ACE SCIENCE KS3 SCIENCE TASKS BIOLOGY

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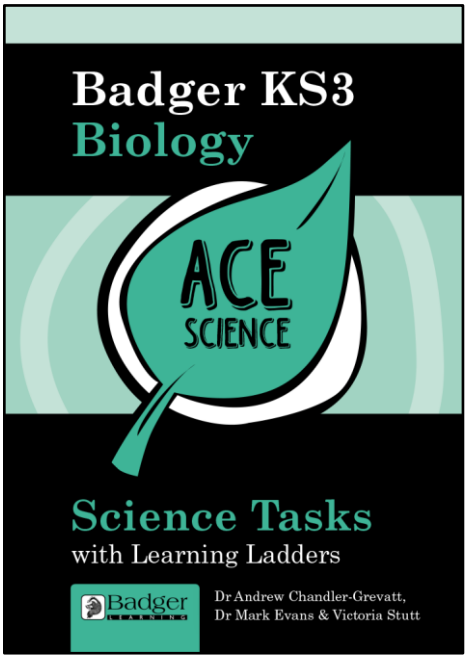

1 TEACHER NOTES: MAKING A MODEL CELL

NATIONAL CURRICULUM LINKS

CELLS AND ORGANISATION

- cells as the fundamental unit of living organisms, including how to observe, interpret and record cell structure using a light microscope
- the functions of the cell wall, cell membrane, cytoplasm, nucleus, vacuole, mitochondria and chloroplasts
- the similarities and differences between plant and animal cells
- the role of diffusion in the movement of materials in and between cells
- the structural adaptations of some unicellular organisms.

TASK:

Make a model of a plant or animal cell.

SUGGESTED APPROACH:

Please read the introduction to this book to get the most out of this task. It is unusual in its format as it requires learners to make a 3D model. Set homework to make a cell, then label it and make a legend in class, using the ACE Learning Ladder as a guide. Ask learners to do a short presentation about their model cell.

To ensure that the assessment is formative, learners could either make improvements (after teacher, self or peer assessment) to their exhibit or the teacher could set specific tasks to aid progression. For example: a worksheet to label a diagram of a plant or animal cell, or match cell parts to their jobs. These types of task are available in most published schemes.

RESOURCES:

None if set as a homework. For class activity, a variety of materials for making model cells, for example: plastic and cardboard cartons, cling film, dried peas, golf balls or ping pong balls, wallpaper paste (optional: make appropriate risk assessment), plastic bags, scissors, glue.

PRIOR LEARNING EXPERIENCE:

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

- observing cells under a microscope
- simple structures of animal and plant cells
- adaptations in specialised cells.

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TASK SHEET:

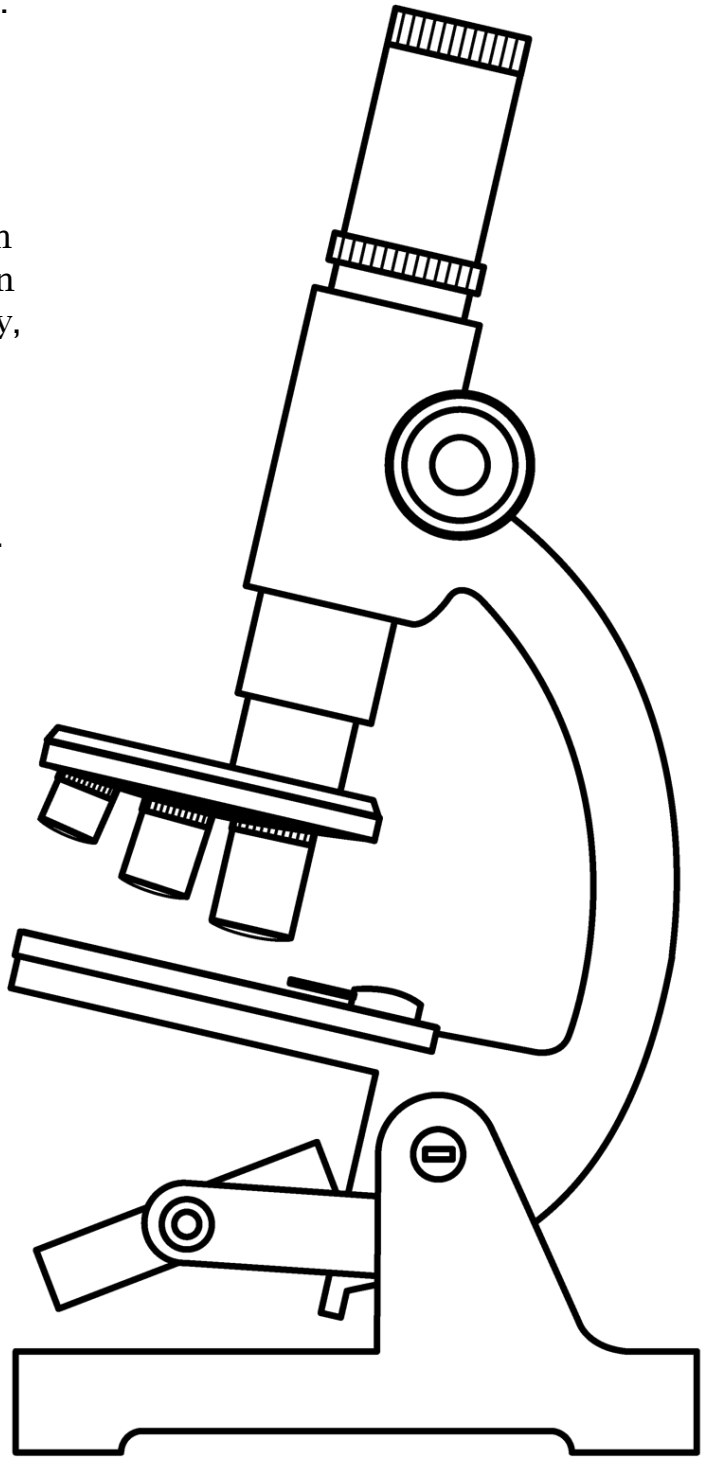
MAKING A MODEL CELL

Imagine the Science Museum has asked you to make a model cell for a display. Make a model of one of the following:

- an animal cell
- a plant cell
- a specialised cell.

Use the key words below to label each part of the model cell clearly. Make an information card, perhaps using a key, to describe what cells are and the structures they contain.

Your teacher may ask you to give a short presentation about your model.



KEY WORDS

cell, cell membrane, cell wall, chloroplast, cytoplasm, nucleus, mitochondria , vacuole

1 ACE Learning Ladder: Making a Model Cell

ACE Learning Ladder

Assessment check	What you could include:
Advanced	You will have made a detailed model cell, drawing on detailed scientific knowledge and understanding. You might: • Represent the structures found within the cell of your choice approximately to scale or relative size. • Explain the role of each part of the cell shown in detail. • Discuss how different cells are specialised for different roles, and what stem cells are and their potential uses. • Explain the different types of microscopes available and the cell organelles these allow you to observe. • Use a range of appropriate scientific words, symbols and units accurately.
Confident	You will have made a model cell, drawing on scientific knowledge and understanding. You might: • Show the structures found within the cell of your choice paying attention to accuracy of shape and location within the cell. • Explain the role of each part of the cell shown. • Discuss how the cell your model shows is similar or different to other cells. • Explain how to use a microscope to observe cells. • Use a range of appropriate scientific words, symbols and units.
Establishing	You will have made a simple model cell, drawing on some scientific knowledge and understanding. You might: • Show the structures found within the cell of your choice. • State the name and role for each structure in your model. • List one or two differences between animal and plant cells. • Give a simple description of how to use a microscope. • Use some appropriate scientific words, symbols and units.

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SUPPORT SHEET 1: ESTABLISHING TO CONFIDENT

