

π future: maThs π
infinite: limitless

Whole Number and Fu

π maThs E1 E2 E3 π

π maThs Level 1 & 2 π



11. Metric Measures

Course Content: Choose your topic ...

MATHS L1 to L2

Whole Number and Functions



place value



negative numbers



add and subtract



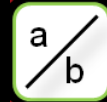
multiply divide



round numbers



ratio scale



fraction



decimal numbers

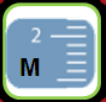


percent



percent decimal fraction

Parts of a whole



metric measure



imperial measure



perimeter



area



volume



formulae bodmas

Measure and Shape



charts data



averages



probability

Handling Data

Topic Introduction : Metric Measurements



Metric
Measurements

The **metric system** is the attempt to use science to produce a set of standard units for measurements that people can agree on and use. These new measurement units should replace the old ones that were created over hundreds and thousands of years where civilisations across the world developed and formed their own and different measurement units and equipment based on a large variety of objects and items.

When you have a very large amount or only a tiny **fraction** of a unit, it can be useful to change the unit to a different one, this keeps the number small or avoids using **decimal** amounts. To do this you will need to learn a set of Latin prefixes that replace the names of the **place values** so ensure you check out this topic first!

Choose an icon to select where to start

2
M



Warm up Exercise 1

1	x	8	=	
2	x	8	=	
3	x	8	=	
4	x	8	=	
5	x	8	=	
6	x	8	=	
7	x	8	=	
8	x	8	=	
9	x	8	=	
10	x	8	=	

1	6	5	9	2	8	7	1
5							
2							
6							
10							
8							
7							
3							
9							
4							

Lets start today by revising ! Complete the above sums and multiplication grid

2
M



Warm up Exercise 2

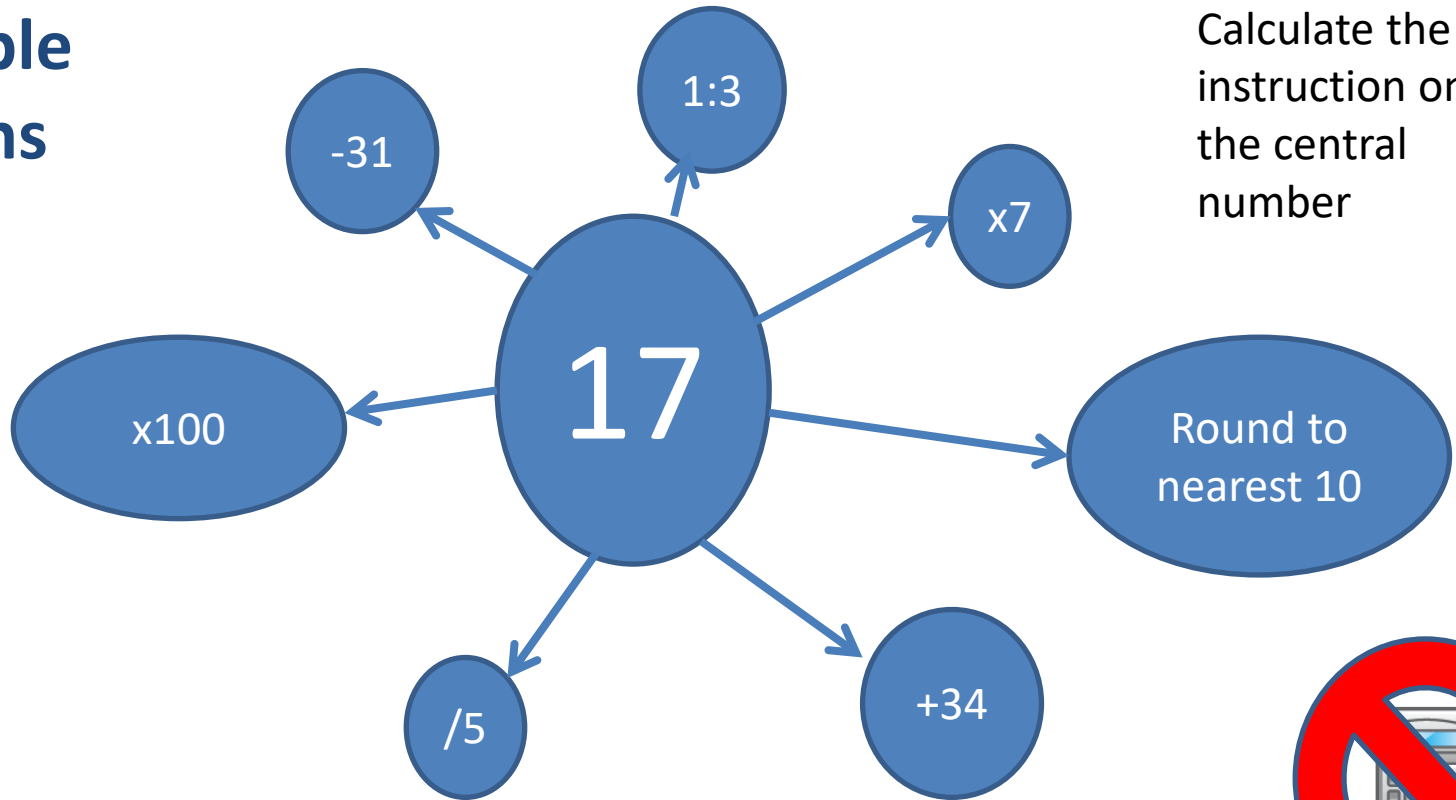
/1000	/100	/10	NUMBER	X10	X100	X1000
			365			
			2567			
			23			
			98765			
			9			
			4.5			
			67.4			

