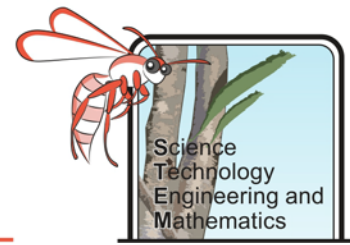


# Chopping on Rock – Teacher Resource



## Intended Use of Resources

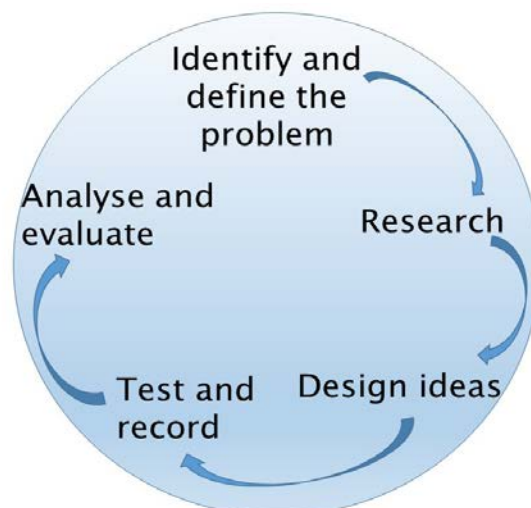
This project has been designed so that teachers from different STEM areas can pick and choose sections relevant to their subject area to work on. All activities in this package do not need to be completed to get value from the package – each activity can be completed as a stand-alone or can be approached, as a team, as a larger project. The package has potential to be extended into a much longer project to include curriculum points from different STEM subjects.

There are three **student workbooks - Open, Guided and Scaffolded**, that go alongside this resource; all have the same suggestions for activities, however, they have been written and edited to provide differentiated learning options to support good teaching practice. Teachers may pick and choose which versions they give which students, and may wish to edit them further to address their learning needs. Due to the differentiation of the workbooks, the **Open** activities will enable more syllabus links to be addressed, which is why each activity has its own syllabus links key. However, if you wish to give a truly open ended investigation then you could just give the students the challenge and background information section of the Student Booklet.

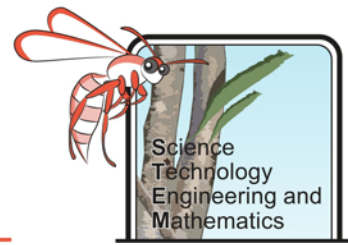
The Woodside Australian Science Project (WASP) STEM resources aim to be accessible and supportive for teachers and students, please contact us if you have questions, feedback, require assistance or would like to arrange an incursion or a professional development workshop - [www.wasp.edu.au](http://www.wasp.edu.au).

## The Student Challenge

You are moving house and your parents have decided that they would like some new equipment for the kitchen. They would like to keep it modern and stylish, but also practical. In particular they would like a new chopping board, as they are sick of the flimsy plastic one they have been using. You have decided for their anniversary you would like to have one made for them, and have taken on the challenge of designing it yourself.



# Chopping on Rock – Teacher Resource



## Background Information

Some of the earliest tools ever used by humans were those intended for food preparation; chopping, grinding and tenderising have always been important techniques in the kitchen. Rocks have made ideal chopping boards due to their high durability and also their availability (there were a lot more rocks around in the Neolithic time than plastic factories!) The simple chopping board, is actually anything but – and can be designed for multi-purpose use, for example a heat mat and chopping board combined. New designs are still entering the market, with developments to make them more user friendly, or convenient for storage and cleaning.

One of the most important aspects of a chopping board is that it is food safe. Chopping boards need to be able to be cleaned easily and effectively, so that they do not harbour any bacteria. It is vital that their surface is not too absorbent. This will also prevent bad smells as well as staining, therefore the porosity and permeability of the material is an important factor to determine its suitability.

Personalised chopping boards have become very popular in the past few years, especially as housewarming, wedding and anniversary gifts. Often they are made with engravings including names or dates. For foodies they might include words suggesting what to place where on them, such as cheese names. A softer rock material will make this easier to inscribe, however, it will also be easier to damage.

There is a wide array of materials that are used for chopping boards, and it is important that they have been tested properly to ensure that they can withstand everyday use, as well as any accidental knocks or bumps that might occur. Chopping boards need to be durable, reliable, cost effective and convenient.

