

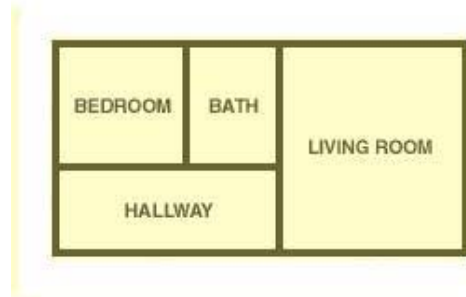


## MATHS – BUILDING BLOCKS TO A NEW HOME

A Scheme of Work in six 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 our own home environment and in the construction of eco friendly homes. The topic incorporates design, materials and their cost implications. All lessons offer the opportunity to work with teachers from other departments within the school. 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   |
|---|--|--|--|---|---|
| I | To develop an understanding of area and surface area | <p>1 Understand how 3D buildings are constructed from 2D shapes</p> <p>2 2D shapes and their areas</p> | <p><b>Starter</b> Ask students to list what they think makes an eco-friendly, renewable home.</p> <p><b>Main activity</b> Ask students what are the basic rooms required in the design of a one bedroom flat. Using one of the given set cases on the PowerPoint, or from their own design, create a floor space containing living room, /kitchen, bedroom, bathroom, hallway.<br/>How much floor space?<br/>How much wall space?</p> <p><b>Issues</b> How much floor space needs carpet/wooden floor/tiles?<br/>How much wall space needs paint? Consider windows and doors</p> <p><b>Plenary</b> Issues to do with orientation<br/>a) If you live in the northern hemisphere, then the longer walls of your house should face south. Southern exposure of the house is crucial to get maximum solar benefits.<br/>b) If you live in the southern hemisphere, then the longer walls of your house should face north. Northern exposure of the house is crucial to get optimum solar benefits.<br/>Resource:<br/><a href="http://www.house-energy.com/Landscape/Orientation.htm">http://www.house-energy.com/Landscape/Orientation.htm</a></p> | <p>1. Name 2D shapes used to make the building.</p> <p>2. Area and surface area calculations</p> <p>3. Eco issues</p> | <p>Create a one bedroom flat from cardboard.</p> <p>Construct floor space using shapes such as circles, triangles, pentagons etc.</p> |

|   | Strategy objectives  | Learning objectives  | Possible teaching activities   | Learning outcomes   | Differentiation   |
|---|--|--|--|---|---|
| 2 | Collect data from the web or catalogues, or a pre-set data list, and perform a mathematical analysis of the cost of paint required for their home  | 1 Handling data<br>2 Interpret data<br>3 Problem solving   | <p><b>Starter</b> Discuss health-and-safety issues against cost and availability for renewable paints.</p> <p><b>Main activity</b> Look at cost and amount of paint required for your one-bedroom flat using renewable against other types of paints.</p> <p><b>Resource:</b> NNFCC Renewable Building Materials Factsheet: Paints, Primers and Varnishes<br/> <a href="http://www.nnfcc.co.uk/metadot/index.pl?id=5972;isa=DBRow;op=show;dbview_id=2457&amp;reason=0YBrowser.HTML\Shell\Open\Command">http://www.nnfcc.co.uk/metadot/index.pl?id=5972;isa=DBRow;op=show;dbview_id=2457&amp;reason=0YBrowser.HTML\Shell\Open\Command</a></p> <p><b>Plenary:</b> Students to report back their findings.</p>                      | 1. Identify the necessary information to solve the problem<br>2. Break up a complex calculation into simpler manageable steps | Give set price information on paints  |
| 3 | Collect data from the web or catalogues or set data list and perform a mathematical analysis of costs of walls and panels required for their home. | 1 Handling data<br>2 Interpret data<br>3 Problem solving   | <p><b>Starter</b> Discuss advantages of using renewable building materials against cost and availability.</p> <p><b>Main Activity</b> Calculate costs of walls and panels for your one-bedroom flat made from renewables against other types.</p> <p><b>Resource:</b><br/>           NNFCC Renewable Building Materials Factsheet: Walls and Panels<br/> <a href="http://www.nnfcc.co.uk/metadot/index.pl?id=5971;isa=DBRow;op=show;dbview_id=2457&amp;reason=0YBrowser.HTML\Shell\Open\Command">http://www.nnfcc.co.uk/metadot/index.pl?id=5971;isa=DBRow;op=show;dbview_id=2457&amp;reason=0YBrowser.HTML\Shell\Open\Command</a></p> <p><b>Use a home survey.</b> Look at your own house for renewable building materials.</p> | 1 Identify the necessary information to solve the problem<br>2 Break up a complex calculation into simpler manageable steps   | Give set price information on walls and panels.<br>Look at a range of real building materials and make measurements to calculate area and volume.   |
| 4 | Collect data from the web or catalogues or set data list and perform a mathematical analysis of costs of insulation required for                   | 1 Using and applying mathematics.<br>2 Units of Measurement<br>. Understand and use proportionally | <p><b>Starter</b> "<i>Fitting insulation in your home won't just make it feel cosier - it will cut down the carbon footprint - and is just one of the measures that could save you up to £250 in energy bills a year</i>". Discuss</p> <p><b>Resource:</b><br/> <a href="http://www.channel4.com/4homes/eco/easy-energy-and-money-saving-tips-2.html">http://www.channel4.com/4homes/eco/easy-energy-and-money-saving-tips-2.html</a></p> <p><b>Main Activity:</b> Insulation: If the one bedroom flat was part of a complex of flats and being built from scratch what</p>  | 1 Identify the necessary information to solve the problem.<br>2 Break up a complex calculation into simpler manageable steps  | Using simple models look at the optimum design layout for a block of flats.<br>Possible cross curricula experimental work with science on insulation properties of various materials.<br>Visit a local block of flats |

