Introduction to product design for KS2 and KS3

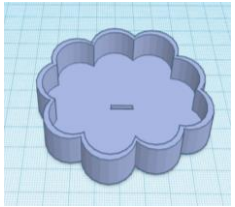
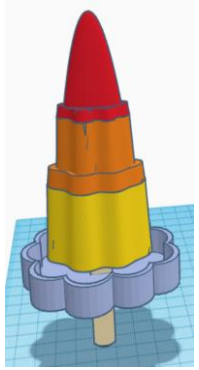
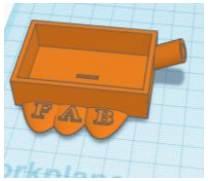
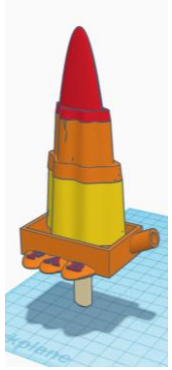
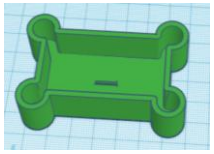
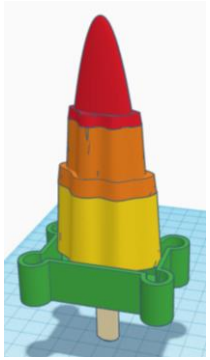
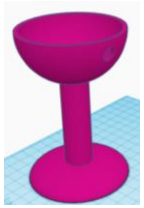
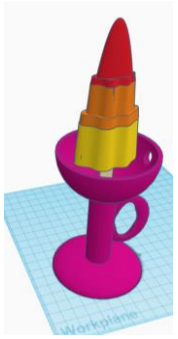
Overview of the workshop task:

The aim of this workshop is to use a simple browser-based Computer Aided Design software to design a drip tray to solve the problem of dripping ice lollies on a summer's day. I usually start by demonstrating the problem, by getting a member of staff to sit with an ice lolly and I use a hairdryer on a low setting to mimic a warm summer's day. We watch the lolly begin to melt and drip. The pupils love it!

Pupils consider the problem, take key measurements, sketch design ideas, then develop their design in Autodesk Tinkercad, a colourful, easy to use, free software which works in the web browser, so no software to download.

After completing their lolly drip tray design, they use life sized digital models of ice lollies, to assess whether their drip tray is likely to work. They can then make any necessary amendments to their design.

Below are examples of lolly drip tray designs created in Tinkercad by school pupils aged 9 to 11 years.

Diane Burton, WMG, University of Warwick

Things to do before running the workshop

1) Set up a Tinkercad account and try out the software (you and your students) – see next slide.

2) Open this svg file lolly shapes to cut out and print it on thick paper or cardboard. These are scaled to the size of 3 different commonly found ice lolly shapes. Children can measure them when using the measurement sheet (slide 7).

3) If you have a 3D printer, you can download and print scaled section models of the 3 different lolly shapes. The stl files are at www.warwick.ac.uk/tinkercad. Photos of these 3D printed model are on the measurement sheet (slide 7).

4) Collect a few lolly sticks for the children to measure. Most are a just under 10mm wide x 2mm thick. Draw a line 45mm up from the bottom of the stick – this is the point at which the lolly sits, leaving 45mm of stick to hold.

5) Print a measurement sheet (slide 7) and design sheet (slide 8) for each child. If you feel it would be useful, print a copy of the cm to mm practice sheet (slide 6) for each child.

6) Print some copies of the real example of a design sheet that has been completed really well (slide 9).

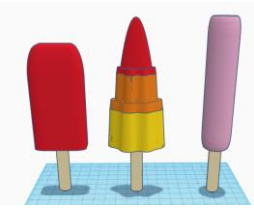
7) Print a copy of slide 10 for each child – this shows how to use the scaled lolly models to assess your design.

8) Import these scaled models of 3 common lolly shapes to your Tinkercad account and put them in your Parts Collection for children to use to assess their designs. The links are below, use this video for further instructions.