## Activities

This booklet contains extra information on each activity, including syllabus links the overall activity objective, suggestions for recommended equipment or alternative ways to run investigations as well as useful resources and website links\*.

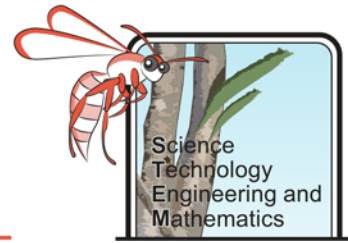
The syllabus links have been colour coded. These links to the Australian Curriculum are also relevant to the Western Australian Syllabus. – Please see the colour key below:

Covered in Scaffolded, Guided and Open Student Booklet

Covered in Guided and Open Student Booklet

Covered in Open Student Booklet

*Italics – WA syllabus for DT and D and T*



## Chopping on Rock – Teacher Resource

### ***List of activities***

- [Background Research](#)
- [Density of Different Materials](#)
- [Shaking up the Style](#)
- [Durability of Materials](#)
- [Reactivity of Materials](#)
- [Porosity and Permeability](#)
- [Testing for Bacteria](#)
- [Cost Analysis](#)
- [Designing and Planning the Product](#)

*\*Please note that these were accessed in February 2018 – these addresses may change slightly, we would be grateful if you could let us know if these sites are no longer accessible.*

### Background Research

#### **Objective**

For students to understand how rock forming processes can affect the properties of the rocks, thus making them useful for different products. To begin to consider what the most important features of chopping boards are to gain a clearer understanding of why they may conduct further tests on materials.

The background research is also intended to give students an introduction to STEM as a concept - and see the interconnection between the different subjects and why it might be necessary for people to be able to integrate STEM practices in their jobs.

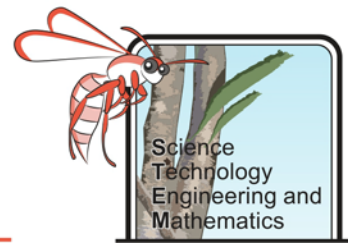
#### **Useful resources and websites:**

WASP Year 8 Rock Cycle worksheets, posters and information:

<http://www.wasp.edu.au/mod/page/view.php?id=87>

ESWA rocks and minerals video: <https://www.youtube.com/watch?v=WYtF-ZdTr7s>

# Chopping on Rock – Teacher Resource



## Density of Different Materials

### Objective

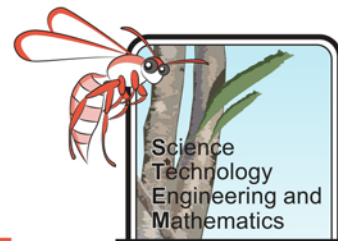
Students will gain an understanding of how to measure and calculate the density of irregular objects using scientific and mathematical methods, they will practice rearranging equations to gain a better understanding of the relationship between volume, mass and density. Students will apply their learning and understanding to discuss how density relates to product design and consider why density is relevant for a chopping board design.

The size of the rocks and the equipment your school has will really determine how big a measuring beaker/container you will need to use. If you have small samples students could easily measure the volume just by half filling a beaker, adding the sample and then finding the difference in volume as the water level will have risen. If you have displacement cans these can also be used instead of beakers/ice-cream tubs.

Use plastic containers for this experiment, as glass can easily break if students drop the rocks into the water.

Large graduated cylinders will give most accurate measurements, however, you will either need to use very small samples, or add an extra step where the students pour the water into them, it could get messy so a funnel might be needed.

	Australian Syllabus Links
Science	<p>ACSSU153 Sedimentary, igneous and metamorphic rocks contain minerals and are formed by processes that occur within Earth over a variety of timescales.</p> <p>ACSIS140 Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed.</p> <p>ACSIS141 Measure and control variables, select equipment appropriate to the task and collect data with accuracy</p> <p>ACSIS145 Summarise data, from students' own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions based on evidence.</p> <p>ACSIS146 Reflect on scientific investigations including evaluation of the quality of the data collected, and identifying improvements</p>
Design and Technology	<p>ACTDEK034 Analyse ways to produce designed solutions through selecting and combining characteristics and properties of materials, systems, components, tools and equipment.</p> <p>ACTDEP035: Critique needs or opportunities for designing and investigate, analyse and select from a range of materials, components, tools, equipment and processes to develop design ideas.</p>



