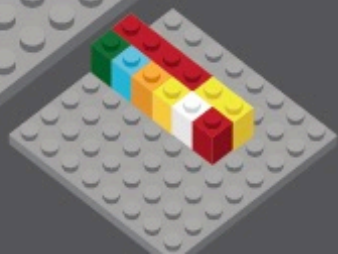
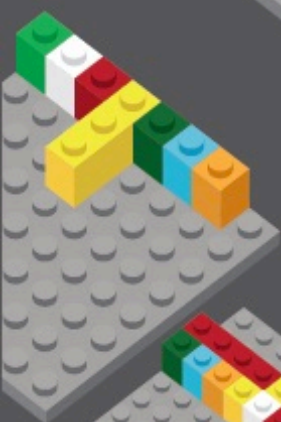
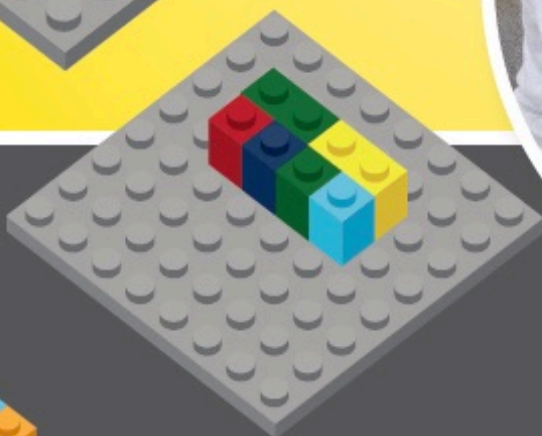
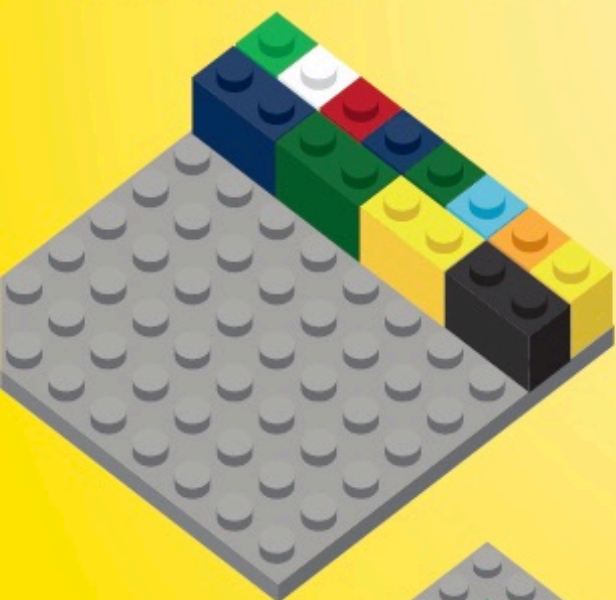


TEACHER EDITION

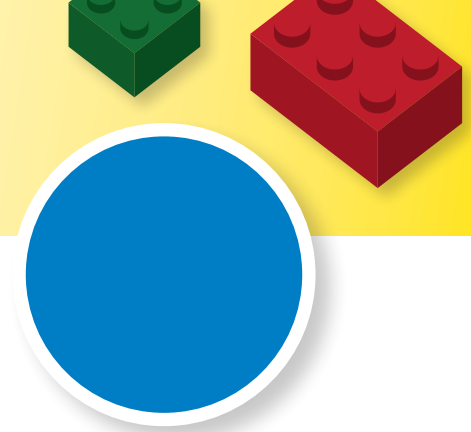


BASIC MEASUREMENT

USING LEGO® BRICKS



Dr. Shirley Disseler



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SUGGESTED BRICKS

Size	Number
1x1	24
1x2	16
1x3	8
1x4	8
1x8	2
1x10	2

Note: Using a baseplate helps keep the bricks in place. Two large baseplates are suggested for these activities.

STANDARD UNITS AND COMPARING MEASURES OF LENGTH

Students will learn/discover:

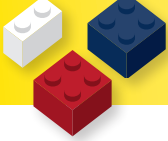
- How to compare measures using different units
- How to define standard unit of measure

Why is this important?

Students begin to study measurement by looking at various units of measure and learning that the standard unit is an important attribute of measurement. Using a standard unit of measure is important to precision in science, math, and engineering. Students should understand that using the same unit to measure different objects provides a frame of reference for comparison, which will lead to appropriate use of measurement concepts in more advanced math and real-world activities.

Vocabulary:

- **Attribute:** A quality or characteristic to be measured (e.g., length, distance, volume, time, etc.)
- **Unit of measure:** A quantity used to measure an attribute of a given object or event; units of measure may be *standard* or *nonstandard*
- **Standard unit of measure:** A quantifiable unit of measurement that is recognized by all members in a given area as part of a measurement system. For example, standard units of measure for length in the US include



feet, inches, yards, and miles, as defined by the customary measurement system. Standard units of measure for length in the UK include centimeters, meters, and kilometers, as defined by the metric measurement system.

