

## **Challenging topics**

### **Using millimetres and metres**

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### Introduction

The ability to convert between millimetres and metres is important in many contexts in the workplace. The construction industry uses millimetres extensively so, to function effectively in this environment, learners will have to be able to use this unit of measure. The same industry also uses metres, so the ability to convert from one set of units to the other becomes important, despite the fact that some learners are intimidated by the size of measurements that are made in metres but recorded in millimetres.

The same issue arises in the theatre when locations on the stage are given in millimetres but the dimensions of the auditorium are given in metres.

Similarly, when equipping an office, a playschool or a workshop, learners may find that the dimensions of the space are given in metres but the equipment is measured in millimetres.

### Learning objectives/outcomes

To help learners to:

- convert measurements in millimetres to measurements in metres
- understand how to represent metric measurements as decimals.

### Resources required

Overhead projector (OHP), whiteboard or flipchart to record feedback from the whole class.

For each learner you will need:

- mini-whiteboard and felt tip pen
- **Sheet 2: Examples from the workplace: anything wrong?**

For each small group of learners you will need:

- 30 cm ruler
- Card set A – Core conversions
- Card set B – More conversions (3 pages)
- **Sheet 1: Solution to hexagonal jigsaw** (optional).

You will need to cut up card sets A and B before the session.

## Starting points

Learners should have already used metric measurements. They are most likely to have practical experience of measuring in centimetres (cm) using a 30 cm ruler. However, in some industries like construction, millimetres (mm) and metres (m) are the most common units of measurement, rather than centimetres. To be successful in the workplace, learners will need to be familiar with these units of measurement and be able to convert between them speedily and accurately.

To learners who are familiar with measuring lengths in metres, measurements of, for example, 1,334 mm may be daunting. This session is intended to make learners more adept at manipulating numbers of this size and identifying mistakes where they occur.

## Planning learning in multiple environments

As teachers, we spend a lot of time planning the learning experience within our classroom, workshop or training area. However, it is worth considering how we can encourage our learners to explore their learning in a wider range of settings. Pointing learners in the direction of a relevant TV programme, a newspaper article, or even an advertisement, can bring learning alive. There may be opportunities to ask learners to observe something on the way to work or college, to reflect on an aspect of their own social or home lives, or to apply a newly learned skill in a workplace situation. All these can help the learning process, making it more real and relevant.

Mathematics occurs everywhere in our lives. Helping learners to recognise the occasions where it pops up, and to incorporate these into their own thinking, is a step towards real and useful learning.

## Time needed for this session

1 hour

## Suggested approach

### Stage 1 – beginning the session

Make a list on the whiteboard or OHP of familiar objects in the room. Make sure that the items are a mixture of ones that measure less than 30 cm and ones that measure more, for example, an A4 sheet of paper, a mobile phone, an ID badge, a chair, a table top, a bench top.

## Working in groups

Ask learners to work in pairs. Give each pair a 30 cm ruler. Ask the pairs to measure and record the dimensions of the items listed on the board.

### Class discussion

When all pairs have completed this task, invite each pair in turn to report the dimensions of one of the items on the board. Prompt the learners to identify the units of measurement they used. Write their answers on the board.

#### Comment

When it is appropriate, point out that, for items longer than 30 cm, learners are likely to have measured the lengths in multiples of 30, so their answers will be in cm. However, in some contexts, for example, the construction industry or stage set design, the units of measurement commonly used are millimetres and metres. Learners will have to be able to use these other units of measurement as well as the one they may be most familiar with.

### Stage 2 – working in groups

Give each pair **Card set A: Core conversions**, already cut up into triangular pieces. Explain that their task is to arrange the pieces so that adjacent sides have equivalent measurements. Explain that the completed jigsaw will form a hexagon.

#### Comment

- You may need to remind learners what a hexagon looks like so that they can begin to make the shape.
- If learners are struggling, you might suggest that they identify the ‘outside’ pieces, as they would with a normal jigsaw. Point out that these are the pieces with numbers on only two sides, with the third side blank.
- Avoid the temptation to give learners the answers.
- If more help is needed, give learners a start by asking them to find the matching card for 1 metre, expressed in millimetres.