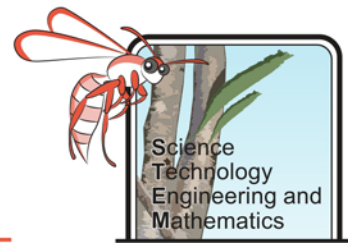
## Chopping on Rock – Teacher Resource

	<p><b>ACDTEP036</b> Generate, develop, test and communicate design ideas, plans and processes for various audiences using appropriate technical terms and technologies including graphical representation techniques.</p> <p><b>ACTDEP037</b> Select and justify choices of materials, components, tools, equipment and techniques to effectively and safely make designed solutions.</p> <p><b>ACTDEP039</b> Use project management process when working individually and collaboratively to coordinate production of designed solutions.</p> <p><b>WATPPS51</b> <i>Produce a simple plan designed to solve a problem, using a sequence of steps</i></p>
<b>Mathematics</b>	<p><b>ACMNA183</b> Carry out the four operations with rational numbers and integers, using efficient mental and written strategies and appropriate digital technologies</p> <p><b>ACMMG195:</b> Choose appropriate units of measurements for area and volume and convert from one unit to another.</p>

### Useful websites and resources:

BBC bitesize activity on determining density and finding the volume of an irregular shape:  
<https://www.bbc.co.uk/education/guides/zb7hyc/revision>

Video on how to measure the volume of an irregular shape:  
<https://www.youtube.com/watch?v=e0geXKxeTn4>



# Chopping on Rock – Teacher Resource

## Shaking Up the Style

### Objective

Students will consider different shapes for their chopping boards, calculating the surface area, volume and density of these shapes to practice rearranging equations and then consider the practicalities of making these shapes out of different materials - including if the chopping board will become too heavy to lift easily and therefore impractical.

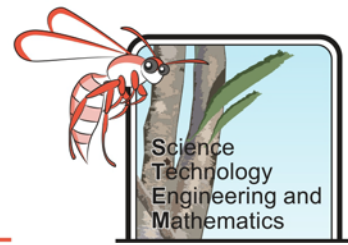
	Australian Syllabus links
<b>Digital Technologies</b>	<p>ACTDIP026 Analyse and visualise data using a range of software to create information, and use structured data to model objects or events.</p>
<b>Design and Technology</b>	<p>ACTDEK034 Analyse ways to produce designed solutions through selecting and combining characteristics and properties of materials, systems, components, tools and equipment.</p> <p>WATPPS48 <i>Consider components/ resources to develop solutions, identifying constraints.</i></p>
<b>Mathematics</b>	<p>ACMNA183 Carry out the four operations with rational numbers and integers, using efficient mental and written strategies and appropriate digital technologies</p> <p>ACMMG195: Choose appropriate units of measurements for area and volume and convert from one unit to another.</p> <p>ACMMG196: Find perimeters and areas of parallelograms, trapeziums, rhombuses and kites.</p> <p>ACMMG197: Investigate the relationship between features of circles such as circumference, area, radius and diameter. Use formulas to solve problems involving circumference and area.</p> <p>ACMMG198 Develop formulas for volumes of rectangular and triangular prisms and prisms in general. Use formulas to solve problems involving volume.</p>

### Useful websites and resources

BBC bitesize activities – geometry of shapes, finding areas and perimeters:

<http://www.bbc.co.uk/schools/gcsebitesize/maths/geometry/>

# Chopping on Rock – Teacher Resource



## Durability of Materials

### Objective

Students will test the durability of different materials to see how well they stand up to daily chopping and any knocks and bumps they might get in daily usage to determine which materials are the most suitable to be made into a chopping board.

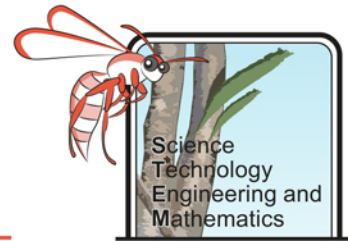
This experiment is meant to be a realistic test of how well the materials will withstand normal daily use - therefore the forces do not need to be particularly great, a 100 g mass swinging at it from a distance of 10 - 20 cm away should be realistic enough - the aim is not to smash all the samples, and students may need to be reminded that the force of chopping and even tenderising is really not that great.

