CURRICULUM GUIDE FOR

Properties of Matter

Wallingford Public Schools
Kindergarten
Science

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UNIT SUMMARY

Students will use hand-on materials to investigate properties of matter such as heavy/light, sink/float, wet/dry, hot/cold, loud/quiet, flexibility, etc. They will recognize and describe how objects are similar and or different based on their observable properties. Students will be able to explain how a push or a pull causes an object to move.

A kit of materials and activities has been developed to assist the teacher to meet the goals. Teachers should select **at least two activities** for each of the properties. Please **do not** attempt to do all of the activities and assessments in the guide.

STAGE 1- STANDARDS/GOALS

What should students understand, know, and be able to do? Stage one identifies the desired results of the unit including the related state science content standards and expected performances, enduring understandings, essential questions, knowledge and skills.

Knowledge and Skills

What students are expected to know and be able to do.

The knowledge and skills in this section have been extracted from Wallingford's K-5 Science Scope and Sequence.

Knowledge

The student will be able to…

K1. Select the appropriate senses to describe an object.
K2. Identify different physical properties (heavy/light, sink/float, wet/dry, hot/cold, loud/quiet, flexibility, etc.) of materials.
K3. Explain how objects are similar and/or different.
K4. Explain how a push or a pull causes movement to an object.
K5. Recognize that matter responds differently to change or energy.

Skills

The students will be able to...

S1. Ask "how do you know?" and/ or "why" in appropriate situations.
S2. Use their five senses to describe an object.
S3. Describe an object by comparing it to something else.
S4. Sort by observable properties.
- heavy/light sink/float wet/dry hot/cold loud/quiet flexibility etc.

S5. Predict what might happen.
S6. Design an investigation to help answer an investigable question.
S7. Conduct simple investigations.
S8. Demonstrate safe use of materials and simple equipment.
S9. Record and communicate their observations using illustrations, words, graphs, etc.

Note: Teachers are encouraged to discuss how some materials are better suited for certain purposes. For example, Why are homes built from wood and not marshmallows? Why are balls made from rubber and plastic but not metal.

Enduring Understandings *Insights learned from exploring generalizations via the essential questions (Students will understand THAT…)* *K-12 enduring understandings are those understandings that should be developed over time, they are not expected to be mastered over one unit or one year.*	**Essential Questions** *Inquiry used to explore generalizations*
<u>*Overarching Enduring Understandings:*</u> • Science is the method of observation and investigation used to understand our world. (K-12) • Inquiry is the integration of process skills, the application of scientific content, and the critical thinking to solve problems.(K-12) • Matter can be described, organized, and classified for understanding. (K - 12) <u>*Unit Specific Enduring Understandings:*</u> • Objects can be described and classified based on their properties. • Matter can change. • Not all matter responds the same way to change.	• How do scientists gather information about objects? • What information can scientists gather? • How do some properties of matter give us better information than other properties? • How do materials respond to change? • What senses would you use to best describe objects? • How is an object affected or changed by a push or a pull?

Content Standard(s) *Generalizations about what students should know and be able to do*	
Content Standards (CSDE Science Framework 2004)	**Primary Expected Performances** (CSDE Science Framework 2004)
Properties of Matter – How does the structure of matter affect the properties and uses of materials? **K.1 – Objects have properties that can be observed and used to describe similarities and differences.** • Some properties can be observed with the senses, and others can be discovered using simple tools or tests. *Science and Technology in Society – How do science and technology affect the quality of our lives?* **K.4 – Some objects are natural, while others have been designed and made by people to improve the quality of life.** • Humans select both natural and man-made materials to build shelters based on local climate condition, properties of the materials and their availability in the environment. *Science and Technology in Society – How do science*	A1. Use the senses and simple measuring tools, such as rulers and equal-arm balances, to observe common objects and sort them into groups based on size, weight, shape or color. A2. Sort objects made of materials such as wood, paper and metal into groups based on properties such as flexibility, attraction to magnets and whether they float or sink in water. A3. Count objects in a group and use mathematical terms to describe quantitative relationships such as: same as, more than, less than, equal, etc. A9. Describe the types of materials used by people to build houses, and the properties that make the materials useful. A10. Describe how the motion of objects can