2
M



Warm up Exercise 3

Bubble maths



Calculate the instruction on the central number



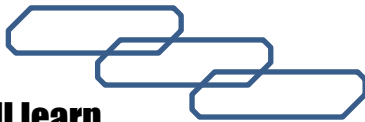


Progress Checker 1

What do you already know about Metric Measures ?

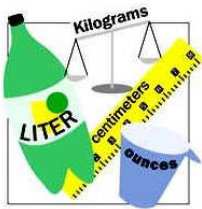
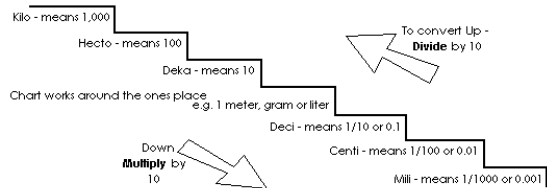
How would you rate your skills in using metric measures?

- 1) Excellent ability
- 2) Good ability, but working to improve
- 3) Ok, making a start but I know I have lots to still learn



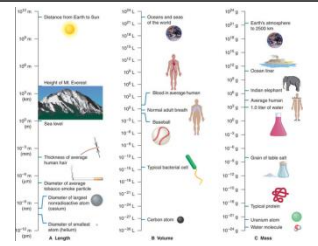
My aims for today **are...**

- A To recognise the correct metric units for lengths, weights and capacity measurements**
- B Replace place value names with Latin prefixes**
- C Convert one metric unit to another to solve practical problems**



THESE PREFIXES MAY BE APPLIED TO ALL SI UNITS

Multiples and Submultiples	Prefixes	Symbols
1 000 000 000 000 - 10 ¹²	tera (tré-á)	T
1 000 000 000 - 10 ⁹	giga (jí-ge)	G
1 000 000 - 10 ⁶	mega (meg-á)	M*
1 000 - 10 ³	kílo (kí-á)	k*
100 - 10 ²	hecto (hék-á)	h
10 - 10 ¹	deka (dék-á)	da
0.1 - 10 ⁻¹	deci (dés-í)	d
0.01 - 10 ⁻²	centi (sén-í)	c*
0.001 - 10 ⁻³	milli (míl-í)	m*
0.000 001 - 10 ⁻⁶	micro (mí-á)	µ
0.000 000 001 - 10 ⁻⁹	nano (nan-á)	n
0.000 000 000 001 - 10 ⁻¹²	pico (pí-á)	p
0.000 000 000 000 001 - 10 ⁻¹⁵	femto (fém-á)	f
0.000 000 000 000 000 001 - 10 ⁻¹⁸	atto (át-á)	a





Introductory Video and Discussion

**How is the metric system of measure different to other systems ?
Why do we have more than one unit of measure eg. mg, kg**

**Is there an easy way of converting between different units ?
What is a 'Conversion table' and where do you find them ?**

**What is the largest unit you can think of, or the smallest ?
Do all countries use the metric system ?**



Watch the introductory video and then discuss the above

Your thoughts..



Vocabulary and Jobs

- Unit** [redacted]
- Deca** [redacted]
- Kilo** [redacted]
- Milli** [redacted]
- Centi** [redacted]
- Deci** [redacted]
- Litre** [redacted]
- Metre** [redacted]
- Gram** [redacted]
- Convert** [redacted]
- Ratio** [redacted]
- Measure** [redacted]
- Metric** [redacted]

- Builder
- Architect
- Designer
- Plumber
- Electrician
- Sports
- Pilot
- Manufacturer
- Carpet fitter

.... Can you think of more?

.....
.....

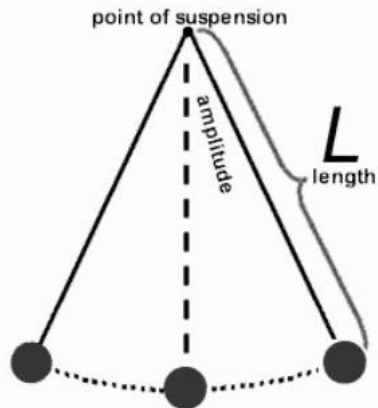
These are the words you will be using in this topic