U-shaped lolly: https://www.tinkercad.com/things/grgtnB4f8P5

Rocket lolly: https://www.tinkercad.com/things/9lEmL9Tvl8b

Cylinder lolly: https://www.tinkercad.com/things/aPzpj6cCP03



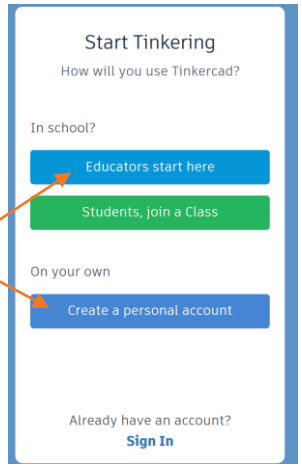
These scaled digital lolly models are the same dimensions as the lolly shapes to cut out on the svg file (pt 2 above) and also the stl files (pt 3) that can be 3D printed.

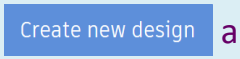
Getting started with Tinkercad software

1. Use Microsoft Edge or Google Chrome web browser and go to www.tinkercad.com

Tinkercad is free to use and works in the web browser, so no software to download.

Click **Join Now** to set up an account – this screen appears. Either **Create a personal account** or explore the **Educators start here** option.



Once you have your account, on the dashboard screen, click Create new design 

and have a go at dragging some shapes down.

Click to download Mouse Control Diagram, and Basics Worksheet to try some simple exercises. Or try the Basics Video Tutorial

Each new Tinkercad design is automatically given a unique randomly generated name, so all students can work simultaneously on their designs within the same Tinkercad account and all files will be saved in real time. It is good practice to get students to rename their file with a name they will remember and you will recognise as theirs.

Tinkercad Project Folders can help for organising different classes or projects. Click here for further information.

There are various other options for managing pupils work, individual schools and teachers can decide what works best for them. Further information at https://www.tinkercad.com/teach.

Now you are ready to run the workshop!

1) Introduce the problem of small children with an ice lolly on a warm day. Ask for ideas on a product that would help.

2) After discussion, show slide 5 - use the pictures to explain what they will be doing. You may wish to show the images of lolly drip trays designed by children in school – on slide 1.

3) Discuss the importance of taking measurements when you design a product to ensure the product will work. When we design products, we use mm rather than cm as it gives a more detailed accurate measurement. If you think the children might benefit, use slide 6 for them to practice cm to mm. During WMG outreach workshops, we find a lot of children lack confidence in using mm, hence this worksheet has been included.

4) Give each child a printed measurement sheet, either the cut out lolly shapes or 3D printed lolly section models, a lolly stick, a ruler and pencil or pen. They should take accurate measurements in mm. Check their measurements with them.

5) Give each child a design sheet. Discuss design ideas and what they should aim to include in their sketches – as per notes on the design sheet. It is worth discussing the need to take account of the thickness of the wall round the lolly drip tray, the lolly must sit inside that wall, so the drip tray must be several mm bigger than the lolly. The wall needs to be about 2mm thick all the way round – so 2mm on the left side and 2mm on the right. Often they forget this and make the drip tray too small! Don't give away all this information, discuss it and get them to realise themselves.

6) Show the children the lolly drip tray Tinkercad video tutorial. Click here for the video. If you have any streaming issues, right click on the video whilst it is running and select *Save video as …* and save it to your computer.

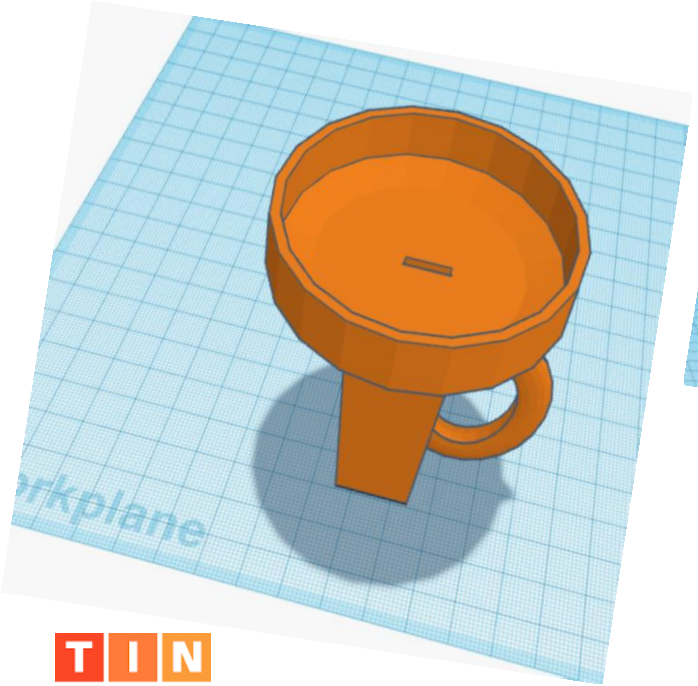
7) The children start on Tinkercad, click Create new design and begin work, referring to their design/measurement sheets.

