Converting Units in Context

Overview

In this activity students make a variety of measurements related to realistic contexts and use them to perform calculations that involve converting between units of measurement. The various questions should stimulate engaging discussion and encourage estimation, and visualisation of measurements.

Skills and Knowledge

- Using common measuring tools
- Estimating and visualising measurements
- Converting between units of measurement
- Multiplying and dividing with measurement units

Preparation and Materials

- Select several of the questions on Activity Sheet 1
- Collect appropriate equipment for a practical approach to the questions, e.g. cm tape measures, large drink bottles, glasses and measuring jug, coins and rulers or milk cups, a teabag and measuring cup
- Calculators (optional)
- Photocopy Activity Sheet 1 (1 per pair of students) (optional – see alternative procedures below)
- Photocopy Activity Sheet 2 (one per student)
- Download one or two authentic house plans from the internet (optional for Activity Sheet 2).

Suggested Procedure

This activity could be done in several ways, depending on the size of the group and the amount of equipment available.

Method 1: A 'stations' approach

Set up the equipment for each of the questions you have selected in different positions around the room. For example you could put a large drink bottle and glasses on one table; a few coins on another, a carton of milk, teabags and cups on another, etc.

Put the appropriate measuring equipment such as tape measures, rulers, measuring cups on a separate table (so that students will have to select the equipment they need for each task).

Arrange students into pairs.

Give each pair a copy of Activity Sheet 1.

Ask them to move around the tables and perform the measurements needed to answer as many of the questions as they can.

Remind them to replace the measuring equipment at the front when they have completed each task.

If the class is quite large, and the equipment insufficient for all to use it at once, then some of the class could start with Activity Sheet 1 (also working in pairs) while others take measurements. They would then change places.

Circulate while students are doing the measurements and encourage them to think about the strategies they will use.

Method 2: A whole class 'scaffolded' approach

Begin by posing the first question you have selected. For example question 1.

Ask:

- *If everyone in this room lay head to toe, how far do you think we would stretch?*
- *Would anyone like to make a guess?*
- *Can everyone write down a rough guess on their own paper?*

The next step is to encourage students to think of a strategy for finding the actual answer.

Explain:

- *Now we have to work it out more exactly.*
- *Arrange yourself into pairs and discuss how we could do it.*

Take suggestions from the students and organise them to make the appropriate measurements.

Depending on the question(s) selected, this could involve:

- measuring the heights of all the people in the room
- deciding on an appropriate sized drink from the bottle by pouring into a glass and measuring its volume
- measuring the diameter or thickness of a ten cent coin, or several silver coins
- making a cup of tea and gradually adding milk (in measured amounts) until it looks the right colour
- timing how long it takes to walk a measured distance, e.g. 20 metres.

Doing the calculations

When appropriate measurements are made discuss what calculations you will need to do.

Answers will depend on the question. For example:

- add all of the heights together
- multiply the time for washing one glass
- multiply the thickness of the ten cent coin
- divide the volume of the drink bottle by the volume of the glass

Note: Since many adults avoid dividing, some students may suggest an alternative strategy, such as adding or multiplying until you get reach the volume in the bottle.

This is also acceptable, but you may want to explore dividing with a calculator as well.

Encourage students to use estimation techniques with rounding, before doing the exact calculations.

Apart from division, the actual calculations could be done with or without calculators, depending on the needs of your students.

Interpreting the answers - converting units

Large numbers of small units

When the multiplications or additions have been done you are likely to have a very large number that would be very hard to visualise or interpret meaningfully.

For example, the people in the room could stretch between 2,700 – 3,400 cm or more.

Do not let students waste time on complex 'long division' calculations (eg ÷ 220 ml) which would divert from the focus of the activity and are not recommended in most adult numeracy curriculum documents.

Ask:

- *Is this number of centimetres easy to imagine or make sense of?*
- *How could we turn this into something that we can visualise better?*

Hopefully students will suggest changing this to metres, to get a better sense of the length.

Encourage them to use in the head methods for dividing by 100, rather than using calculators.

Meaning of remainders or decimal parts

For some calculations there will be a remainder or a decimal part in the answer.

It is useful to discuss what this means in a real context like this. For example:

> *If all the people in the room stretched to 2,465 cm.*
> *2,465 cm becomes 24.65 m.*

Ask: *What does this .65 mean?*

Ensure students understand that it is .65 of a metre, $\frac{65}{100}$ of a metre, or 65 centimetres.

This interpretation is also important for calculations which initially involve division. For example:

> *'How many drinks can we pour from this 2 litre soft drink bottle?'*

Suppose 180 ml was decided to be a reasonable size for a soft drink.