- **Nonstandard unit of measure:** A unit of measurement that is not part of a recognized measurement system. Different nonstandard units of measure are not equivalent to one another (e.g., a given object measures differently in paper clips than pencils).

How to use the companion student book, *Basic Measurement Using LEGO® Bricks—Student Edition*:

- After students build their models, have them draw the models and explain their thinking in the Student Edition. Recording the models on paper after building them with bricks helps reinforce the concepts being taught.
- Discuss the vocabulary for each lesson with students as they work through the Student Edition.
- Use the assessment in the Student Edition to gauge student understanding of the content.

Part 1: Show Them How

Show students a 1x1 brick. Ask them what they notice about the 1x1 brick (*answer*: it has 1 stud).

Have students select another 1x1 brick and compare/contrast it with the first brick. Ask them how the bricks are alike and different (*possible answer*: both bricks have 1 stud but are different colors).

Explain to students that the color of the brick and the number of studs are considered *attributes* of the brick.

In this lesson, pairs of students will use different standard units to measure an assortment of everyday items. Before the lesson, collect a variety of small classroom objects for students to measure. Some suggestions are:

Unsharpened pencil	Marker
Jumbo paper clip	Crayon
Piece of notebook or copy paper	Straw
String	Ruler



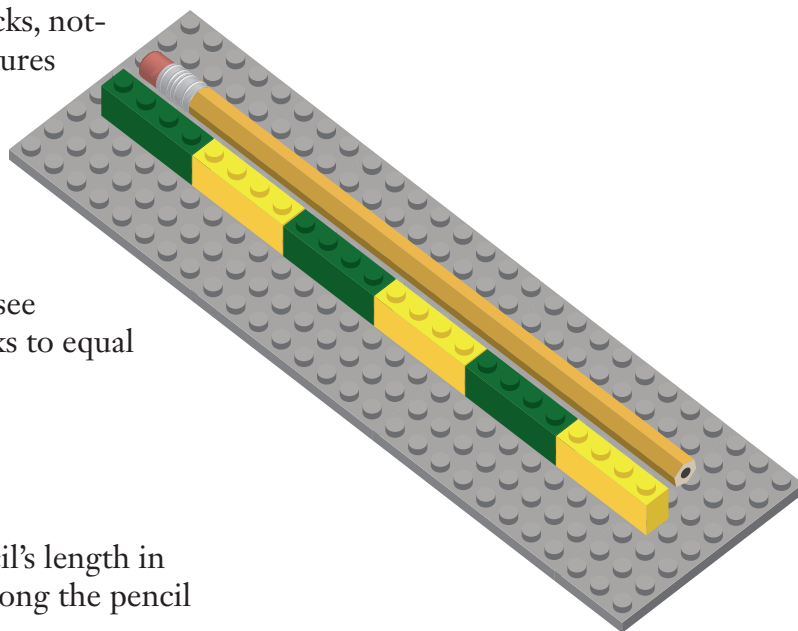
1. Provide each pair of students with an unsharpened pencil. Ask students to select one brick of their choice. Explain to students that they will use bricks to measure the length of the pencil.
2. Place two baseplates side by side and put the pencil on the baseplates. Have students estimate how many of their chosen bricks are needed to equal the length of the pencil.

Ask students to record their estimates before measuring, noting how many bricks of what size will equal the length of the pencil.

3. Have students measure the length of the pencil in bricks and record the measurement in bricks, noting how many bricks long the pencil measures and what size bricks were used.

(Answer for this example: My pencil is six 1x4 bricks long.)

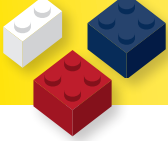
Ask students to compare their answers to see which size of brick requires the most bricks to equal the length of the pencil.