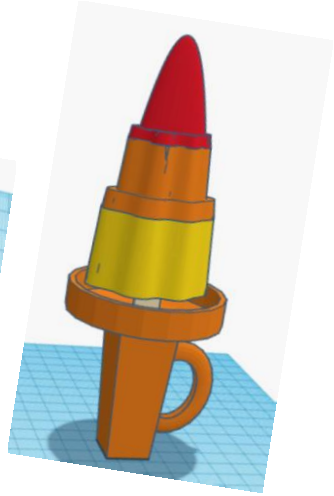
8) When they have the main shape of their drip, give them the sheet showing how to use the scaled lolly models to assess their design. After using the lolly models, they might amend their design to ensure the lolly sits fully inside the drip tray.

9) When they are happy with their design, they can take screenshots of their design work and discuss the merits of their lolly drip tray design. If a number of children are doing the workshop, they can discuss each other's designs.

Design a product to solve a problem using CAD software

A drip tray for an ice lolly!





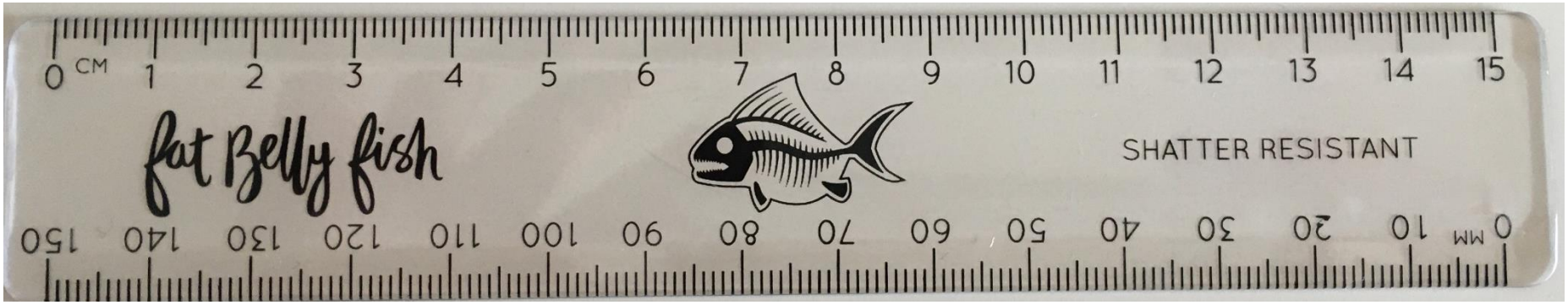
Tinkercad - free online CAD software

How do you convert from centimetres to millimetres?

Computer aided design software such as Tinkercad uses mm and not cm. You need to be able to use your ruler to take measurements in mm.

Look at these measurements on your ruler and fill in the gaps on this diagram

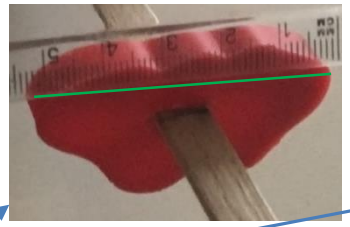
3.5cm = ____ mm	3.2cm = ____ mm	6.3cm = ____ mm	9.4cm = ____ mm	11.6cm = _____mm
2cm = ____ mm	4.6cm = ____ mm	7.7cm = ____ mm	10cm = _____mm	12.2cm = _____mm
1cm = ____ mm	5.9cm = ____ mm	8.1cm = ____ mm	10.1cm = _____mm	14.9cm = _____mm

