**Second Grade Overview:**

**Unit Summary:** In this unit, students explore the mathematics concept of measurement and science concept of physical properties before applying them in their toy box design. In order to help report their findings to the toy company, students learn about the importance of standard units of measurement and use various tools to measure length. To gain a better understanding of the toys that they are organizing and the materials that they will be able to use, students explore the physical properties of these objects and materials.

**Engineering Design Challenge –**

Parents have been complaining about kids’ messy toys and how hard it is to bring toys with them because to get the toys out, they have to dump out the entire box. So a toy company wants to build a new and improved toy box. They have come to you for help – What could they do to help keep the toys organized when they are in the box?

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| **Science Connections** | **Technology & Engineering Connections** | **Mathematics Connections** |
| Physical characteristics (color, size, shape, weight, texture, flexibility, strength and the types of materials in the object) | Importance of materials, engineering design and nature vs. human- made | Standard units of measurement Understand length as a measurable attribute; use tools to measure length |

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| **Second Grade Unit Overview** | | | | | |
|  | Day 1 – Non-standard units | Day 2 – Standard vs. Non-standard | Day 3 –Physical properties | Day 4 – Testing Materials | Day 5 – Designing a toy box |
| Literacy Activities | Book: *How Big is a Foot?*  Strategy: Story Structure | Book: *Measuring Penny*  Strategy: Compare & Contrast | Book: *Living Color*  Strategy: Identifying Details | Book: *Leo Cockroach*  Strategy: Sequencing to lead to summarizing | Book:  *Too Many Toys*  Strategy: Summarizing narrative text |
| STEM integration activities | Treasure Hunt modeling activity | Design your own “standard” | Sort materials by physical properties and describe objects in terms of these properties (Mystery bag) | Testing materials, Planning and initial design | Create, test and redesign your toy organizer |

**Related Standards:**

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| **Science** | **Technology & Engineering** | **Mathematics** |
| ***NSES Content Standards (NRC)*** -  Content Standard B: Physical Science   * Properties of objects and materials (K-4)   Content Standard E: Science and Technology   * Abilities for technological design (K-4) | ***National Standards (ITEEA) –***  **Standard 2**: Students will develop an understanding of core concepts of technology.  K-2 D. Different materials are used in making things.  **Standard 8**. Students will develop an understanding of attributes of design.  K-2 A. Everyone can design solutions to a problem.  K-2 B. Design is a creative process.  **Standard 9**: Students will develop an understanding of engineering design.  K-2 A. The engineering design process includes identifying a problem, looking for ideas, developing solutions, and sharing solutions with others.  K-2 B. Expressing ideas to others verbally and through sketches and models is an important part of design. | ***Common Core State Standards for Mathematics***   1. Measure the length of an object by selecting and using appropriate tools such as rulers, yardsticks, meter sticks, and measuring tapes. 2. Measure the length of an object twice, using length units of different lengths for the two measurements; describe how the two measurements relate to the size of the unit chosen. |
| ***MN Science Standards***  **2.2.1.1.1 (Physical Science) – Std:** 1. Objects can be described in terms of the materials they are made of and their physical properties.  **Benchmark**: Describe objects in terms of color, size, shape, weight, texture, flexibility, strength and the types of materials in the object. | ***MN Science Standards***  **2.1.2.2.1 (NSE)**  2. Engineering design is the process of identifying a problem and devising a product or process to solve the problem.  **2.1.2.2.2 (NSE)** - Describe why some materials are better than others for making a particular object and how materials that are better in some ways may be worse in other ways. | ***MN Mathematics Standards***  **2.3.2.1:** Understand the relationship between the size of the unit of measurement and the number of units needed to measure the length of an object.  **2.3.2.2:** Demonstrate an understanding of the relationship between length and the numbers on a ruler by using a ruler to measure lengths to the nearest centimeter or inch. |

**Implementation Options (Primary):**

* 5 day Unit (30- 45 reading aloud w/skills, 30 – 45 STEM **or** 20-30 read aloud, 30- 45 STEM)
* 10 Day Unit (All done during Science Block with alternating literacy, science)

**PictureSTEM: Module Organization**

* In recognizing that time and flexibility are important and teachers often have more flexibility with their trade book or read aloud choices during whole group reading instruction, our unit includes a whole group/read aloud literacy component.
* The guided reading and independent reading instruction have intentionally been left open for teacher choice or pre-determined reading curriculum. Suggestions for themes that could be have been made at the beginning of the unit for guided or independent reading themes that would be a good fit with this STEM unit.
* The STEM activity was designed as an inquiry-based, hands-on activity related to the literacy component and set in a real life context that is authentic to engineering.