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|---|---|---|---|---|--|
|   | their home.   |   | <p>insulation would be best to use?<br/>           Look at arrangement of a block of flats and consider its orientation and insulation. Interpret technical data around insulation materials, such as units, density and percentage composition.</p> <p><b>Resource:</b> NNFCC Renewable Building Materials Factsheet: Walls and Panels<br/> <a href="http://www.nnfcc.co.uk/metadot/index.pl?id=5969;isa=DBRow;op=show;dbview_id=2457&amp;reason=0YBrowser.HTML\Shell\Open\Command">http://www.nnfcc.co.uk/metadot/index.pl?id=5969;isa=DBRow;op=show;dbview_id=2457&amp;reason=0YBrowser.HTML\Shell\Open\Command</a><br/> <a href="http://www.house-energy.com/Insulation/Insulation-House.htm">http://www.house-energy.com/Insulation/Insulation-House.htm</a></p>   |   | or Eco-building to see how renewables are used.          |
| 5 | Collect data from the web or catalogues or set data list and perform a mathematical analysis of costs of electricity required for their home. | <p>1 Using and applying mathematics.</p> <p>2 Understand and use proportionally</p> | <p><b>Starter:</b> <i>"How much does it cost to leave lights on? Did you know that it's estimated that lighting in most homes accounts for 10 to 15 per cent of the electricity bill, and that the average household could save as much as £25 per year, just by switching off unused lights around the home? The average household wastes £37 a year, simply by leaving appliances on standby."</i> Discuss</p> <p><b>Resource:</b><br/> <a href="http://www.channel4.com/4homes/eco/easy-energy-and-money-saving-tips-3.html">http://www.channel4.com/4homes/eco/easy-energy-and-money-saving-tips-3.html</a></p> <p><b>Main Activity:</b> Look at electricity bills and find out unit costs for different providers.</p> <p><b>Resource:</b> Link to your local electricity tariffs<br/> <a href="http://www.cheap-gas-and-electricity-bills.com/electricity-contracts.html">http://www.cheap-gas-and-electricity-bills.com/electricity-contracts.html</a></p> <p>Use a home survey. Look at your own electricity bills. Find out about energy efficient light bulbs. Energy efficiency around electricity, solar panels, wind power.</p> <p><b>Resource</b> on Solar Energy:<br/> <a href="http://www.house-energy.com/Solar/Basics.htm">http://www.house-energy.com/Solar/Basics.htm</a></p> | <p>1 Identify the information necessary to solve the problem.</p> <p>2 Break up a complex calculation into simpler manageable steps</p> | Cost to run different electrical appliances in the home. |

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|--------|-------------------------------|--|--|--|--|
| 6<br>+ | Extensions for future lessons | 1 Calculating<br>2 Shape, space and measure<br>3 Handling data<br>4 Using and applying mathematics | Discuss renewables. Do a survey of your classroom, school environment and/or look at your own home.<br>Calculate floor/wall space in your bedroom.<br>Check at home for renewables.<br><br>Research Eco Homes<br><a href="http://www.channel4.com/4homes/eco/index.html">http://www.channel4.com/4homes/eco/index.html</a><br><br>Look at design ideas linked to renewables<br><br>Chair design:<br><a href="http://en.wikipedia.org/wiki/Chair">http://en.wikipedia.org/wiki/Chair</a><br>What should you look for in a seat?<br><a href="http://www.betterseating.org/lookfor.html">http://www.betterseating.org/lookfor.html</a><br><br>Tile design. Work on symmetry and pattern:<br><a href="http://www.vam.ac.uk/vastatic/microsites/1312_artsandcrafts/design_a_tile/">http://www.vam.ac.uk/vastatic/microsites/1312_artsandcrafts/design_a_tile/</a> | Understanding how mathematics can be used and applied to real life problem solving | Students perform individual or group research into renewable issues.<br><br>School visit to look at the use of renewables in an office/industry. |

## ADDITIONAL RESOURCES

### POWERPOINT PRESENTATION

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

## CURRICULUM LINKS

### Lesson 1

This lesson covers 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 in plane shapes.

Level 6 Know and use the formulae for the circumference and area of a circle.

Level 5 Use units of measurement to estimate, calculate and solve problems in everyday contexts involving length and area.  
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 2, 3 and 4

These lessons cover a number of curriculum links from 'Handling data' and 'Using and applying mathematics'.

Level 8 Select and combine known facts and problem solving strategies to solve problems.

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 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 Identify the necessary information to solve a problem.

Level 4 Choose appropriate units and interpret, with appropriate accuracy, numbers on a range of measuring instruments.

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 5

This lesson covers a number of links from 'Using and applying mathematics', 'Handling data' 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 Examine critically the results of a statistical enquiry, and justify the choice of statistical representation in written presentations.

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 6 Design a survey to capture the necessary data to construct tables for large discrete and continuous sets of raw data.

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 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 Solve number problems that give rise to remainders.

### Lesson 6+

Eco Homes extension work covers a number of curriculum links from 'Using and applying mathematics', 'Shape, space and measure', 'Handling data' and 'Calculating'.

Level 8 Select and combine known facts and problem solving strategies to solve problems.

Level 8 Understand the difference between formulae for perimeter, area and volume in simple contexts.

Level 7 Calculate lengths, areas and in plane shapes.

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 Use logical argument to establish the truth of a statement.

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 context involving length, area and volume.

Level 4 Choose appropriate units and interpret, with appropriate accuracy, numbers on a range of measuring instruments.

Level 4 Use a calculator to solve number problems and interpret the display.

Level 3 Classify 2D shapes in various ways by using mathematical properties.