MAKING A MODEL CELL

CELLS TO SYSTEMS

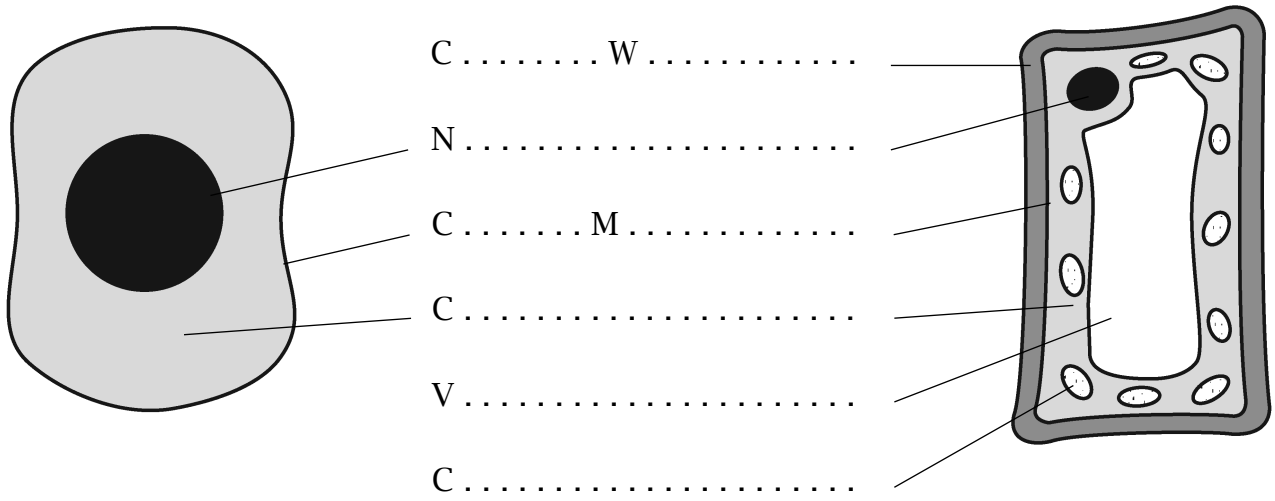
Key words

Link the correct job to each cell part.

Parts of cell	Jobs
Cell	controls the cell
Cell membrane	lets some substances in and out of the cell
Cytoplasm	place where respiration (and energy production) occurs
Nucleus	stores cell sap
Mitochondria	place where chemical reactions take place

Animal cell

Plant cell



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SUPPORT SHEET 2: CONFIDENT TO ADVANCED

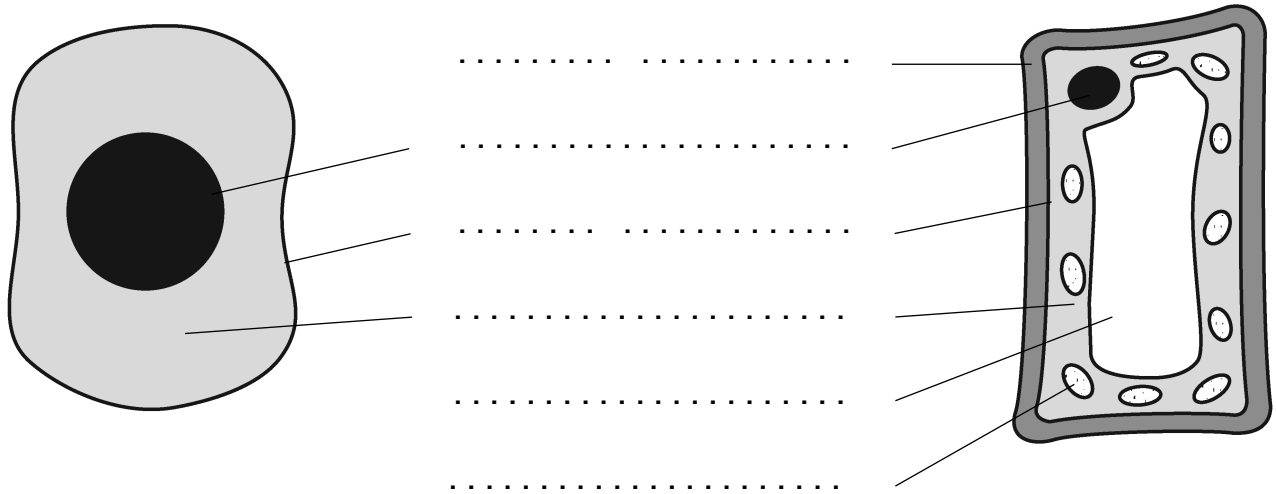
MAKING A MODEL CELL

To help you think about some of the cell parts your model should include, fill in the missing cell parts to the table below.

Parts of cell	Jobs
	controls the cell
	lets some substances in and out of the cell
	place where respiration (and energy production) occurs
	stores cell sap
	place where chemical reactions take place

Animal cell

Plant cell



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SUPPORT SHEET 3: ADVANCED EXTEND AND STRETCH

MAKING A MODEL CELL

- Make a *scale* model of a *specialised* plant or animal cell.
- Label all parts of the cell correctly, including unusual characteristics, explaining their function.
- Explain in detail the importance of understanding cell structure and function.
- Explain how the cell's shape is related to its function.

