

Student Name

Mathematics Stage 5 Core

NUMBERS OF ANY MAGNITUDE

Book 1 Identify and describe very small
and very large measurements

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OVERVIEW

SYLLABUS CONTENT

MA5-MAG-C-01 solves measurement problems by using scientific notation to represent numbers and rounding to a given number of significant figures

Identify and describe very small and very large measurements

- Identify and describe the meaning of common prefixes, such as milli, centi and kilo
- Establish the meaning of prefixes for very small or very large measurement units

HISTORY

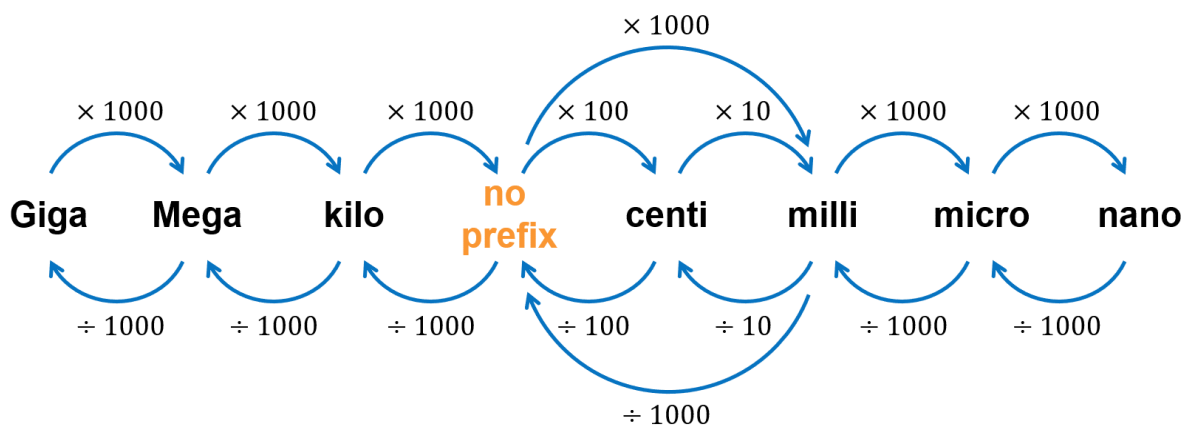
- The metric system was introduced in France during the French revolution to replace the inconsistent imperial system of measurement.

- Metric units: $\text{km} \xrightarrow{\times 1000} \text{m} \xrightarrow{\times 100} \text{cm} \xrightarrow{\times 10} \text{m}$
- Imperial units: $\text{miles} \xrightarrow{\times 1760} \text{yards} \xrightarrow{\times 3} \text{feet} \xrightarrow{\times 12} \text{inches}$

RELEVANCE

- Metric prefixes are based on powers of 10, which makes it easy to convert units.
- This consistency simplifies calculations and reduces errors in fields like science, engineering, and commerce.
- The metric system is internationally recognised and used by almost every country worldwide.
- This standardisation enables communication, trade, and collaboration across borders, as everyone understands and uses the same units of measurement.

SUMMARY



THE METRIC SYSTEM

METRIC PREFIXES

- The **metric** system of measurement bases everything on **powers of 10**.
- The **prefix** of a unit of measurement tells you how large or small it is.

Prefix		Meaning	Index notation	Number	Fraction
Giga	G	Billion	10^9	1 000 000 000	-
Mega	M	Million	10^6	1 000 000	-
kilo	k	Thousand	10^3	1000	-
(no prefix)		One	1	1	1
centi	c	Hundredth	10^{-2}	0.01	$\frac{1}{100}$
milli	m	Thousandth	10^{-3}	0.001	$\frac{1}{1000}$
micro	μ	Millionth	10^{-6}	0.000 001	$\frac{1}{1\,000\,000}$
nano	n	Billionth	10^{-9}	0.000 000 001	$\frac{1}{1\,000\,000\,000}$

- Unusual units, e.g. centilitres, are often used in laboratory, pharmaceutical, or medical fields.

SI UNITS

- **SI units** are internationally agreed upon units of measurement.
- The prefix of the SI unit tells you how large or small the unit of measurement is.

