# MATHS – IT'S ALL IN THE BAG

A Scheme of Work in seven lessons for Key Stage 3 or 4, with PowerPoint presentation

## INTRODUCTION

The aim of the scheme is to introduce students to the concept of renewables in Maths lessons. By considering issues around shopping bags and food packaging, including such issues as environmental impact and carbon footprint. There is an accompanying PowerPoint that can be used or amended for use with students. Homework has not been stipulated but the project lends itself to research by students both in the classroom and at home.


## LESSON PLANS

| | Strategy objectives | Learning objectives | Possible teaching activities | Learning outcomes | Differentiation |
|---|---|---|---|---|---|
| 1 | 1 To develop an under-standing of nets of 3D shapes by using shopping bags.<br>2 To explore the concept of renewables in the context of shopping bags. | 1 Understand how different bags are put together.<br>2 Nets of 3D shapes<br>3 2D shapes and their symmetry properties<br>4 Know the possibilities for using renewables for shopping bags | **Starter** Give students various sorts of shopping bags from different supermarkets. Discuss the different materials and nets of the bags. What sorts of shape make a bag?<br>**Main activity**<br>a) What does a shop want from a bag?<br>Collect answers such as: easy to store before use, does not take up much room, cheap to produce, easy to use, biodegradable.<br>b) What does a customer want from a bag?<br>Collect answers such as: durability, quantity of shopping that can be contained (min to max range), material used, biodegradable, reusable.<br>Construct nets of various bags.<br>Discuss renewables used in the bags (both textiles and plastics).<br>**Plenary** Discussion linked to next lesson and how bag size/quality and shopping habits affect our environment.<br>**Resources** Mathematical Models by Cundy and Rollett (Tarquin Publications ISBN 0 906212 20 0) | 1 Name 2D shapes used to make bags.<br>2 Symmetries involved in construction of bags<br>3 Nets involved in construction of bags<br>4 Eco issues | Cut up some bags and boxes and look at the nets.<br>Discussion of the materials/properties and why they are used. |
| 2 | 1 Area, surface area and volume. | 1 Volume in relation to the transportation of shopping.<br>2 2D and 3D shapes and their properties | **Starter** Why are supermarket bags a certain size?<br>**Main activity** Look at shapes of supermarket bags and shopping bought. Do reusable bags have a different net? Look at storage of shopping in the boot of a car or other space. Do certain bags have an advantage over others?<br>Students calculate area and volume of bags and food containers, to find out which bags they think are best.<br>**Equipment** Bring various-sized boxes and bags to the lesson to allow students to experiment with packing.<br>**Plenary** Students to report back their findings | Understanding of volume | Shapes of packaging offered to students create natural differentiation. |

<table>
<tr><th></th><th>Strategy objectives</th><th>Learning objectives</th><th>Possible teaching activities</th><th>Learning outcomes</th><th>Differentiation</th></tr>
<tr><td>3<br>4<br>5</td><td>1 Design a survey to capture data.<br>2 Collect data and perform a mathematical analysis using ICT.</td><td>1 Handling data<br>2 Interpreting data</td><td>Starter Survey of shopping habits from local supermarkets. Consider what would you expect the bags to hold.<br><br>Main activity Counting approximate number of items in a bag. Average bag load? Number of shopping bags used per shopper? Number of eco-bags? During survey, question customers about their choice of shopping bags.<br><br>Subsequent lessons involved in interpreting data.<br><br>Alternatively, or additionally, use a home survey. Look at your household weekly shop. Record products and types of packaging. Can you find out what percentage of the packaging is reusable? What percentage of items do you think are over packaged?</td><td>1 Using ICT:<br>▪ pie charts for categorical data<br>▪bar charts and frequency diagrams for discrete and continuous data<br>▪simple time graphs for time series<br>▪ scatter graphs</td><td>Alternative areas for exploration: Number of shoppers using public transport. car park facilities, distance from home to shop.</td></tr>
<tr><td>6</td><td>1 Carbon footprint</td><td>1 Using and applying mathematics</td><td>How many food miles has your product travelled to reach your dinner table? Find out approximately what this adds to its carbon footprint (see table below). Use maps to estimate the distance travelled by customers and supermarket deliveries.<br><br><u>Carbon emissions for different forms of transport</u><br><br><table><tr><th>Transport</th><th>Carbon emissions<br>(kg per km)</th></tr><tr><td>Walk</td><td>0.00</td></tr><tr><td>Bicycle</td><td>0.00</td></tr><tr><td>Bus</td><td>0.09</td></tr><tr><td>Train</td><td>0.06</td></tr><tr><td>Motorbike</td><td>0.10</td></tr><tr><td>Car</td><td>0.21</td></tr><tr><td>Plane</td><td>0.16</td></tr></table><br>More information and how to calculate your own carbon footprint try http://actonco2.direct.gov.uk/index.html</td><td>1 Identify the necessary information to solve the problem.<br><br>2 Break up a complex calculation into simpler manageable steps.</td><td>Local, national and international journeys</td></tr>
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| 7 + | More ideas on packaging for incorporation in lessons above, or for further lessons. | 1 Calculating<br>2 Shape, space and measure<br>3 Handling data<br>4 Using and applying mathematics | **Packaging** Min/max amount of packaging to ensure goods are not damaged in transit.<br>Costs of packaging.<br>Select a food item and investigate how it could be packaged to avoid damage on its life journey to your home.<br>Discuss various types of packaging used - Could you use less? Do you need to use more?<br>Transport issues and carbon footprint.<br>Bulk packaging issues involved in the transportation of the product from its source to the store. Does the packaging have to be this shape to allow 20 to fit in a container?<br>Does the shelf-life date link to packaging? e.g. cans, long life products.<br>Does the shelf-life date link to transport implications? e.g. refrigerated/frozen storage.<br>Look at costs of packaging against environmental issues.<br><br><u>Useful websites</u><br>British Plastic Federation www.bpf.co.uk/<br>British Retail Consortium www.brc.org.uk/<br>European Bioplastics www.european-bioplastics.org<br>Food and Drink Federation<br>www.fdf.org.uk/reducingpackaging.aspx<br>The Industry Council for Packaging and the Environment (INCPEN) www.incpen.org/<br>Waste and Resources Action Programme (WRAP)<br>www.wrap.org.uk/ | 1. Under-standing how mathematics can be used and applied to real-life problem solving | Students perform individual or group research into packaging issues. |

