Units of Measurement: A. The Imperial System

Canada uses the metric system – most of the time! However, there are still places and occasions where the imperial system of measurement is used. People often talk about their height in feet and inches or their weight in pounds. Many recipes measure in cups and teaspoons. Another example is the term ‘two by four’ when talking about lumber. That term means that a plank is roughly two inches thick and four inches wide.

Another place where the imperial system of measurement is often seen is in the grocery store, especially in the meat/fish and fresh produce sections. Prices and weights are often given in both metric and imperial units of measurement. For example, you may see a sign advertising “Potatoes – 89¢ a pound (lb.) or $1.96 per kilogram (kg)”.

The USA uses only a system of measurement related to the imperial one, so items imported from there often do not have a metric equivalent given. Cookbooks frequently use one or the other system of measurement.

For all these reasons, it is important to understand both systems and be able to convert one into the other.

The most common imperial units of measurement are:

<table>
<thead>
<tr>
<th>Quantity</th>
<th>Unit</th>
<th>Symbol</th>
</tr>
</thead>
<tbody>
<tr>
<td>length</td>
<td>foot</td>
<td>ft.</td>
</tr>
<tr>
<td>weight</td>
<td>pound</td>
<td>lb.</td>
</tr>
<tr>
<td>volume</td>
<td>gallon</td>
<td>gal.</td>
</tr>
</tbody>
</table>

Here are the most common conversions of imperial units of measurement:

<table>
<thead>
<tr>
<th>Length</th>
<th>Weight</th>
<th>Volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 foot (ft.) = 12 inches (in.)</td>
<td>1 pound (lb.) = 16 ounces (oz.)</td>
<td>1 pint (pt.) = 2 cups</td>
</tr>
<tr>
<td>1 yard (yd.) = 3 feet</td>
<td>1 ton = 2000 pounds (lbs.)</td>
<td>1 quart (qt.) = 2 pints</td>
</tr>
<tr>
<td>1 mile (mi.) = 5280 feet or 1760 yards</td>
<td></td>
<td>1 gallon (gal.) = 4 quarts</td>
</tr>
</tbody>
</table>

When we convert units in the imperial system, we use a familiar rule:

**When we convert a larger unit to a smaller unit, we multiply by the conversion factor.**

**When we convert a smaller unit to a larger unit, we divide by the conversion factor.**
Example 1:

A two by four measures 6 feet 8 inches. How long is it in inches?

Solution:

As 1 foot = 12 inches, the conversion factor is 12. Since we are converting a larger unit (feet) to a smaller unit (inches), we multiply by 12.

6 feet = 6 x 12 = 72 inches.

Then we need to add the 8 inches to the 72 inches.

6 feet 8 inches = 72 + 8 = 80 inches

Or we can write it in a shortened way, using quotation marks: ’ represents feet and” represent inches.

So 6’ 8” = 80”

Example 2:

How many pints or cups are in 1 gallon of milk?

Solution:

1 gallon = 4 quarts - 1 quart = 2 pints

So 1 gal. = 4 quarts x the conversion factor of 2 = 8 pints.

1 pint = 2 cups so 8 pints x the conversion factor of 2 = 16 cups.

Example 3:

A piece of wood measures 300 mm, how much is that in inches?

Solution:

25.4 mm = 1 inch

We are converting from a smaller unit (mm) to a larger unit (inches), so we divide:

300 mm ÷ 25.4 = 11.81

So 300 mm is equivalent to 11.8”
Practice 1:

1. Circle the larger of the two units:
   a) in.  ft.   b) mi.  yd   c) pt.  cup
   d) lb.  oz.   e) qt.  gal.   f) ton  lb.

2. Convert the following:
   a) 5 lbs = ______ oz.
   b) 2 mi. = ______ yds.
   c) 106 ins. = ___ ’ ___”
   d) 3 gals. = ___ pints
   e) 60 ins. = ___ ’ ___”
   f) 1200 lbs. = _____ tons
   g) 27 ft. = _____ yds.
   h) 7 ft = ___ ins.
   i) 3 yds. = ______
   j) 3 qts. = ___ cups
   k) 16 pts. = ___ gals.
   l) 41 oz. = ___ lbs ___oz.

