LESSON TITLE: UNITS OF MEASURE

TOTAL TIME: ONE 60-MINUTE PERIOD

BRIEF DESCRIPTION

In this *The House That STEM Built* lesson plan, students are going to take a look at the two major measurement systems that are used in Canada, the imperial system and the SI (metric) system. Students will become familiar with the imperial system by comparing both measurements on rulers before following along with *The House That STEM Built: Units of Measure* video and getting the chance to practice working with the imperial system. Students will then take a look at real-life examples of using both the metric and imperial systems while doing the "This or That: Units Edition" activity.

CURRICULUM OUTCOMES

Taken from the New Brunswick Grade 10 Geometry, Measurement, and Finance curriculum.

GENERAL CURRICULUM OUTCOMES

GCO Measurement (M): Develop spatial sense through direct and indirect measurement.

SPECIFIC CURRICULUM OUTCOMES

SCO M2: Demonstrate an understanding of the imperial system by: describing the relationships of the units for length, area, volume, capacity, mass and temperature.

SCO M3: Solve problems, using SI and imperial units, that involve linear measurement using estimation and measurement strategies.

NEW BRUNSWICK GLOBAL COMPETENCIES ACHIEVED[1]

- Critical Thinking and Problem-Solving
    - Learners engage in an inquiry process to solve problems, as well as acquire, process, interpret, synthesize, and critically analyze information to make informed decisions.
    - Learners construct, relate and apply knowledge to all domains of life, such as school, home, work, friends, and community.
    - Learners formulate and express questions to further their understanding, thinking, and problem-solving.
- Collaboration
    - Learners participate in teams by establishing positive and respectful relationships, developing trust, and acting interdependently and with integrity.
    - Learners learn from and contribute to the learning of others by co-constructing knowledge, meaning, and content.
- Communication
    - Learners ask effective questions to create a shared communication culture, attend to understand all points of view, express their own opinions, and advocate for ideas.

LEARNING OBJECTIVES

Learners will

- compare and contrast the imperial and SI measuring systems and their uses in Canada,
- convert between the imperial and SI measuring systems, and
- solve problems involving SI and Imperial units.

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1 https://www2.gnb.ca/content/dam/gnb/Departments/ed/pdf/K12/curric/competencies/NBCompetencies.pdf?fbclid=IwAR1ldrZs1gFgiNm8rC4oz7Fmx6mSn-6t_QJkenev0eD33rZ-foYYn6bmdmc *also available at* https://tinyurl.com/nb-competencies

MATERIALS

- → Video: *The House That STEM Built: Units of Measure*.
- → Rulers (must show both metric and imperial units, 1 per pair).
- → "This or That: Units Edition" activity cards.
- → "This or That: Units Edition" answer record sheet (1 per pair).
- → Scissors.
- → Tape.

MINDS ON: 10 MINUTES

GROUPING: PAIRS

Hand out a ruler to each pair of students.

Ask students to take a look at the lines on both sides of the ruler. On one side they should see centimetres and the other inches. Inches and centimetres might also be on the same side just on opposite edges.

While they look at their rulers, ask students how many millimetres make up a centimetre. What about an inch? Is there a smaller unit than an inch in the imperial system? How do people denote the size of something if it is smaller than an inch? What smaller increments are the inches on the ruler broken up into?

This would be a great time to review fractions and those that are associated with inches on a ruler and mention that 12 inches make up one foot (or one standard-length ruler).

ACTIVITY: 20 MINUTES

GROUPING: ENTIRE CLASS

Watch *The House That STEM Built: Units of Measure* video. Included in this video are many opportunities to stop and discuss the topic as well as try some examples. Feel free to pause the video and ask some or all of the following questions to prompt conversation.