### Stage 3 – reviewing the learning

When the jigsaw is complete, ask each learner to explain the reasoning behind one of their matches.

If appropriate, ask some or all of the following questions to prompt whole class discussion.

- Explain how you could use **1cm = 10 mm** to find the number of centimetres in a metre.

- Explain how you could use  $10\text{mm} = 0.01\text{m}$  to write 1 cm as a decimal of a metre. How could you check the answer?

Return to the list of familiar items on the whiteboard. Ask learners to use their mini-whiteboards to convert the measurements to mm. If necessary, ask learners to check the measurements using their rulers.

#### Stage 4 – working in groups

Give each pair **Card set 2: More conversions**, which you have cut up into triangular pieces before the session.

The first hexagonal jigsaw is at the centre of the new one, so learners can repeat their matches to begin the new hexagon. By matching equivalent sides, a new hexagon can be completed.

#### Comment

If the jigsaw does not take shape, learners will know that they have to look again at their matches. Avoid the temptation to give learners the answers. If learners are struggling you might suggest, as before, that they start with the pieces that form the outside edges.

If learners have completed the jigsaw successfully, there will be no need to give out **Sheet 1: Solution to hexagonal jigsaw**.

#### Stage 5

In whole class discussion, ask learners to identify which of the matches is the odd one out. There are a number of possibilities so allow the discussion to develop.

If no one suggests it, draw attention to '25,004 mm' and its match, '25 m'. This is the only matching pair where one is an approximation to the other. This creates an opportunity to discuss the conversions in the jigsaw between large numbers in millimetres and metres.

#### Stage 6 – reviewing the learning

Hand out **Sheet 2: Examples from the workplace: anything wrong?** to each learner.

Ask learners to identify any mistakes they can find in the advertisements for kitchen work surfaces and accessories.

**Comment**

The measurements used here are the same as those used in the hexagonal jigsaw.

**Stage 7 – extending the learning**

If catalogues are available, or learners have access to the internet, they could create example advertisements. Ask learners to create a set of examples in which errors have been made and mix them with examples where measurements are accurate. Another group can then be set the challenge of correcting the errors and confirming the accurate conversions.

## Context sheet

### Society, health and development (SHD)

The conversion of metres to millimetres may occur in a number of settings in the childcare context. In this activity, the need to use both units of measurement is set in a practical context.

#### Playschool storage

##### Scenario

The playschool where you are working wants to buy some cupboards to store the toys and other equipment that the children use. They do not want to spend a great deal of money so they decide to buy some flat-pack furniture to do the job. You volunteer to see how many cupboards can fit into the available space.

##### Task

Measure a playschool room or a room that could be used for a playschool, identifying the areas that are not going to be moved, for example, carpet area, chairs and desks. Use an extending ruler and record your measurements; you may choose to use metres for this. Collect a catalogue of flat-pack furniture, or use the internet, to find the dimensions of storage cupboards; these will be in millimetres. Work out how many cupboards can fit comfortably into the space available. If you have a price list, you may also be able to cost the project.

If learners are on work placement at a playschool, they may be able to use the playschool as the model for their measurements, which will make the mathematics relevant. Visiting a nearby playschool could also provide measurements. Failing this, any suitable room can provide the measurements. The learners may like to plan the layout of this room for a playgroup.

#### Engineering

The scenario and task described above can be adapted to Engineering where the dimensions of storage shelves are taken from a catalogue of specialised equipment and the shelving is to go into an existing space in a workshop.

#### Creative and media

The use of millimetres and metres in the theatre is commonplace. An important example is when a full set of stage measurements is produced to identify cues for lighting. This scenario starts the process.

