# Appendix

## Lesson 1.1: Referents

### Practice – I

1. Which SI and which imperial unit are most appropriate for measuring the following? Explain your reasoning.

   a. the distance across town

   kilometre and mile – Most towns will be at least a few kilometres or miles across.

   b. the width of a book

   centimetres and inches – Most book widths will be smaller than a 30 cm/12 in ruler.

   c. the length of a sofa

   centimetres or metres and feet or inches – Most sofas are approximately the length of a person, and people are usually measured in these units.

   d. the height of a building

   metres and yards – Each floor of a building will be a few metres or yards high.

2. Use the referents table you made in *Lesson 1.1* to estimate the following.

   a. the length of your pencil

   Responses will vary.

   b. the perimeter of the room you are in

   Responses will vary.

c. the height of your desk/table

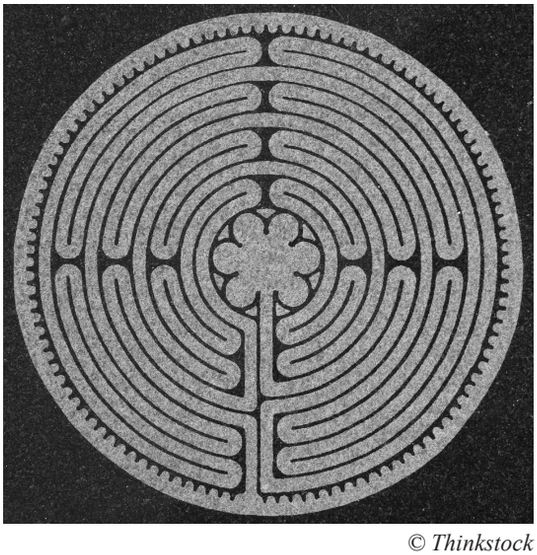
Responses will vary.

d. the thickness of your textbook

Responses will vary.

3. Use an appropriate measuring tool to check your estimates from question 2.
Responses will vary.

4. A labyrinth is a single path that follows an intricate pattern. People have been walking labyrinths for personal, psychological, and spiritual advancement for thousands of years.



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a. Describe a referent that could be used to estimate the length of the labyrinth path from the entrance to the centre.

Counting the number of steps required to walk the distance and multiplying that number by the length of one step will give a reasonable estimate.

b. Explain how a person could accurately determine the length of the labyrinth path.

You could run a string along the length of the labyrinth path and then measure the string using a tool such as a tape measure.

Please complete *Lesson 1.1 Explore Your Understanding Assignment* located in *Workbook 1.1* before proceeding to *Lesson 1.2*.

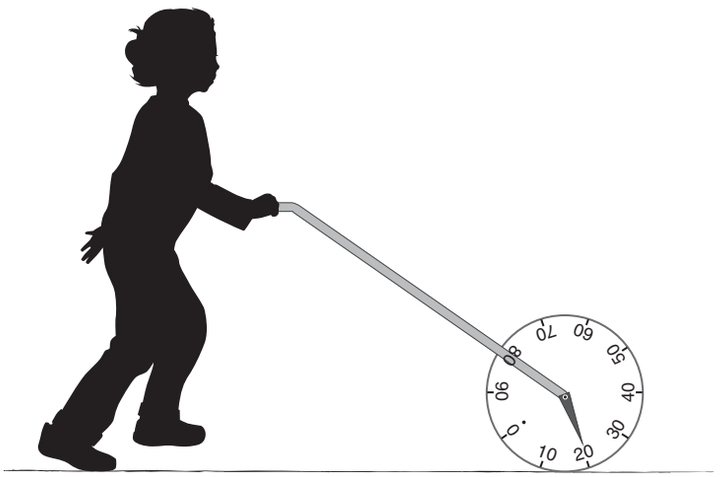
## Lesson 1.2: Measuring Instruments

### Practice – II

1. A vernier calliper is much more precise than a ruler. That is, it is capable of taking much finer measurements. Describe a reason someone may choose to use a ruler instead of a vernier calliper if both tools are available.

   Reading a vernier calliper involves taking a measurement from the fixed scale as well as from the vernier scale, whereas reading a ruler only requires taking a measurement from the fixed scale. This means reading is generally quicker. Often, the precision offered by a ruler is sufficient for what is being measured.

2. This diagram shows a child walking with a measuring instrument called a trundle wheel.






   a. Predict how the trundle wheel measures a distance.

