

Unit 4

Measurement

Topic A: Metric system of measurement

- International system of units
- Metric conversion
- The unit factor method

Topic B: Metric units for area and volume

- Convert units of area and volume
- The relationship between mL, g and cm^3

Topic C: Imperial system

- The system of imperial units
- Imperial unit conversion

Topic D: Converting between metric and imperial units

- Imperial and metric conversions

Unit 4 Summary

Unit 4 Self - test

Topic A: Metric System of Measurement

International System of Units

Metric system (SI – international system of units): the most widely used system of measurement in the world. It is based on the basic units of meter, kilogram, second, etc.

SI common units:

Quantity	Unit	Unit symbol
Length	meter	m
Mass (or weight)	gram	kg
Volume	litre	L
Time	second	s
Temperature	degree (Celsius)	$^{\circ}\text{C}$

Metric prefixes (SI prefixes): large and small numbers are made by adding SI prefixes, which is based on multiples of 10.

Key metric prefix:

Prefix	Symbol (abbreviation)	Power of 10	Multiple value	Example
mega	M	10^6	1,000,000	1 Mm = 1,000,000 m
kilo-	k	10^3	1,000	1 km = 1,000 m
hecto-	h	10^2	100	1 hm = 100 m
deka-	da	10^1	10	1 dam = 10 m
meter/gram/liter		1		
deci-	d	10^{-1}	0.1	1 m = 10 dm
centi-	c	10^{-2}	0.01	1 m = 100 cm
milli-	m	10^{-3}	0.001	1 m = 1,000 mm
micro	μ	10^{-6}	0.000 001	1 m = 1,000,000 μm

Metric prefix for length, weight and volume:

Prefix	Length (m - meter)	Weight (g - gram)	Liquid volume (L - liter)
mega (M)	Mm (Megameter)	Mg (Megagram)	ML (Megaliter)
kilo (k)	km (Kilometer)	kg (Kilogram)	kL (Kiloliter)
hecto (h)	hm (hectometer)	hg (hectogram)	hL (hectoliter)
deka (da)	dam (dekameter)	dag (dekagram)	daL (dekaliter)
meter/gram/liter	m (meter)	g (gram)	L (liter)
deci (d)	dm (decimeter)	dg (decigram)	dL (deciliter)
centi (c)	cm (centimeter)	cg (centigram)	cL (centiliter)
milli (m)	mm (millimeter)	mg (milligram)	mL (milliliter)
micro (μ)	μm (micrometer)	μg (microgram)	μL (microliter)

Large

Small

Metric Conversion

Metric conversion table:

Value	1,000	100	10	1	.	0.1	0.01	0.001
Prefix	kilo	hecto	deka	meter (m) gram (g) liter (L)	.	deci	centi	milli
Symbol	k	h	da		.	d	c	m

Larger
←
→
 Small

Steps for metric conversion through decimal movement:

- Identify the number of places to move on the metric conversion table.
- Move the decimal point.
 - Convert a **smaller** unit **to** a **larger** unit: move the decimal point to the **left**.
 - Convert a **larger** unit **to** a **smaller** unit: move the decimal point to the **right**.

Example: 326 mm = (?) m

- Identify mm (*millimeters*) and m (*meters*) on the conversion table. L SEP

Count places from mm to m: 3 places L SEP

meter . d c m
3 2 1

- Move 3 decimal places. (1 m = 1000 mm)

Convert a smaller unit (mm) to a larger (m) unit: move the decimal point to the left.

$$326. \text{ mm} = 0.326 \text{ m}$$

Move the decimal point three places to the left (326 = 326.).

Example: 4.675 hg = (?) g

- Identify hg (*hectograms*) and g (*grams*) on the conversion table.

Count places from hg to g: 2 places

h da gram
1 2

- Move 2 decimal places. (1 hg = 100 g)

Convert a larger unit (hg) to a smaller (g) unit: move the decimal point to the right.

$$4.765 \text{ hg} = 476.5 \text{ g}$$

Move the decimal point two places to the right.