If students find it easier, they could also put the material at the bottom of a slope and roll an object into it (such as a steel ball).

Remind students to wear closed toed shoes just in case anything drops and to wear safety glasses in case a piece of rock breaks off and hits them in the eye.

	Australian Syllabus links
Science	<p>ACSIS140 Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed.</p> <p>ACSIS141 Measure and control variables, select equipment appropriate to the task and collect data with accuracy</p> <p>ACSIS145 Summarise data, from students' own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions based on evidence.</p> <p>ACSIS146 Reflect on scientific investigations including evaluation of the quality of the data collected, and identifying improvements</p>
Design and Technology	<p>ACTDEK034 Analyse ways to produce designed solutions through selecting and combining characteristics and properties of materials, systems, components, tools and equipment.</p> <p>ACTDEP035: Critique needs or opportunities for designing and investigate, analyse and select from a range of materials, components, tools, equipment and processes to develop design ideas.</p> <p>ACDTEP036 Generate, develop, test and communicate design ideas, plans and processes for various audiences using appropriate technical terms and technologies including graphical representation techniques.</p> <p>ACTDEP037 Select and justify choices of materials, components, tools, equipment and techniques to effectively and safely make designed solutions.</p>

## Chopping on Rock – Teacher Resource



	<p><b>ACTDEP039</b> Use project management process when working individually and collaboratively to coordinate production of designed solutions.</p> <p><i>WATPPS46</i> <i>Investigate a given need or opportunity for a specific purpose.</i></p> <p><b>WATPPS51</b> <i>Produce a simple plan designed to solve a problem, using a sequence of steps</i></p>
<b>Mathematics</b>	<p><b>ACMSP284</b> Investigate techniques for collecting data, including census, sampling and observation.</p>

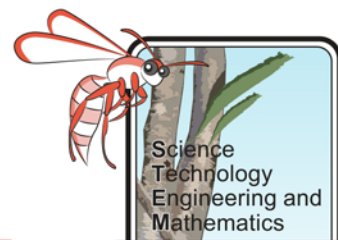
### Useful websites and resources

Drop testing method used in engineering video:

<https://www.youtube.com/watch?v=khJQgRLKMU0>



# Chopping on Rock – Teacher Resource



## Reactivity of Materials

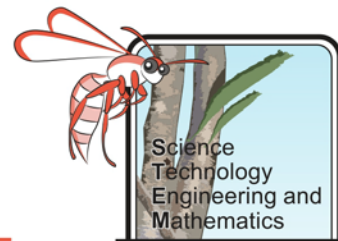
### Objective

Students will test different possible chopping board materials to determine how they react to everyday household liquids, such as cleaning products and food juices, e.g. lemon juice. This will enable them to critically analyse which materials are suitable for a chopping board and will not dissolve or become unsafe.

This experiment may be easiest if completed by a whole class - where one group tests how a particular material (e.g. limestone) reacts with different liquids, and other groups tests different materials (e.g. slate, granite, marble) using the same liquids. Or one group has a particular liquid e.g. lemon juice and tests different possible chopping board materials, and other groups have different liquids. By testing as a class it means that you will not have to use as much equipment, however, it is important that all students ensure that they use the same volume of liquid and material sample sizes to make the test fair.

Students may realise that if they coat the materials they may not react to the liquids, and as an extension activity may wish to repeat the experiment with coatings added to the materials. As the intended use is to make a chopping board the coating must be food safe.

	Australian Syllabus links
Science	<p>ACSSU225 Chemical change involves substances reacting to form new substances</p> <p>AC SIS140 Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed.</p> <p>AC SIS141 Measure and control variables, select equipment appropriate to the task and collect data with accuracy</p> <p>AC SIS145 Summarise data, from students' own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions based on evidence.</p> <p>AC SIS146 Reflect on scientific investigations including evaluation of the quality of the data collected, and identifying improvements</p>
Design and Technology	<p>ACTDEK034 Analyse ways to produce designed solutions through selecting and combining characteristics and properties of materials, systems, components, tools and equipment.</p> <p>ACTDEP035: Critique needs or opportunities for designing and investigate, analyse and select from a range of materials, components, tools, equipment and processes to develop design ideas.</p> <p>ACDTEP036 Generate, develop, test and communicate design ideas, plans and processes for various audiences using appropriate technical terms and technologies including graphical representation techniques.</p> <p>ACTDEP037</p>



## Chopping on Rock – Teacher Resource

Select and justify choices of materials, components, tools, equipment and techniques to effectively and safely make designed solutions.

