# Anticipation Guide: Metric System

**Before Reading:** In the space to the left of each statement, place a check mark (✓) if you agree or think the statement is true or an (X) if you disagree or think the statement is false.

**During or After Reading:** Add new check marks or cross-through the X’s for which you have changed your mind. Keep in mind that this is not like the traditional “worksheet”. You may have to put on your thinking caps and “read between the lines.” Use the space under each statement to note the **page, column, and paragraph(s)** where you have found information to support your thinking (evidence).

\_\_\_\_ 1. The basic unit of liquid (volume) is the liter.

\_\_\_\_ 2. A paperclip weighs about 1 gram.

\_\_\_\_ 3. A centimeter is 100 meters.

\_\_\_\_ 4. 1 centimeter is 10 millimeters.

\_\_\_\_ 5. A fingernail is about 1 centimeter wide.

\_\_\_\_ 6. Kilometer is abbreviated as mm.

\_\_\_\_ 7. 1000 meters is a km.

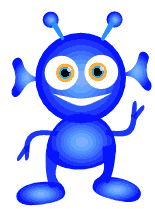
\_\_\_\_ 8. The prefix for billion is “tera”.

\_\_\_\_ 9. The prefix “micro” is written as 0.000001.

\_\_\_\_ 10. The sun is about 1 gigameter wide.

**Measuring Metrically with Maggie**

**An Introduction to Metric Units**



Wow, I just flew in from planet Micron.  It was a long flight, but well worth it to get to spend time with you!

My name is Maggie in your language (but you couldn't pronounce my real name!)

When I first arrived I couldn't understand how you measure things, but my friend Tom taught me all about measurement, and I am going to share with you everything he taught me.

The first thing Tom told me was that you can measure things using two different systems: **Metric** and US Standard.

Today is my day to learn Metric !

Tom says that if I understand 10, 100, and 1000 then I will have a very easy time learning the metric system. I wish I had ten fingers!

## Liquids

|  |  |
| --- | --- |
| orange juice | Since it was such a long flight, the first thing I could use is something cold to drink.  But I want to know how much to ask for! So I can get a drink that is not too big or too small. |

Tom says I only need to know about:

|  |
| --- |
| * **Milliliters** * **Liters** |
| Milliliter | | A **milliliter** (that is "milli" and "liter" put together) is a very small amount of liquid.  Here is a milliliter of milk in a teaspoon. |
| It doesn't even fill the teaspoon! | | |

Tom says if you collect about 20 drops of water, you will have 1 milliliter:

|  |  |  |
| --- | --- | --- |
| 20 drops of water | droplet | make about 1 milliliter |

And that a teaspoon can hold about **five** milliliters:

|  |  |  |
| --- | --- | --- |
| 1 full teaspoon of liquid | Teaspoonful | is about 5 milliliters |

Milliliters are often written as ml (for short), so "100 ml" means "100 milliliters".

But a milliliter is definitely not enough for someone who is thirsty! So Tom told me about liters.

|  |  |
| --- | --- |
| liter water | A **liter** is just a bunch of milliliters put all together. In fact, 1000 milliliters makes up 1 liter.  1 liter = 1,000 milliliters  This jug has exactly 1 liter of water in it.  Liters are often written as L (for short), so "3 L" means "3 Liters". |

Milk, soda and other drinks are often sold in liters.

Tom says to look on the labels, so the next time you are at the store take a minute and check out how many liters (or milliliters) are in each container!

Now I know that a milliliter is very small, and a liter is like a jug in size, I think I will ask for half a liter of juice!

So this is all you need to know:

**1 Liter = 1,000 Milliliters**

## Mass (Weight)

Next I wanted to eat some chocolate ... so I should learn about mass. You often call it "weight", but it is only because of the gravity on your planet that items have weight!

Tom tells me that to understand mass, I should know these three terms:

|  |
| --- |
| * **Grams** * **Kilograms** * **Tonnes** |

Grams are the smallest, Tonnes are the biggest.

Let’s take a few minutes and explore how heavy each of these is.