ACE Science KS3 Science Tasks Chemistry

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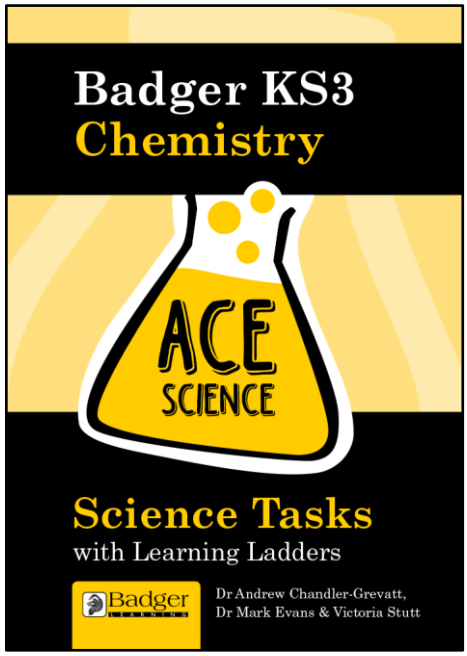

1 TEACHER NOTES: ICE CUBE POSTER

NATIONAL CURRICULUM LINKS

THE PARTICULATE NATURE OF MATTER

- the properties of the different states of matter (solid, liquid and gas) in terms of the particle model, including gas pressure
- changes of state in terms of the particle model.

TASK:

Draw a poster that explains why an ice cube melts (and evaporates) when left out of the freezer.

SUGGESTED APPROACH:

Please read the introduction to this book to get the most out of this task. It is suitable for a homework task or class activity.

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. Starter suggestions: matching key words – melting, evaporating, condensing, solidification, freezing – to pictures of these events, e.g. melting ice cube. Match words and phrases describing the behaviour of solids, liquids and gases to the correct state. Allow learners to use secondary resources such as class notes, textbooks and library books to develop their poster. In the plenary, peer or self assess using the ACE Learning Ladder.

RESOURCES:

A4 plain paper, pencils, pens, rulers.

PRIOR LEARNING EXPERIENCE:

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

- properties of solids, liquids and gases
- changes of state between the three states of matter
- particle theory, arrangement and behaviour of particles in the three states of matter.

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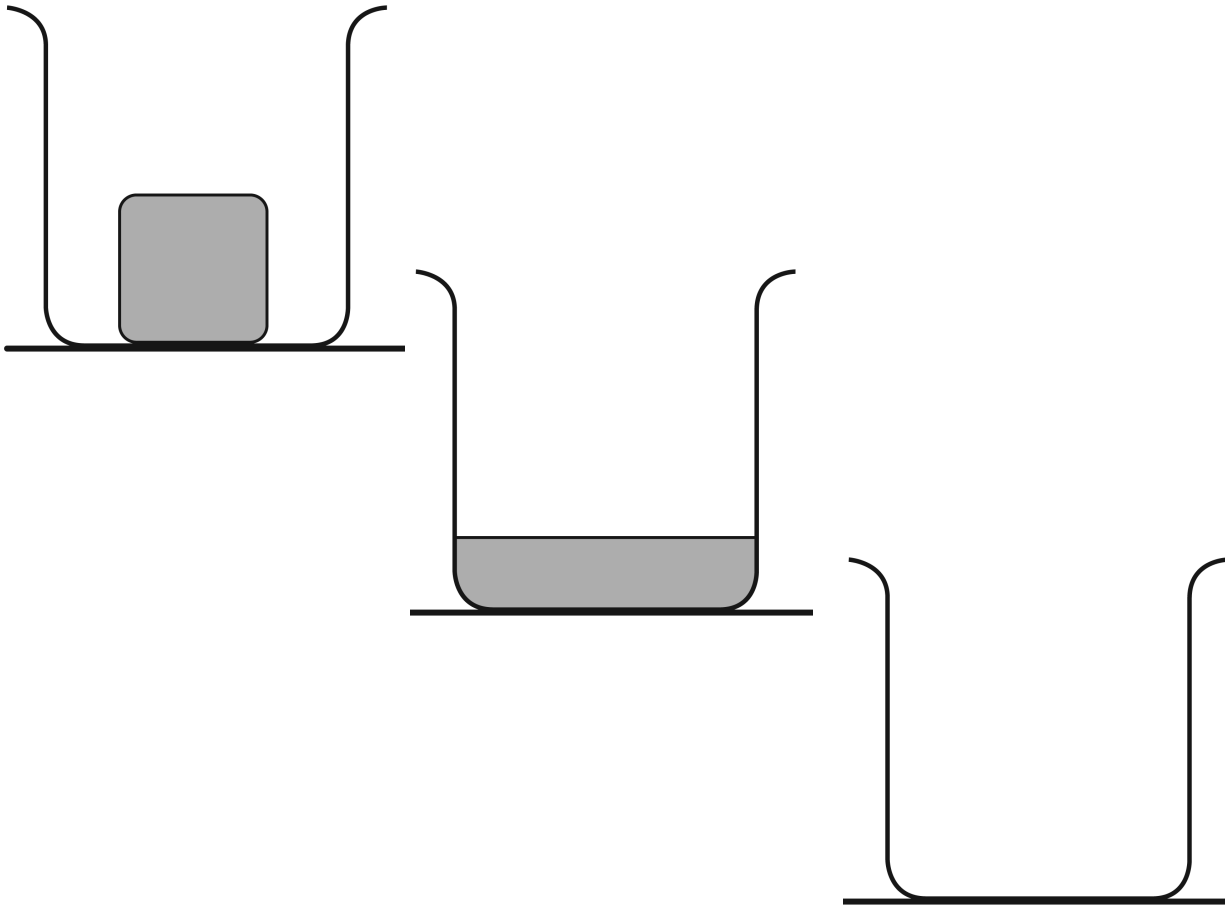
TASK SHEET:

ICE CUBE POSTER

Some students were watching an ice cube in a beaker as it slowly melted. They were wondering why it melts. When they inspected the beaker the next lesson, the water was gone.



Draw a poster that explains why an ice cube melts when left out of the freezer and what happens to the water when it is left in a beaker for a while. Use a particle model to help explain your ideas.

KEY WORDS

boiling, compressible, conservation of mass, density, energy, evaporating, fixed, forces between particles, freezing, gas, liquid, melting, moving randomly, particles, solid, solidification, states of matter, temperature, vibrating

1 ACE Learning Ladder: Ice Cube Poster

ACE Learning Ladder

Assessment check	What you could include:
Advanced	You will have drawn a detailed poster explaining why an ice cube melts, drawing on detailed scientific knowledge and understanding. You might: • Draw a detailed particle diagram for the water particles in each state, showing that water particles are molecules. • Explain why energy is required for the ice to melt or evaporate and where this comes from. • Use the idea of melting points and boiling points to describe the changes. • Compare the melting and evaporating of an ice cube to observations that would be expected from other substances undergoing the same processes. • Use a range of appropriate scientific words, symbols and units accurately.
Confident	You will have drawn a poster explaining why an ice cube melts, drawing on scientific knowledge and understanding. You might: • Draw a particle diagram for the water particles in each state. • Explain the differences in movement and energy of the particles at each state. • Explain what has to happen to the particles to be able to melt or evaporate. • Describe whether the melting and evaporating of an ice cube is a physical or chemical change. • Use a range of appropriate scientific words, symbols and units.
Establishing	You will have drawn a simple poster explaining why an ice cube melts, drawing on some scientific knowledge and understanding. You might: • Draw a simple particle diagram for the water particles in each state, with help. • State how the particles are arranged in each state, what their movement is like and how much energy they have. • Describe what happens when the ice cube melts and when it evaporates, in terms of what would be observed. • State if melting and evaporating are a physical or chemical change. • Use some appropriate scientific words, symbols and units.

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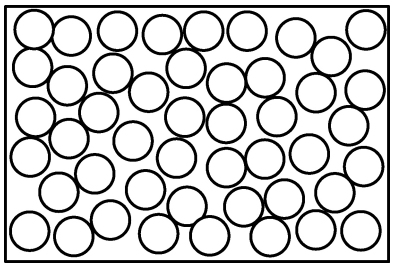
SUPPORT SHEET 1: ESTABLISHING TO CONFIDENT

ICE CUBE POSTER

Correctly identify the state of matter shown in the diagrams below. Complete the sentences about each before starting the task, by choosing which sentence finishers correctly describe the state shown in each diagram.