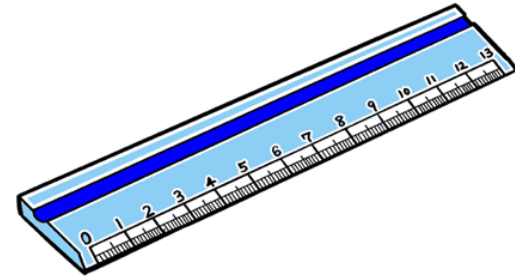


The 'Metre'

The metre is 1 x 10 millionth of the distance from the pole to the equator



A pendulum that swings for 1 second in a single direction has a one metre length

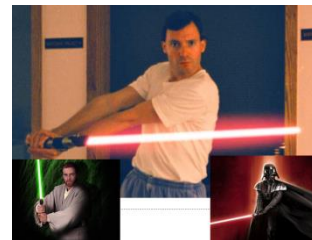


ruler

1 metre long = 100 cm long


Using the speed of light to measure the 'Metre'

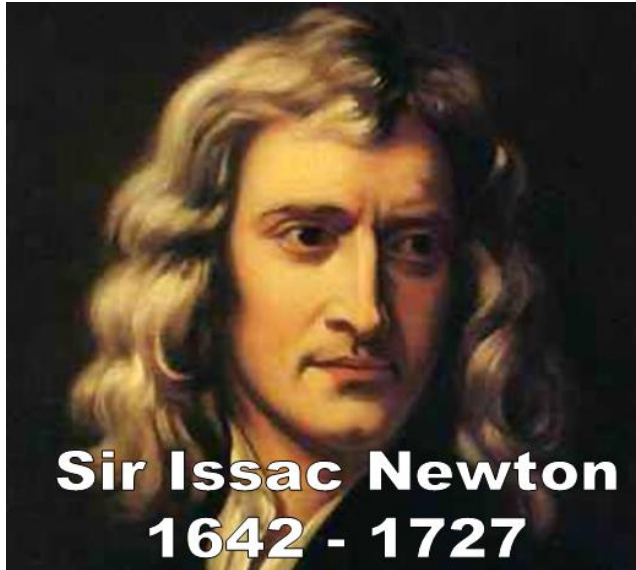
- the length of the path travelled by light in vacuum during a time interval of $1/299,792,458$ of a second.





The 'Gram'

The weight of 1cm³ of water 



Sir Issac Newton
1642 - 1727

Discoverer of Gravity
and that Mass is
attracted to other mass
in the universe



The prototype
'kilogram' in
Paris

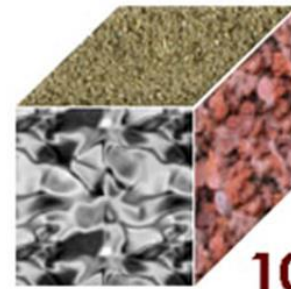




Lesson: Main Teach 3

The 'Litre'

In 1795, the litre was introduced in [France](#) as one of the new "Republican Measures", and defined as one cubic decimetre.

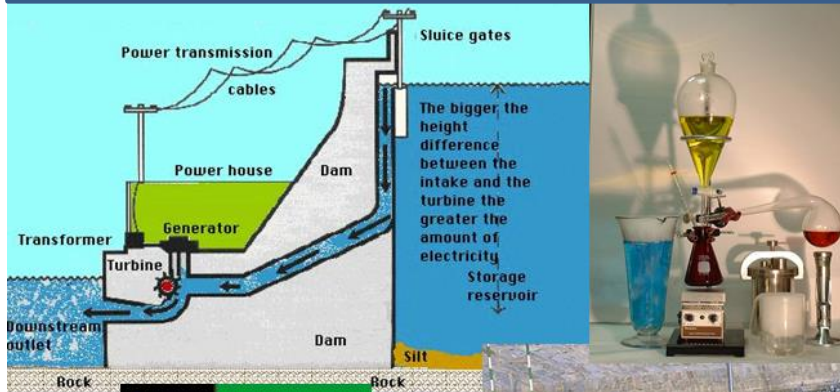


10 cm

Volume
= 1000 cm³
= 1 litre







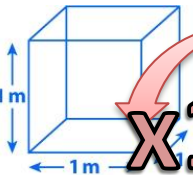


10 cm

10 cm





Lesson: Main Teach 4

<h2>Kilometre</h2> 	<h2>Metre</h2> 	<h2>Centimetre</h2> 	<h2>Millimetre</h2> 
<h2>Kilogram</h2> 	<h2>Gram</h2> 	<p style="text-align: center;">x1000</p>	
<h2>Kilolitre</h2>  <p>$1\text{ m}^3 = 1000\text{ L}$</p>	<h2>Litre</h2> 	<p style="text-align: center;">x1000</p>	
		<h2>Millilitre</h2> 	



Lesson: Main Teach 5

Metric prefixes in everyday use

Text	Symbol	Factor
tera	T	1 000 000 000 000
giga	G	1 000 000 000
mega	M	1 000 000
kilo	k	1 000
hecto	h	100
deca	da	10
(none)	(none)	1
deci	d	0.1
centi	c	0.01
milli	m	0.001
micro	μ	0.000 001
nano	n	0.000 000 001
pico	p	0.000 000 000 001

These are the Latin Prefixes you will need to know and use to be able to convert within the Metric System of Measuring

Do you know any already ??