**Where do I stand?**

**Scenario**

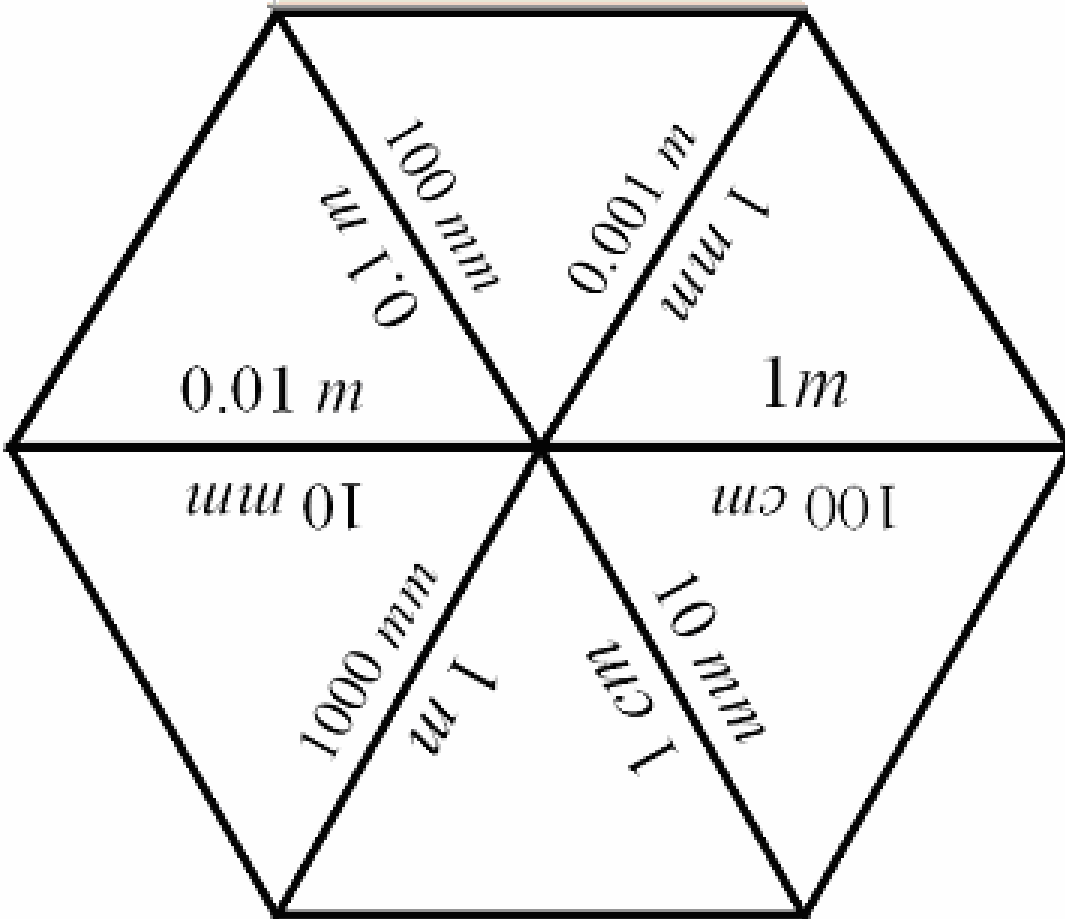
You are helping an amateur dramatic society to set up their lighting for a production. They are going to use very little scenery for the play so they want to make the best use of their lighting. They ask you to recommend three key areas to act as focal points on the stage, which is where they are going to concentrate their lighting effects.

