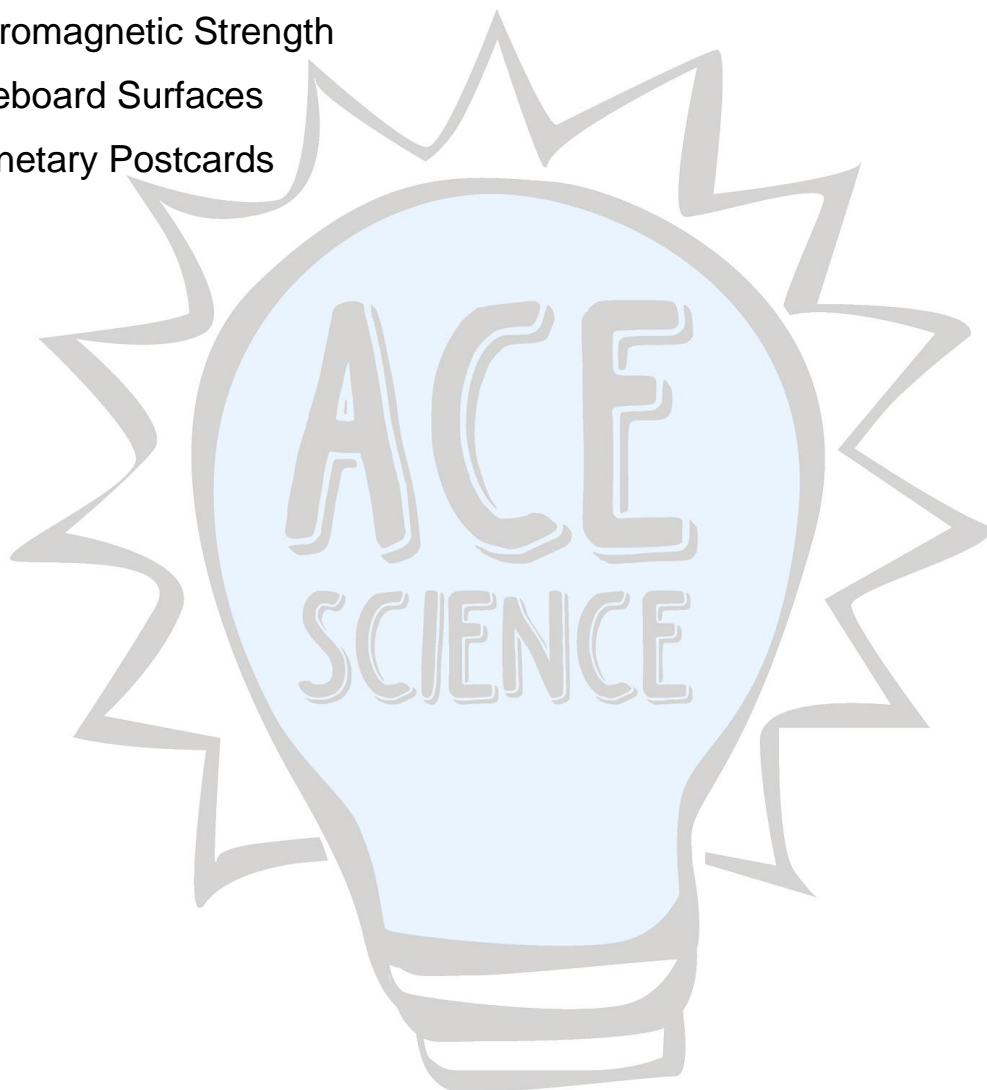
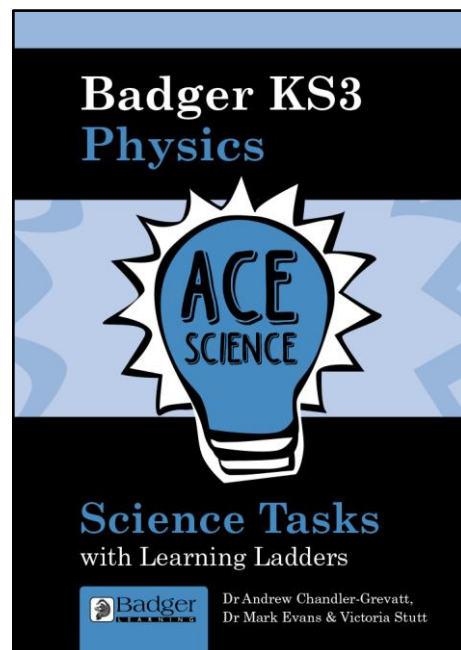


