VISIT MATH

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Unit conversion

Topic	Arithmetic
Learning objectives	Metric system conversion, square and cubic meters, conversion of different units
Age group	10-14 years (to be adapted in each country)
Estimated duration	2h
Activities	Converting older units to more recent ones
Related visits	Agrinio, Boulogne S/ Mer, Gand, Lille, Montauban, Namur, Paris, Tournai

Previous knowledge required

Basic knowledge of fractions

Step by step: the sequence in the classroom

Step 1: Introducing the topic

Short presentation of the heritage elements in this sequence

Meters, inches, miles, nautical miles, litres... Most of these names must mean something to you, perhaps not all of them. And there is a reason why: defining the basic measurement system is, after all, quite subjective, and various people throughout history have designed what they saw as perfect systems, while sometimes contradicting themselves.

Although most of the world uses the metric system today, some countries (like the US or the UK) prefer alternative systems, such as the U.S. customary units or the imperial system. In fact, since the invention of the meter as a standardised unit is rather recent (it dates back to the 1860's), you can imagine how difficult it could be for people from different countries to compare measures.

In addition, these units do not always use the decimal numeral system: for example, in the old Spanish inch was 1/12 of a foot, which was itself 1/6 of a toise. In Greece, a finger was 1/16 of a foot, and in Italy, an ounce would be 1/12 of a pound although

the weight of the pound could vary between 310 to 340 grams depending on the state it was measured in!
And yet, the name of some of these units have stuck with us – although their meaning can have been altered to fit our metric system. A pint is technically 0,58 litres but has been rounded down to 0,5 litres for practical purposes, and the mile is still used in some countries although its length may vary.

Links between these elements and math topics

Unit conversion relies a lot on fractions and asks pupils to be rigorous when answering a problem: their results must be written with the right unit (or else they do not mean anything). Pupils must learn how to convert centimetres to metres but also cubic centimetres to litres for examples. Conversions can also be applied to other units that use other systems than base ten, so that pupils can learn how to get an idea about lengths, areas or volumes in other countries. This principle could also go as far as learning about the link between different currencies outside Europe.

Step 2: Class activities

For the teachers: here are some hands-on activities that you can use in class. You may use them and adapt them as you see fit!

Why is it important to convert units?

Units are commonly used in our everyday life. There are plenty of them: your size is in metres and centimetres, a bottle of water is in litres, you drive in kilometres per hour and you weigh a certain amount of kilogrammes.
All the numbers you put before the unit of measurement make sense only because you wrote down the unit. Saying you are 1,3 high or that you had to pay 50 at the supermarket does not make any sense: the unit of measurement is necessary.
In addition, if you want to add or subtract quantities, you need to make sure that they are both on the same unit. You cannot add litres and kilogrammes!

How can one convert units?

First of all, you have to make sure that you are talking about the same thing: mass, volume, speed, etc. Then, use a table like this one to get organised.

km	hm	dam	m	dm	cm	mm

Each unit in this table is equal to ten times the one on its right. One metre is equal to 10 decimetres, one hectometre is equal to 10 decametres. Therefore, one kilometre is equal to 10x10x10=1000 metres and one decimetre is equal to 10x10=100 millimetres.

By using the same logic, each unit is equal to a tenth of the one on its left. One metre is equal to 0,1 or 1/10 decametre, and one decimetre is equal to 0,001 or 1/10x1/10x1/10=1/1000 hectometre.

Application

Using that same logic, convert:

36 kilometres into metres:

1,745 litres into decilitres:

198/10 decagrams into centigrams:

155 decagrams into kilograms (use both the fraction and decimal forms):

0.5 centimetres into decimetres (use both the fraction and decimal forms):

1903/100 millilitres into litres (use both the fraction and decimal forms):

To go further

Square metres do not convert the same way. Indeed, each unit in the following table is equal to 100 times the one on its right, and 1/100 or 0,01 times the one on its left.

km^2		hm^2		dam^2		m^2		dm^2		cm^2		mm^2	

Did you know? Although the names “square hectometre” and “square decametre” probably do not mean a lot to you, they are also known as much more frequently used names: hectares and ares.