**ACTDEP039**

Use project management process when working individually and collaboratively to coordinate production of designed solutions.

**WATPPS51**

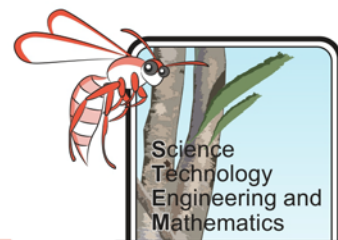
*Produce a simple plan designed to solve a problem, using a sequence of steps*

### Useful websites and resources

BBC revision and activity on types of reaction:

<https://www.bbc.co.uk/education/topics/zypsgk7>

# Chopping on Rock – Teacher Resource



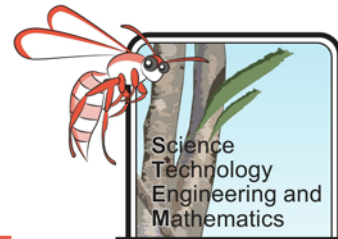
## Porosity and Permeability

### Objective

Students will test possible chopping board materials to determine if they are porous or permeable, and consider how this might affect their suitability as a chopping board material in terms of hygiene, and ease of cleaning.

If the materials prove to be porous or permeable this can mean that they will take longer to dry, or may even end up storing liquids for some time within them - this will lead to bacterial growth and make them unhygienic. If pore spaces could also trap pieces of food, they could start to rot and make the chopping board unsafe as well as smelly. The materials can be coated to make them waterproof and fill in the pore spaces, students may wish to repeat the experiment after they have coated materials to see if they find any improvement.

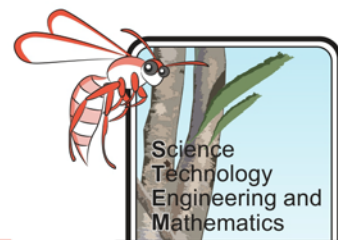
	Australian Syllabus links
Science	<p><b>ACSSU153</b> Sedimentary, igneous and metamorphic rocks contain minerals and are formed by processes that occur within Earth over a variety of timescales.</p> <p><b>ACSIS140</b> Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed.</p> <p><b>ACSIS141</b> Measure and control variables, select equipment appropriate to the task and collect data with accuracy</p> <p><b>ACSIS145</b> Summarise data, from students' own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions based on evidence.</p> <p><b>ACSIS146</b> Reflect on scientific investigations including evaluation the quality of the data collected, and identifying improvements</p>
Design and Technology	<p><b>ACTDEK033</b> Analyse how characteristics and properties of food determine preparation techniques and presentation when designing solutions for healthy eating</p> <p><b>ACTDEK034</b> Analyse ways to produce designed solutions through selecting and combining characteristics and properties of materials, systems, components, tools and equipment.</p> <p><b>ACTDEP035:</b> Critique needs or opportunities for designing and investigate, analyse and select from a range of materials, components, tools, equipment and processes to develop design ideas.</p> <p><b>ACDTEP036</b> Generate, develop, test and communicate design ideas, plans and processes for various audiences using appropriate technical terms and technologies including graphical representation techniques.</p>



## Chopping on Rock – Teacher Resource

	<p><b>ACTDEP037</b> Select and justify choices of materials, components, tools, equipment and techniques to effectively and safely make designed solutions.</p> <p><b>ACTDEP039</b> Use project management process when working individually and collaboratively to coordinate production of designed solutions.</p> <p><b>WATPPS51</b> <i>Produce a simple plan designed to solve a problem, using a sequence of steps</i></p>
<b>Mathematics</b>	<p><b>ACMSP284</b> Investigate techniques for collecting data, including census, sampling and observation.</p>

# Chopping on Rock – Teacher Resource



## Testing for Bacteria

### Objective

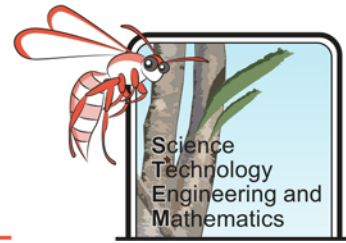
Students will use agar plates to swab potential chopping board materials after they have been used and cleaned to see how much bacteria they host and determine which material is the most suitable considering health and hygiene purposes.