# ACE SCIENCE KS3 SCIENCE TASKS PHYSICS

## CONTENTS

1. Investigating Insulation
2. Heat in the Kitchen
3. What are Forces?
4. Journey of Pram, Car or Submarine
5. Investigating Turning Forces
6. Bungee Testing
7. Designing Ear Defenders
8. Investigating Hearing with Age
9. Light Effects
10. How does a Torch work?
11. Wiring a House
12. Electromagnetic Strength
13. Skateboard Surfaces
14. Interplanetary Postcards



# 1

TEACHER NOTES:

## INVESTIGATING INSULATION

### NATIONAL CURRICULUM LINKS

#### WORKING SCIENTIFICALLY

Experimental skills and investigations

#### CALCULATION OF FUEL USES AND COSTS IN THE DOMESTIC CONTEXT

- domestic fuel bills, fuel use and costs
- fuels and energy resources.

#### ENERGY CHANGES AND TRANSFERS

- heating and thermal equilibrium: temperature difference between two objects leading to energy transfer from the hotter one to the cooler one, through contact (conduction) or radiation; such transfers tending to reduce the temperature difference; use of insulators.

#### CHANGES IN SYSTEMS

- energy as a quantity that can be quantified and calculated; the total energy has the same value before and after a change.

### TASK:

Plan an investigation, collect evidence safely and present the data appropriately.

This task is designed to encourage students to develop their planning and data collection skills. It draws on their knowledge and understanding of energy transfers and insulation.

### SUGGESTED APPROACH:

Please read the introduction to this book to get the most out of this task.

In class, use a starter activity as the stimulus to the task; introduce the task and ACE Learning Ladder, and allow 30–40 minutes to complete it. Allow students to use secondary resources such as class notes, textbooks and library books to develop their ideas. In the plenary, peer or self assess using the ACE Learning Ladder.

You may wish to show examples of different types of insulation and recap how insulation works and why it is necessary.

### RESOURCES:

Lined and plain A4 paper. Possibly examples of insulation.

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TEACHER NOTES:

## INVESTIGATING INSULATION

### PRIOR LEARNING EXPERIENCE:

Before students attempt this task, they must be familiar with:

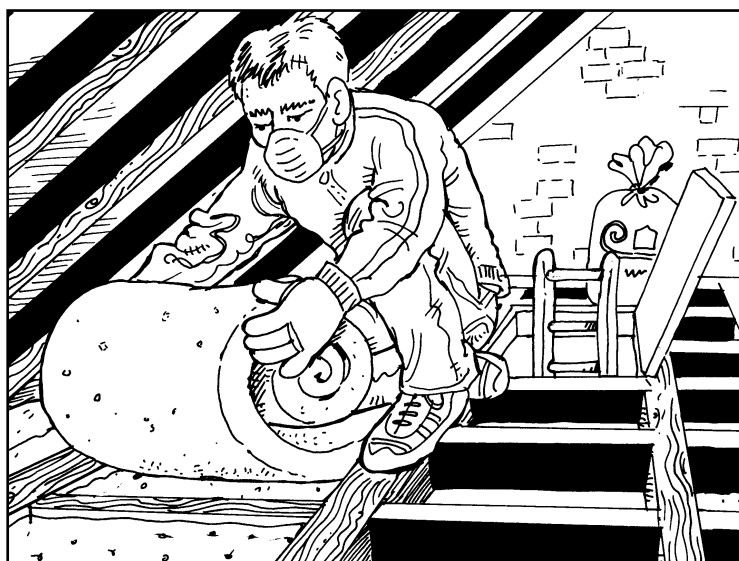
- insulating materials
- energy transfers
- planning investigations
- planning how to collect valid results.