and technology affect the quality of our lives? **1.4 – The properties of materials and organisms can be described more accurately through the use of standard measuring units.** • Various tools can be used to measure, describe and compare different objects and organisms.	be changed by pushing and pulling. A17. Estimate, measure and compare the sizes and weights of different objects and organisms using standard and nonstandard measuring tools.
Scientific Inquiry	A INQ.1 Make observations and ask questions about objects, organisms and the environment. A INQ.2 Use senses and simple measuring tools to collect data. A INQ.3 Make predictions based on observed patterns.
Scientific Literacy	A INQ.4 Read, write, listen and speak about observations of the natural world. A INQ.5 Seek information in books, magazines and pictures. A INQ.6 Present information in words and drawings.
Scientific Numeracy	A INQ.8 Use nonstandard measures to estimate and compare the size of objects. A INQ.9 Count, order and sort objects by their properties. A INQ.10 Represent information in bar graphs.

Common Misconceptions Children Have

By identifying misconceptions early, teachers can design appropriate lessons to address and change student misconceptions.

- If it is big it sinks; if it is small it floats.
- If it is big, it is heavy; if it's small, it's light.
- Fish float. (They have neutral buoyancy and only float when they are dead.)
- Property is land / house. Property in this unit is a type of characteristic used to describe matter.
- The same amount of liquid in a tall thin container is more than when poured into a short fat container. When if fact it is the same amount (volume) of liquid that takes on a different shape.
- The difference between bending and breaking.

STAGE 2-DETERMINE ACCEPTABLE EVIDENCE

How will we know if students have achieved the desired results and met the content standards? How will we know that students really understand? Stage two identifies the acceptable evidence that students have acquired the understandings, knowledge, and skills identified in stage one.

Performance Task(s) *Authentic application in new context to evaluate student achievement of desired results designed according to GRASPS. (Goal, Role, Audience, Setting Performance, Standards)*	**Other Evidence** *Other methods to evaluate student achievement of desired results*
• Raft / Boat Performance Task Students will need to make a raft or boat that floats for at least 5 minutes. Students will need to choose from a variety of materials- some that float as well as some that sink. The teacher will have to have covered the concepts of various materials in terms of how they sink and float. Suggested materials – wooden craft sticks, paper towel tubes, cardboard, plastic straws, egg cartons, aluminum foil, glue sticks, school glue, rubber cement, clay, etc. • Lego Vehicle Performance Task Students will use Lego / Duplo blocks to build a vehicle that must travel X number of feet when pushed. (use masking tape on floor for start and finish lines) Students may need to modify their vehicles in order to achieve the desired result. Have students draw the original vehicle and changes made to it. Then have students write the number of blocks used. The class will have to have covered the concepts of heavy / light and push / pull. • Dramatic Center Performance Tasks 1. Students will be asked to sort the items by properties and place them back in the center. Students will need to explain their choices for placement. (The teacher will need to remove many items from the dramatic center prior to the task.) 2. Students will demonstrate their understanding of hot/cold by sorting food items by how you eat them. Note – some foods could fit in both categories.	• Teacher observations • Graphic organizer- Use a Venn diagram to compare and contrast selected items (things that you push, things that you pull and things that you could push and pull). • Teacher and student interview -Student explains how two items are the same and different. • Student demonstrations - Find two items in the room – one that is flexible and one that is not flexible. - Find two items that will change when they get wet. • Science Journal / illustration -Draw pictures of items that can be loud or quiet. Label illustrations. - Draw pictures of items that can sink or float. Label illustrations. • Treasure hunt - have a search party look for different properties in the school building.

STAGE 3 – LESSON ACTIVITIES

What will need to be taught and coached, and how should it best be taught, in light of the performance goals in stage one? How will we make learning both engaging and effective, given the goals (stage 1) and needed evidence (stage 2)? Stage 3 helps teachers plan learning experiences that align with stage one and enables students to be successful in stage two. Lesson activities are suggested, however, teachers are encouraged to customize these activities, maintaining alignment with stages one and two.

