Unit 2 Materials and Motion

Content Area: **Science**
Course(s): **Science**
Time Period: **Marking Period 3**
Length: **10 Weeks**
Status: **Published**

Unit Overview

The **Materials and Motion Module** provides early-childhood students with integrated experiences with physical science, earth science, and engineering core ideas that relate to students' interests and are teachable and learnable. We begin with a study of natural resources and properties of materials and how those properties determine their use—wood, paper, and fabric. Students come to understand that humans use natural resources for everything they do and that people affect the world around them. Students use those materials to engineer structures, applying physical science core ideas of energy transfer.

After building a repertoire of practices with materials, students investigate the effect of pushes and pulls, and apply their intuitive notion of the concept of variables to change the strength and direction of rolling balls to achieve specific outcomes.

Throughout the **Materials and Motion Module**, students engage in science and engineering practices by asking questions, participating in collaborative investigations, observing, recording, and interpreting data to build explanations, and designing objects and systems to achieve specific outcomes. Students gain experiences that will contribute to beginning-level understanding of the crosscutting concepts of patterns; cause and effect; scale, proportion, and quantity; systems and system models; energy and matter, and structure and function.

Standards

Disciplinary Core Ideas (DCI's)

K-PS2-1	Plan and conduct an investigation to compare the effects of different strengths or different directions of pushes and pulls on the motion of an object.
K-PS2-2	Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.
K-PS3-1	Make observations to determine the effect of sunlight on Earth's surface.
K-PS3-2	Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area.
K-ESS3-3	Communicate solutions that will reduce the impact of humans on the land, water, air,

	and/or other living things in the local environment.
K-ESS3-2.ETS1.A.1	Asking questions, making observations, and gathering information are helpful in thinking about problems.

Crosscutting Concepts (CC's)

CCC.1.1	children recognize that patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.
CCC.2.1	students learn that events have causes that generate observable patterns. They design simple tests to gather evidence to support or refute their own ideas about causes.
CCC.3.1	students use relative scales (e.g., bigger and smaller; hotter and colder; faster and slower) to describe objects. They use standard units to measure length.
CCC.4.1	students understand objects and organisms can be described in terms of their parts; and systems in the natural and designed world have parts that work together.
CCC.5.1	students observe objects may break into smaller pieces, be put together into larger pieces, or change shapes.

Science and Engineering Practices (SEP's)

SEP.1.a	Ask questions based on observations to find more information about the natural and/or designed world(s).
SEP.1.b	Ask and/or identify questions that can be answered by an investigation.
SEP.1.c	Define a simple problem that can be solved through the development of a new or improved object or tool.
SEP.3.a	With guidance, plan and conduct an investigation in collaboration with peers (for K).
SEP.3.c	Evaluate different ways of observing and/or measuring a phenomenon to determine which way can answer a question.
SEP.4.a	Record information (observations, thoughts, and ideas).
SEP.4.b	Use and share pictures, drawings, and/or writings of observations.
SEP.6.c	Generate and/or compare multiple solutions to a problem.
SEP.7.d	Distinguish between opinions and evidence in one’s own explanations.
SEP.8.d	Communicate information or design ideas and/or solutions with others in oral and/or written forms using models, drawings, writing, or numbers that provide detail about scientific ideas, practices, and/or design ideas.

Essential Questions

Investigation 1 - Getting to know Wood

- Where does wood come from?
- What is made of wood?
- What happens when wood gets wet?
- How can you sink wood?
- How many passengers will a wood raft hold?
- How can you change the shape of wood?

- How are sawdust and shavings the same?
- How are sawdust and shavings different?
- How is particleboard made?
- How is plywood made?

Investigation 2 - Getting to know Paper

- What is made of paper?
- What makes paper good for writing?
- What happens when water gets on paper?

Investigation 3 - Getting to know Fabric

- How are fabrics different?
- How are fabrics made?
- How are different kinds of fabrics used?
- What happens to water in sunshine and shade?

Investigation 4 - Getting Things to Move

- What causes objects to move?
- What happens when objects collide?

Application of Knowledge: Students will know that...