Example: 30.5 mL = (?) kL

- Identify mL (*milliliters*) and kL (*kiloliters*) on the conversion table.

Count places from mL to kL: 6 places

k h da liter. d c m
6 5 4 3 2 1

- Move 6 decimal place. (1 kL = 1,000,000 mL)

Convert a smaller unit (mL) to a larger (kL) unit: move the decimal point to the left.

$$30.5 \text{ mL} = 0.0000305 \text{ kL}$$

Move the decimal point six place to the left (add 0s).

The Unit Factor Method

Convert units using the unit factor method (or the factor-label method)

- Write the original term as a fraction (over 1). Example: 10g can be written as $\frac{10\text{ g}}{1}$
- Write the conversion formula as a fraction $\frac{1}{(\quad)}$ or $\frac{(\quad)}{1}$. Example: 1m = 100 cm can be written as $\frac{1\text{ m}}{(100\text{ cm})}$ or $\frac{(100\text{ cm})}{1\text{ m}}$
 (Put the desired or unknown unit on the top.)
- Multiply the original term by $\frac{1}{(\quad)}$ or $\frac{(\quad)}{1}$. (Cancel out the same units).

Metric conversion using the unit factor method:

Example: 1200 g = (?) kg

- Write the original term (the left side) as a fraction: $1200\text{ g} = \frac{1200\text{ g}}{1}$
- Write the conversion formula as a fraction. 1 kg = 1000 g: $\frac{1\text{ kg}}{(1000\text{ g})}$ “kg” is the desired unit.
- Multiply: $1200\text{ g} = \frac{1200\text{ g}}{1} \cdot \frac{1\text{ kg}}{(1000\text{ g})}$ The units “g” cancel out.

$$= \frac{1200\text{ kg}}{1000}$$

$$= \boxed{1.2\text{ kg}}$$

Example: 30 cm = (?) mm

- Write the original term (the left side) as a fraction: $30\text{ cm} = \frac{30\text{ cm}}{1}$
- Write the conversion formula as a fraction. 1 cm = 10 mm: $\frac{(10\text{ mm})}{1\text{ cm}}$ “mm” is the desired unit.
- Multiply: $30\text{ cm} = \frac{30\text{ cm}}{1} \cdot \frac{(10\text{ mm})}{1\text{ cm}}$ The units “cm” cancel out.

$$= \frac{(30)(10)\text{ mm}}{1}$$

$$= \boxed{300\text{ mm}}$$

Adding and subtracting SI measurements:

Example:
$$\begin{array}{r} 3\text{ m} \\ - 2000\text{ mm} \\ \hline \end{array} \Rightarrow \begin{array}{r} 3000\text{ mm} \\ - 2000\text{ mm} \\ \hline 1000\text{ mm} \end{array}$$
 1 m = 1,000 mm

Example:
$$\begin{array}{r} 25\text{ kg} \\ + 4\text{ g} \\ \hline \end{array} \Rightarrow \begin{array}{r} 25000\text{ g} \\ + 4\text{ g} \\ \hline 25004\text{ g} \end{array}$$
 Combine after converting to the same unit.
1 kg = 1000 g

Topic B: Metric Units for Area and Volume

Convert Units of Area and Volume

Area unit conversion

- Area unit conversion: convert the length or distance **twice**.

Since the units of area are always expressed as square units (in m^2 , cm^2 , ft^2 , yd^2 , etc.)

Example: The area of a square is side squared ($A = s^2$).



(Convert the unit of the side twice.)

- Steps for area unit conversion:

Steps

- Determine the number of decimal places it would move with ordinary units of length.
- Double** this number, and move that number of decimal places for units of area.

(Since area is in m^2 , cm^2 , ft^2 , yd^2 , etc.)