The suggested lesson activities are not sequenced in any particular order. Teachers may select which lesson activities will best meet the needs of their students and the unit objectives. ***Each lesson activity is coded with the corresponding knowledge (K) and/or skill (S) objectives that are found in stage one.***

Note: Choose at least two activities (dots) from each property group (in uppercase letters). These are recommended activities that correspond to the K-5 science scope and sequence.

HEAVY/LIGHT

- Activity 1, "Balancing Blocks," page 77 of *Investigating Science with Young Children*
  (K3, S1, S5, S7, S8)

- Activity 2, "Using Objects to Balance," page *78 of Investigating Science with Young Children*
  (K2, K3, S1, S3, S4, S5, S6, S7, S8)

- Activity 3, "Trying Different Arrangements," page 80 of *Investigating Science with Young Children*
  (K2, K3, S1, S3, S4, S5, S6, S7, S8)

- Weighing activity – use scale to compare weights of common objects found in your room. Document results in a science journal / or chart paper. Create a center that has students explore how selected items compare – heavier or lighter or the same.
  (K2, S3, S4, S5, S7, S8, S9)

    - *How do scientists gather information about an object?*
    - *What information can scientists gather?*
    - *How do materials respond to change?*

SINK/FLOAT

Note: Any time kindergartners are exposed to water, they will want to play with it before beginning to do a meaningful activity. Activity 2, "Using Hands in Water," page 28 of *Investigating Science with Young Children,* provides the structure for allowing them to explore water and play before beginning an investigation.

- KWL or another way to elicit prior knowledge. Use the big book, *Sink or Float?* Make a foil boat to float. Create a challenge in water center where students use the foil boat to float another object.
  (K2, K5, S1, S4, S5, S6, S7, S9)

- Set up a water table so that students can experiment with items that sink and float. Use a water table or large, flat container (contained in kit materials) filled with water. Put out a variety of objects from the classroom that sink and float. (Sponges are provided in the kit for cleanup.)
  -Demonstrate for the children a way to test the objects. Hold the object down on the bottom of the water container and release it. The "floaters" will rise to the surface. The "sinkers" will stay on the bottom.
  -Ask children to create two sets of objects - those that sink and float -and record their observation as a drawing.
  (K2, S1, S3, S4, S5, S7, S8, S9)

- Invite the children to search for floaters that can be used to support or carry other objects that sink. This is a more complex way of thinking about floating and sinking.
  -Have the children collect objects (wooden blocks, Styrofoam, foil, rocks, and small plastic toys) that they think may float or sink. Allow them to test to see if they float or sink.
  -Investigate which "floater" can support the most "sinkers". Illustrate the best "floaters".
  (K2, S1, S3, S4, S5, S6, S7, S8, S9)

- Sink and float with real fruit – as a whole group lesson. This lesson will clarify the misconception that "If it is big and heavy it sinks; if it is small and light it floats."
  <u>suggested fruits</u>: raisins, whole melon, grapes, orange, apple, grapefruit, banana
  <u>note</u>: banana in a peel floats, banana out of the peel floats, banana mashed into a ball will sink
  (K2, K3, S1, S3, S4, S5, S7, S9)

- Students may make a bulletin board with a water line that has two columns—their predictions of things that would float or sink, and the results.

    - *How do scientists gather information about an object?*
    - *What information can scientists gather?*
    - *How do materials respond to change?*

WET/DRY

- Activity 3, **"**Drying Hands on Papers," page 29 *of Investigating Science with Young Children* (K1, K2, K3, S1, S2, S3, S4, S5, S7, S9)

- Have a drying race.
  -Hang a clothesline in the classroom (provided in kit).
  -Have each child soak two identical paper towels. Use clothespins to hang one towel flat. Hang the second towel over the line so that it folds in half.