- A bigger push or pull makes things go faster.
- Basic materials can be transformed into new materials (particleboard and plywood).
- Different kinds of wood come from different kinds of trees. Trees are natural resources. Some kinds of wood are processed and made by people.
- Engineers design and test solutions to problems.
- Fabric can be made of woven threads.
- Fabric is a flexible material with a wide range of properties. The properties of fabrics determine their uses.
- Fabrics can absorb, transmit, or repel water.
- Gravity pulls things down.
- Land, air, water, and trees are natural resources.
- Paper can be reused, recycled, and fabricated.
- Paper has many observable properties.
- People make paper from wood
- People reuse and recycle to conserve natural resources.

- Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it.
- Sawdust is tiny wood pieces that can be recycled.
- Some paper changes when soaked in water. Some paper breaks down into small fibers.
- Some papers absorb water; others do not.
- The properties of papers determine their uses.
- The Sun warms Earth's surface.
- Wet fabric dries when water evaporates, leaving the fabric unchanged.
- When objects touch or collide, they push on one another and can change motion.
- Wood can be changed by sanding and mixing with water.
- Wood can be described in terms of its properties
- Wood floats in water but can be made to sink.

Application of Skills: Students will be able to...

- compare properties and structures of fabric
- compare properties of several kinds of paper
- describe how and where fabrics are used
- describe how wood interacts with water
- determine the usefulness of different kinds of paper for writing and drawing
- discover how fabric interacts with water
- examine how wood can be changed and recyled
- explain how objects move
- investigate how paper reacts with water
- list kinds of wood that come from different types of trees
- produce changes in wood by mechanical actions (sanding and mixing with water)
- produce new materials made from basic materials(plywood and particleboard)
- recognize that wood floats in water but can be made to sink
- test how many passengers different kinds of wood can support in water
- use knowledge of the properties of materials to design and build a model structure for a specific purpose
- use the knowledge of the motion of rolling objects to solve a problem

Assessments

Pre-Assessment/Survey

Investigation 1:

- Formative Assessments: Science Notebook entry, Embedded Assessment, and Performance Assessment

- Benchmark Assessments: Survey, Investigation 1 I-Check

Investigation 2 -

- Formative Assessments: Science Notebook entry and Embedded Assessment
- Benchmark Assessments: Investigation 2 I-Check

Investigation 3 -

- Formative Assessments: Science Notebook entry, Embedded Assessment, and Performance Assessment
- Benchmark Assessments: Investigation 3 I-Check

Investigation 4 -

- Formative Assessments: Science Notebook entry, Embedded Assessment, and Performance Assessment
- Benchmark Assessments: Posttest

Suggested Activities

Investigation 1 : Getting to Know Wood

Part 1. Observing Wood (whole class)

- Students work with five different wood samples to observe their properties.
- name the wood samples and teacher writes the words
- identify natural wood sources
- identify human made wood resources
- search outdoors for wood
- student notebook entry

Part2. Wood and Water (center)

- students begin with free exploration
- go on a hunt for matching wood samples
- drop water on the wood samples
- float wood samples in a basin
- student notebook entry

Part 3. Testing a Raft (center)

- students test the wood to find out how many paper clips it takes to sink it
- organize results by making a concrete graph
- student notebookentry

Part 4. Sanding Wood (center or outdoors)

- students use sandpaper to change the shape of wood
- go outside and find a stick to sand
- collect sawdust ot tape into student notebook
- student notebook entry

Part 5. Sawdust and Shavings(center)

- explore the sawdust
- explore the shavings
- combine the two materials
- drop mixture in water
- investigate the wet wood
- student notebook entry

Part 6. Making Particleboard (center)

- distribute and stir up the cornstarch mixture
- shape the sawdust wood
- let the wood dryover night
- online activity- video What is Agriculture?