- 0:55 – Before we get started, can anyone describe what the imperial system is vs. the SI system when it comes to measurements?
- 1:58 – Why do you think Canadians still use the imperial system in the construction industry when we have been using the metric system since the 1970s?
- 2:38 – We use the imperial system of measurement because of our close ties with the American lumber and construction industry. In Europe, you will find that they use the metric system. Are there any obvious pros to using the imperial system for us? What about the cons?
- 4:07 – We can see in the shower example that the floor surface is 42 inches wide and 84 inches long. If we wanted to know the size of the floor in feet, what would we have to do? How could we calculate that? Since there are 12 inches in a foot, we can divide both 42 and 84 inches by 12 inches/foot to find that the floor is 3.5 feet wide and 7 feet long.
- 4:38 – How many of the 1′ × 2′ tiles would we need to cover the length of the shower floor?
- 6:09 – Has anyone heard the expression “measure twice, cut once”? What is the meaning of that expression? How does it relate to the work of the tile setter or finishing carpenter?
- 6:16 – Has anyone seen one of these specialized surveyors’ tools before? Where else have you seen one of these being used?
- 7:21 – If we wanted to convert the 2.5″ drop per 120″ length into a percentage grade what could we do? If we divide 2.5″ by 120″, we get 0.0208. This can be multiplied by 100 to give us a grade percentage of 2.08%. Proper drainage requires a minimum 2%

grade. Does this example meet the requirement?

→ 8:48 – What are some other examples that you can think of where the imperial system is used for measurements? Think about sports, food, etc.

ACTIVITY: 20 MINUTES

GROUPING: PAIRS

Before class, cut out the "This or That" activity cards. If you have examples of the common household/classroom items from the cards available, feel free to tape the cards directly onto the items and arrange them around the room. If you do not have the items, just tape the pairs of cards around the room or on desks.

In pairs, hand out copies of the answer record sheets to the "This or That" activity.

Ask students to choose a station to start at and decide which of the items is a better buy based on the quantity given.

Some of these cards will be easier and more intuitive, while others might need estimation and conversion factors. Be prepared to provide those factors with the tougher questions (1 oz = 33.8 ml, 1 gal = 4.5 L).

CONCLUSION: 10 MINUTES

GROUPING: ENTIRE CLASS

Wrap up the activity by voting on the responses from the activity. Is everyone in general agreement? Are there any discrepancies? Feel free to stop and walk through any answers that caught students off guard.

DIFFERENTIATION

CONTENT

Use *The House That STEM Built: Units of Measure* video to spark a conversation about:

- → Do your students take a shop/building technology class? Are there any opportunities for a cross-subject project? Build a birdhouse or other simple project and use only the imperial system to make your measurements.
- → Host a debate in your classroom about the benefits and downfalls of using the imperial measuring system in construction.
- → Besides construction, where else do Canadians use the imperial measuring system? Can you think of any reasons why you think this might be the case?

Have students research the history of the metric system. Why do some countries prefer to stick to the imperial system? Create a video or podcast episode to address this issue!

Are there any local experts that would be willing to talk to your class about their job? Ask them to stop in.

PRACTICE

Feel free to allow students to continue to use measuring tools (rulers, measuring tapes etc.) while they convert between metric and imperial if needed.

Provide students with a classroom or outdoor scavenger hunt where the goal is to measure various objects using both the metric and the imperial measuring systems.

How tall are your students? Ask students to measure each other in centimetres before converting to inches, and then feet and inches.

What if we were to use the metric system in construction in Canada? Find an example of a builder's blueprint and look at the measurements closely. Many examples of different types of blueprints can be found at https://www.edrawsoft.com/building-plan-examples.html. Some of them include measurements. Other examples can be found through

Google Images or by speaking to a local professional. How different would it look if the building was built in Europe? Divide the building into sections and ask students in groups to tackle converting all of the measurements in one of the rooms.

PRODUCT

Create a conversion tool that students can fill in, decorate, and keep so that they can use it when they have to convert between the two systems. This could be done physically on cardstock or online using design tools such as https://www.canva.com/.

What are some things to remember when moving between the imperial and the metric system? Create a music video explaining the process.

Ask students to create a blueprint of their dream house. How large is your house going to be? What about specific rooms? Use the imperial system to create your plan. Compared to an actual house, are your measurements realistic? Backup research might be required. Blueprints can be created on graph paper or by using programs like RoomSketcher (https://www.roomsketcher.com/) which allow students to create their visions digitally.

EXTENSION

The imperial measuring system includes a lot more than inches and feet for lengths and widths. It also includes weight, fluid, and capacity. Take a look at some recipes for simple common baking items (think cake, cookies, bread). Which system do they often employ? Using conversion tools, convert your recipe into the metric system and, if resources are available, try baking one of the recipes.