      As the person pushes the trundle wheel, the wheel turns. The number of turns corresponds to the distance traveled. Many trundle wheels include a mechanism that clicks once per revolution. This means you can count the number of clicks to measure the distance.

   b. There are numbers written on the trundle wheel. What unit do you expect these values represent?

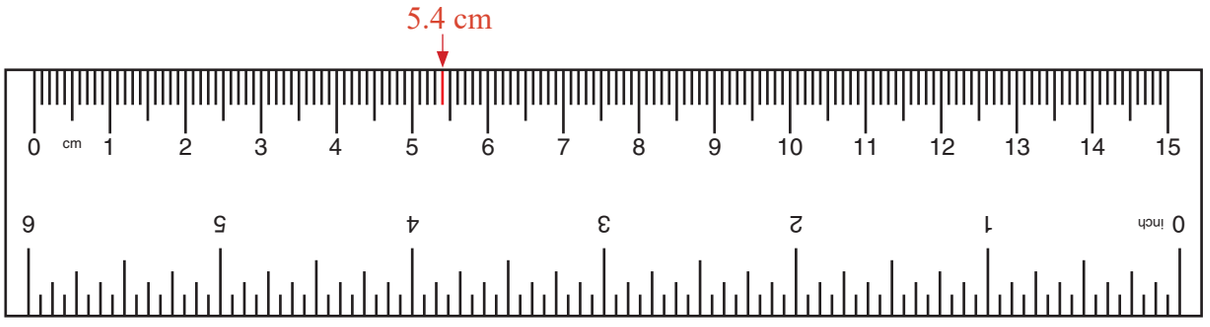
      Based on the size of the child, centimetres are the most likely unit. This also means the wheel will turn 1 metre with each revolution.

c. Describe a situation where a trundle wheel would make a good measuring instrument.

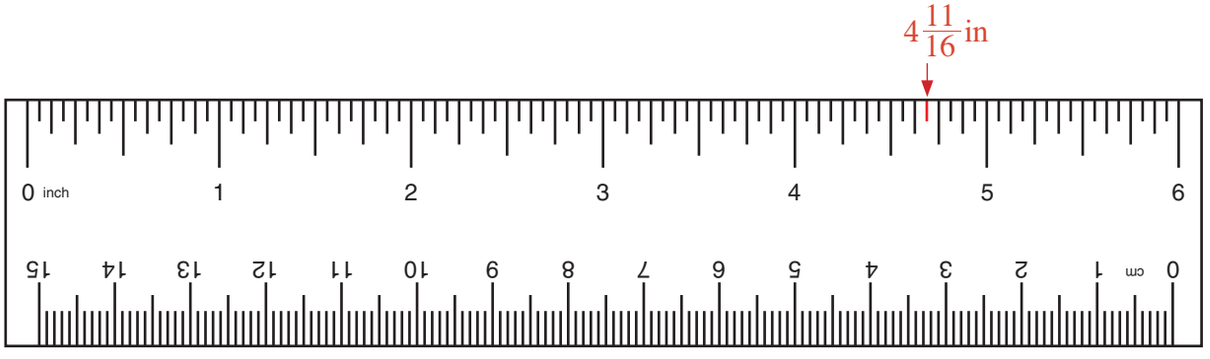
Trundle wheels are useful for measuring moderately long distances such as the width of a property or the length of a football field.