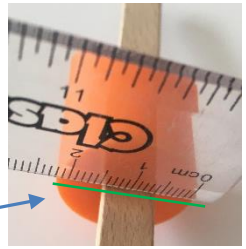


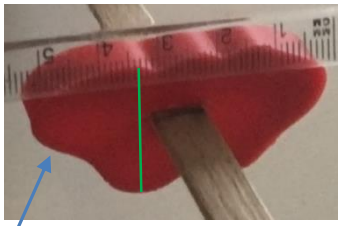
Name:

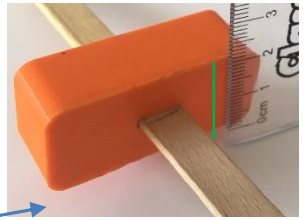
Take measurements in millimetres (mm)

1. Measure all 3 lolly models – to ensure your drip tray is big enough to work with all 3 lolly shapes.









Widest lolly model is _____ mm

Longest lolly model is_____ mm

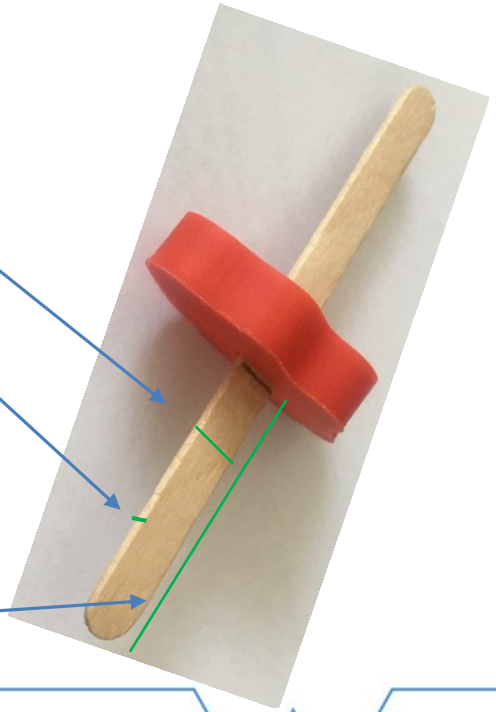
2. Measure the lolly stick – to ensure the hole for the lolly stick is the correct size

Width of stick is_____ mm

Depth of stick is_____ mm

3. Measure the stick below the lolly – this is the part of the stick you hold.

Length of stick below the lolly line is_____ mm



Name:

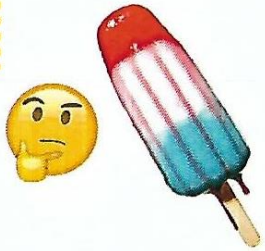
Lolly drip tray design sheet

Sketch your design here and include **measurements in millimetres (mm) from your measurement sheet..**