Part 7. Making Plywood (center)

- students simulate the manufacture of two kinds of wood—particleboard and plywood
- read Are You an Engineer?
- student notebook entry

Investigation 2 : Getting to Know Paper

Part 1. Paper Hunt (whole class)

- students observe and compare the properties of ten kinds of paper
- go on a hunt for matching samples
- read The Story of a Box
- student notebook entry

Part 2. Using Paper (center)

- students compare tagboard and paper towel samples
- test paper samples with crayons, markers and pencils
- students compare how well the papers fold and which has the best surface for writing

- student notebook entry

Part 3. Paper and Water (center)

- drop water on paper samples
- soak paper samples overnight
- explore paper outdoors
- introduce and decorate paper flags student notebook entry

Paper 4. Paper Recycling (center

- make the paper pulp
- screen the pulp
- soak up the water and roll out the paper
- dry the paper overnight
- student notebook entry

Part 5. Papier-Mâché (center)

- students learn how to recycle paper by making new paper from old and crafting papiermâché bowls.

Investigation 3: Getting to Know Fabric

Part 1. Feely Boxes and Fabric Hunt (center)

- students observe and compare the properties of ten kinds of fabric
- search for different ways fabrics are used
- students take apart fabrics to learn how they are woven from threads
- student notebook entry

Part 2. Taking Fabric Apart (center)

- students take apart fabrics to learn how they are woven from threads
- read What is Fabric made of?
- Make a summary chart
- online activity- view video What is Agriculture?
- student notebook entry

Part 3. Water and Fabric (center)

- students investigate how fabrics interact with water
- drop water on terry cloth, nylon and cotton
- observe all fabrics
- hang fabrics out to dry
- student notebook entry

Part 4. Graphing Fabric Uses (whole class)

- introduce the fabric graph
- choose a cloth for making pants
- make a picture graph
- read How are Fabrics Used?
- student notebook entry

Part 5. Reuse and Recycle Resources (whole class)

- read Land Air and Water
- sort materials for recycling
- set up class recyling center
- online activity Recycling Center
- sing I am Wood
- student notebook entry

Part 6. Building Structures (center)

- students observe the warming effect of the Sun
- design a structure to reduce the effect of heating
- test structures
- student notebook entry

Investigation 4 : Getting Things to Move

Part 1. Pushes and Pulls (whole class)

- get a toy, chair, ball to move
- rolling activity
- push / pull activity
- read Pushes and Pulls
- studnet notebook entry

Part 2. Colliding Objects (whole class)

- use gravity to pull balls down slopes to investigate collisions
- introduce ramps and roll balls down ramps
- explore differnet possibilities through the design challenge
- student notebook entry

Part 3. Rolling Outdoors (whole class)

- students find ways to change the strength and direction of the pull on a rolling ball to meet design challenges
- create an outdoor and indoor slope
- online activity Build a Roller Coaster

Part 4. Balloon Rockets (whole class)

- students change the strength of the push on a balloon rocket flying on a line to explore cause and effect
- place objects on the flight line
- student notebook entry

Activities to Differentiate Instruction

Differentiation for special education:

- General modifications may include:
    - Modifications & accommodations as listed in the student's IEP
    - Assign a peer to help keep student on task
    - Modified or reduced assignments
    - Reduce length of assignment for different mode of delivery
    - Increase one-to-one time
    - Working contract between you and student at risk
    - Prioritize tasks
    - Think in concrete terms and provide hands-on-tasks
    - Position student near helping peer or have quick access to teacher
    - Anticipate where needs will be
    - Break tests down in smaller increments

Content specific modifications may include:

- Provide equipment photo cards for each object with the object name
- Use a graphic of the syringe system on the word wall to illustrate compressed air and pressure
- Add words to the word wall as needed
- Scaffolding thinking through graphic organizers
- Design individual projects or small-group investigations

Differentiation for ELL's:

- General modifications may include:
    - Strategy groups
    - Teacher conferences
    - Graphic organizers
    - Modification plan
    - Collaboration with ELL Teacher
    - Model and encourage the use of new vocabulary
    - Project the equipment photo card for each object and write the object's name on the word wall.