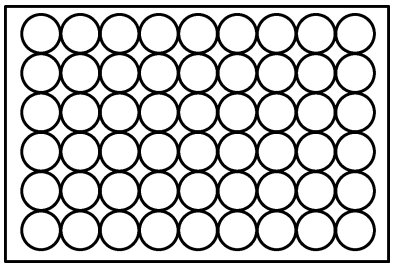


This represents a . . . . . .

The particles have
- high levels of energy
- medium levels of energy
- low levels of energy.

They
- can move about past one another
- cannot move about
- can move about completely freely.

The particles are arranged
- in a regular pattern
- randomly and apart from one another
- randomly but in contact with one another.



This represents a . . . . . .

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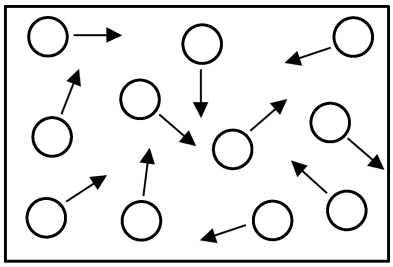
SUPPORT SHEET 1: ESTABLISHING TO CONFIDENT

ICE CUBE POSTER



This represents a . . . . . .

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They
- can move about past one another
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- can move about completely freely.

The particles are arranged
- in a regular pattern
- randomly and apart from one another
- randomly but in contact with one another.

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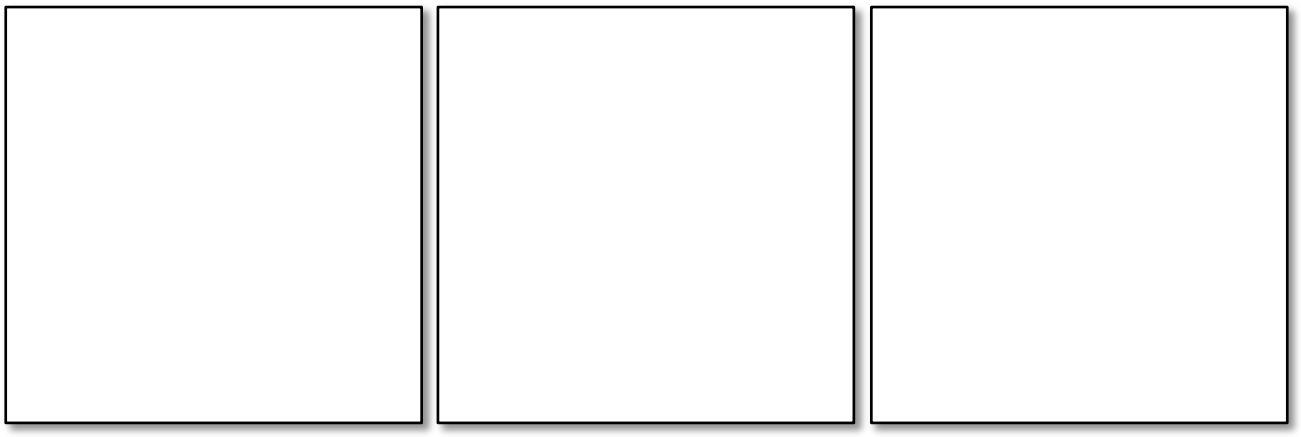
SUPPORT SHEET 2: CONFIDENT TO ADVANCED

ICE CUBE POSTER

Use the spaces below to plan particle diagrams for each state of matter.



- What explanations will you need to include to describe what each state is like?

- How could you describe what happens to particles within substances moving between each of the states shown?

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SUPPORT SHEET 3: ADVANCED EXTEND AND STRETCH

ICE CUBE POSTER

Water has the chemical formula H_2O. It exists as molecules.

- What does this formula tell us about what water is made from?

- Use the spaces below to plan particle diagrams for each state of matter, which clearly show water is a molecule.