Example: Convert.

$$0.03 \text{ km}^2 = (?) \text{ m}^2$$

$$0.03 \text{ km}^2 = \underbrace{0030000}_{\text{move 4 places left}} \cdot \text{m}^2 = \boxed{30000 \text{ m}^2}$$

Example: $3200 \text{ cm}^2 = (?) \text{ m}^2$

Convert cm to m: move 2 decimal places left.

$$1 \text{ m} = 100 \text{ cm}$$

$2 \times 2 = 4$, move 4 places left for area.

$$3200. \text{ cm}^2 = \underbrace{0.3200}_{\text{move 4 places left}} \text{ m}^2 = \boxed{0.32 \text{ m}^2}$$

km to m: move 3 decimal places right ($1 \text{ km} = 1,000 \text{ m}$)

$2 \times 3 = 6$, move 6 places right for area.

Volume unit conversion

- Volume unit conversion: convert the length or distance **three times**.

Since the units of volume are always expressed as cubic units (in m^3 , cm^3 , ft^3 , yd^3 , etc.)

Example: The volume of a cube is side cubed ($V = s^3$).



(Convert the unit of the side three times.)

- Steps for volume unit conversion:

Steps

- Determine the number of decimal places it would move with ordinary units of length.
- Triple** this number, and move that number of decimal places for units of volume.

(Since volume is in m^3 , cm^3 , ft^3 , yd^3 , etc.)

Example: Convert.

$$5300 \text{ mm}^3 = (?) \text{ cm}^3$$

$$5300 \text{ mm}^3 = \underbrace{5.3}_{\text{move 3 places left}} \text{ cm}^3$$

(5300 = 5300.)

Example: $3 \text{ m}^3 = (?) \text{ cm}^3$

m to cm: move 2 decimal places right.

$$1 \text{ m} = 100 \text{ cm}$$

$3 \times 2 = 6$, move 6 places right for volume.

$$3 \text{ m}^3 = \underbrace{3000000}_{\text{move 6 places right}} \text{ cm}^3$$

$$3 = 3.$$

mm to cm: move 1 place left.

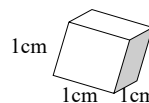
$$1 \text{ cm} = 10 \text{ mm}$$

$3 \times 1 = 3$, move 3 places left for volume.

The Relationship between *mL*, *g* and *cm*³

How are *mL*, *g*, and *cm*³ related?

- Recall: millimeter = mL, gram = g, cubic centimeter = *cm*³
- A cube takes up 1 *cm*³ of space (1 *cm* × 1 *cm* × 1 *cm* = 1 *cm*³).
(*cm*³ = cc (cubic centimeter) in chemistry and medicine)
- A cube holds 1 mL of water and has a mass of 1 gram at 4⁰ C.



The relationship between *mL*, *g* and *cm*³ – formulas:

$$1 \text{ cm}^3 = 1 \text{ mL} = 1 \text{ g}$$

Or $1 \text{ cm}^3 = 1 \text{ mL}$ $1 \text{ mL} = 1 \text{ g}$ $1 \text{ cm}^3 = 1 \text{ g}$

Example: Convert.

1) $16 \text{ cm}^3 = (?) \text{ g}$

$$16 \text{ cm}^3 = \boxed{16 \text{ g}}$$

$$1 \text{ cm}^3 = 1 \text{ g}$$

2) $9 \text{ L} = (?) \text{ cm}^3$

$$9 \text{ L} = 9000 \text{ mL}$$

$$= \boxed{9000 \text{ cm}^3}$$

$$1 \text{ L} = 1,000 \text{ mL}$$

$$1 \text{ mL} = 1 \text{ cm}^3$$

3) $35 \text{ cm}^3 = (?) \text{ cL}$

$$35 \text{ cm}^3 = 35 \text{ mL}$$

$$= \boxed{3.5 \text{ cL}}$$

$$1 \text{ cm}^3 = 1 \text{ mL}$$

move 1 decimal place left. c m

$$450 \text{ kg} = (?) \text{ L}$$

4) $450 \text{ kg} = 450,000 \text{ g}$

$$= 450,000 \text{ mL}$$

$$= \boxed{450 \text{ L}}$$

$$1 \text{ kg} = 1,000 \text{ g}$$

$$1 \text{ g} = 1 \text{ mL}$$

$$1 \text{ L} = 1,000 \text{ mL}$$

Example: A swimming pool that measures 10 m by 8 m by 2 m. How many *kiloliters* of water will it hold?