Quantity	SI unit
Length	Metre (m)
Capacity	Litre (L)
Mass	Gram (g)
Time	Second (s)
Energy	Joule (J)

- **Note:** for time, we use metric units only when using smaller units of measurement; millisecond is widely used; kilosecond is only used in specific scientific and computing fields.

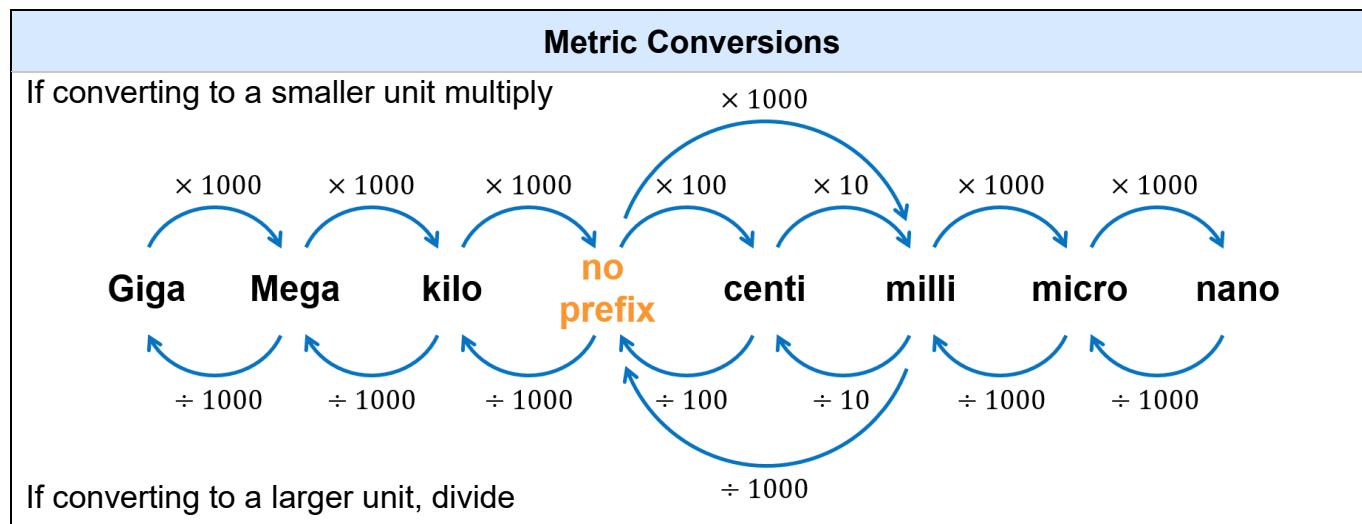
1 Complete the table.

Prefix	Meaning	Index notation
Giga G	Billion	10^9
Mega M	Million	10^6
kilo k	thousand	10^3
(no prefix)	One	1
centi C	hundredth	10^{-2}
milli m	thousandth	10^{-3}
micro μ	millionth	10^{-6}
nano n	Billionth	10^{-9}

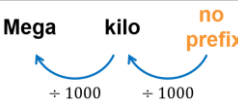
2 Complete the table.

Prefix	Meaning	Index notation
kilo k	Thousand	10^3
(no prefix)	One	1 or 10^0
nano n	Billionth	10^{-9}
Giga G	Billion	10^9
milli m	Thousandth	10^{-3}
Micro μ	Millionth	10^{-6}
centi c	Hundredth	10^{-2}
Mega M	Million	10^6

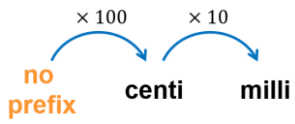
METRIC CONVERSIONS



Example Convert metric units.

Convert 35 cm to mm $35 \text{ cm} \times 10$ $= 350 \text{ mm}$		Why do we multiply when converting to a smaller unit? <i>We need smaller units, so we multiply.</i>
Convert 520 000 L to ML $520\,000 \text{ L} \div 1000 \div 1000$ $= 0.52 \text{ ML}$		What does "base unit" mean? <i>The base unit has no</i>

Convert these units.

a 25 m to mm  25 000 mm	b 1500 kg to g  1 500 000 g	c 6700 g to kg  6.7 kg
d 11.55 L to mL 11 550 mL	e 8 500 000 mL to kL 8.5 kL	f 80 mL to L 0.08 L

- Note: a tonne (t) is 1000 kg or 1 Mg

Key ideas

- The metric system is based on powers of
- kilo means one
- milli means one
- A is the same as a Megagram, which is 1000 kg.