If they have already completed the porosity and permeability experiment you may want to get students to provide a hypothesis about which materials they believe will host the most bacteria.

It is very important that the agar plates are disposed of safely and that once they have been sealed they remain sealed. Please check the current disposal requirements for agar plates if you run this activity.

	Australian Syllabus links
Science	<p>ACSSU149 Cells are the basic units of living things; they have specialised structures and functions</p> <p>ACSIS140 Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed.</p> <p>ACSIS141 Measure and control variables, select equipment appropriate to the task and collect data with accuracy</p> <p>ACSIS145 Summarise data, from students' own investigations and secondary sources, and use scientific understanding to identify relationships and draw conclusions based on evidence.</p> <p>ACSIS146 Reflect on scientific investigations including evaluation the quality of the data collected, and identifying improvements</p>
Design and Technology	<p>ACTDEP034 Analyse ways to produce designed solutions through selecting and combining characteristics and properties of materials, systems, components, tools and equipment.</p> <p>ACTDEP035: Critique needs or opportunities for designing and investigate, analyse and select from a range of materials, components, tools, equipment and processes to develop design ideas.</p> <p>ACTDEP036 Generate, develop, test and communicate design ideas, plans and processes for various audiences using appropriate technical terms and technologies including graphical representation techniques.</p> <p>ACTDEP037 Select and justify choices of materials, components, tools, equipment and techniques to effectively and safely make designed solutions.</p> <p>ACTDEP039 Use project management process when working individually and collaboratively to coordinate</p>

# Chopping on Rock – Teacher Resource



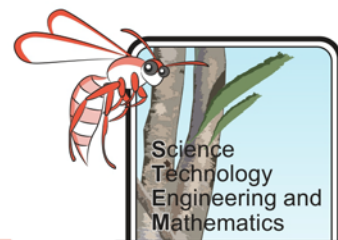
	production of designed solutions.
<b>Mathematics</b>	ACMSP284 Investigate techniques for collecting data, including census, sampling and observation.

## Useful websites and resources:

Video on swabbing agar plates: [https://www.youtube.com/watch?v=A0b6\\_kg2oMc](https://www.youtube.com/watch?v=A0b6_kg2oMc)

Debunking the 5 s rule using agar plates video:  
<https://www.youtube.com/watch?v=3FMZbloPn2w>

# Chopping on Rock – Teacher Resource



## Cost Analysis

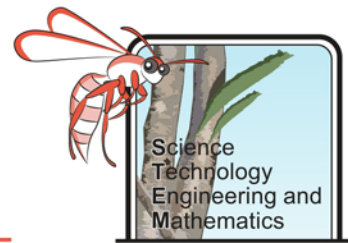
### Objective

Students will consider how cost effective it is to make their own chopping boards, they will look into sourcing material to make them with and compare prices from different merchants to find the cheapest available. They can investigate the potential of making more than one and selling the extras to help cover the costs or even make profit. They can create cost analysis spreadsheets and learn to input formula to Excel, to have it do their calculations for them.

This activity can be extended by adding more conditional formatting into the Excel spreadsheet. Students can investigate different shapes and dimensions for their chopping boards, to consider which style is most cost effective, but also consider the aesthetics of the design (squares and rectangles are cheaper and easier to make with little to no waste, whereas circles or other shapes can involve a lot more work and have more waste but may be more aesthetically pleasing (this means they may also be able to sell them for more)).

