make minor adjustments to their designs if necessary.

Energy and Electromagnetism (cont)	Inv. 4	Extensions	244	**Science and Engineering Extensions:** *Make a rheostat *Compare magnets to electromagnets *Make a model motor *Build a cardboard telegraph *Change the electromagnet
	Inv. 5	Extensions	279–280	**Science and Engineering Extensions:** *Share light *Construct a periscope *Create sunprints
Motion, Force, and Models	2.1	Guiding	108	**Step 9 -- Introduce the work of engineers** Students are introduced to the work of engineers and the design process. They then begin designing their investigations.
	2.4	Guiding	134	**Step 3 -- Design an investigation** Students design their ramp systems to roll a ball down a ramp and over a hill.
	Inv.2	Extensions	144	**Science Extension** Students roll balls down slopes outdoors and design their own investigations.
	Inv. 3	Extensions	177	**Science and Engineering Extensions:** * Design a coin sorter * Test consumer products

Motion, Force, and Models (cont)	4.3	Getting Ready (GR)	208	**Step 2 -- Preview Part 3** 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 **What do engineers do when they create a product to solve a problem?**
	4.3	Guiding	210	**Step 2 -- Focus question: What do engineers do when they create a product to solve a problem?** Students are introduced to the challenges they can choose to solve.
	4.3	Guiding	213	**Step 17 -- Review the work of engineers** Students review what engineers do and complete their design plans.
	Inv. 4	Extensions	218	**Science and Engineering Extensions:** * Develop a soft-drink dispensing machine model
Soils, Rocks, and Landforms	4.2	GR	215	**Step 2 -- Preview Part 2** 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 stoen. The focus question for this part is How are natural resources used to make concrete?
	4.2	Guiding	217	**Step 3 -- Focus question: 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.

Soils, Rocks, and Landforms (cont)	4.3	GR	222	**Step 2 -- Preview Part 3** Students go on a walk around the school and schoolyard, searching for earth materials in use. They search for various objects and structures and consider what natural resources were used to construct them. The focus question is How do people use natural resources to make or build things?
	4.3	Guiding	224	**Step 2 -- Focus Question: How do people use natural resources to make or build things?** Students begin considering the properties of natural resources as criteria for using them as building materials.
	4.3	Guiding	225	**Step 9 -- Discuss observations** Encourage student discourse as students discuss their observations of how schoolyard things are made the durabiltiy of the items.
Environments	1.1	GR	85	**Step 2 -- Preview Part 2** The class conducts two different investigations to find out how isopods respond to the environmental factors of water and light. Based on their findings, students design an isopod environment in a terrarium. The focus question is What do isopods need from their environment?
	1.1	Guiding	92	**Step 28 -- Design an isopod environment** Based on their observations of isopods under different conditions for water and light, students create a terrarium habitat to house the organisms.

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

Module	Investigation/Part	Where?	Page Number	Description
Mixtures and Solutions	1.3	GR	77	**Step 2 -- Preview Part 3** Students are given a dry mixture (gravel, powder, and salt) to separate. The mixture includes a new mystery material, magnetite. Studetns separate the mixture by using magnets, screens, fibers, and evaporation. The focus question is **How can you separate a mixture of dry materials?**
	1.3	Guiding	79	**Step 5 -- Develop a plan for separation** Students design their plans for separating the mixture
	4.3	GR	198	**Step 5 -- Plan to read *Science Resources:* "Air Bags"** Students read the selection before exploring investigations of chemical reactions.
	4.3	Guiding	203	**Step 14 -- Read "Air Bags"** Students think about the reaction in a bag in an application context (car air bags)
	Inv. 4	Extensions	216	**Science and Engineering Extensions:** *Get involved with World Water Monitoring Day

Weather on Earth	2.4	GR	152	**Step 2 -- Preview Part 4** Students set up solar water heaters using black and white collectors to see if color affects temperature change in water. They also set up open and covered solar water heaters to find out if exposure to air affects temperature change in water. The focus question is **What is the best design for a solar water heater?**
	2.4	Guiding	154	**Step 2 -- Focus question: What is the best design for a solar water heater?** Students are introduced to the challenge.
	Inv. 2	Extensions	165	**Science and Engineering Extensions:** *Designother solar water heaters *Solar energy technology in your community
	Inv. 3	Extensions	207	**Science and Engineering Extensions:** * Make a rain gauge
Sun, Moon, and Planets	Inv. 1	Extensions	91	**Science and Engineering Extensions** Students research sundials in and consider ways to make one in the schoolyard.
Living Systems	Inv. 2	Extensions	137	**Science Extensions** Students design an experiment to test the sugar content of breakfast cereals using yeast as an indicator.
	3.2	Guiding	171	**Step 9 -- Construct the circulatory system model** Students design and engineer a model of the circulatory system (heart/lung model)