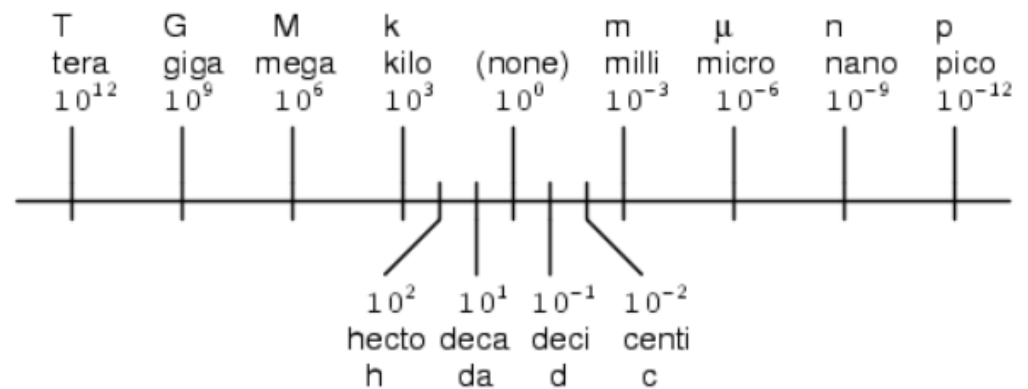
Where have you heard of them??

Why do we use them??

Which ones are used most commonly??



METRIC PREFIX SCALE





Lesson: Main Teach 6

The Metric System of Measures

thousand K	hundred	ten	unit U	Decimal point	tenth	hundredth	thousandth
1000	100	10	1 (Unit)	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1000}$	
Kilo	Hecto	Deca	Metre gram litre	deci	centi	milli	← Latin prefixes

Lets take what we already know about the names of the 'Place Values' and rename each column. We are going to use LATIN to rewrite each column starting with the units column. We then set up a table of the Latin names just like the place value table. When we write in the columns values for how much we have measured we will then be able to move to different columns to read other units very easily.



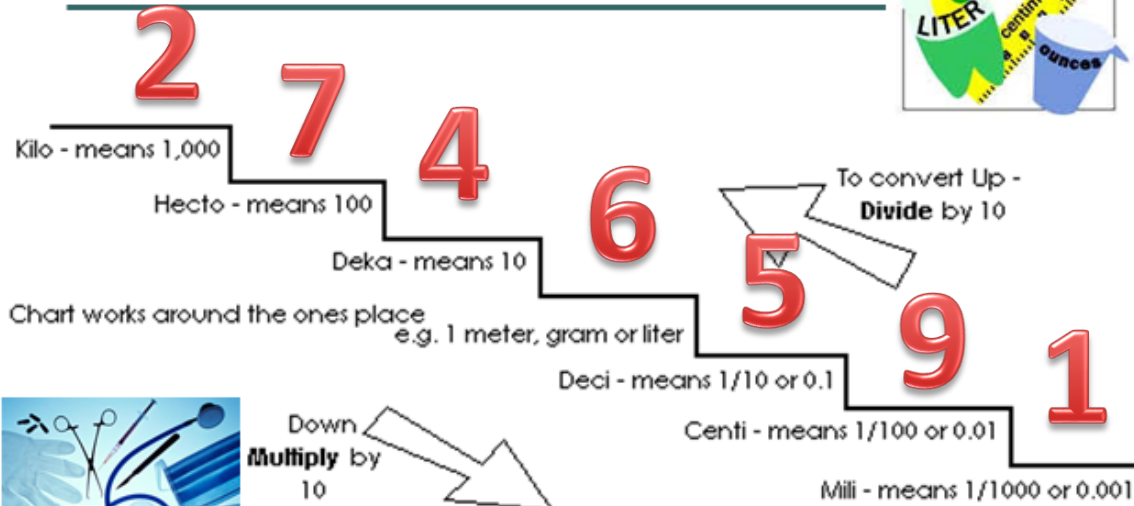
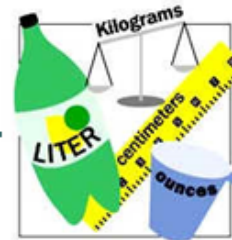
Important learning point: learn the names of each column Kilo, hecto, deca, unit, deci, centi, milli off by heart





Lesson: Main Teach 7

Metric Measurements and Conversions



On the table of metric units left, the unit is either METRE (the standard unit of metric length, GRAM (one of the units for weight) or LITRE (the standard unit of metric capacity). Placing values in different columns shows how many of each unit you have measured. Placing values in more columns means there is more than one way of reading the value

Eg

Lets take the unit to be METRE as we want to measure distance. In the unit column there is a '6'. This means we have measured six metres. Great so far...!!

Now, there is a '4' in the tens column. What does that mean??