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## TASK SHEET:

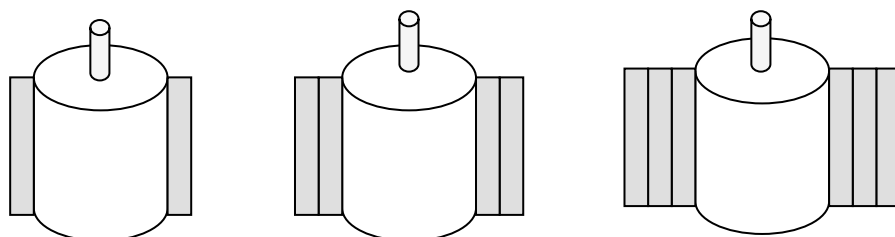
# INVESTIGATING INSULATION

According to the Energy Saving Trust, if everyone in the UK installed 270mm loft insulation, we could save around £520 million and nearly three million tonnes of carbon dioxide every year.



### TASK

Which is the best thickness of insulation to use in a loft?



### IN YOUR PLAN INCLUDE:

- equipment list
- variables - the ones you will keep the same (control) the one you will change (independent) and the one you will measure (dependent)
- a description of what you will do
- include a suitable range and intervals for your observations
- safety precautions.

### COLLECTING RESULTS:

- draw a table for your results.
- plan to collect a sufficient number of results

### KEY WORDS

conduction, control variable, convection, dependent variable, energy transfer, independent intervals, insulation, radiation, range, temperature, thermal, variable

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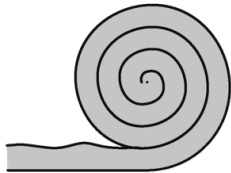


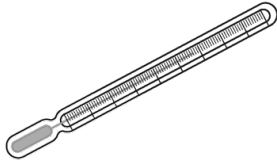
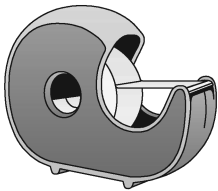

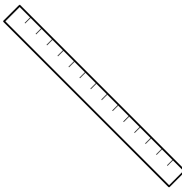


## ACE LEARNING LADDER: INVESTIGATING INSULATION

### ACE LEARNING LADDER

Assessment check	What you could include:
Advanced	<p>You will have planned an in-depth investigation into insulation, drawing on scientific knowledge and understanding. You might:</p> <ul style="list-style-type: none"> <li>• Write a detailed method that clearly shows all variables you will control, change and measure.</li> <li>• Give a detailed justification for your method and the number of repeats you plan to make, explaining how you will ensure accuracy and precision.</li> <li>• Explain, in detail, your method in terms of your scientific knowledge and understanding of insulation and energy transfers.</li> <li>• Consult secondary sources of information when writing a risk assessment for your investigation.</li> <li>• Use a range of appropriate scientific words, symbols and units accurately.</li> </ul>
Confident	<p>You will have planned an investigation into insulation, drawing on scientific knowledge and understanding. You might:</p> <ul style="list-style-type: none"> <li>• Write a method that clearly shows all variables you will control, change and measure.</li> <li>• Justify your method and the number of repeats you plan to make.</li> <li>• Explain your method in terms of your scientific knowledge and understanding of insulation and energy transfers.</li> <li>• Recognise familiar risks within your investigation and describe how you will control these.</li> <li>• Use a range of appropriate scientific words, symbols and units.</li> </ul>
Establishing	<p>You will have planned a simple investigation into insulation, drawing on scientific knowledge and understanding. You might:</p> <ul style="list-style-type: none"> <li>• With help, write a method.</li> <li>• Identify factors you will keep the same and change.</li> <li>• Select appropriate equipment for your investigation.</li> <li>• Describe how many repeats you will use.</li> <li>• Identify possible risks to yourself and others.</li> <li>• Use some appropriate scientific words, symbols and units.</li> </ul>

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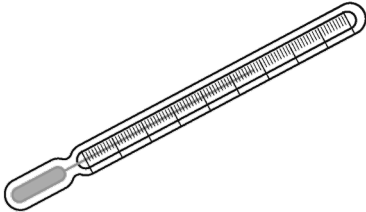
## SUPPORT SHEET 1: ESTABLISHING TO CONFIDENT INVESTIGATING INSULATION