Application

Now, how would you convert the following measurements?

1 square metre into square centimetres:

52 square hectometres into square decametres:

315/10 square centimetres into square millimetres

61 ares into square kilometres (use both the fraction and decimal forms):

741,5 square decimetres into hectares (use both the fraction and decimal forms):

991/1000 square centimetres into square decimetres (use both the fraction and decimal forms):

85 square metres into kilometres (use both the fraction and decimal forms):

Quick note for the teacher: the last question of the previous exercise is a trick question, the units are not the same!

Cubic meters also observe specific rules. This time, each unit is equal to 1000 times the one on its right and 1/1000 or 0,001 times the one on its left.

km^3			hm^3			dam^3			m^3			dm^3			cm^3			mm^3		

Did you know? One litre is equal to one cubic decimetre.

Application

Convert the following measurements:

36 cubic hectometres into cubic decametres:

85,129 cubic metres into cubic centimetres:

96/10 cubic centimetres into cubic millimetres:

0,75 cubic hectometres into cubic kilometres (use both the fraction and decimal forms):

43/10 cubic millimetres into cubic centimetres (use both the fraction and decimal forms):

1 litre into square metres (use both the fraction and decimal forms):

The imperial unit system

Converting units does not always mean you have to multiply or divide by multiples of 10. Some unit systems, like the imperial system in England, tend to use multiples of 3 or 12 for example.

Did you know ? The imperial units come from another older unit system called the Winchester measures. And before that? Well, there were Anglo-Saxon units, which were derived from Roman ones, etc. When measuring things, there is only one rule: to ensure that everyone is working with the same units!

The imperial unit system would look like this:

League	Mile	Furlong	Chain	Yard	Foot	Inch

x 3 | x 8 | x 10 | x 22 | x 3 | x 12

For example, a mile would be 8 furlongs, 80 chains or 1760 yards long. Therefore, a yard would be 1/1760 of a mile!

Although the imperial system is not used in European countries anymore, it still is in England or in the US. Furthermore, old measurement systems looked a lot like this before metres were created!

Application

Convert the following measurements:

2 miles in chains:

3.5 yards in inches:

4 yards in furlongs:

1 inch in leagues:

From the metric system to the imperial system

Converting from the metric to the imperial system can sometimes be quite tricky. In order to keep things simple, you may consider that a foot is 3/10 of a meter.

Application

Bearing that in mind, convert the following measurements:

1 meter into feet:

3 centimetres into inches:

2,5 decametres into chains:

5 hectometres into leagues:

Step 3: Homework and development ideas

We may not always realis e it, but we often face situations where we need to convert units.

Holiday trips

For example, you may need to convert currencies. Indeed, all countries in the European Union do not necessarily use the Euro as a currency.
Swedish crowns (1 crown is approximately equal to 1/11 of one Euro).
Now imagine you are planning a trip to Sweden. All the following prices will be given in crowns, turn them into euros to create your budget!

First you need to book a room in a hotel: it will cost you 3000 crowns for 3 days.
Then you need to plan for transportation from and to the airport: 50 crowns for one bus ticket.
Plan out your food: six meals at the restaurant will cost about 500 crowns per meal.
How about souvenirs? They would cost a total of 250 crowns.
How much would that cost in euros?

Imagine you are planning a trip to Poland this time.
Polish zloty (1 zloty is approximately equal to 1/5 of one Euro)
The hotel room for 3 days would cost you 140 zloty per night.
A bus ticket would cost you 3,4 zloty.
Eating in a restaurant for six meals would cost you about 30 zloty for each meal.
Finally, you can buy your family gifts for about 50 zloty!
How much would this trip cost in euros?

The recipe

Do you want to cook? Here are the ingredients for a yummy chocolate cake!

7 ounces of butter

7 ounces of sugar

4 eggs

5 ounces of flour

2,5 ounces of cocoa powder

2 tablespoons of baking powder

14 ounces of cigarillos

One 8-inch round cake tin.

Can you turn all the quantities into the metric system? One gram is 1/28 of an ounce.

Once you are done, you can check the full recipe here:

https://www.bbc.co.uk/food/recipes/i_cant_believe_you_made_90494

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