**Literacy Component:**

Suggested guided reading themes: animals, habitats

The whole group lessons focus on vocabulary and comprehension development by using the following structure:

* Use a high-quality trade books connected to a STEM activity
* Targets a comprehension strategy
* Teach vocabulary at the point of contact
* Encourage higher level thinking through questioning

Each of the five literacy lessons include a different comprehension strategy as well as incorporating both fiction and non-fiction texts.

**STEM Component:**

These activities are designed to follow the literacy lesson and provide students with a chance to see the connections that are made possible through STEM integration.

* Inquiry-based activity that incorporates different components of the STEM fields.
* Builds on previous learning and knowledge from the literacy lesson
* Sets the learning in a real world context
* Activities and challenges authentic to engineering/engineers (ex: working for a client)

**Books:**

**Day 1:** Myller, Rolf. ( 1991). *How Big is a Foot?* New York, NY: Yearling

**Day 2:** Leedy, Loreen. (1997). *Measuring Penny.* New York, NY: Henry Holt

**Day 3:** Jenkins, Steve ( 2007). *Living Color*. Boston, MA: Houghton Miflin

**Day 4:** O’Malley, Kevin. (1999). *Leo Cockroch…Toy Tester*. New York: Walker & Company

**Day 5:** Shannon, David. (2008).*Too Many Toys.* New York: Scholastic

**Additional Books - Day 3 & 4 - Physical properties/characteristics – (color, size, shape, weight, texture, flexibility, strength and the types of materials in the object)**

Living color – Steve Jenkins

Actual size – Steve Jenkins

For good measure – Ken Robbins (measurement book)

An egg is quiet (color, size, shape) - Diana Hutts Aston and Sylvia Long

A rock is lively - Diana Hutts Aston and Sylvia Long

If you Find a Rock – Peggy Christian

Birds of a feather – Gervais and Pittau

Out of Sight - Gervais and Pittau

**Lesson Summaries:**

**Summary - Activity #1 (STEM): Treasure Hunt MEA**

This activity will continue the concept of standard and nonstandard units that was introduced in Activity #1. As students are learning that without a consistent (or common) unit for measurement, the same object when measured using different units will produce different results. They will explore this idea through a modeling activity in which the students need to help solve the problems of how to develop a treasure map that anyone can follow regardless of their height and stride. The activity begins with acting out the problem of Susie and her treasure map to help set the context and introduce students to the problem of where to bury her treasure and how to tell her friends to find the treasure. After acting out the problem, students work in pairs to come up with a solution that will help Susie to create a treasure map for her upcoming birthday party.

Optional assessment - Proper Hops MEA

**Summary - Activity #2 (Literacy): How Big is a Foot?**

In this activity the teacher will read the story, *How Big is a Foot?* By Rolf Myller, which tells the story of a king who uses a non-standard measurement (his foot) to order a bed for his wife, the queen. Unfortunately, the bed makers’ foot is a different size and so he ends up with the wrong size bed for the queen. This story introduces students to the idea that foot size varies between people and therefore feet are not a good unit of measurement. Also, students are introduced to the idea that when they use their foot as a measure there is not going to be a common understanding of the length of the object they are measuring. This reinforces the idea about the need for a standard unit of measurement that the students explored in the related STEM activity with Susie and her treasure hunt.

* **Reading Comprehension Strategy: Using story structure** to identify key details (who, what, when, where, how etc.)

**Summary - Activity #3 (STEM): Design your own “standard” measuring tool**

In the first part of this activity, students will measure a fixed distance, for example the length of their desks using different arbitrary units (unit cubes, books, and paper clips) determined by each pair of students. The teacher will collect and record each pair’s measurement in a class data table. The idea is for students to further explore the concept of using different arbitrary units and how that will produce different results when measuring a fixed object. In the second part, students will create a common or “standard” measuring tool as a class that they will use to measure the same fixed distance.

**Summary - Activity #4 (Literacy): Measuring Penny**

In this activity, students will listen to a story titled, *Measuring Penny*, in which the main character Lisa decides to use her dog Penny as the subject for her measuring homework of using standard and non-standard units. This story helps to review what students have learned in the previous STEM lesson by exploring multiple ways to measure a variety of objects. This helps students to understand that there are different measuring units (standard and nonstandard) that can be used to measure the same objects. Throughout the story, the main character explores a number of different measurements including length, weight, volume, time, temperature and money. At the end of the activity, students will continue to move towards an understanding of why standard units are important.