## ADDITIONAL RESOURCES

### POWERPOINT PRESENTATION

This is available in Teachers' Resources as a separate file.

# CURRICULUM LINKS

Lessons 1 and 2

These lessons cover a number of curriculum links from 'Shape, space and measure' and 'Using and applying mathematics'.
Level 8 Understand the difference between formulae for perimeter, area and volume in simple contexts.
Level 7 Calculate lengths, areas and volumes in right prisms.
Level 6 Visualise and use 2D representations of 3D objects.
Level 5 Use units of measurement to estimate, calculate and solve problems in everyday contexts involving length, area and volume.
Level 4 Make 3D models by linking faces or edges.
Level 3 Classify 3D and 2D shapes in various ways by using mathematical properties.

Lessons 3, 4 and 5

These lessons cover a number of curriculum links from 'Handling data'.
Level 8 Estimate and find the median, quartiles and interquartile range for large data set.
Level 7 Examine critically the results of a statistical enquiry, and justify the choice of statistical representation in written presentations.
Level 6 Design a survey to capture the necessary data to construct tables for large discrete and continuous sets of raw data.
Level 6 On paper and using ICT construct and modify:

- pie charts for categorical data
- bar charts and frequency diagrams for discrete and continuous data
- simple time graphs for time series
- scatter graphs.

Level 5 Compare and interpret two simple distributions using the range and one of the mode, median or mean.
Level 4 Collect and record discrete data.
Level 4 Group data in equal class intervals and decide how best to represent it to show the information most clearly.
Level 3 Construct bar charts and pictograms, where the symbol represents a group of units.

Lesson 6

This lesson covers a number of links from 'Using and applying mathematics and 'Calculating'.
Level 8 Select and combine known facts and problem-solving strategies to solve problems.
Level 8 Use percentages to solve problems involving repeated proportional change.
Level 7 Make and justify estimates and approximations of calculations.
Level 6 Interpret, discuss and synthesise information presented in a variety of mathematical forms

Level 6 Calculate percentages to find the outcome of a given percentage increase or decrease.
Level 5 Identify the necessary information to solve a problem.
Level 5 Multiplying decimals with one or two places by single digit whole numbers.
Level 4 Use a calculator to solve number problems and interpret the display
Level 3 Solve number problems that give rise to remainders.

Lesson 7

Packaging extension work covers a number of curriculum links from 'Using and applying mathematics', 'Shape, space and measure', 'Handling data' and 'Calculating'.
Level 8 Understand the difference between formulae for perimeter, area and volume in simple contexts
Level 7 Calculate lengths, areas and volumes in right prisms.
Level 7 Make and justify estimates and approximations of calculations.
Level 6 Interpret, discuss and synthesise information presented in a variety of mathematical forms.
Level 6 Visualise and use 2-D representations of 3-D objects.
Level 6 Design a survey to capture the necessary data to construct tables for large discrete and continuous sets of raw data
Level 6 on paper and using ICT construct and modify:

- pie charts for categorical data
- bar charts and frequency diagrams for discrete and continuous data
- simple time graphs for time series
- scatter graphs.

Level 5 Use units of measurement to estimate, calculate and solve problems in everyday contexts involving length, area and volume
Level 4 Make 3D models by linking faces or edges.
Level 4 Use a calculator to solve number problems and interpret the display.
Level 3 Classify 3D and 2D shapes in various ways by using mathematical properties.