3. Indicate each of the following measurements on the diagram provided.

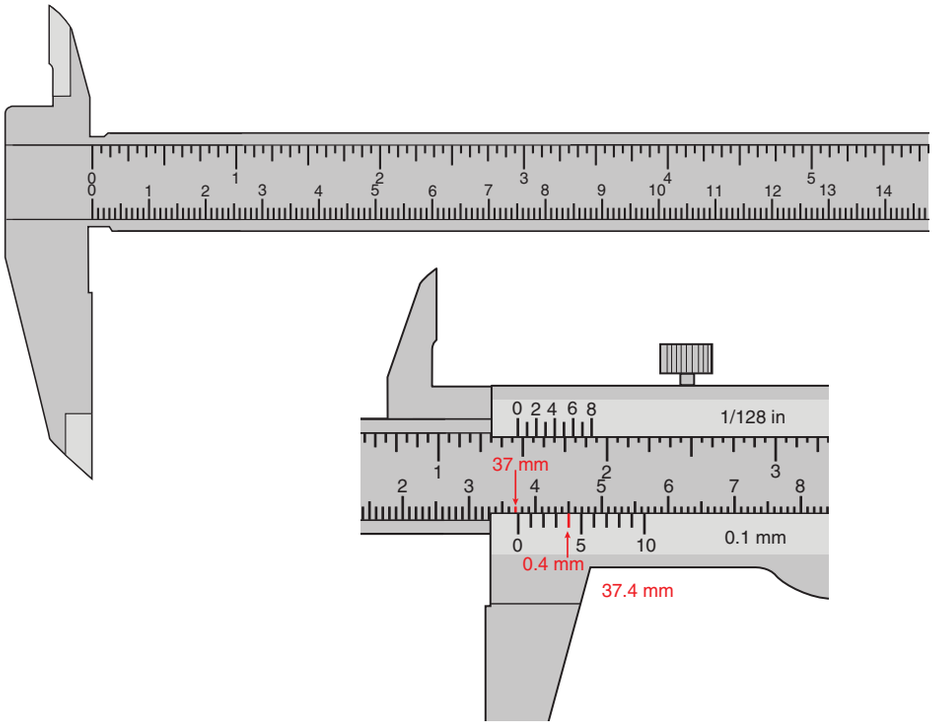
a. a metric ruler showing 5.4 cm



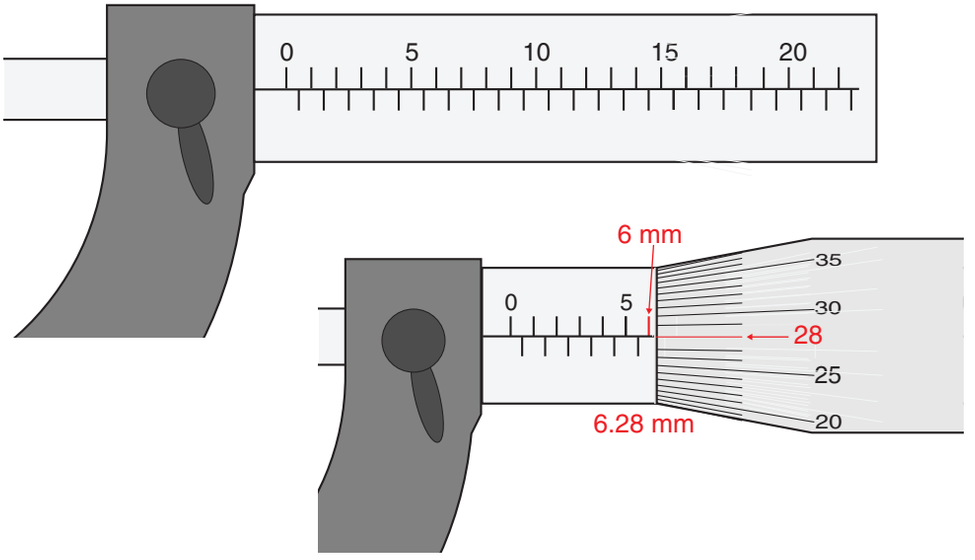

b. an imperial ruler showing $4\frac{11}{16}$ in



c. a vernier calliper showing 37.4 mm (Your sketch only needs to show where important lines will be.)




d. a micrometer showing 6.28 mm (Your sketch only needs to show where important lines will be.)




Please complete *Lesson 1.2 Explore Your Understanding Assignment* located in *Workbook 1.2* before proceeding to *Lesson 1.3*.

## Lesson 1.3: The SI System

### Practice – III

1. Explain the advantages of having a common system of measurement throughout the world.
With a common system, people all over the world are familiar with the same measurement units. This makes communication about measurement much easier.

2. All of the unit conversion strategies shown in this *Lesson* used conversion ratios. Describe how you can tell if you have chosen an appropriate format of a conversion ratio for a conversion.
If the correct conversion ratio is chosen, all of the unwanted units will be eliminated, leaving just the desired unit.

3. Complete each of the following unit conversions using different strategies.

   a. How many centigrams are equal to 9.95 milligrams?

   Strategies will vary. A sample is shown.

$$\frac{x}{9.95\text{ mg}} = \frac{100\text{ cg}}{1000\text{ mg}}$$

$$\frac{x}{9.95\text{ mg}} \cdot 9.95\text{ mg} = \frac{100\text{ cg}}{1000\text{ mg}} \cdot 9.95\text{ mg}$$

$$\frac{x}{9.95\text{ mg}} \cdot 9.95\text{ mg} = \frac{100\text{ cg}}{1000\text{ mg}} \cdot 9.95\text{ mg}$$

$$x = 0.995\text{ cg}$$

   b. 921 dam = _____ dm

   Strategies will vary. A sample is shown.

$$921\text{ dam} \cdot \frac{10\text{ dm}}{0.1\text{ dam}} = 921\text{ dam} \cdot \frac{10\text{ dm}}{0.1\text{ dam}}$$

$$= 92100\text{ dm}$$

   c. Convert 66.5 kilowatts to hectowatts. (The symbol for watt is "W".)