$$V = w l h = (8\text{m}) (10\text{m}) (2\text{m}) = 160 \text{ m}^3$$

$$160 \text{ m}^3 = (?) \text{ kL}$$

$$160 \text{ m}^3 = 160,000,000 \text{ cm}^3$$

1 m = 100 cm, $3 \times 2 = 6$, move 6 places right for volume.

$$160,000,000 \text{ cm}^3 = 160,000,000 \text{ mL}$$

$$1 \text{ mL} = 1 \text{ cm}^3$$

$$160,000,000 \text{ mL} = 160 \text{ kL}$$

$$1 \text{ kL} = 1,000,000 \text{ mL}$$

$$160 \text{ m}^3 = \boxed{160 \text{ kL}}$$

The swimming pool will hold 160 kL of water.

Topic C: Imperial System

The System of Imperial Units

Imperial system units: a system of measurement units originally defined in England, including the foot, pound, quart, ounce, gallon, mile, yard, etc.

Length, weight, liquid volume and time:

Quantity	Units
Length	inch, foot, yard, mile, etc.
Weight	pound, ounce, ton, etc.
Liquid volume	fluid ounce, pint, quart, gallon, cup, teaspoon, etc.
Time	year, week, day, hour, minute, second, etc.
Temperature	degree / Fahrenheit (⁰ F)

Imperial equivalents:

Unit name	Symbol (abbreviation)	Relationship
<i>Length</i>		
inch	in. or ”	
foot	ft. or ’	1 ft = 12 in
yard	yd.	1 yd = 3 ft
mile	mi.	1 mi = 5280 ft
<i>Weight</i>		
ounce	oz.	
pound	lb.	1 lb = 16 oz
ton	ton	1 ton = 2000 lb
<i>Liquid volume</i>		
fluid ounce	fl oz.	
pint	pt.	1 pt = 16 fl oz
quart	qt.	1 qt = 2 pt
gallon	gal.	1 gal = 4 qt
cup	c.	1 c = 8 fl oz
teaspoon	tsp.	3 tsp = 1 tbsp
tablespoon	tbsp.	16 tbsp = 1 c
<i>Time</i>		
second	s.	1 min. = 60 s
minute	min.	1 hr = 60 min = 3600 s
hour	hr.	1 d = 24 hr
day	d.	1 wk = 7 d
week	wk.	1 yr = 52 wk
year	yr.	1 yr = 365 d

Imperial Unit Conversion

Imperial conversion using the unit factor method:

- Write the original term as a fraction (over 1). Example: 10g can be written as $\frac{10 \text{ g}}{1}$
- Write the conversion formula as a fraction $\frac{1}{(\quad)}$ or $\frac{(\quad)}{1}$. Example: 1 ft = 12 in can be written as $\frac{1 \text{ ft}}{(12 \text{ in})}$ or $\frac{(12 \text{ in})}{1 \text{ ft}}$
(Put the unknown or desired unit on the top.)
- Multiply the original term by $\frac{1}{(\quad)}$ or $\frac{(\quad)}{1}$. (Cancel out the same units).

Example: 4 ft = (?) in

- Write the original term (the left side) as a fraction: $4 \text{ ft} = \frac{4 \text{ ft}}{1}$
- Write the conversion formula as a fraction. 1 ft = 12 in: $\frac{(12 \text{ in})}{1 \text{ ft}}$ “in” is the desired unit.
- Multiply: $4 \text{ ft} = \frac{4 \text{ ft}}{1} \cdot \frac{(12 \text{ in})}{1 \text{ ft}} = \frac{(4)(12 \text{ in})}{1} = \boxed{48 \text{ in}}$ The units “ft” cancel out.

Example: 20 qt = (?) pt

- Write the original term as a fraction: $20 \text{ qt} = \frac{20 \text{ qt}}{1}$
- Write the conversion formula as a fraction. 1 qt = 2pt: $\frac{(2 \text{ pt})}{1 \text{ qt}}$ “pt” is the desired unit.
- Multiply: $20 \text{ qt} = \frac{20 \text{ qt}}{1} \cdot \frac{(2 \text{ pt})}{1 \text{ qt}} = \boxed{40 \text{ pt}}$ The units “qt” cancel out.