**Task**

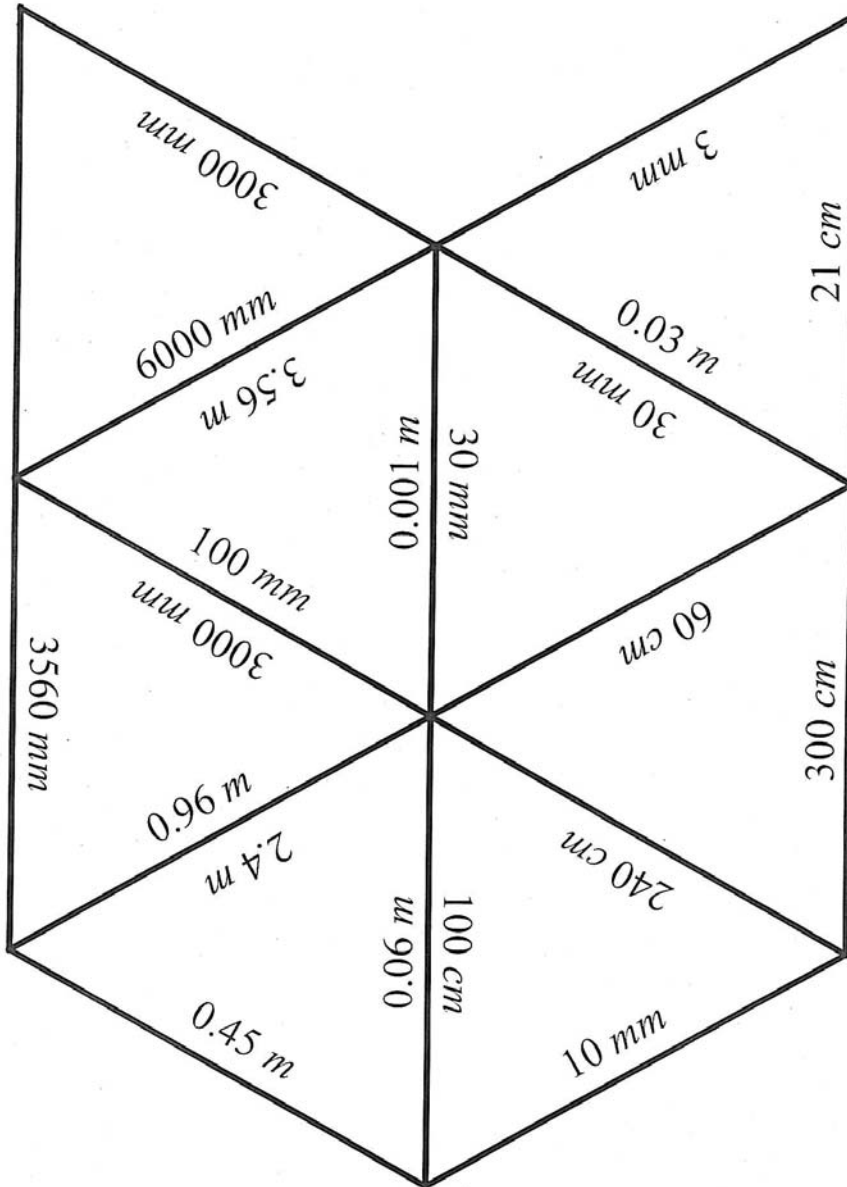
You have to measure a stage, using appropriate units to identify important areas. Using two fixed points, such as entrance points and exit points, give measurements in millimetres from these points to three key areas of the stage.