   Strategies will vary. A sample is shown.

   0.001 kW = 0.01 hW

   Move the decimal point to the right one time to convert kilowatts to hectowatts.

   66.5 kW = 665 hW

4. A pharmaceutical company has designed a pill that contains 25 mg of a drug. If the company produces 367 kg of the drug, how many pills can the company make?

   Express both masses in terms of the same unit.

   0.001 kg = 1000 mg, so kilograms can be converted to milligrams by moving the decimal 6 places to the right.

   367 kg = 367000000 mg

   $$\frac{367000000\ \cancel{\text{mg}}}{25\ \cancel{\text{mg}}} = 14680000$$

   The company can make 14 680 000 pills.

Please complete *Lesson 1.3 Explore Your Understanding Assignment* located in *Workbook 1.3* before proceeding to *Lesson 1.4*.

## Lesson 1.4: The Imperial System

### Practice – IV

1. State an imperial unit that is appropriate for each of the following measurements.

   a. the length of a city block

      yard

   b. the width of your pencil

      inch

   c. the weight of a loaded semi-trailer

      ton

   d. the amount of gasoline used to fill a vehicle's gas tank

      gallon

2. Determine a conversion ratio that could be used to convert miles to inches.

$$1 \text{ mi} \cdot \frac{1760 \text{ yd}}{1 \text{ mi}} = 1760 \text{ yd}$$
$$1760 \text{ yd} \cdot \frac{36 \text{ in}}{1 \text{ yd}} = 63360 \text{ in}$$
$$1 \text{ mi} = 63360 \text{ in}$$

Other conversion ratios are possible, but all will reduce to 1 mi = 63360 in.

3. Complete the following conversions.

   a. 5000 lbs to tons

$$\frac{x}{5000 \text{ lbs}} = \frac{1 \text{ ton}}{2000 \text{ lbs}}$$
$$\frac{x}{\cancel{5000 \text{ lbs}}} \cdot \cancel{5000 \text{ lbs}} = \frac{1 \text{ ton}}{2000 \cancel{\text{lbs}}} \cdot 5000 \cancel{\text{lbs}}$$
$$x = 2.5 \text{ tons}$$

   b. _____ in = 6 ft

$$6 \cancel{\text{ft}} \cdot \frac{12 \text{ in}}{1 \cancel{\text{ft}}} = 72 \text{ in}$$

4. Ellen has 13 gallons of water, Shania has 50 quarts of water, and Sophie has 105 pints of water. Which of the girls has the most water?

Shania: 50 qt

$$\text{Ellen: } 13 \cancel{\text{gal}} \cdot \frac{4 \text{ qt}}{1 \cancel{\text{gal}}} = 52 \text{ qt}$$

$$\text{Sophie: } 105 \cancel{\text{pt}} \cdot \frac{1 \text{ qt}}{2 \cancel{\text{pt}}} = 52.5 \text{ qt}$$

Sophie has the most water.

Please return to *Unit 1 Measurement Lesson 1.4* in the *Module* to continue your exploration.

## Lesson 1.4: The Imperial System

### Practice – V

1. Convert 77 yd 2 ft to feet.

$$77 \text{ yd} \cdot \frac{3 \text{ ft}}{1 \text{ yd}} = 231 \text{ ft}$$

$$77 \text{ yd } 2 \text{ ft} = 231 \text{ ft} + 2 \text{ ft}$$
$$= 233 \text{ ft}$$

2. Convert 50 oz to pounds. Leave your final answer as a mixed fraction.

$$50 \text{ oz} \cdot \frac{1 \text{ lb}}{16 \text{ oz}} = \frac{50}{16} \text{ lbs}$$
$$= 3\frac{2}{16} \text{ lbs}$$
$$= 3\frac{1}{8} \text{ lbs}$$

Please complete *Lesson 1.4 Explore Your Understanding Assignment* located in *Workbook 1.4* before proceeding to *Lesson 1.5*.

## Lesson 1.5: Conversions Between the SI and Imperial System

### Practice – VI

1. Why are there two conversion ratios listed for each pair of measurements listed in the conversion table in *Lesson 1.5*?

When one of the values in a conversion ratio is 1, the conversion simplifies to a straightforward multiplication or division. By carefully selecting the most helpful of the two conversion ratios, you can always use multiplication.