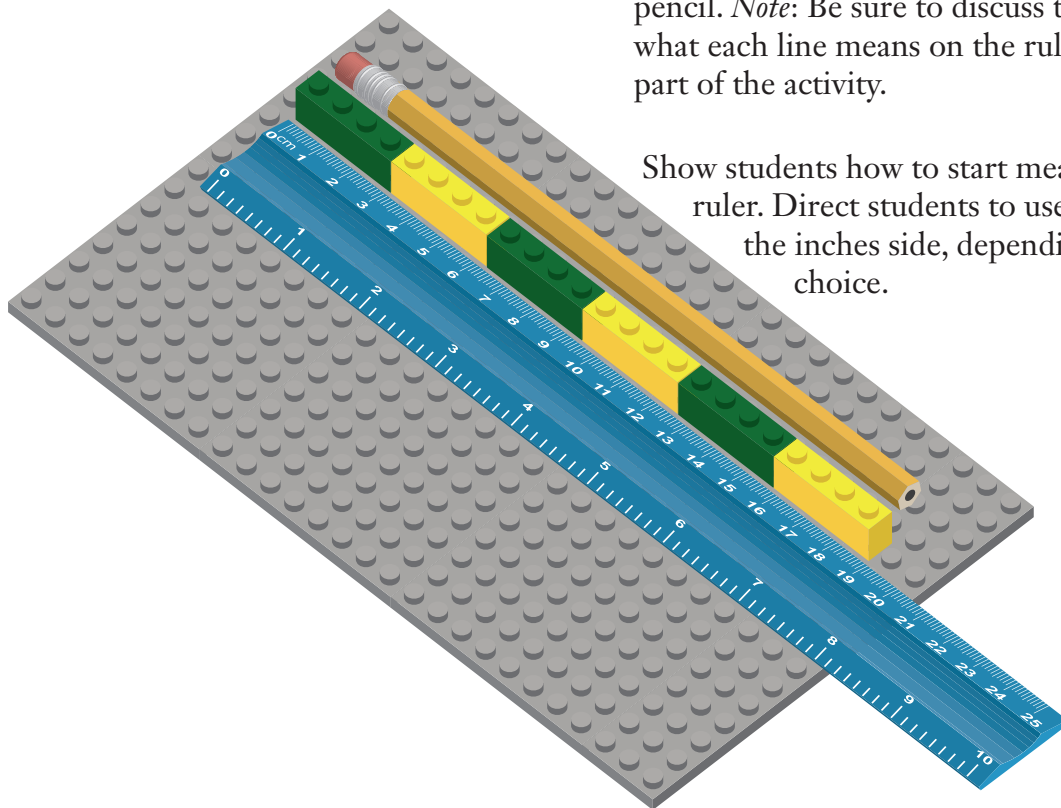
4. Ask students to count and record the pencil's length in number of studs, noting how many studs long the pencil measures.

(Answer for this example: My pencil is 24 studs long.)

Students should discover that all of the pencils are the same number of studs long, no matter which bricks are used as the unit of measurement. Students might also discover that they can use the idea of sets to find the number of studs. In this example, the pencil measures 6 bricks that each have 4 studs, or 6 sets of 4 (6×4). Depending on the level of the students, the concept of sets can be discussed.

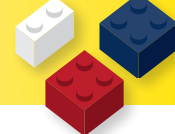


5. Explain to students that in this case the stud serves as a standard unit of measure since it is always the same length. No matter which bricks are used, a stud measures the same amount every time. The bricks themselves are non-standard units of measure since each brick size is different. For example, it will take twelve 1x2 bricks to measure the pencil, or eight 1x3 bricks.
6. Have students repeat this process with another item (see suggested list) and discuss what they discover.
7. Have students place a ruler next to the bricks and the pencil. *Note:* Be sure to discuss the parts of a ruler and what each line means on the ruler prior to starting this part of the activity.



Show students how to start measuring at the end of the ruler. Direct students to use either the centimeter or the inches side, depending on their age and your choice.

8. Ask students to observe where the pencil ends and record its length in number of centimeters or inches. In this example, the pencil is about 19 centimeters long (or $7\frac{1}{2}$ inches long). This comparison shows students another standard measurement tool.
9. Repeat this with other items you have collected. Have students record and make statements.



Part 2: Show What You Know

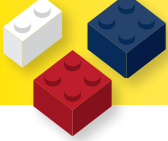
Provide each pair of students with an assortment of at least four items to measure in bricks and studs. Choose any items (see suggested list), but make sure to include items that you have not already measured in Part 1. Have them experiment with at least three sizes of bricks to make sure they understand the idea of standard stud measures.

1. Measure each item using the 1x1 brick and three additional brick sizes of your choice. Find the length of the item in number of bricks and number of studs. What did you discover?

Note: Provide or have students create a chart for their data collection. Answers will vary depending on the type and size of the materials.

Sample chart:

Brick	Paper clip		String		Marker		Straw	
	Bricks	Studs	Bricks	Studs	Bricks	Studs	Bricks	Studs
1x1								
1x2								
1x3								
1x4								



2. Using the bricks and your ruler, measure and record the length of five bricks in centimeters and/or inches.

Note: Provide or have students create a chart for their data collection. Have students answer this question only if they have been introduced to the ruler and know what the marks on the ruler represent.

Sample chart:

Brick	Centimeters	Inches
1x2	$1\frac{1}{2}$ cm	$\frac{9}{16}$ in
1x4	3 cm	$1\frac{1}{4}$ in
1x6	$4\frac{7}{10}$ cm	$1\frac{14}{16}$ in
1x8	$6\frac{2}{10}$ cm	$2\frac{1}{2}$ in
1x10	8 cm	$1\frac{1}{16}$ in