3. Convert the following weights as shown:
   a) The baby weighs 120 oz. = _____ lbs _____ oz.
   b) Mary wants to lose 48 oz through her new diet = _____ lbs ____ oz.
   c) The Olympic weightlifter was able to lift a quarter of a ton = ______ lbs.

4. Convert the following heights as shown:
   a) The doorway is 6’ 2” high = ______ ins.
   b) Sally is 64” tall = ______’ ______”
   c) Fred has grown to 77” = ______’ ______”

5. Joe can reach 6’ 11” above the ground. He wants to make the basketball team so he has to be able to reach the rim of the basketball hoop. The hoop is 9’ 10” above the ground. How far will Joe have to leap to reach that rim? _____’ ____”

6. Tim plans to make a shoe-rack for his girlfriend. He has a piece of wood that is 14.5 inches wide. How many cm is equivalent to 14.5”? How many mm? ___cm ______ mm

Answers on the next page
Practice 1 Answers:

1 a) ft. b) mi. c) pt. 
   d) lb e) gal. f) ton

2 a) 80 oz. b) 3520 yds. c) 8’ 10”
   d) 24 pts. e) 5’ 0” f) 0.6 tons
   g) 9 yds.  h) 84 ins. i) 36”
   j) 12 cups k) 2 gals. l) 2 lbs. 9 oz.

3 a) 7 lbs. 8 oz. b) 3 lbs. 0 oz. c) 500 lbs.

4 a) 74 ins. b) 5’ 4” c) 6 ft. 5 ins.

5 Joe needs to leap 2 ft. 11 ins.

6 Tim is a great guy! 14.5” = 36.8 cm or 368 mm
UNITS OF MEASUREMENT: B. THE METRIC SYSTEM

The metric system is used in most countries of the world, and the United States is now making greater use of it as well. The metric system does not use inches, feet, pounds, and so on, although units for time and electricity are the same as those you use now.

An advantage of the metric system is that it is easier to convert from one unit to another. That is because the metric system is based on the number 10.

The basic unit of length is the metre. It is just over a yard. In fact, 1 metre ≈ 1.0936 yards.

<table>
<thead>
<tr>
<th>(Comparative sizes are shown)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Metre</td>
</tr>
<tr>
<td>1 Yard</td>
</tr>
</tbody>
</table>

The other units of length are multiples of the length of a metre:
10 times a metre, 100 times a metre, 1000 times a metre, and so on, or fractions of a metre:

\[
\begin{align*}
\frac{1}{10} \text{ of a metre}, & \quad \frac{1}{100} \text{ of a metre}, \quad \frac{1}{1000} \text{ of a metre}, \quad \text{and so on.}
\end{align*}
\]

Metric Units of Length

| 1 kilometre (km) = 1000 metres (m) |
| 1 hectometre (hm) = 100 metres (m) |
| 1 dekametre (dam) = 10 metres (m) |
| 1 metre (m) |
| 1 decimetre (dm) = \( \frac{1}{10} \) metre (m) |
| 1 centimetre (cm) = \( \frac{1}{100} \) metre (m) |
| 1 millimetre (mm) = \( \frac{1}{1000} \) metre (m) |

You should memorize these names and abbreviations. Think of kilo- for 1000, hecto- for 100, and so on. We will use these prefixes when considering units of area, capacity, and mass (weight).

THINKING METRIC

To familiarize yourself with metric units, consider the following.

1 kilometre (1000 metres) is slightly more than \( \frac{1}{2} \) mile (0.6 mi).

1 metre is just over a yard (1.1 yd).

1 centimetre (0.01 metre) is a little more than the width of a paper-clip (about 0.4 inch).
1 inch is about 2.54 centimetres

1 millimetre is about the width of a dime

The millimetre (mm) is used to measure small distances, especially in industry.

The centimetre (cm) is used for body dimensions and clothing sizes, mostly in places where inches were previously used.