- Use a graphic of the syringe system on the word wall to illustrate compressed air and pressure
- Activate prior knowledge by showing pictures of different weather conditions. Turn and talk with peer to describe and make connections to what they observe.
- Provide sentence frames for students who need them
- Use Spanish provided resources if applicable

- Content specific vocabulary important for ELL students to understand include: above absorb basswood bead up below break cedar change communicate compare different evaporate fewer float glue grain graph laminate layer less material mixture more observe particleboard pine plywood property raft rough same sand sandpaper sawdust screen senses shape shavings sink smooth soak spread strong test texture tree waterlogged wood woodworker around bend blot bumpy chipboard construction paper corner corrugated cardboard corrugated paper crease drop dry facial tissue fiber flat flip flour fold half kraft paper mold newsprint over paper paper towel paper-mâché pulp recycling rolling slick stiff strip submerge tagboard tear thick thin waxed paper wet wheat pasteburlap cloth cold conserve corduroy denim fabric fleece hot knit least magnet most natural resource nubby recycle reuse ripstop nylon rough satin scratchy seersucker shiny slippery smooth soak soft sparkle organza structure temperature terry cloth texture thread warp waterproof woven cause collide collision direction distance effect fast gentle gravity motion move

Differentiation to extend learning for gifted students may include:

- build a roller coaster with recyclables
- experiment with magnets
- weave a pattern
- experiment with different grades of sandpaper
- knit or crochet
- set up bowling
- Utilize the Math extension problems and Science extensions provided in Foss Teacher Manual

Integrated/Cross-Disciplinary Instruction

Math:

Create a wood chart

Create a wood chart to use throughout the investigation. After you discuss the names of the woods, set up the chart. On the chart, tape a sample of each kind of wood, and write the name of the wood under each sample. Record a few words, phrases, or sentences dictated by students that tell what students know about wood. Use the chart for review, and add to it as the module progresses. If students draw in their science notebooks, the words on the display will also be available for them to copy.

Create sorting challenges

Write a sorting challenge on a sheet of paper. Here are some possibilities.

Sort these objects by color.

Sort these objects by size.

Sort these objects by shape.

Sort these objects by texture.

Provide a basket of objects for students to sort. One week provide pattern blocks, another week provide buttons, another week provide crayons, and so on.

Create a class book of objects made of wood

Have each student contribute a page to a class book called Objects Made of Wood. Explain that each student's page will consist of a drawing of the object and a sentence caption, such as "This chair is made of wood.

Weigh paper clips

Reinforce the concept that students are adding mass (students may say weight) to the wood to make it sink. (Some students perceive paper clips as being so light that the paper clips don't weigh anything.) Use a balance to demonstrate that paper clips do have mass.

Social Studies:

Visit a lumberyard

Contact a lumberyard and plan a field trip. Look at the different kinds of wood available and all the different shapes and sizes the wood is cut into. While you are there, ask a yard person to saw a piece of wood and point out the sawdust produced. Ask him or her to demonstrate the jointer, too, if the yard has one. Shavings come from the jointer.

This is an opportunity to introduce students to careers in construction that involve wood and lumber.

Visit a construction site

Take a field trip to new housing under construction or another site where wood is being used to build a structure. Talk to the carpenter about how wood is used to make sturdy buildings.

Visit a woodworker

Contact a woodworker, and plan a field trip or invite the person to class. You might check with the local middle school or high school to see if they have a woodworking class. Ask the woodworker to demonstrate the safe use of tools to shape wood. This is an opportunity to introduce students to careers in construction using wood.

SCIENCE:

Observe inside a branch

Cut a length of a tree branch (bark and all) in half, the long way, so it can be laid open to see the wood inside.

Take students on a tree walk to think about all the wood that might be in a tree. Bring the cut branch so students can see what a branch or trunk looks like when it is cut open to reveal the wood interior.

Start a wood center

Plan to have a small table designated as a wood center while you are doing the activities in this module. You might start with the tree and wood-production posters and the wood samples that go with each. Borrow the colored posters, Trees book, and tree rounds from the **Trees and Weather Module**, if you have one available.

Bring in interesting pieces of local woods and a variety of things made out of wood. Add any wood pieces that students bring from home to share. These might include blocks, toothpicks, wood-pattern blocks, marble tracks, and the like.