> 2 litre = 2,000 ml
>
> 2,000 ÷ 180 = 11.11111

Ask:

- *How many whole drinks can we pour?*
- *What does this .11111 mean?*

Ensure students understand that this means there is a small amount of a drink left in the bottle. If you wish to be more exact you could discuss rounding off the decimal so it is around $\frac{11}{100}$ of a drink left over.

Decimal parts closer to .5 should be interpreted as about half a drink.

For example, *a 190 ml drink would give a result of 10.526 ...*

Encourage rounding to 10.5 and interpreting the result as 10 $\frac{1}{2}$ drinks as this is meaningful in this context.

Continue with other choice questions as a whole class, encouraging students to take on a greater role in suggesting methods as you go.

Extensions for Activity Sheet 1

Activity Sheet 1 contains three extension questions. These are open-ended questions which are designed to engage students in thinking a little more about strategies before they get started, as well as engaging them in measuring, calculating and converting units.

They are suitable for use with more advanced or independent students working in pairs or small groups, or as an example of problem solving if using a whole class approach.

Discussion and decisions would be likely to involve:

- How to accurately measure the length of your normal walking 'steps'?
- What size of 'drip' is typical for a dripping tap?
- How long to time it for a reasonable estimate?
- Where could you find out about other water use facts, like how much water is used in a typical load of washing?
- The proportions of each silver coins you might expect in the kilometre or coins.
- Whether to calculate a minimum and maximum and present the answer as a range or possibilities?

Introducing Activity Sheet 2

Distribute some copies of house plans that you have located from the internet so that students can see how measurements are represented on them.

Explain:

> *On house plans used by architects and builders the measurements are always shown in millimetres. This makes it difficult for many people to visualise because they do not normally think in millimetres.*

Select one longer measurement and one shorter from the plan and discuss how they could be converted to centimetres or metres to be able to visualise them better.

Model an approach which relies on knowledge of metric units and thinks about the calculation, rather than blindly following rules.

For example:

> *If the length on the plan is 3,250 mm*
>
> *That is a bit more than 3,000 mm – which we know is 3 metres*
>
> *So the length is 3 metres plus a bit. It must be 3.250 metres*
>
> *Once it is written this way it is easy to imagine that it could be the width of a small classroom.*

Distribute Activity Sheet 2 to students in pairs and ask them to work through the measurements together, discussing what they could represent as they go.

Converting units in context

Activity Sheet 1

Question	Guess	Measurement & Calculations	Final answer
1. If everyone in the room lay head to toe, how far would we stretch?			
2. How many drinks could you pour from this bottle?			
3. How many cups of white tea could you make with a carton of milk?			
4. How long would a line of 1,000 ten cent coins stretch?			
5. What would a bag of 50 potatoes weigh?			
6. How many minutes will it take you to walk a kilometre?			
7. How many litres of water are used when a tap runs for a minute?			
8. How long would it take to wash and dry 10 frozen glasses?			
9. How high would a stack of 50 ten cent coins reach?			

Extension Questions:

1. If you walked 10,000 in a day, how far would that be?

2. How much water is wasted by a dripping tap
   - in a day?
   - in a week?
   - in a month?

   How could you describe your findings in a campaign to persuade people to fix their taps? For example, it would be enough water for … baths, or … loads of washing, or …

3. Imagine a trail of coins at a school fundraiser. What might a kilometre of silver coins be worth? Of gold coins?

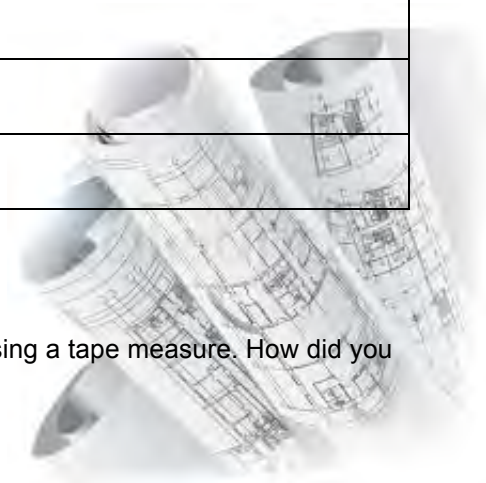
Converting units in context

Activity Sheet 2

All of the measurements below came from a house pan. Rewrite them in metres or centimetres so that they are easier to 'see' or visualise.

When you have converted the measurement, work with a partner to think of at least one item in a house that the measurement might have come from.

Measure in mm	Measure converted to cm or m	Possible part of house
Examples: *5,460 mm* *70 mm*	*5.460 m* *7 cm*	*Length of a sitting room* *Width of a skirting board*
750 mm		
1 600 mm		
590 mm		
4 500 mm		
33 mm		
1 805 mm		
2 030 mm		
935 mm		
6 050 mm		
2 005 mm		
1 205 mm		
103 mm		



Check at least five of your estimated house parts at home using a tape measure. How did you go?