How hot is it outside? Compare temperature measured in degrees Fahrenheit to that measured in degrees Celsius. Take a look at an American weather forecast. How hot is it there? Are there other systems for measuring temperature? What are they and how do they compare to the other two systems?

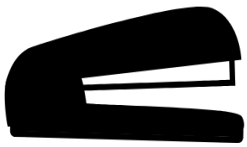
THIS OR THAT: UNITS EDITION

Activity Cards

Cut out the following cards and post them around the room. If you have the following items, feel free to post them directly on the items. Allow students in teams of two to move around the room and determine which item per set is the largest or smallest. Students can use their knowledge of converting measurements or physical measuring tools (rulers, measuring tapes, etc.) to help them out at your discretion.

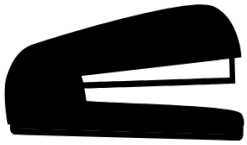
Q1

5 in



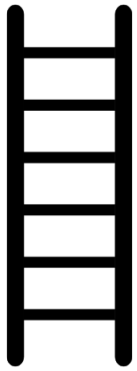
Which stapler is taller?

12cm



Which ladder is longer? Q2

6 1/4 ft

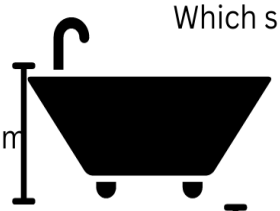


64in

Q3

Which sink is deeper?

27cm



7 1/2 in

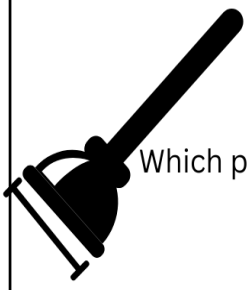
Q4

Which cleaning bottle holds more liquid?

700ml

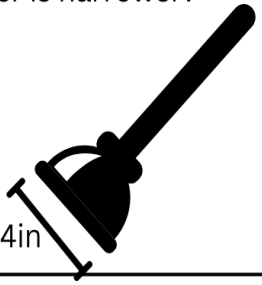
30oz

Q5



Which plunger is narrower?

1/2 ft



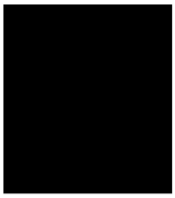
6 1/4in

Q6

Which square is largest?

65 1/8in

5 1/2 ft

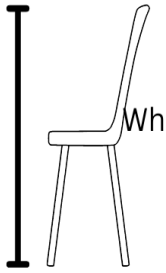


THIS OR THAT: UNITS EDITION

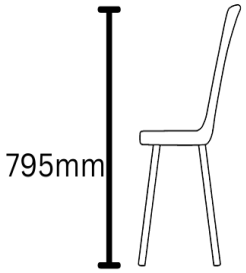
Activity Cards (continued)

Q7

Which chair is shorter?



90cm

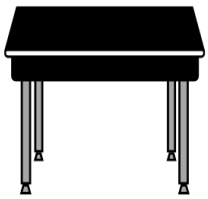


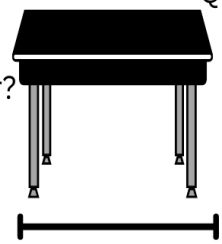
795mm

Q8

Which desk is wider?

2ft 6in

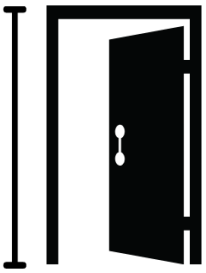




34in

Q9

Which door is taller?



2m

6ft 8in

Q10

Which leaf is thicker?

205mm

5in

Q11

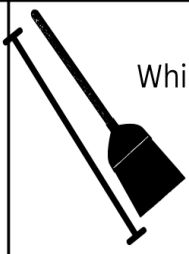
Which pitcher holds more water?

2.66L

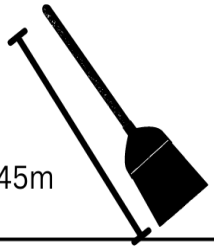
1gal

Q12

Which broom is shorter?



1200mm



1.45m

THIS OR THAT: UNITS EDITION

Answer Record Sheet

Note the number on the card and place the answer in the appropriate box below.

1.	2.
3.	4.
5.	6.
7.	8.
9.	10.
11.	12.