### Grams

|  |  |
| --- | --- |
| paperclip | A paperclip weighs about 1 gram.  Hold one small paperclip in your hand. Does that weigh a lot? No! A gram is very light. That is why you often see things measured in hundreds of grams. |

Grams are often written as g (for short), so "300 g" means "300 grams".

|  |  |  |
| --- | --- | --- |
| Tom tells me a loaf of bread weighs about **700 g** |  | http://www.mathsisfun.com/measure/images/bread-loaf.jpg |

### Kilograms

Once you have 1,000 grams, you have 1 **kilogram**.

|  |  |
| --- | --- |
| 1 kilogram = 1,000 grams  A dictionary has a mass of about one kilogram. | Dictionary |

Kilograms are great for measuring things that can be lifted by people (sometimes very strong people are needed of course!).

|  |  |
| --- | --- |
| bathroom-scales | Kilograms are often written as kg (that is a "k" for "kilo" and a "g" for "gram), so "10 kg" means "10 kilograms".  When you weigh yourself on a scale, you would use kilograms. Tom weighs about 40 kg. How much do you weigh? |

But when it comes to things that are **very** heavy, we need to use the tonne.

### Tonne

Once you have 1000 kilograms, you will have 1 tonne.

1 tonne = 1,000 kilograms

|  |  |
| --- | --- |
| car | Tonnes (also called Metric Tons) are used to measure things that are very heavy.  Things like cars, trucks and large cargo boxes are weighed using the tonne.  This car has a mass of about 2 tonnes. |

Tonnes are often written as t (for short), so "5 t" means "5 tonnes".

Final thoughts about mass:

**1 kilogram = 1,000 grams**

**1 tonne = 1,000 kilograms**

## Length

|  |  |
| --- | --- |
| carpenter's rule | Measuring how long things are, how tall they are, or how far apart they might be are all examples of length measurements. |

Tom says I should know about:

|  |
| --- |
| * **Millimeters** * **Centimeters** * **Meters** * **Kilometers** |



Small units of length are called **millimeters**.

A millimeter is about the **thickness** of a plastic id card (or credit card).

Or about the thickness of 10 sheets of paper on top of each other.

This is a very small measurement!

### Centimeters

|  |  |
| --- | --- |
| fingers | When you have something that is 10 millimeters, it can be said that it is 1 centimeter.  1 centimeter = 10 millimeters  A fingernail is about **one centimeter wide**. |

You might use centimeters to measure how tall you are, or how wide a table is, but you would not use it to measure the length of football field. In order to do that, you would switch to meters.

### Meters

|  |  |
| --- | --- |
| 1 meter | A **meter** is equal to 100 centimeters.  1 meter = 100 centimeters  The length of this guitar is about 1 meter  Meters might be used to measure the length of a house, or the size of a playground. |

### Kilometers

|  |  |
| --- | --- |
| roads | When you need to get from one place to another, you will need to measure that distance using kilometers. A kilometer is equal to 1,000 meters.  The distance from one city to another or how far a plane travels would be measured using kilometers. |

Final thoughts about measuring length:

**1 centimeter = 10 millimeters**

**1 meter = 100 centimeters**

**1 kilometer = 1000 meters**

## Temperature

|  |  |
| --- | --- |
| thermometer | I was feeling a bit hot, so I asked Tom how to measure [temperature](http://www.mathsisfun.com/temperature-conversion.html).  So he showed me a [thermometer](http://www.mathsisfun.com/measure/thermometer.html)**.** But I saw **2 sets of numbers**!  Tom explained that a thermometer measures in degrees (°) of either **Celsius or Fahrenheit**.  *"Why two scales?", I asked.*  *Tom said that some people like one scale and some like the other, and that I should learn both!*  He then gave me an example: when water freezes the thermometer shows:   * **0 degrees Celsius** on the left side, * but on the right side it shows **32 degrees Fahrenheit**.   So there can be two numbers for the same thing! |

He gave me more examples.

* A hot sunny day might have a temperature of **30 degrees Celsius** but would be **86 degrees in Fahrenheit**.
* Water boils at **100 degrees Celsius** or **212 degrees Fahrenheit**.
* And you can bake cookies in your oven at a temperature of **180 degrees Celsius**, but that would be **356 degrees Fahrenheit**.

I decided to get my own thermometer, so I would learn about all this.

In the **Metric System** there are standard ways of talking about big and small numbers:

* "kilo" for a thousand,
* "mega" for a million,
* and more ...

|  |  |
| --- | --- |
| long rope | Example: A long rope measures one thousand meters It is easier to say it is 1 **kilo**meter long,  and even easier to write it down as **1 km**. |

In that example we used ***kilo*** in front of the word ***meter*** to make *"****kilometer****"*.

And the abbreviation is "***km***" (***k*** for kilo and ***m*** for meter, put together).

Here are some more examples:

Example: You put your bag on a set of scales and it shows 2000 grams, we can call that 2 kilograms, or simply 2 kg.