ACE SCIENCE KS3 SCIENCE TASKS PHYSICS

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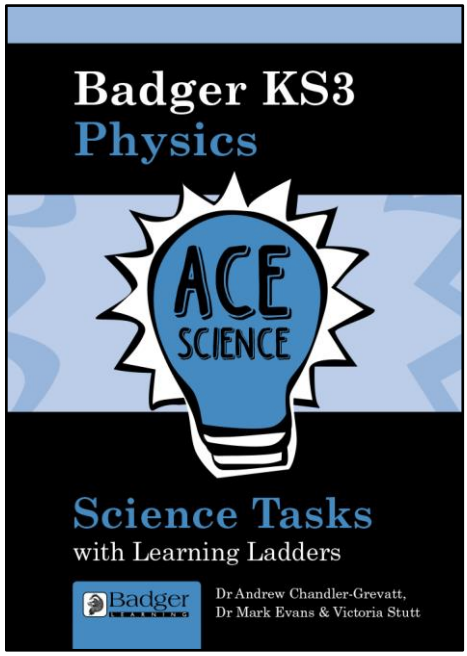

1 TEACHER NOTES: INVESTIGATING INSULATION

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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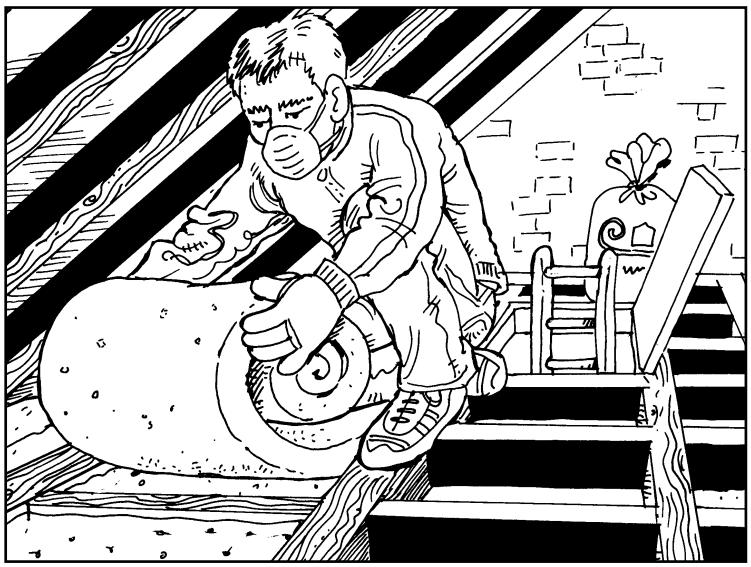
TASK SHEET:

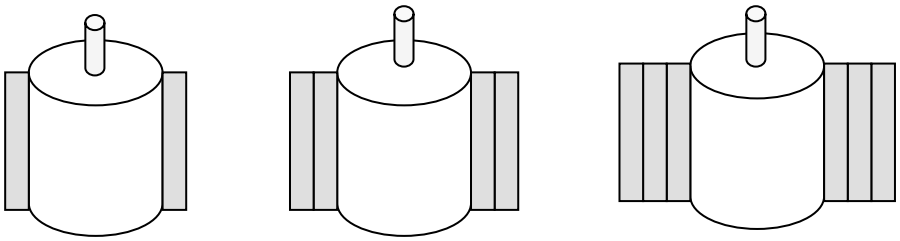
INVESTIGATING INSULATION

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

1 ACE Learning Ladder: Investigating Insulation

ACE Learning Ladder

Assessment check	What you could include:
Advanced	You will have planned an in-depth investigation into insulation, drawing on scientific knowledge and understanding. You might: • Write a detailed method that clearly shows all variables you will control, change and measure. • Give a detailed justification for your method and the number of repeats you plan to make, explaining how you will ensure accuracy and precision. • Explain, in detail, your method in terms of your scientific knowledge and understanding of insulation and energy transfers. • Consult secondary sources of information when writing a risk assessment for your investigation. • Use a range of appropriate scientific words, symbols and units accurately.
Confident	You will have planned an investigation into insulation, drawing on scientific knowledge and understanding. You might: • Write a method that clearly shows all variables you will control, change and measure. • Justify your method and the number of repeats you plan to make. • Explain your method in terms of your scientific knowledge and understanding of insulation and energy transfers. • Recognise familiar risks within your investigation and describe how you will control these. • Use a range of appropriate scientific words, symbols and units.
Establishing	You will have planned a simple investigation into insulation, drawing on scientific knowledge and understanding. You might: • With help, write a method. • Identify factors you will keep the same and change. • Select appropriate equipment for your investigation. • Describe how many repeats you will use. • Identify possible risks to yourself and others. • Use some appropriate scientific words, symbols and units.