Example: 8 mi = (?) yd mi" to ft to yd

- Write the original term as a fraction: $8 \text{ mi} = \frac{8 \text{ mi}}{1}$
- Write the conversion formula as a fraction.
 $1 \text{ mi} = 5280 \text{ ft: } \frac{(5280 \text{ ft})}{1 \text{ mi}}$ “ft” is the desired unit.
 $1 \text{ yd} = 3 \text{ ft: } \frac{1 \text{ yd}}{(3 \text{ ft})}$ “yd” is the desired unit.
- Multiply: $8 \text{ mi} = \frac{8 \text{ mi}}{1} \cdot \frac{(5280 \text{ ft})}{1 \text{ mi}} \cdot \frac{1 \text{ yd}}{(3 \text{ ft})} = \frac{(8)(5280)(1 \text{ yd})}{3} = \boxed{14080 \text{ yd}}$

Topic D: Converting between Metric and Imperial Units

Imperial and Metric Conversion

Key imperial and metric unit conversions:

Quantity	Metric to imperial	Imperial to metric	Abbreviation
Length	1 m \approx 39 in	1 in = 2.54 cm	inch: in. or ”
	1 m \approx 3.28 ft	1 ft \approx 30.48 cm	foot: ft. or ’
	1 m \approx 1.09 yd	1 mi \approx 1.61 km	yard: yd.
	1 km \approx 0.6214 mi	1 yd \approx 0.914 m	mile: mi.
Weight	1 kg \approx 2.2 lb	1 oz \approx 28.35 g	pound: lb.
	1 g \approx 0.035 oz	1 lb \approx 454 g	ounce: oz.
	1 ton \approx 910 kg		
Volume	1 L \approx 0.264 gal	1 qt \approx 0.946 L	gallon: gal.
	1 L \approx 2.1 pt	1 gal \approx 3.79 L	pint: pt.
	1 L \approx 1.06 qt	1 pt \approx 470 mL	quart: qt.
	1 mL = 0.2 tsp	1 tsp = 5 mL	teaspoon: tsp.

Imperial - metric unit conversion (the unit factor method):

- Write the original term as a fraction (over 1). Example: 10 gal can be written as $\frac{10 \text{ gal}}{1}$
- Write the conversion formula as a fraction $\frac{1}{(\quad)}$ or $\frac{(\quad)}{1}$.
Example: 1 mL = 0.2 tsp can be written as $\frac{1 \text{ mL}}{(0.2 \text{ tsp})}$ or $\frac{(0.2 \text{ tsp})}{1 \text{ mL}}$
(Put the desired or unknown unit on the top.)
- Multiply the original term by $\frac{1}{(\quad)}$ or $\frac{(\quad)}{1}$. (Cancel out the same units).

Example: 2 ft = (?) m

- Write the original term (the left side) as a fraction: $2 \text{ ft} = \frac{2 \text{ ft}}{1}$
- Write the conversion formula as a fraction. 1 m \approx 3.28 ft: $\frac{1 \text{ m}}{(3.28 \text{ ft})}$ “m” is the desired unit.
- Multiply: $2 \text{ ft} = \frac{2 \text{ ft}}{1} \cdot \frac{1 \text{ m}}{(3.28 \text{ ft})} \approx \boxed{0.61 \text{ m}}$

Example: $120 \text{ oz} = (?) \text{ kg}$ “oz” to “g” to “kg”

- Write the original term (the left side) as a fraction: $120 \text{ oz} = \frac{120 \text{ oz}}{1}$
- Write the conversion formula as a fraction. $1 \text{ oz} \approx 28.35 \text{ g}$: $\frac{(28.35 \text{ g})}{1 \text{ oz}}$ “g” is the desired unit.
- Multiply: $120 \text{ oz} = \frac{120 \cancel{\text{oz}}}{1} \cdot \frac{(28.35 \cancel{\text{g}})}{1 \cancel{\text{oz}}} = 3402 \text{ g} = \boxed{3.402 \text{ kg}}$ $1 \text{ kg} = 1000 \text{ g}$