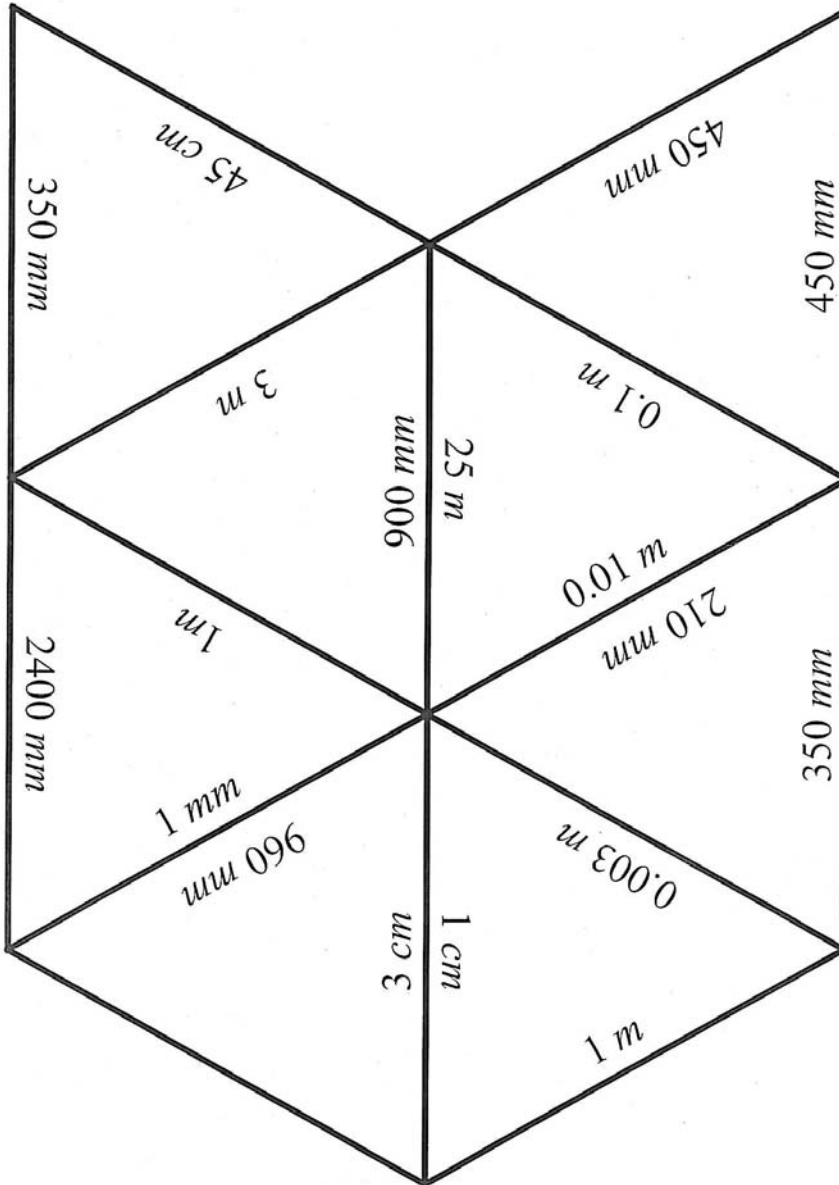
Card set A: Core conversions



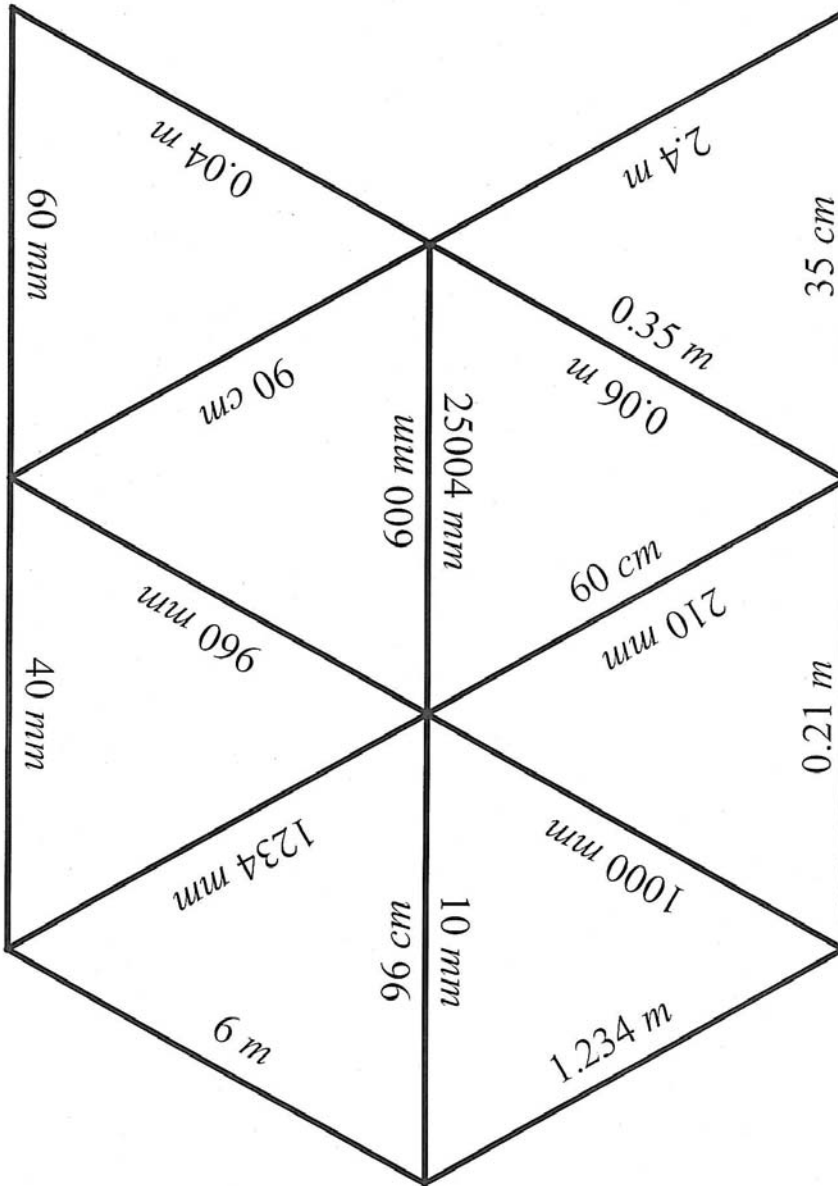
Card set B: More conversions (page 1 of 3)