Bring in sawdust from different kinds of wood, a few wood scraps, sandpaper, and appropriate woodworking tools for students to explore.

Conduct another sinking-wood investigation

Ask students to find out if it makes a difference where the paper clips are placed when sinking a raft. Have students answer the question: Does it take more, fewer, or the same number of clips to sink the wood if the clips are placed evenly around the sides of the wood sample or placed all on one side?

MA.K.CC.B.4	Understand the relationship between numbers and quantities; connect counting to cardinality.
CRP.K-12.CRP1.1	Career-ready individuals understand the obligations and responsibilities of being a member of a community, and they demonstrate this understanding every day through their interactions with others. They are conscientious of the impacts of their decisions on others and the environment around them. They think about the near-term and long-term consequences of their actions and seek to act in ways that contribute to the betterment of their teams, families, community and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.
SOC.6.3.4.A.1	Determine what makes a good rule or law and apply this understanding to rules and laws in your school or community (e.g., bike helmet, recycling).
VPA.1.3.2.B.4	Vocalize the home tone of familiar and unfamiliar songs, and demonstrate appropriate posture and breathing technique while performing songs, rounds, or canons in unison and with a partner.

Resources

All websites are appropriate for students except for those marked as teacher-only.
Amusement Park Physics
URL: www.learner.orgDescription: What variables and laws of physics affect amusement park ride design? At this website, you'll find out by designing your own roller coaster and experimenting with bumper car collisions. Primary students may need to adult help with this site.
Cotton's Journey
URL: www.cottonsjourney.comDescription: Students can choose two kinds of cotton fields, watch them grow, and compare. Photos of the cotton field and close-ups of the plants follow the progress for 22 weeks. Also available on this site are teacher materials, including a cotton growth poster, student booklets, and a video, "Cotton's Journey from Seed to You."

Exploratorium Snacks: Center of Gravity
URL: www.exploratorium.eduDescription: Here is a simple way to find the balance point of any long, thin object. All that is needed is a long stick (like a meter- or yardstick) and a lump of clay.
Exploratorium Snacks: Downhill Race
URL: www.exploratorium.eduDescription: Directions are given for making two rolling "wheels" from cookie tins. Inside, magnets are placed in the center or around the rim to compare how the added weight affects the wheels speeds.
How Paper Is Made
URL: www.idahoforests.orgDescription: Find out how paper is made from wood pulp and recycled material. View a short video that shows how tissue paper is made. This site has a “Forests Are For Kids” link.
How Rollercoasters Work
URL: science.howstuffworks.comDescription: Examine the principles that keep coaster cars flying around their tracks on this HowStuffWorks website. Also look at the hardware that keeps everything running, as well as the forces that make the ride so much fun. Primary students may need to adult help with this site.
I Was Wondering: Women's Adventures in Science
URL: Description: This project of the National Academy of Sciences showcases the accomplishments of contemporary women in science and highlights the varied and intriguing careers of some of today's most prominent scientists.
It's a Material World
URL: www.mrl.ucsb.eduDescription: Guess different materials based on a set of clues.
How Water Slides Work
URL: www.howstuffworks.comDescription: Illustrations and photographs show the construction of an intricate water slide, which looks like a fantastic classroom runway construction. Primary students may need to adult help with this site.
Gilmer Wood Company
URL: www.gilmerwood.comDescription: Check out their astounding collection of unusual wood samples from around the world at Wood Sample Images.
Oriland Origami Studio
URL: www.oriland.comDescription: Choose from several origami projects, from very simple to elaborate.
The History of Weaving
URL: www.alientravelguide.comDescription: Describes the history of weaving, starting with string and how early people used it to make woven cloth.
The Wisconsin Paper Council
URL: wipapercouncil.orgDescription: Take a tour of the paper-making process from trees to paper, learn paper facts, play games, and learn how to make your own paper. This site also has a “Fun & Learning” link.
The Yo-Yo Guy
URL: www.yoyoguy.comDescription: The official Yo-Yo Guy tells how to set up your yo-yo and do tricks.
Tryscience.org Field Trips
URL: www.tryscience.orgDescription: Find out about more than 400 science and technology centers and museums worldwide. Use an interactive map of the world to find and explore a science and technology center or museum near you. You can also find online adventures and field trips, ideas for experiments at home, plus live webcams. TryScience.org is your gateway to experience the excitement of contemporary science and technology through on and offline interactivity with science and technology centers worldwide. TryScience is brought to you through a partnership between IBM Corporation, the New York Hall of Science (NYHOS), the Association of Science-Technology Centers (ASTC), and science centers worldwide.