Equipment options			
			
Insulating material	Large beaker with cover	Stopwatch	Thermometer
			
String, sticky tape, or elastic bands	Kettle	Ruler	Other?
<p><b>Variables</b></p> <p><b>Control, dependent, independent</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> thickness of insulation</li> <li><input type="checkbox"/> type of insulation</li> <li><input type="checkbox"/> starting temperature of water</li> <li><input type="checkbox"/> time intervals</li> <li><input type="checkbox"/> temperature decrease</li> <li><input type="checkbox"/> others?</li> </ul>		<p><b>Safety for yourself and others</b></p> <p><b>Risks</b></p> <ul style="list-style-type: none"> <li><input type="checkbox"/> insulating material</li> <li><input type="checkbox"/> glass</li> <li><input type="checkbox"/> thermometer</li> <li><input type="checkbox"/> hot water</li> </ul> <p>How will you control them?</p>	
<p><b>Range and intervals</b></p> <p>How many thicknesses of insulation will you compare?</p> <p>How many times will you repeat each measurement?</p>		<p><b>About insulation</b></p> <p>Insulating material traps warm air. This slows down convection (warm air rising) and heat loss from the house.</p> 	

# 1

## SUPPORT SHEET 2: CONFIDENT TO ADVANCED INVESTIGATING INSULATION

<p style="text-align: center;"><b>Equipment</b></p> <p>Possible equipment.</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> insulating material</li> <li><input type="checkbox"/> large beaker with a cover</li> <li><input type="checkbox"/> thermometer or data logger</li> <li><input type="checkbox"/> stopwatch</li> <li><input type="checkbox"/> string, rubber bands or sticky tape</li> <li><input type="checkbox"/> kettle</li> <li><input type="checkbox"/> other?</li> </ul>	<p style="text-align: center;"><b>Techniques</b></p> <p><b>Measuring temperature</b> What is the advantage of using a data logger over a thermometer?</p> <p><b>Starting temperature</b> How will you decide the starting temperature? Does it matter?</p>
<p style="text-align: center;"><b>Variables</b></p> <p>Consider the variables that you can control, measure and change.</p> <p>What will you do to control the variables?</p>	<p style="text-align: center;"><b>Safety</b></p> <p>What risks are there when using:</p> <ul style="list-style-type: none"> <li><input type="checkbox"/> insulating material?</li> <li><input type="checkbox"/> a kettle?</li> <li><input type="checkbox"/> glass?</li> </ul> <p>How will you control them for yourself and for others?</p>
<p style="text-align: center;"><b>Range, intervals and reliability</b></p> <p><b>Range:</b> How many thicknesses of insulation will you investigate?</p> <p><b>Intervals:</b> What intervals of measurements are you using?</p> <p><b>Reliability:</b> How many times will you do each test? How will you ensure that your investigation is reliable?</p>	<p style="text-align: center;"><b>About insulation</b></p> <p>Insulating materials usually trap air and slow down thermal energy transfers.</p> <p>Heat energy is usually lost from the roof by convection. Roof insulation does reduce this.</p> <p>The thicker the insulation, the more expensive it is to install. Is it worth putting very thick insulation in the roof?</p>

<p style="text-align: center;"><b>Techniques</b></p> <p>What makes insulation effective?</p> <p>What's the best way to measure the effectiveness of insulation?</p> <p>When would you start the measurement and finish it? What effect may this have?</p> <p>How will you ensure the water starts at the same temperature? Does it matter?</p> <p>What is it exactly that you want to investigate?</p>	<p style="text-align: center;"><b>Controlling risk</b></p> <p>Safety - research guidance from:</p> <ul style="list-style-type: none"> <li>• CLEAPSS</li> <li>• Using hot water</li> <li>• Other?</li> </ul> <div style="text-align: right;">  </div>
<p style="text-align: center;"><b>Variables</b></p> <p>Identify the variables that are not easy to control and consider how to reduce errors from them.</p> <div style="text-align: center;">  </div>	<p style="text-align: center;"><b>Controlling errors</b></p> <p>What possible errors could happen in your measurements?</p> <p>Consider each stage of the investigation. How can you ensure that you measure accurately?</p> <p>Consider the errors that may occur when you carry out the investigation. How will you control them?</p>
<p style="text-align: center;"><b>Precision and reliability</b></p> <p>Which measurements will need to be precise?</p> <p>How will you ensure precision?</p> <p>How are reliability and error control linked?</p> <p>How will you ensure the results are reliable?</p>	<p style="text-align: center;"><b>About insulation</b></p> <p>Thick insulation is more expensive. Is it worth having very thick insulation?</p> <p>What else could you do to reduce thermal energy loss from your home?</p>