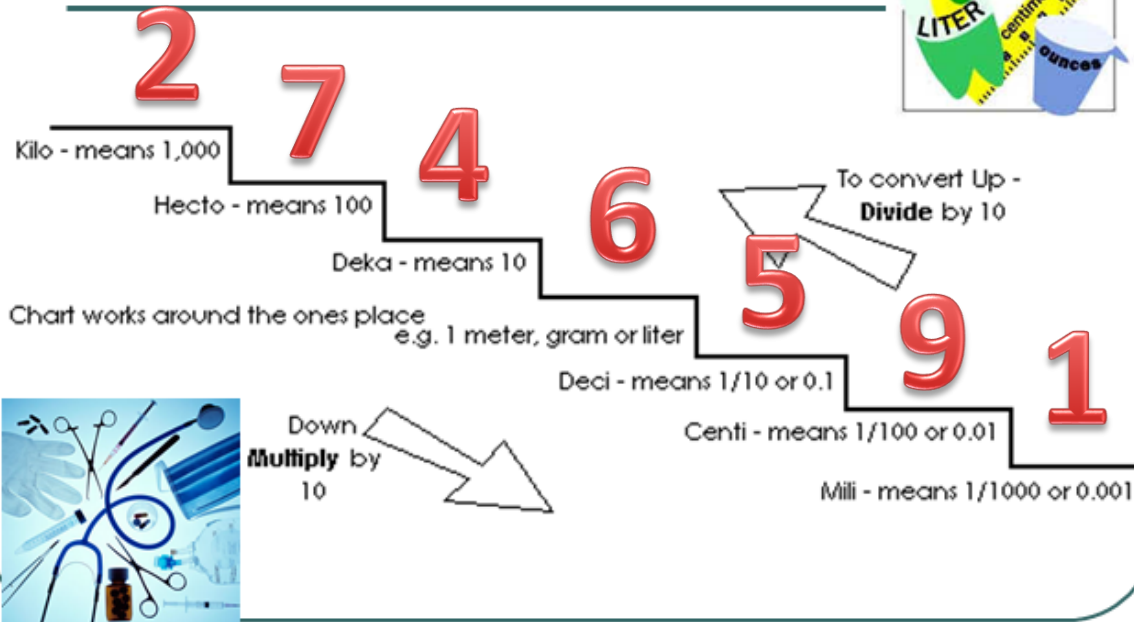
Well, we could say... Four sets of ten metres + six metres = Forty six metres

Or we could say... Four DEKA metres + six metres (another way is 4.6 Deka metres !)



Lesson: Main Teach 8

Metric Measurements and Conversions



Continuing on...

on the left of the 4 and 6 is a 7
what do you have now??

You could say... 7 4 6 metres

or you could say ... 74.6 deka
metres

or you could say... 7.46 hecto
metres

I just depends on which STEP you are
standing on !!

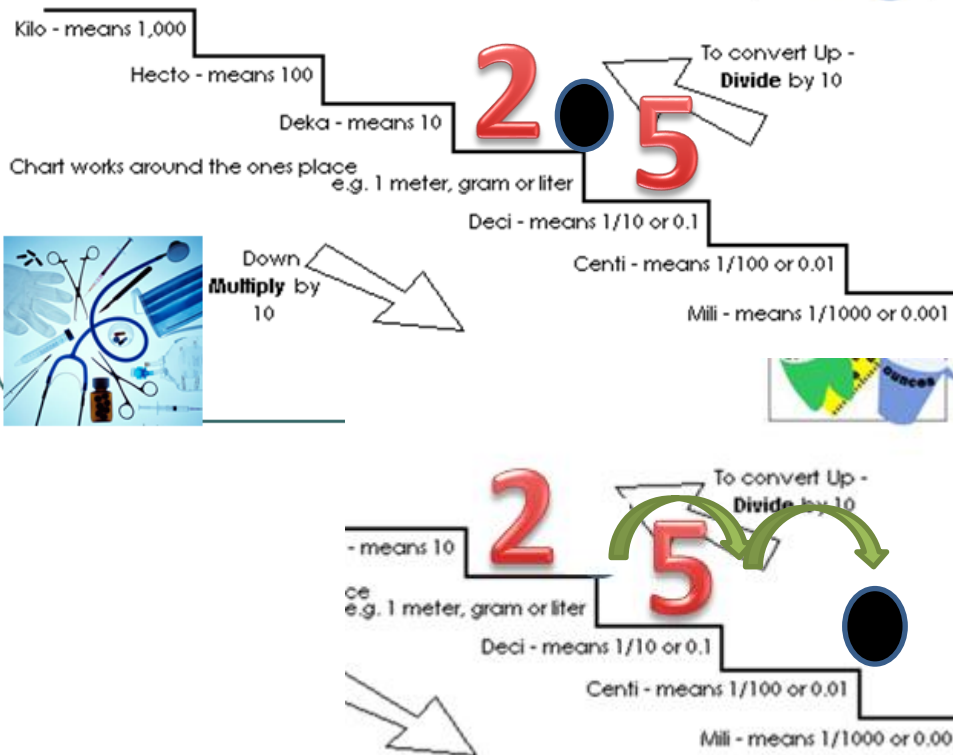
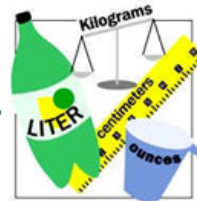
How many Kilo metres are there ??