-Ask students to predict which towel will dry first. Stop periodically to check until one of the towels is dry.
-If you like, experiment with a variety of materials to see which dry first.
-If you like, put one wet paper towel in a paper bag and one wet paper towel in a sealed plastic bag. Predict which will dry first.
(K1, K2, K3, S1, S2, S3, S5, S7, S9)

- Compare pairs of the same object, one wet and one dry.
-Use objects found in your classroom as well as those found in the kit. Examples of objects include sponges, rocks, and different kinds of paper, cotton balls, sugar cubes, and chalk.
-Predict and compare how objects such as sugar cubes behave in hot vs. cold water.
-Use brown paper towels and drop water with the droppers and observe the absorption patter. Challenge students to make different shapes or letters.
-Show the two identical objects. Ask children to predict what will happen when one of the objects gets wet
-Put one of the objects in a cup of water. Compare the two objects.
-Make a center where students explore objects that are "easy to change by water" or "not easy to change by water."
-Paint with ice cubes and dry Kool-aid or dry tempura paint. Have students observe the melting of the ice cube and how the paint/Kool-aid changes properties when water is added. Have students predict what might happen. Compare and contrast dry and wet paint/Kool-aid.
(K2, K3, S1, S3, S4, S5, S7, S9)

  - *What information can scientists gather?*
  - *How do materials respond to change?*
  - *What senses would you use to best describe objects?*

LOUD/QUIET

- Read the book, *The Listening Walk,* and then take students out on a listening walk. Encourage them to identify loud and quiet sounds. When you return, make a bar graph of the loud and quiet sounds you heard.
(K1, K2, S2, S3, S9)

- Cut out pictures and sort them in groups as loud and quite. Use a Venn diagram to sort pictures and loud, quiet or an object that can be sometimes loud and sometimes quiet.
(K1, K2, K3, S2, S3, S9)

- Play Huckle Buckle Bean Stalk – have a couple of students leave the room and 'hide' a familiar object somewhere in the room. Students try to find the object while the class guides with their claps. Loud claps indicate the students are close to the object and quiet claps indicate that students are closer to finding the hidden object.
(K1, K2, S1, S5, S9)

- Use CD's or tapes and play the music loudly and quietly.
  (K1, K2, S1, S5, S9)

- Experiments with rubber bands.
  -Have the children make musical instruments using rubber bands and various sizes of containers (like a Pringle's box, paper towel roll, tissue box) to create loud and quiet sounds.
  -Try out various sizes of rubber bands (large, short, fat, thin) to see what kind of sounds they make. Try making loud and quiet sounds. Discuss the sound differences.
  -Give students 2 containers that are alike but give them different widths of rubber bands. Which container makes the loudest sound? Make a bar graph using the actual containers. Talk about what the bands have in common in each column of the graph.
  (K1, K2, K3, S1, S2, S3, S4, S5, S6, S7, S8, S9)

    - *What information can scientists gather?*
    - *How do materials respond to change?*
    - *What senses would you use to best describe objects?*

HOT/COLD

- Teach in the context of daily activities. Talk about hot and cold as you do the weather chart, washing hands, eating snacks, or cooking.
  (K1, K2, S1, S2, S5, S6, S9)

- Take two objects. Put one object in the shade, the other in the sun. Talk about the effects of hot and cold on each object. (examples- rocks, water, ice cube, ice cream cup)
  (K1, K2, K3, S1, S2, S3, S4, S5, S6, S7, S9)

- Read *The Snowy Day* or the *The Snow Lion.* Give students containers of crushed ice or snow. Ask them to describe whether they are hot or cold. Ask them how they can get the ice or snow to melt. They could use their hands, put the container in a warm spot in the room, and breathe on it. One discovery they may make is the more heat there is, the faster the ice or snow will melt.
  (K1, K2, K3, S1, S2, S3, S4, S5, S6, S7, S8, S9)

- Melting race – Allow students to select a location in the room that will allow their frozen bottle of water to melt the fastest or slowest. Collect snow balls and discover what types of snow balls (sizes, compactness, composition, etc) melt the fastest.
  (K1, K2, K3, S1, S2, S3, S4, S5, S6, S7, S8, S9)

- Read several books about seasons. Include texts that have illustrations of people dressed appropriately for the seasons. Fold a paper in half and have students draw themselves dressed for hot weather and cold weather.
  (K2, K3, S9)

    - *How do scientists gather information about an object?*
    - *What information can scientists gather?*
    - *How do materials respond to change?*

- *What senses would you use to best describe objects?*

SIMILARITIES/DIFFERENCES

- Activity 2, "Describing Toy Structures," page *65* of *Investigating Science with Young Children*
  (K2, S1, S3, S8, S9)

- Activity 3, "Using Construction Toys in New Ways," page 66 of *Investigating Science With Young Children*
  (K2, K3, S1, S3, S4, S5, S7, S8, S9)

- Comparing students - Have students work with partners to verbalize ways (observable and non-observable) that they are similar and different. Have them illustrate and share these characteristics with the class.
  (K2, S3, S9)

- Other ideas:
  -Compare Beanie Babbies, teddy bears, shoes, or other types of objects from home.
  -Give each child an envelope with the same shapes. Have students glue these shapes on construction paper to create a collage. Compare how the collages are similar and different.
  -Compare pictures of families.
  -During snack time, how are your snacks similar and different?
  -Compare two books
  -Etc.