NON-FICTION BOOKS:

- *ABCs of Origami: Paper Folding for Children*
- *All Kinds of Motion*

- *Around and Around*
- *Asphalt to Ecosystems: Design Ideas for Schoolyard Transformation*
- *Back and Forth*
- *Back and Forth*
- *Be a Friend to Trees*
- *Beyond Ecophobia: Reclaiming the Heart of Nature Education*
- *Biggest, Strongest, Fastest*
- *Building a House*
- *Building with Shapes*
- *Dinosaurs to the Rescue: A Guide to Protecting Our Planet*
- *Experiments with Motion*
- *Floating and Sinking*
- *Force and Motion*
- *Forces and Movement*
- *From Tree to House*
- *From Tree to Table*
- *From Wood To Paper*
- *Gears Go, Wheels Roll*
- *Gravity All Around*
- *Homes: Around The World*
- *Inclined Planes*
- *Inclined Planes to the Rescue (Series)*
- *Last Chance To See*
- *Learn about the Way Things Move*
- *Look inside a Log Cabin*
- *Los engranajes trabajan, las ruedas ruedan / Gears Go, Wheels Roll*
- *Make It Move!*
- *Make It Move! (Spanish)*
- *Math In Motion: Origami in the Classroom*
- *Motion*
- *Motion and Movement*
- *Outbreak! The Science of Pandemics*
- *Paper, Paper, Everywhere*
- *Papermaking For Kids*
- *Papier-mâché For Kids*
- *Plastic*
- *Properties*
- *Push and Pull*
- *Recycle! A Handbook for Kids*
- *Sadako and the Thousand Paper Cranes*
- *Schoolyard-Enhanced Learning: Using the Outdoors as an Instructional Tool, K-8*
- *Science Experiments for Young Learners*
- *Sink or Float*
- *Ten-Minute Field Trips: A Teacher's Guide to Using the Schoolgrounds for Environmental Studies (3rd edition)*
- *The Amazing Paper Book*
- *The Paper Airplane Book*
- *The Piñata Maker / El Piñatero*
- *The Sewing Machine*

- *Toads*
- *Tool Book*
- *Trapdoor Spiders (Spiders Series)*
- *Tree Finder: A Manual For The Identification Of Trees By Their Leaves*
- *Tree of Life: The Incredible Biodiversity of Life on Earth*
- *Trees*
- *Trees Are Terrific!*
- *Up and Down*
- *Waste Disposal*
- *What Is A Fish?*

FICTION BOOKS:

- *A New Coat For Anna*
- *A Pocket For Corduroy*
- *Caps For Sale*
- *Charlie Needs A Cloak*
- *Everybody Needs a Rock*
- *Henry and Mudge and the Tall Tree House*
- *Joseph Had A Little Overcoat*
- *Mighty Tree*
- *No Roses For Harry!*
- *Pelle's New Suit*
- *Pinocchio*
- *Red Leaf, Yellow Leaf*
- *Sam Johnson And The Blue Ribbon Quilt*
- *The Crane Wife*
- *The Emperor's New Clothes*
- *The Goat In The Rug*

21st Century Skills

CRP.K-12.CRP1	Act as a responsible and contributing citizen and employee.
CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP5	Consider the environmental, social and economic impacts of decisions.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP9	Model integrity, ethical leadership and effective management.
CRP.K-12.CRP11	Use technology to enhance productivity.

CRP.K-12.CRP12	Work productively in teams while using cultural global competence.