Grade 8 Mathematics: Measurement

Free sample lesson

Ontario curriculum: Mathematics (2020), Strand E: Spatial Sense. 18 days.

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This is Lesson 1 of 12 from the full unit, exactly as it appears in the Teacher Guide, followed by the student worksheet. The full unit is at unitplans.ca.

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Lesson 1: Metric prefixes, very big and very small

1 day · about 60 minutes · E2.1

> **Learning goal**
>
> - We are learning to describe very large and very small measurements with metric prefixes.

> **Success criteria**
>
> - I can name the prefixes from pico to tera and their values.
> - I can convert a measurement such as 4.5 MW into watts.

Materials

- Prefix ladder chart (draw on board)
- Calculators

Minds On (15 min)

1. Show three images: a hard drive labelled 2 TB, a wind turbine rated 3 MW, and a microscope image of bacteria labelled 2 µm.
2. Ask: "What do T, M and µ mean? Which is biggest? Smallest?" Think-pair-share for 3 minutes.
3. Record ideas on chart paper without correcting yet.

Action (30 min)

1. Build the prefix ladder together: tera (10^{12}), giga (10^{9}), mega (10^{6}), kilo (10^{3}), base unit, milli (10^{-3}), micro (10^{-6}), nano (10^{-9}), pico (10^{-12}).
2. Model: each step of three places is ×1000. Moving to a smaller unit makes the number bigger.
3. Work through 4.5 MW = 4 500 000 W and 2 µm = 0.000 002 m together.
4. Students complete the worksheet in pairs. Circulate and ask the prompts below.

Consolidation (15 min)

1. Pairs share question 6 (nanometres in a millimetre) and compare strategies.
2. Revisit the Minds On chart and correct any ideas.
3. Exit: "Write one measurement from your life that uses a prefix, and convert it to the base unit."

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Questions to ask

- If you move from metres to micrometres, should the number get bigger or smaller? Why?
- How many "jumps of 1000" are there between mega and micro?

Watch for

- Thinking a bigger prefix means a bigger number in the answer. Converting 4.5 MW to W gives a bigger number because the unit is smaller.
- Mixing up milli (10^{-3}) and micro (10^{-6}).

Differentiation

Support	Extend
Give the prefix ladder as a printed card. Start with kilo and milli before mega and micro.	Research the newest prefixes (ronna, quetta) and give an example of where they might be used.

Answer key: Metric prefixes

1. Fill in the value of each prefix as a power of ten: tera, giga, mega, kilo, milli, micro, nano, pico.

   > **Answer:** tera 10^{12}, giga 10^{9}, mega 10^{6}, kilo 10^{3}, milli 10^{-3}, micro 10^{-6}, nano 10^{-9}, pico 10^{-12}

2. How many bytes are in 1 gigabyte (metric)?

   > **Answer:** 1 000 000 000 bytes
   > 1 GB = 10^{9} bytes = 1 000 000 000 bytes

3. A wind turbine produces 4.5 megawatts. How many watts is that?

   > **Answer:** 4 500 000 W
   > $4.5 \times 10^{6} = 4.5 \times 10^{6}$ W

4. A bacterium is 2 micrometres long. How long is it in metres?

   > **Answer:** 0.000 002 m (2×10^{-6} m)

5. Which is larger: 750 megabytes or 0.8 gigabytes? Explain.

   > **Answer:** 0.8 GB is larger. 0.8 GB = 800 MB, and 800 MB > 750 MB.

6. A computer chip has parts that are 5 nanometres wide. How many 5 nm parts fit side by side across 1 millimetre?

> **Answer:** 200 000
> 1 mm = 10^{-3} m; 5 nm = 5×10^{-9} m; $10^{-3} \div (5 \times 10^{-9}) = 200\,000$

7. Why do scientists use prefixes such as giga and nano instead of writing out all the zeros?

> **Answer:** Sample: Prefixes make huge and tiny numbers shorter and easier to read and compare, and fewer zeros means fewer copying mistakes.

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Student worksheet: Metric prefixes

Success criteria

- I can name the prefixes from pico to tera and their values.
- I can convert a measurement such as 4.5 MW into watts.

Show your work. Write very large or very small answers in standard form and with an exponent.

1. Fill in the value of each prefix as a power of ten: tera, giga, mega, kilo, milli, micro, nano, pico.

2. How many bytes are in 1 gigabyte (metric)?

3. A wind turbine produces 4.5 megawatts. How many watts is that?

4. A bacterium is 2 micrometres long. How long is it in metres?

5. Which is larger: 750 megabytes or 0.8 gigabytes? Explain.

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7. Why do scientists use prefixes such as giga and nano instead of writing out all the zeros?

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