Well.... on the km STEP there is a 2, great so we have 2 km..... but..... we also have all the other values on the right
So we actually have 2.746591 km



Lesson: Main Teach 9

Metric Measurements and Conversions



Its all about moving a decimal point !

Here we have two and a half metres or 2.5 m

We want to change this to centimetres

Step 1) Set up the table of units to include the one you have (ie metres) and the one you want to move to (ie centimetres)

Step 2) Move the decimal point off the starting step (here it starts on the METRE step) and move it so it is next to and immediately on the right of the new unit (here it moves to CENTIMETRE)

Step 3) Read off you new value looking to the left and right of the decimal point inserting any ZEROS you need on empty place values

THAT'S IT YOU'RE DONE !!



Lesson: Helpful Hints

Metric Unit Order Rules

King Henry Doesn't Usually Drink Chocolate Milk

Kilo	Hecto	Deca	Unit	deci	centi	milli
Thousand	Hundred	Ten	Unit	Tenth	Hundredth	Thousandth
1000	100	10	1	0.1	0.01	0.001

Use the rhyme above to remember the unit prefixes.

Dividing by 10 Rules

Move the decimal point one place to the **left** for each zero when dividing by 10, 100 or 1000 etc...

e.g. $122.75 \div 10 = 12.275$

And

Remove a 0 for each zero when dividing by 10, 100, 1000 etc...

e.g. $122000 \div 100 = 1220$

Multiplying by 10 Rules

Move the decimal point one place to the **right** for each zero when multiplying by 10, 100 or 1000 etc...

e.g. $122.75 \times 10 = 1227.5$

Or

Add a 0 for each zero when multiplying by 10, 100, 1000 etc...

e.g. $122 \times 100 = 12200$

Converting between metric units

Just means
moving the
decimal
point ●

8.2 metres is

820 cm

8200 mm

and

0.0082 km



Lesson: Try out

Block 1 : Watch tutor led demo (in class or on video)

Try these, 1) Which is bigger? Kilometres or Millimetres
3) Kilogram is a measure of capacity / length / weight ?

2) Which is smaller? Centilitres or Litres
4) 1/1000 is Centi / Kilo / Milli

Block 2 : Watch tutor led demo (in class or on video)

Try these, 5) Which is larger? Giga, Milli, Kilo

6) Which is smaller? Micro, Mega, Centi

7) 100cm = M

8) 1000m = KM

9) 1 Kg = g

10) 1 L = ml

11) convert 165g to kg

12) convert 0.55 litres into ml

13) convert 3.78 km into metres

Block 3 : Watch tutor led demo (in class or on video)

Try these, 14) convert 14 decimetres into cm

15) convert 0.23 hectograms into centigrams

16) convert 0.0406 km into mm

17) convert 0.00708 KL into ml



Lesson: Websites and links

A metric conversion website with online conversion formulae

<http://www.metric-conversions.org/>

A metric conversion website with tables and charts

<http://convert.french-property.co.uk/>

A video showing conversions between units

<https://www.khanacademy.org/math/arithmetic/rates-and-ratios/metric-system-tutorial/v/conversion-between-metric-units>

A webpage explaining how to move the decimal point to convert units

<http://www.purplemath.com/modules/metric.htm>

A game of speed matching two measures with the same value but different units

<http://www.sheppardsoftware.com/mathgames/measurement/MeasurementMeters.htm>

A you tube video with powerpoint presentation showing basics and conversions

<http://www.youtube.com/watch?v=UyDMwnkeAwQ>

Online posting a parcel game, measure the length and weight then read the table of prices

http://www.bbc.co.uk/schools/teachers/ks2_activities/maths/measures.shtml



Lesson: Practice – just the numbers

Circle the largest unit

- 1) Kilogram, milligram
- 2) Centimetre, KM
- 3) Gram, KG
- 4) Millilitre, KL

Convert these lengths

- 5) 30cm tom
- 6) 13mm tocm
- 7) 0.4m tocm
- 8) 14m tokm
- 9) 0.56cm tomm
- 10) 0.1km tocm

Convert these weights

- 11) 457g tokg
- 12) 900mg tog
- 13) 0.72 kg tog
- 14) 143mg tog
- 15) 250g tokg

Convert these capacities

- 16) 540 ml to L
- 17) 0.28 KL to L
- 18) 890 ml to L
- 19) 5.49 L to ml
- 20) 0.04 L to ml

Convert these measures

- 21) 210g to hg
- 22) 45 kg to Mega grams
- 23) 0.7 decimetres to cm
- 24) 1/8 litres to ml
- 25) 0.00463 Gigametres to km