  - *How do scientists gather information about an object?*
  - *What information can scientists gather?*
  - *How do materials respond to change?*
  - *What senses would you use to best describe objects?*
  - *How is an object affected or changed by a push or a pull?*

PUSH/PULL

- Have the children use the wagon supplied in the kit to carry books to the library or to other children in the classroom. Start out with one book and then add books one at a time. Talk about the difficulty of pushing or pulling more weight. The more items in the wagon, the harder it is to push or pull.
  (K2, K3, K4, K5, S1, S3, S5, S6, S7, S8)

- You will need at least 10 rectangular blocks for each pair of children. (Dominoes work well at tables) Have the children arrange ten or more blocks in a line with a small space between each. Have a child gently push the first block in his/her line toward the second block. Discuss the results of the first block falling: the energy from the push to the first block is transferred from block to block. Have the children talk about what must happen in order to get all the blocks to fall.
  (K4, K5, S1, S5, S6, S7, S8)

- Read the big book, *Pull and Pull* by Marcia Freeman.

    - *How do scientists gather information about an object?*
    - *What of information can scientists gather?*
    - *How do materials respond to change?*
    - *How is an object affected or changed by a push or a pull?*

FLEXIBLIITY

- Will It Bend? Activity
  Materials in a bag / mystery box
  Examples: drinking straw, craft stick, pipe cleaner, pencil, paper clip, index card, etc.
  Show items one at a time and name them as they are pulled out of the bag. Discuss whether they are flexible or non flexible. Sort items by into two groups ITEMS THAT BEND and ITEMS THAT DO NOT BEND (emphasize that breaking in half is not the same as bending).
- Draw flexible and non flexible items in science journal, find items from home or school that fit in the categories, make candy canes by twisting two pipe cleaners.
  (K2, K3, S1, S3, S5, S8, S9)
- Have students move around the room moving like 'stick men' and then like a 'rubber band.
- Have students predict whether an object will bend or not using a Yes/No index card.

    - *How do scientists gather information about an object?*
    - *What of information can scientists gather?*
    - *How do materials respond to change?*

Ways to integrate the lessons with other content areas:
Integrated Language Arts

- For example, read Water and wet activities incorporate nicely into the week students explore the letter W.
- Make class big books describing a set of properties; for example, make a book of Times I Am Loud and Times I Am Soft.
- Write poems, songs, and descriptions of their observations.
- See included literature resources page for additional non-fiction suggestions.
- The study of opposites can be integrated throughout the entire year.
- Use Venn Diagrams to compare and contrast objects by their properties.
- Tie the concept words to everyday life in the classroom. Post them on the wall and encourage students to use them whenever they are appropriate.

Mathematics

- Graph the results of activities.
- Sort objects by their properties.
- Non-standard measurement and estimations.
- Sequencing with push and pull.
- Patterns.

LITERATURE RESOURCES

These literature resources have been purchased to supplement the kit and are housed in each elementary school library.

Physical Science Literature Circle/Guided Reading Sets (6 copies per school)
Puddles, Jonathan London

Physical Science Read Aloud (1 copy per school)
Which Witch is Which?, Pat Hutchins
The Very Quiet Cricket, Eric Carle
I Thought I Heard, Alan Baker
The Listening Walk, Paul Showers

Literature (Big Books) for Students (1 copy per school)
Balance and Motion, Lisa Trumbauer (Newbridge)
Sink or Float, Lisa Trumbauer (Newbridge)
Sound, Lisa Trumbauer (Newbridge)
Push and Pull, Marcia Freeman (Newbridge)