Example: The doctor wants you to take 5 **thousandths** of a liter of medicine (a thousandth is one thousand times smaller), he is more likely to say "take 5 **milli**liters", or write it down as **5 mL**.

"kilo", "mega", "milli" etc are called "prefixes":

**Prefix**: a word part that can be added to the beginning of another word to create a new word

So, using the prefix "milli" in front of "liter" creates a new word "millilter".

Here we list the prefix for commonly used big and small numbers:

## Common Big and Small Numbers

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **The Number** | **Prefix** | **Symbol** |
| trillion | 1,000,000,000,000 | tera | T |
| billion | 1,000,000,000 | giga | G |
| million | 1,000,000 | mega | M |
| thousand | 1,000 | kilo | k |
| hundred | 100 | hecto | h |
| ten | 10 | deka | da |
| **unit** | **1** |  |  |
| tenth | 0.1 | deci | d |
| hundredth | 0.01 | centi | c |
| thousandth | 0.001 | milli | m |
| millionth | 0.000 001 | micro | µ |
| billionth | 0.000 000 001 | nano | n |
| trillionth | 0.000 000 000 001 | pico | p |

 Just remember for large values (each one a thousand times bigger):

"kilo mega giga tera"

and for small values (each one a thousand times smaller):

"milli micro nano pico"

### Try To Do Some Yourself!

* How would you refer to a million liters?
* How about one **billionth** of a meter?

See the bottom of this page for more questions to challenge yourself ...

## Much Bigger and Smaller

There are also prefixes for much bigger and smaller numbers:

here are also prefixes for much bigger and smaller numbers:

## Some Very Big, and Very Small Numbers

|  |  |  |  |
| --- | --- | --- | --- |
| **Name** | **The Number** | **Prefix** | **Symbol** |
|  | Very Big ! |  |  |
| septillion | 1,000,000,000,000,000,000,000,000 | yotta | Y |
| sextillion | 1,000,000,000,000,000,000,000 | zetta | Z |
| quintillion | 1,000,000,000,000,000,000 | exa | E |
| quadrillion | 1,000,000,000,000,000 | peta | P |
|  | Very Small ! |  |  |
| quadrillionth | 0.000 000 000 000 001 | femto | f |
| quintillionth | 0.000 000 000 000 000 001 | atto | a |
| sextillionth | 0.000 000 000 000 000 000 001 | zepto | z |
| septillionth | 0.000 000 000 000 000 000 000 001 | yocto | y |

### length continuum

## All Big Numbers We Know

|  |  |  |
| --- | --- | --- |
| **Name** | **As a Power of 10** | **As a Decimal** |
| Thousand | 103 | 1,000 |
| Million | 106 | 1,000,000 |
| Billion | 109 | 1,000,000,000 |
| Trillion | 1012 | 1,000,000,000,000 |
| Quadrillion | 1015 | etc ... |
| Quintillion | 1018 |  |
| Sextillion | 1021 |  |
| Septillion | 1024 |  |
| Octillion | 1027 |  |
| Nonillion | 1030 |  |
| Decillion | 1033 |  |
| Undecillion | 1036 |  |
| Duodecillion | 1039 |  |
| Tredecillion | 1042 |  |
| Quattuordecillion | 1045 |  |
| Quindecillion | 1048 |  |
| Sexdecillion | 1051 |  |
| Septemdecillion | 1054 |  |
| Octodecillion | 1057 |  |
| Novemdecillion | 1060 |  |
| Vigintillion | 1063 |  |

## All Small Numbers We Know

|  |  |  |
| --- | --- | --- |
| **Name** | **As a Power of 10** | **As a Decimal** |
| thousandths | 10-3 | 0.001 |
| millionths | 10-6 | 0.000 001 |
| billionths | 10-9 | 0.000 000 001 |
| trillionths | 10-12 | etc ... |
| quadrillionths | 10-15 |  |
| quintillionths | 10-18 |  |
| sextillionths | 10-21 |  |
| septillionths | 10-24 |  |
| octillionths | 10-27 |  |
| nonillionths | 10-30 |  |
| decillionths | 10-33 |  |
| undecillionths | 10-36 |  |
| duodecillionths | 10-39 |  |
| tredecillionths | 10-42 |  |
| quattuordecillionths | 10-45 |  |
| quindecillionths | 10-48 |  |
| sexdecillionths | 10-51 |  |
| septemdecillionths | 10-54 |  |
| octodecillionths | 10-57 |  |
| novemdecillionths | 10-60 |  |
| vigintillionths | 10-63 |  |