Complete the sums

- 26) $6 \times 250 \text{ m} = \dots\dots\dots \text{ km}$
- 27) $9 \times 4 \text{ cm} = \dots\dots\dots \text{ mm}$
- 28) $7 \times 390 \text{ g} = \dots\dots\dots \text{ kg}$
- 29) $5 \times 900 \text{ ml} = \dots\dots\dots \text{ L}$

Complete these sums

- 30) $300 \text{ cm} + 1200 \text{ cm} = \dots\dots\dots \text{ m}$
- 31) $0.9 \text{ L} - 600 \text{ ml} = \dots\dots\dots \text{ ml}$
- 32) $2.4 \text{ km} - 1800 \text{ m} = \dots\dots\dots \text{ km}$
- 33) $5 \text{ g} - 3400 \text{ mg} = \dots\dots\dots \text{ mg}$
- 34) $840 \text{ ml} + 0.2 \text{ L} = \dots\dots\dots \text{ cl}$

Complete these sums

- 35) $0.2 \text{ kg} / 4 = \dots\dots\dots \text{ grams}$
- 36) $2.5 \text{ L} / 5 = \dots\dots\dots \text{ ml}$
- 37) $700 \text{ cm} / 0.35 \text{ m} = \dots\dots\dots$
- 38) $120 \text{ mg} / 0.06 \text{ g} = \dots\dots\dots$
- 39) $1,284,309 \text{ km} / 1000 = \dots\dots\dots \text{ m}$

Round the following measures

- 40) 45.328m to nearest 10 cm
- 41) 1.5459 kg to the nearest gram
- 42) 0.9354 ml to 2dps
- 43) 14.7 mm to the nearest cm



Lesson: Practice – word problems

- 1) Eight laps of a 400m race track is to be run. What is the total distance of the race in km ?**
- 2) Rainfall fills a lake and makes it rise half a centimetre. Before the rainfall the lake had a reading on a flooding scale of 45mm, what is the new reading after the rainfall?**
- 3) To check whether a Christmas tree will fit in a space, the height is measured. The tree is 180cm tall, but the gap was measured in metres as 1.95m. Will the tree fit in the gap ?**
- 4) How many 450ml drinks can be made from a 2.5 litre bottle?**
- 5) I want to add 375 g to my suitcase that already weighs 8.4kg. The weight limit I am allowed to carry on a plane trip is 10kg. Will I be able to add the extra weight to my suitcase?**
- 6) A ton is 1000kg. A lorry is weighed in at 1.84 tons but should be no more than 1.5 tons. How many kilograms needs to be removed from the lorry to ensure it is not overweight?**
- 7) A swimming pool has 600 kilolitres in it. Chlorine is to be added in the ratio that for every 1000 litre of swimming pool water you need 1 ml of chlorine. How many litres of water is in the swimming pool? How much chlorine needs to be added?**



Functional Question - Information

- Nissan Qashqai 1.6 Acenta
- Length 4330mm
- Width 1780mm
- Height 1615mm
- Weight 1830kg
- Wheel Type 430mm
- Fuel Tank capacity 55 litres
- Average fuel economy 21 km per litre





Lesson: Practice – Making it Functional 2

Use the information on the previous page

Functional Question



- 1. You have bought a new Nissan Qashqai. The car park space at work allocated for your vehicle is 2 metres wide x 4 metres long.
- a) Will the new car fit in the space? Give a reason
- b) A colleague has a space that is 50cm wider and longer, could you swap with them? Show your working
- c) Give a reason why you think, Nissan have put all the measurements in mm.



Lesson: Practice – Making it Functional 2

Use the information on previous pages



Functional Question

- 2.a) The maximum fuel capacity for the car is 55 litres. What is the most you could pay for the petrol if it costs £1.40 per litre?
- b) The average fuel economy is 20 km per litre of petrol. You are asked by your boss to go to Leicester (distance 90km). Approximately how much petrol would be used in a return journey from Milton Keynes. How much money would you claim?
- c) You like to put petrol in the tank when it is a quarter full. If you had to do a return journey to Leeds the following day (distance 205km), would you need more petrol? Show your working
- d) Would the answer be different if the fuel economy was 40% less?
- Show your reasoning

TOPIC ANSWERS 1

Block 1 answers

- 1 kilometres
- 2 centilitres
- 3 Weight
- 4 Milli

Block 2 answers

- 5 Giga
- 6 Micro
- 7 1 M
- 8 1 km
- 9 1000g
- 10 1000ml
- 11 0.165 kg
- 12 550ml
- 13 3780m