The metre (m) is used to measure larger objects (for example, the height of a building) and for shorter distances (for example, the length of a rug)

The kilometre (km) is used to measure longer distances, mostly in situations in which miles were previously used.
MENTAL CONVERSION AMONG METRIC UNITS

When you change from one unit to another you can move only the decimal point, because the metric system is based on 10. Look at the table below:

<table>
<thead>
<tr>
<th>Units</th>
<th>1000</th>
<th>100</th>
<th>10</th>
<th>1</th>
<th>0.1</th>
<th>0.01</th>
<th>0.001</th>
</tr>
</thead>
<tbody>
<tr>
<td>km</td>
<td></td>
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<td>dam</td>
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<td>m</td>
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<td>dm</td>
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<td>cm</td>
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<tr>
<td>mm</td>
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</tr>
</tbody>
</table>

Example:
Complete: 8.42 mm = _______ cm

Think: To go from mm to cm will mean I will have fewer cm than mm because cm are larger than mm. So I move the decimal point one place to the left.
8.42 mm 0.842 so, 8.42 mm = 0.842 cm

Example:
Complete: 1.886 km = _______ cm

Think: To go from km to cm means that there will be many more cm than there were km because cm are smaller than km. So I move the decimal place to the right 5 places.
1.886 km 1.88600 so, 1.886 km = 188600.0 cm

Example:
Complete: 1 m = _______ cm

Think: To go from m to cm ... m are bigger, and cm smaller... so, there will be more cm than I started with. I can move the decimal place to the right 2 places.
1 m = 1.00 m 1.00 cm so, 1 m = 100 cm

Make metric conversions mentally as much as possible.

The most commonly used units of metric measurement are:

km m cm mm
Practice 2:
Complete. Do as much as possible mentally. Avoid using a calculator!

1. a) 1 km = _____ m  
   b) 1 m = _____ km  

2. a) 1 hm = _____ m  
   b) 1 m = _____ hm  

3. a) 1 dam = _____ m  
   b) 1 m = _____ dam  

4. a) 1 dm = _____ m  
   b) 1 m = _____ dm  

5. a) 1 cm = _____ m  
   b) 1 m = _____ cm  

6. a) 1 mm = _____ m  
   b) 1 m = _____ mm  

7. 6.7 km = _____ m  

8. 9 km = _____ m  

9. 98 cm = _____ m  

10. 0.233 cm = _____ m  

11. 8921 m = _____ km  

12. 6770 m = _____ km  

13. 56.66 m = _____ km  

14. 5.666 m = _____ km  

15. 5666 m = _____ cm  

16. 435 m = _____ cm  

17. 477 cm = _____ m  

18. 3.45 mm = _____ m  

19. 6.88 m = _____ cm  

20. 6.88 m = _____ dm  

21. 1 mm = _____ cm  

22. 1 cm = _____ km  

23. 1 km = _____ cm  

24. 2 km = _____ cm  

Answers on the next page
## Practice 2 Answers

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. a)</td>
<td>1000</td>
<td>2. a)</td>
<td>100</td>
</tr>
<tr>
<td>1. b)</td>
<td>0.001</td>
<td>2. b)</td>
<td>0.01</td>
</tr>
<tr>
<td>4. a)</td>
<td>0.1</td>
<td>5. a)</td>
<td>0.01</td>
</tr>
<tr>
<td>4. b)</td>
<td>10</td>
<td>5. b)</td>
<td>100</td>
</tr>
<tr>
<td>7.</td>
<td>6700</td>
<td>8.</td>
<td>9000</td>
</tr>
<tr>
<td>10.</td>
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<td>11.</td>
<td>8.921</td>
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<tr>
<td>13.</td>
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<td>14.</td>
<td>0.005666</td>
</tr>
<tr>
<td>16.</td>
<td>43500</td>
<td>17.</td>
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<tr>
<td>19.</td>
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<td>20.</td>
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</tr>
<tr>
<td>22.</td>
<td>0.00001</td>
<td>23.</td>
<td>100 000</td>
</tr>
<tr>
<td>24.</td>
<td>200 000</td>
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</tbody>
</table>