1 Convert the following.

a 2 L = mL 2000	b 12 kL = L 12 000	c 9 kL = mL 9 000 000
d 7800 kL = L 7 800 000	e 50 L = mL 50 000	f 300 kL = mL 300 000 000
g 6100 L = kL 6.1	h 400 mL = L 0.4	i 210 000 mL = kL 0.21
j 3 t = kg 3000	k 45 kg = g 45 000	l 76 t = kg 76 000
m 8100 kg = g 8 100 000	n 4 t = g 4 000 000	o 0.52 t = kg 520
p 6800 g = kg 6.8	q 300 kg = t 0.3	r 2300 g = kg 2.3

2 Fill in the table.

	km	m	cm	mm
a	1	1000	100 000	1000 000
b	0.001	1	100	1000
c	0.000 01	0.01	1	10
d	0.000 001	0.001	0.1	1
e	0.000 01	0.01	1	10
f	0.000 17	0.17	17	170
g	0.001 7	1.7	170	1700
h	1.07	1070	107 000	1 070 000
i	0.07	70	7000	70 000
j	0.000 07	0.07	7	70
k	0.000 000 7	0.000 7	0.07	0.7
l	0.000 25	$\frac{1}{4}$	25	250

- 3** There are 20 litres of a chemical stored in a container.
- a** What amount of chemical remains if 750 mL is removed from the container?
Answer in litres.
- 19.25 L
- b** How many containers are required to hold a kilolitre of the chemical?
- 50 containers
- 4** The length of the Murray River is 2575 km. The length of the Hawkesbury River is 80 000 m. What is the difference in their lengths? Answer in metres.
- 2 495 000 m
- 5** Christopher bought 3 kg of sultanas. What mass of sultanas remains if he ate 800 grams?
Answer in kilograms.
- 2.2 kg
- 6** A truck is loaded with 3000 bricks, each of mass 4 kg. Find the total mass (in t) of the bricks.
- 12 t
- 7** The mass of a box of cereal is 375 g. What is the total mass (in kg) of 15 boxes of cereal?
- 5.625 kg
- 8** Find the total mass (in g) of five items of mass 250 mg, 1100 mg, 0.7 g, 5.95 g, and 15.4 g.
- 23.4 g
- 9** An empty plastic box has mass 750 g. It is packed with 8 bottles of drink, each of mass 1.25 kg. Calculate the total mass (in g) of the packed box.
- 10 750 g
- 10** A cyclist travels to and from work over a 1200-metre long bridge. Calculate the distance travelled in a week if the cyclist works for 5 days. Answer in kilometres.
- 12 km

11 Convert the following.

a 7.2 Gg to t

b 2.9 cg to ng

c 9 kL to mL

7200 t

29 000 000 ng

9 000 000 mL

d 4.3 cm to μm

e 5.3 ms to ns

f 9 kg to mg

43 000 μm

5 300 000 ns

9 000 000 mL

12 Warragamba dam holds approximately 2 580 000 ML of water at full capacity. How many gigalitres is this?

2580 GL

13 A computer can access its memory in 24 ns. Convert this to microseconds.

24 000 μs

14 Tera- (T) is the metric prefix for trillion ($10^{12} = 1\,000\,000\,000\,000$). The distance from Mars to the Sun is 0.228 Tm. Convert this distance to kilometres.

228 000 000 km

15 The mass of a hydrogen atom is 1.67×10^{-24} g. What is the mass in nanograms of 1 million hydrogen atoms?

1.67×10^{-9} ng

16 The total solar energy hitting Australia in one minute is estimated (by ChatGPT) to be 7.22×10^{19} Joules. Australia's annual energy consumption is 6500 Petajoules (10^{18}). Assuming we can harness all the solar energy, for how long would we need to collect solar energy to power the whole country for a year?

$6500 \times 10^{18} \div (7.22 \times 10^{19})$

Around 90 minutes.