Block 3 answers

- 14 140cm
- 15 2300cg
- 16 40,600mm
- 17 7,080ml

Just the numbers answers

Circle the largest unit

- 1) Kilogram
- 2) KM
- 3) KG
- 4) KL

Convert these lengths

- 5) 0.3 m
- 6) 1.3 cm
- 7) 400 cm
- 8) 0.014 km
- 9) 5.6 mm
- 10) 100 cm

Convert these weights

- 11) 0.457 kg
- 12) 0.9 g
- 13) 720 g
- 14) 0.143 g
- 15) 0.25 kg

Convert these capacities

- 16) 0.54 L
- 17) 280 L
- 18) 0.89 L
- 19) 5490 ml
- 20) 40 ml

Convert these measures

- 21) 2.1 hg
- 22) 0.045 Mega grams
- 23) 7 cm
- 24) 125 ml
- 25) 4630 km

Complete the sums

- 26) 1.5 km
- 27) 360 mm
- 28) 2.73 kg
- 29) 4.5 L

Complete these sums

- 30) 1.5 m
- 31) 300 ml
- 32) 0.6 km
- 33) 1600 mg
- 34) 104 cl

Complete these sums

- 35) 50 grams
- 36) 500 ml
- 37) 2
- 38) 2
- 39) 1,284,309 m

Round the following measures

- 40) 45.33 m
- 41) 1.546 kg
- 42) 0.94 ml
- 43) 10 mm

Work problems Answers**3.2 km****50mm****Yes****5****Yes****340kg****600,000 litres****0.1 litres of chlorine****Functional Answers**

- 1. a) **No** because the length of the car is more than the parking space. $4\text{m} = 4000\text{mm}$.
- b) **Yes**. The new parking space would be $4.5\text{m} \times 2.5\text{m}$ ($4,500 \times 2,500\text{mm}$)
- c) Any valid reason, eg. **Greater accuracy, easier to read, best to put measurements in one consistent format** etc.

Functional Answers

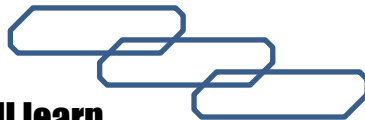
- 2 a) $55 \text{ litres} \times \pounds 1.40 = \pounds 77$.
- b) $90\text{km} \times 2 = 180\text{km}$. At 20km per litre of fuel 180km divided by $20\text{km} = \underline{9 \text{ litres}}$. $9 \text{ Litres} = \pounds 1.40 \times 9 = \pounds 12.60$
- c) **No**. Leicester = 180km and Leeds = 410km . $180 + 410 = 590\text{km}$. 590km divided by 20km per litre = 29.5 litres . 29.5 out of 55 is just over half.
- d) **Yes**. 20km per litre minus $40\% = 12\text{km}$ per litre. 590 divided by $12 = 49.2 \text{ litres}$.



What do you now know about Metric Measures ?

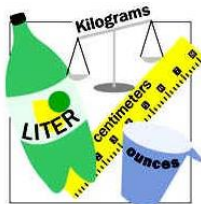
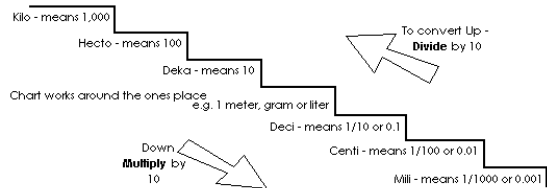
How would you now rate your skills in using metric measures?

- 1) Excellent ability
- 2) Good ability, but working to improve
- 3) Ok, making a start but I know I have lots to still learn

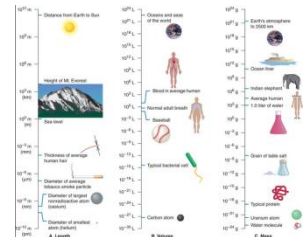


My aims for today were...

- A To recognise the correct metric units for lengths, weights and capacity measurements
- B Replace place value names with Latin prefixes
- C Convert one metric unit to another to solve practical problems



Multiples and Submultiples	Prefixes	Symbols
1 000 000 000 000 - 10 ¹²	tera (tér-á)	T
1 000 000 000 - 10 ⁹	giga (jí-ge)	G
1 000 000 - 10 ⁶	mega (meg-ú)	M*
1 000 - 10 ³	kílo (kí-ú)	k*
100 - 10 ²	hecto (hék-á)	h
10 - 10 ¹	deka (dék-á)	da
0.1 - 10 ⁻¹	deci (dés-í)	d
0.01 - 10 ⁻²	centi (sén-í)	c*
0.001 - 10 ⁻³	milli (míl-í)	m*
0.000 001 - 10 ⁻⁶	micro (mí-ú)	μ*
0.000 000 001 - 10 ⁻⁹	nano (nan-ó)	n
0.000 000 000 001 - 10 ⁻¹²	pico (pí-ú)	p
0.000 000 000 000 001 - 10 ⁻¹⁵	femto (fém-á)	f
0.000 000 000 000 000 001 - 10 ⁻¹⁸	atto (át-á)	a





Continuing to Study and Learn

What else can you do to help yourself to learn and practice? Here are ten suggestions, record which you do each week and also record your progress.

Internet websites

Repeat the lesson, make notes, organise a folder, revise

Own maths workbook

Study together with a friend or family member

Finish activities in this book

Complete class handouts or tasks

Practice exams / past papers

Use maths skills learnt at home or at work in real situations

Play games

Experiment yourself, try new things ask yourself questions



Try making a graph of number of practice methods you use against your progress score in each topic. Are you showing more practice gives better results?