Example: $250 \text{ mL} = (?) \text{ tsp}$

- Original term to fraction: $250 \text{ mL} = \frac{250 \text{ mL}}{1}$
- Conversion formula: $1 \text{ tsp} = 5 \text{ mL}$: $\frac{1 \text{ tsp}}{(5 \text{ mL})}$ “tsp” is the desired unit.
- Multiply: $250 \text{ mL} = \frac{250 \cancel{\text{mL}}}{1} \cdot \frac{1 \text{ tsp}}{(5 \cancel{\text{mL}})} = \boxed{50 \text{ tsp}}$

Example: $10560 \text{ yd} = (?) \text{ mi}$ “yd” to “ft” to “mi”

- Original term to fraction: $10560 \text{ yd} = \frac{10560 \text{ yd}}{1}$
- Conversion formula: $3 \text{ ft} = 1 \text{ yd}$: $\frac{(3 \text{ ft})}{1 \text{ yd}}$ “ft” is the desired unit.
- $1 \text{ mi} = 5280 \text{ ft}$: $\frac{1 \text{ mi}}{(5280 \text{ ft})}$ “mi” is the desired unit.
- Multiply: $10560 \text{ yd} = \frac{10560 \cancel{\text{yd}}}{1} \cdot \frac{(3 \cancel{\text{ft}})}{1 \cancel{\text{yd}}} \cdot \frac{1 \text{ mi}}{(5280 \cancel{\text{ft}})}$
 $= \frac{10560}{1} \cdot \frac{3}{1} \cdot \frac{1 \text{ mi}}{5280}$
 $= \frac{(10560)(3) \text{ mi}}{5280} = \boxed{6 \text{ mi}}$

Example: Two towns are 600 miles apart. How many kilometers separate them? $\frac{[L]}{[SEP]}$

- $600 \text{ miles} = (?) \text{ km}$
- Original term to fraction: $600 \text{ mi} = \frac{600 \text{ mi}}{1}$
- Conversion formula: $1 \text{ km} \approx 0.6214 \text{ mi}$: $\frac{1 \text{ km}}{(0.6214 \text{ mi})}$ “km” is the desired unit.
- Multiply: $600 \text{ miles} = \frac{600 \cancel{\text{mi}}}{1} \cdot \frac{1 \text{ km}}{(0.6214 \cancel{\text{mi}})}$
 $\approx \boxed{965.6 \text{ km}}$

The distance between two towns is 965.6 km.

Unit 4: Summary

Measurement

Metric system (SI – international system of units): the most widely used system of measurement in the world. It is based on the basic units of meter, kilogram, second, etc.

Imperial system units: a system of measurement units originally defined in England, including the foot, pound, quart, ounce, gallon, mile, yard, etc.

Metric prefixes (SI prefixes): large and small numbers are made by adding SI prefixes, which is based on multiples of 10.

Steps for metric conversion through decimal movement:

- Identify the number of places to move on the metric conversion table.
- Move the decimal point.
 - Convert a **smaller** unit **to** a **larger** unit: move the decimal point to the **left**.
 - Convert a **larger** unit **to** a **smaller** unit: move the decimal point to the **right**.

Convert units using the unit factor method (or the factor-label method):

- Write the original term as a fraction (over 1). Example: 10g can be written as $\frac{10\text{ g}}{1}$
- Write the conversion formula as a fraction $\frac{1}{(\quad)}$ or $\frac{(\quad)}{1}$.
Example: 1m = 100 cm can be written as $\frac{1\text{m}}{(100\text{cm})}$ or $\frac{(100\text{cm})}{1\text{m}}$
(Put the desired or unknown unit on the top.)
- Multiply the original term by $\frac{1}{(\quad)}$ or $\frac{(\quad)}{1}$. (Cancel out the same units).