2. Complete the following conversions.

   a. 10 m to yd

$$\frac{x}{10\text{ m}} = \frac{1.094\text{ yd}}{1\text{ m}}$$

$$\frac{x}{10\text{ m}} \cdot 10\text{ m} = \frac{1.094\text{ yd}}{1\text{ m}} \cdot 10\text{ m}$$

$$x = 10.94\text{ yd}$$

   b. 159 lbs to kg

$$159\text{ lbs} \cdot \frac{0.454\text{ kg}}{1\text{ lb}} = 72.186\text{ kg}$$

   c. 34 miles per hour to kilometres per hour

$$\frac{34\text{ mi}}{1\text{ h}} \times \frac{1.609\text{ km}}{1\text{ mi}} = 54.706\text{ km/h}$$

3. The diagram shows a thermometer with both Celsius and Fahrenheit scales.

   a. Describe how a thermometer with both scales can be used to convert between °C and °F.

   The corresponding measurements line up, so you can simply look across from the measure of interest to find its corresponding value in the other system.

   b. Use your strategy to convert

   i. 50°C to °F

   122˚F

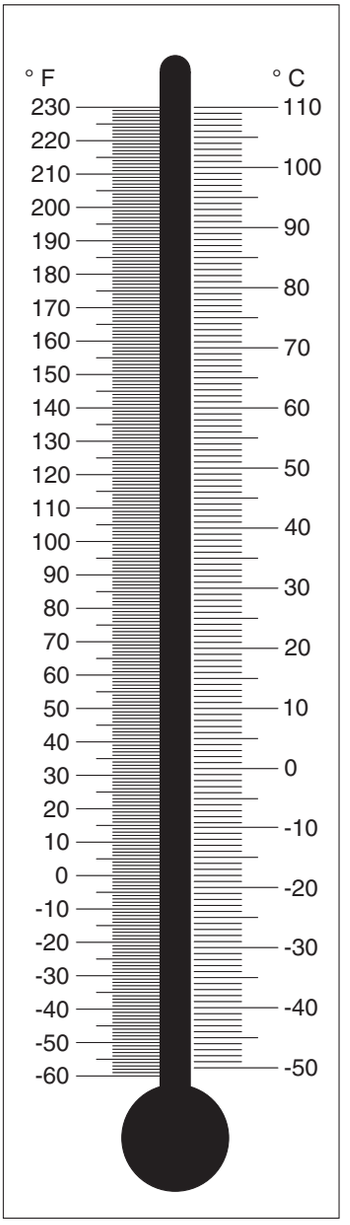
   ii. –10°F to °C

   −23˚C

   c. So far in this *Unit* you have always been able to use a proportion to convert between units. Explain why you cannot use the same strategy to convert between Celsius and Fahrenheit.
   (Hint: Zero will be important to your explanation.)

   For all the unit conversions completed so far, the value 0 has been the same on both scales (when you have 0 of one unit, you also have 0 of another). This means the two units are directly proportional – that is, if you double one value the other will also double, etc. This direct proportionally allowed you to set up and solve a proportion to convert between units.

   The 0 for Fahrenheit does not correspond to the 0 for Celsius, and vice versa. You cannot use a proportion on its own to convert between the two values because the units are not directly proportional.



4. You are considering purchasing one of two used vehicles. Online, you have found that one vehicle has a fuel economy of 36 mi/gal and the other has a fuel economy of 7.2 L/100 km. Assuming imperial gallons were used, which of the two vehicles is more fuel efficient? Be sure to explain your reasoning.

   The rate 36 mi/gal can also be written as $\frac{1 \text{ gal}}{36 \text{ mi}}$ and can be converted to litres per kilometre as follows.

   $$\frac{1 \text{ gal}}{36 \text{ mi}} \cdot \frac{4.546 \text{ L}}{1 \text{ gal}} \cdot \frac{0.621 \text{ mi}}{1 \text{ km}} \doteq \frac{0.0784 \text{ L}}{1 \text{ km}}$$

   $$\frac{0.0784 \text{ L}}{1 \text{ km}} = \frac{x}{100 \text{ km}}$$
   $$\frac{0.0784 \text{ L}}{1 \text{ km}} \cdot 100 \text{ km} = \frac{x}{100 \text{ km}} \cdot 100 \text{ km}$$
   $$7.84 \text{ L} = x$$

   The fuel rate is approximately 7.84 L/100 km for the first vehicle. The second vehicle uses less fuel at 7.2 L/100 km.

Please complete *Lesson 1.5 Explore Your Understanding Assignment*, located in *Workbook 1.5*.