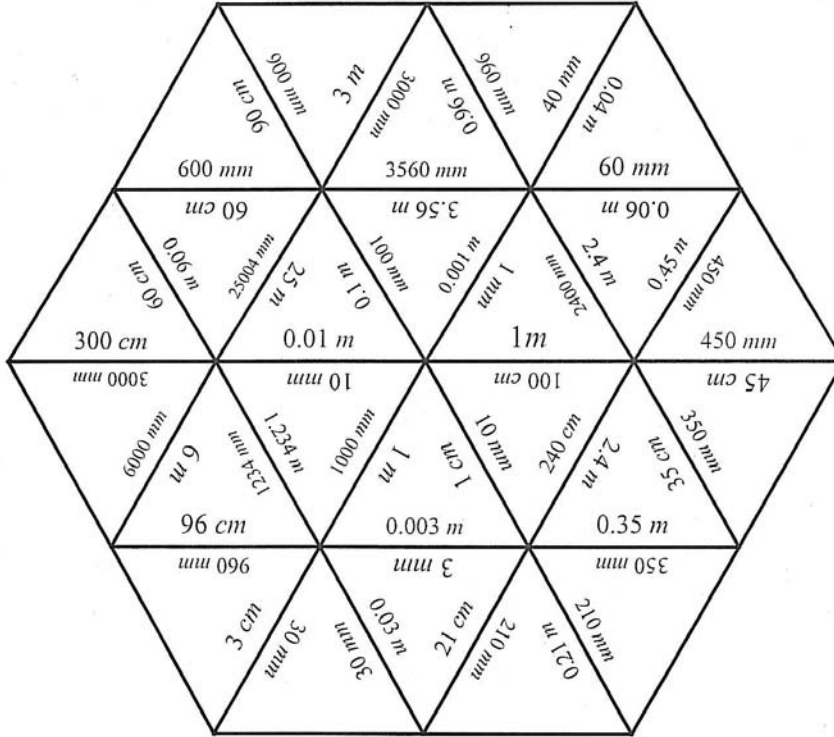
Card set B: More conversions (page 2 of 3)



Card set B: More conversions (page 3 of 3)



Sheet 1: Solution to hexagonal jigsaw



## Sheet 2: Examples from the workplace: anything wrong?

### Worktops

Choose a combination of 60 cm and 90 cm widths if, for example, your kitchen design requires a wider breakfast bar.

60 cm wide

Worktop length in centimetres\*  cm \* 3 cm thickness

90 cm wide

Worktop length in centimetres\*  cm \* 3 cm thickness

Kitchen worktop blank in oak – 3 m x 960 mm x 40 mm

Solid timber 40 mm wide stave construction. Supplied in 150 grit sanded finish and un-oiled ready for machining and finishing. Price is per blank. Standard delivery time is normally 3-5 working days.

### Kitchen accessories

#### Stainless steel hotplate

**£106.50 excl. VAT, £125.14 inc. VAT**

Protect your work surface from hot or wet pans with a stainless steel hot plate. Dimensions: 450 mm x 350 mm x 0.11 mm. Supplied with 6 bolts for installation.

#### Stainless steel scales

**£109.95 excl. VAT, £129.19 inc. VAT**

An essential worktop accessory. Supplied as two parts with the tray either inset or recessed into the work surface and the scales positioned in the tray. This allows easy removal for cleaning. Scales provide both metric and imperial measurements. Weights can be taken directly from the surface of the scales or by using a bowl. Maximum weight measurable is 5 kg. Includes long life lithium batteries. 5 year guarantee.

Overall dimensions: 210mm x 210m x 30mm