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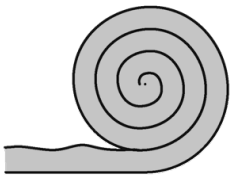
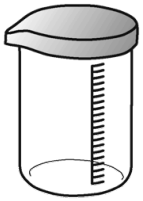
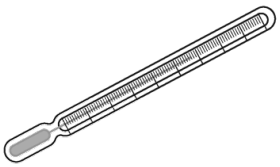
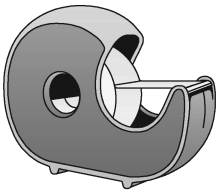
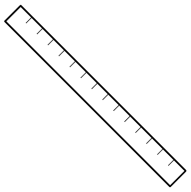
SUPPORT SHEET 1: ESTABLISHING TO CONFIDENT

INVESTIGATING INSULATION

Equipment options			
			
Insulating material	Large beaker with cover	Stopwatch	Thermometer
			?
String, sticky tape, or elastic bands	Kettle	Ruler	Other?

Variables

Control, dependent, independent

- ☐ thickness of insulation
- ☐ type of insulation
- ☐ starting temperature of water
- ☐ time intervals
- ☐ temperature decrease
- ☐ others?

Safety for yourself and others

Risks

- ☐ insulating material
- ☐ glass
- ☐ thermometer
- ☐ hot water

How will you control them?

Range and intervals

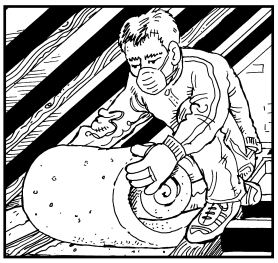
How many thicknesses of insulation will you compare?

How many times will you repeat each measurement?

About insulation

Insulating material traps warm air.

This slows down convection (warm air rising) and heat loss from the house.



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SUPPORT SHEET 2: CONFIDENT TO ADVANCED

INVESTIGATING INSULATION

Equipment

Possible equipment.

- ☐ insulating material
- ☐ large beaker with a cover
- ☐ thermometer or data logger
- ☐ stopwatch
- ☐ string, rubber bands or sticky tape
- ☐ kettle
- ☐ other?

Techniques

Measuring temperature
What is the advantage of using a data logger over a thermometer?

Starting temperature
How will you decide the starting temperature? Does it matter?

Variables

Consider the variables that you can control, measure and change.

What will you do to control the variables?

Safety

What risks are there when using:

- ☐ insulating material?
- ☐ a kettle?
- ☐ glass?

How will you control them for yourself and for others?

Range, intervals and reliability

Range:
How many thicknesses of insulation will you investigate?

Intervals:
What intervals of measurements are you using?

Reliability:
How many times will you do each test?

How will you ensure that your investigation is reliable?

About insulation

Insulating materials usually trap air and slow down thermal energy transfers.

Heat energy is usually lost from the roof by convection. Roof insulation does reduce this.

The thicker the insulation, the more expensive it is to install. Is it worth putting very thick insulation in the roof?

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SUPPORT SHEET 3: ADVANCED EXTEND AND STRETCH

INVESTIGATING INSULATION

Techniques

What makes insulation effective?

What's the best way to measure the effectiveness of insulation?

When would you start the measurement and finish it? What effect may this have?

How will you ensure the water starts at the same temperature? Does it matter?

What is it exactly that you want to investigate?

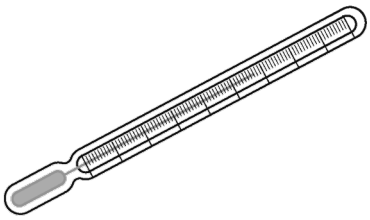
Controlling risk

Safety – research guidance from:

- CLEAPSS
- Using hot water
- Other?

Variables

Identify the variables that are not easy to control and consider how to reduce errors from them.



Controlling errors

What possible errors could happen in your measurements?

Consider each stage of the investigation.
How can you ensure that you measure accurately?

Consider the errors that may occur when you carry out the investigation.

How will you control them?

Precision and reliability

Which measurements will need to be precise?

How will you ensure precision?

How are reliability and error control linked?

How will you ensure the results are reliable?

About insulation

Thick insulation is more expensive. Is it worth having very thick insulation?

What else could you do to reduce thermal energy loss from your home?