Additional Literature Resources That Your Library May Have
The Snowy Day, Ezra Jack Keats
The Snow Lion, David McPhail
Polar Bear, Polar Bear, Eric Carle
The Noisy Book, Margaret Wise Brown
The Quiet Noisy Book, Margaret Wise Brown
The Summer Noisy Book, Margaret Wise Brown
I am Water, Jean Marzollo
Hot and Cold, Allan Fowler
Sound All Around, Wendy Pfeffer
Sink or Float, Kimberlee Graves
What Will Float, Biddulph, big book
Is it Foating, Biddulph, big book
Gingerbread Baby, J. Brett
Louise Makes A Boat, Pfanner

Additional Teacher Resources That Your Library May Have
Discovery Science Book, Explorations for the Early Years (1996), Addison Wesley
Mudpies to Magnets by Robert Williams, Robert Rockwell, and Elizabeth Sherwood
Music and Movement in The Classroom, Greg and Steve includes 2 CD's

Note: The big book bags are found in each school library along with *The Listening Walk* book.

Materials List
Properties of Matter – Kindergarten

Revised April 2005

Expendable Materials	**Reusable Materials**
1 box large tongue depressors	50 clear plastic cups –wide mouth – 9 oz.
1 box sugar cubes	1 small wagon
100 cotton balls	1 clothesline rope
1 roll waxed paper	50 clothespins
4 boxes clay	25 plastic eye droppers
6 big sponges	1 water tub clear plastic (at least 12"deep) w/ removable lid
1 roll aluminum foil	1 equal arm balance (blue)
1 roll absorbent paper towels	1 box dominoes
1 bag assorted sizes and colors rubber bands	1 large equal arm balance with tray balances
5 Styrofoam trays 8" X 6"	
1 box flexible straws	
50 pipe cleaners (12 inches)	
2 plastic knives (cutting clay)	
	1 bag of the following assorted items flexible and not flexible: 5 of each item: spoon, pencil, golf tee, craft stick, straw, pipe cleaner, paper clip, aluminum foil piece, screen, wire, etc.
	1 Teacher's guide *Investigating Science with Young Children*
	Teaching guides for the following big books: • Balance and Motion • Sink and Float • Sound • Push and Pull

Note: The big book bags are found in the school library along with the *The Listening Walk* book.

I N S T I T U T E · F O R · I N Q U I R Y
A DESCRIPTION OF INQUIRY

Appendix A

At the *Exploratorium Institute for Inquiry* our work in science education is deeply rooted in the belief that human beings are natural inquirers and that inquiry is at the heart of all learning. The work that we do with educators is designed to give them an opportunity to personally experience the process of learning science through inquiry. Our hope is that this experience will stimulate their thinking about how to create classrooms that are supportive environments for children's inquiry.

Inquiry is an approach to learning that involves a process of exploring the natural or material world, that leads to asking questions and making discoveries in the search for new understandings. Inquiry, as it relates to science education, should mirror as closely as possible the enterprise of doing real science.

The inquiry process is driven by one's own curiosity, wonder, interest or passion to understand an observation or solve a problem.

The process begins when the learner notices something that intrigues, surprises, or stimulates a question—something that is new, or something that may not make sense in relationship to the learner's previous experience or current understanding.

The next step is to take action—through continued observing, raising questions, making predictions, testing hypotheses and creating theories and conceptual models.

The learner must find her or his own pathway through this process. It is rarely a linear progression, but rather more of a back and forth, or cyclical, series of events.

As the process unfolds, more observations and questions emerge, giving occasion for deeper interaction and relationship with the phenomena—and greater potential for further development of understanding.

Along the way, the inquirer collects and records data, makes representations of results and explanations, and draws upon other resources such as books, videos and the expertise or insights of others.

Making meaning from the experience requires reflection, conversations and comparison of findings with others, interpretation of data and observations, and the application of new conceptions to other contexts. All of this serves to help the learner construct new mental frameworks of the world.

Teaching science using the inquiry process requires a fundamental reexamination of the relationship between the teacher and the learner whereby the teacher becomes a facilitator or guide for the learner's own process of discovery and creating understanding of the world.

Map of IFI Inquiry Structure

(3 Phases of Inquiry Diagram)

Appendix B