* **Reading Comprehension Strategy: Compare and Contrast** within the story looking at the different units that are used

**Summary - Activity #5 (Literacy): Color, Color and Living Color**

In this literacy activity, students will read a story, *Living Color* by Steve Jenkins, with their teacher that explores different animals based on their color. As students learn about all of these brightly colored species, this book will also be setting the stage for sorting objects using the physical property of color. This is important as it models one way that animals can be sorted according to the physical characteristic of color. That will help to provide an example as students learn about sorting by physical properties in the related activity.

* **Reading Comprehension Strategy: Identifying Important Details** using a graphic organizer to help identify and record these details

**Summary - Activity #6 (STEM): Physical Properties (**Mystery bag and testing materials)

In this STEM activity, students will be learning about physical properties and how objects can be sorted in a number of different ways, like according to their physical properties. As students learn about size, shape, weight, texture, flexibility, and strength, they will also learn about how these physical properties can be used to describe objects and the materials that they are made out of. After building some familiarity with these properties by sorting and describing a variety of objects, students will move into the second part of the activity, where they practice using these properties to describe the objects in their mystery bag.

**Summary - Activity #7 (Literacy): Leo Cockroach….Toy Tester**

This literacy activity will introduce students to the story of Leo the Cockroach, who is an underappreciated worker at a toy company where he is in charge of testing toys before they can be sold for the toy company. This story introduces students to an important concept in engineering, the testing phase, as Leo is in charge of testing and revising the toys so they are safe and reliable for the toy company. It sets the context for students’ understanding about why you might want to test your design prior to finishing or selling it and introduces the idea that not everything is made correctly or perfectly the first time and therefore needs to be improved.

* **Reading Comprehension Strategy: Sequencing** important events to lead to summarizing narrative text

**Summary - Activity #8 (STEM):**

In this activity, students are building background knowledge that they will use in solving their engineering design challenge by testing the materials based on their physical properties and determining which materials will be better for which task. Students will then brainstorm individually before deciding on a plan for their group design. They will build and test their design in the next STEM activity.

**Summary - Activity #9 (Literacy): Too Many Toys**

This fiction text by David Shannon titled, *Too Many Toys,* sets the context for the need to design an organization system that will help students to organize their toy box to take with them to their grandma’s/auntie’s house by telling the story of Spencer. Spencer is a little boy who has too many toys and those toys are causing problems for everyone in his family. One day his mom has finally had enough with all of Spencer’s toys and she tells him that he needs to clean up his toys and put some into a box to get rid of them. This enjoyable story helps to set the context for why a student might need a way to organize their toys, which is the engineering design challenge for this unit.

* **Reading Comprehension Strategy: Summarizing Narrative Text**

**Summary - Activity #10 (STEM): Toy Box Engineering Design Challenge**

After reading the story about Spencer and the problems that too many toys can cause, students will have a chance to design an organization system for their toy box to help them to find their toys more easily and more quickly. In this lesson, students will apply the science and mathematics knowledge that they have learned in previous lesson to help them design, build and test an organization system for their toy box. After designing their new toy box, they will have the opportunity to give their directions and measurements to another group to build and share their designs, followed by the opportunity for a redesign of their toy boxes.

# Design Challenge: You will be using your knowledge of materials, physical properties and what we have learned about measurement to help design a new and better toy box. Another second grader wants to take their toys with them to grandma’s house (auntie or friend’s house), but they need to be able to easily locate any of their toys within their storage box. In order to do that, another second grader suggested that they make an organizer to put in their toy box to make it easier to find the toys they want to play with.

**To test the design**– The teacher will have a set of picture cards, which one group member will draw a card and see if the teacher can easily find the toy that matches the picture card that is drawn.

Physical properties (size, shape, weight, texture, flexibility, strength)

Materials –

* 15 boxes of similar size for testing(one/group)
* tape (masking or scotch)

Assortment of toys/crafts to put into the toy box (Suggested list below):

* Lego pieces
* Small playdoh
* Matchbox Cars
* Beads
* Crayons
* Colored pencils
* Post-it notes
* Golf ball
* Bouncy ball
* Smiley stickers

Assortment of materials for building the organizer

* Ribbon/string
* pipe cleaners
* cardstock
* tissue paper
* aluminum foil
* jumbo craft sticks

For each group:

* 12 inch ruler