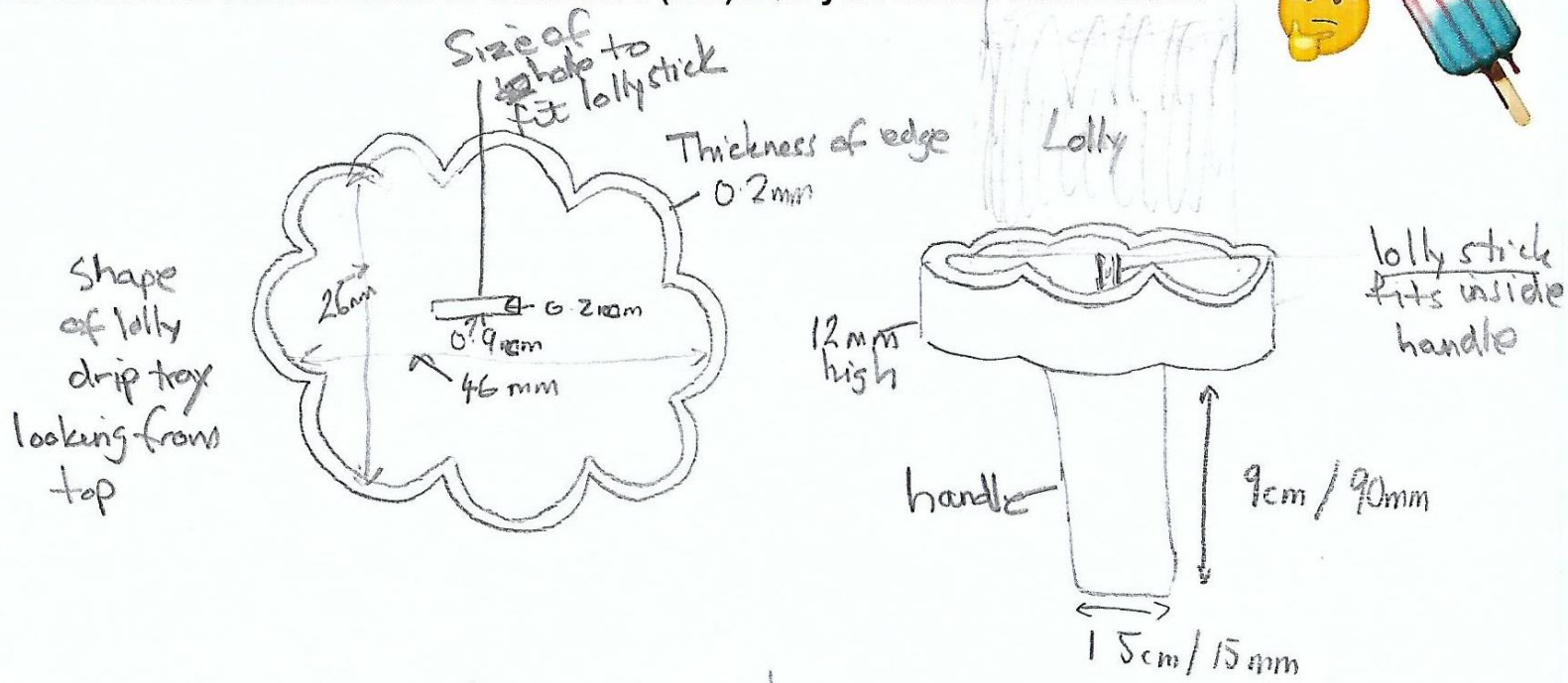
Add some notes to explain how your design will work—refer to the shape and measurements of your design.

Name:

Lolly drip tray design sheet



Sketch your design here and include **measurements in millimetres (mm) from your measurement sheet..**



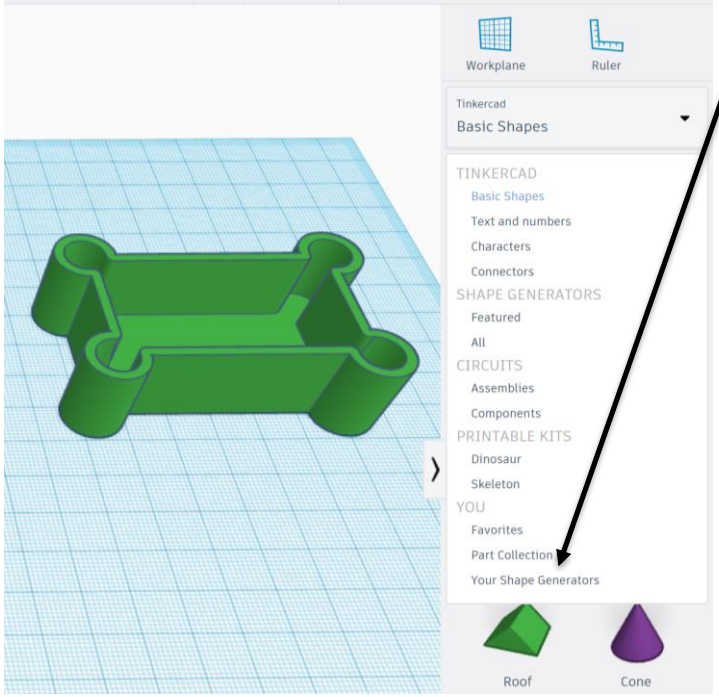
Will work for any lolly – it is wide enough and deep enough.