Key metric prefix:

Prefix	Symbol (abbreviation)	Power of 10	Example
mega	M	10^6	1 Mm = 1,000,000 m
kilo-	k	10^3	1 km = 1,000 m
hecto-	h	10^2	1 hm = 100 m
deka-	da	10^1	1 dam = 10 m
meter/gram/liter		1	
deci-	d	10^{-1}	1 m = 10 dm
centi-	c	10^{-2}	1 m = 100 cm
milli-	m	10^{-3}	1 m = 1,000 mm
micro	μ	10^{-6}	1 m = 1,000,000 μm

Metric conversion table:

Value	1,000,000	1,000	100	10	1	.	0.1	.01	0.001	0.000 001
Prefix	Mega	kilo	hecto	deka	meter (m) gram (g) liter (L)	.	dec	centi	milli	micro
Symbol	M	k	h	da		.	d	c	m	μ

Larger Small

Steps for area unit conversion:

- Determine the number of decimal places it would move with ordinary units of length.
- **Double** this number, and move that number of decimal places for units of area.

Steps for volume unit conversion:

- Determine the number of decimal places it would move with ordinary units of length.
- **Triple** this number, and move that number of decimal places for units of volume.

The relationship between mL, g and cm³ – formulas:

- A cube holds 1 mL of water and has a mass of 1 gram at 40 C.
- $1 \text{ cm}^3 = 1 \text{ mL} = 1 \text{ g}$

Or $1 \text{ cm}^3 = 1 \text{ mL}$ $1 \text{ mL} = 1 \text{ g}$ $1 \text{ cm}^3 = 1 \text{ g}$

Unit 4: Self - Test

Measurement

Topic A

1. Convert each measurement using the metric conversion table.

- a) $439 \text{ mm} = (?) \text{ m}$
- b) $2.236 \text{ hg} = (?) \text{ g}$
- c) $48.3 \text{ mL} = (?) \text{ kL}$
- d) $2.5 \text{ kg} = (?) \text{ hg}$

2. Convert each measurement using the unit factor method.

- a) $7230 \text{ g} = (?) \text{ kg}$
- b) $52 \text{ cm} = (?) \text{ mm}$
- c) $3.4 \text{ dL} = (?) \text{ L}$
- d) $52 \text{ daL} = (?) \text{ cL}$

3. Combine.

- a) $7 \text{ m} - 3000 \text{ mm} = (?) \text{ mm}$
- b) $63 \text{ kg} + 6 \text{ g} = (?) \text{ g}$
- c) $0.72 \text{ L} + 4.58 \text{ L} - 10 \text{ mL} = (?) \text{ mL}$
- d) $25.3 \text{ km} + 357 \text{ dam} = (?) \text{ km}$

Topic B

4. Convert.

- a) $7400 \text{ cm}^2 = (?) \text{ m}^2$
- b) $0.09 \text{ km}^2 = (?) \text{ m}^2$
- c) $5 \text{ m}^3 = (?) \text{ cm}^3$
- d) $567 \text{ mm}^3 = (?) \text{ cm}^3$

5. Complete.

- a) A cube holds 1 mL of water and has a mass of 1 gram at () °C.
- b) $38 \text{ cm}^3 = (\quad) \text{ g}$
- c) $5 \text{ L} = (\quad) \text{ cm}^3$
- d) $27 \text{ cm}^3 = (?) \text{ cL}$
- e) 76 cm^3 of water at 4°C has a mass of () g.
- f) 18 L of water has a volume of _____ cm^3 .
- g) $257 \text{ kg} = (?) \text{ L}$
- h) A fish box that measures 45 cm by 35 cm by 25 cm. How many kiloliters of water will it hold?

Topic C

6. Convert the following imperial system units.

- a) 9 ft to inches
- b) 47 qt to pints
- c) 4 mi to yards
- d) 9276 pounds to tons

Topic D

7. Convert.

- a) 8 ft. to meters
- b) 268 oz. to kilograms
- c) 465 mL to tsp
- d) 15840 yd. to miles
- e) Two towns are 450 miles apart. How many kilometers separate them?