	Australian Syllabus links
<b>Digital Technologies</b>	<p><b>ACTDIP025</b> Acquire data from a range of sources and evaluate authenticity, accuracy and timelines.</p> <p><b>ACTDIP026</b> Analyse and visualise data using a range of software to create information, and use structured data to model objects or events.</p> <p><b>ACTDIP029</b> Design algorithms represented diagrammatically and in English, and trace algorithms to predict output for a given input to identify error sources.</p> <p><i>WATPPS49</i> <i>Design, develop, evaluate and communicate alternative solutions, using technical terms and technology.</i></p>
<b>Design and Technology</b>	<p><b>ACTDEP039</b> Use project management process when working individually and collaboratively to coordinate production of designed solutions.</p>
<b>Mathematics</b>	<p><b>ACMNA183</b> Carry out the four operations with rational numbers and integers, using efficient mental and written strategies and appropriate digital technologies.</p> <p><b>ACMNA184</b> Investigate terminating and recurring decimals</p> <p><b>ACMNA189</b> Solve problems involving profit and loss, with and without digital technologies.</p> <p><b>ACMSP284</b> Investigate techniques for collecting data, including census, sampling and observation.</p>

## Chopping on Rock – Teacher Resource

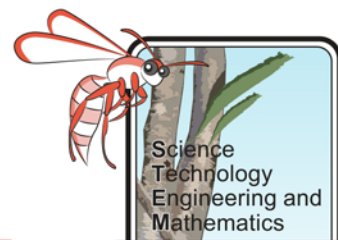


### Useful websites and resources

Simple calculations in Excel: <https://www.youtube.com/watch?v=RgvdCHjOKYg>



# Chopping on Rock – Teacher Resource



## Designing and Planning the Product

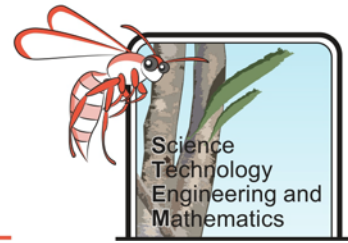
### Objective

Students will design a chopping board, looking at previous existing design to gain ideas. They will also consider the pros and cons of each design in relation to their kitchen, as well as using their knowledge of materials from any previous activities they have done from this booklet. They will then create a plan as to how they would make the chopping board, if they have completed the cost analysis exercise they may wish to discuss how many chopping boards they will make and add in where they will source the material from. They will create 3D scale drawings of their designs to improve their technical drawing skills and if possible transfer these into a computer aided design.

If possible, students will make their chopping boards, however as materials may be costly and time may be tight this has not been included in the resource. If students do make their chopping boards this gives an excellent opportunity to complete the Design Cycle and they can test and evaluate their designs.

	Australian Syllabus links
<b>Science</b>	<p>ACSIS140 Collaboratively and individually plan and conduct a range of investigation types, including fieldwork and experiments, ensuring safety and ethical guidelines are followed.</p> <p>ACSIS146 Reflect on scientific investigations including evaluation the quality of the data collected, and identifying improvements</p>
<b>Digital Technologies</b>	<p>ACTDIP026 Analyse and visualise data using a range of software to create information, and use structured data to model objects or events.</p> <p>WATPPS53 Work independently, and collaboratively when required, to plan, develop and communicate ideas and information when managing processes.</p>
<b>Design and Technology</b>	<p>ACTDEK029 Investigate the ways in which products, services and environments evolve locally, regionally and globally and how competing factors including social, ethical and sustainability considerations are prioritised in the development of technologies and designed solutions for preferred futures.</p> <p>ACTDEK034 Analyse ways to produce designed solutions through selecting and combining characteristics and properties of materials, systems, components, tools and equipment.</p> <p>ACTDEP035: Critique needs or opportunities for designing and investigate, analyse and select from a range of materials, components, tools, equipment and processes to develop design ideas.</p> <p>ACDTEP036 Generate, develop, test and communicate design ideas, plans and processes for various audiences using appropriate technical terms and technologies including graphical representation techniques.</p> <p>ACTDEP037 Select and justify choices of materials, components, tools, equipment and techniques to</p>

## Chopping on Rock – Teacher Resource



effectively and safely make designed solutions.

**ACTDEP039**

Use project management process when working individually and collaboratively to coordinate production of designed solutions.

**WATPPS49**

*Design, develop, evaluate and communicate alternative solutions, using appropriate technical terms and technology.*

### Useful websites and resources

BBC bitesize revision, activity and test on product design methods:

<http://www.bbc.co.uk/schools/gcsebitesize/design/resistantmaterials/designanalysevaluationrev1.shtml>