The new handle is nicer to hold than a stick.

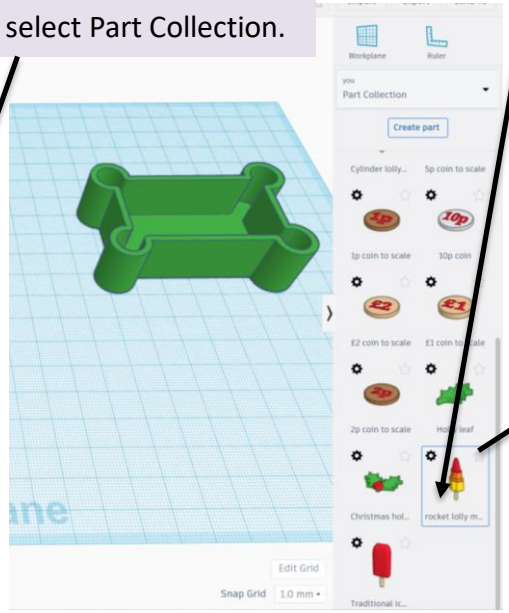
Side of drip tray is 12mm – stops drips coming over edge.

Add some notes to explain how your design will work—refer to the shape and measurements of your design.

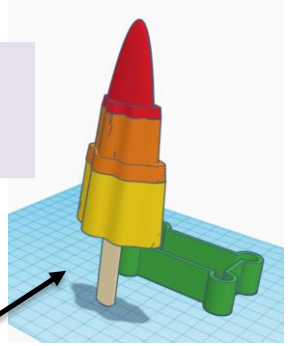
Using the scaled ice lolly models to test your lolly drip tray design in Tinkercad



1) Go to the drop down menu and select Part Collection.

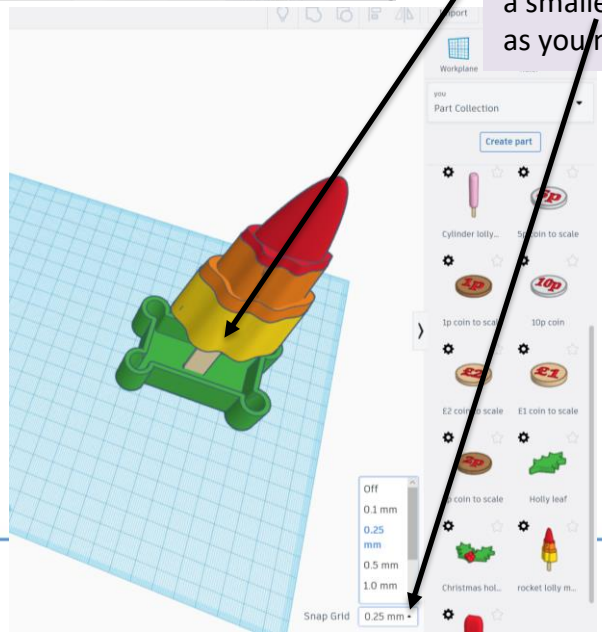


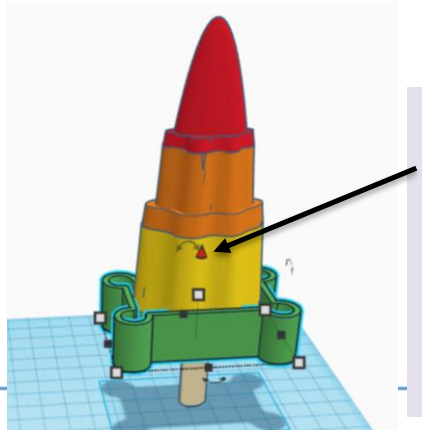
2) Choose a lolly model and drag it to the workplane.



3) Drag the lolly model into place inside the lolly stick hole of the drip tray. Either drag the lolly or select it and use the arrows on the keyboard

It is helpful to change the Snap Grid to a smaller value to give move control as you move the lolly into place.





4) Select the drip tray and use the UP arrow to drag it up into place.

Check that your drip tray is the correct size to ensure it will work.

Diane Burton, WMG, University of Warwick