

## Climate Action Week 2024: Insulation Experiment



Stage: **P4-S2**



Time: **1- 2 hours**

**Introduction:** Following Tuesday's Climate Action Week Live Lesson on engineering sustainable homes, we would like pupils to test different types of insulation in a model home.

### Introduction

This activity asks pupils to build a mock house from two boxes and place different materials in the gaps between the boxes to act as different types of insulation. Pupils time how long it takes for an ice cube to melt or for a glass of warm water to cool down. This can be done as a whole class activity or, if there are enough resources, the class can be placed into groups and insulation materials can be rotated between groups.

### Follow on

After this activity, pupils can move onto our overall week resource: 'Design your sustainable home' and complete design task 2.

### Teacher notes

An insulator is a material that slows down/resists the flow of heat (from a hot place to a cold place). This experiment looks at three different general types of insulation. Blanket insulation, such as rolls of fiberglass/rock wool in the loft, traps the movement of warm air to slow heat moving from a hot to cold place. Foam board insulation behaves in a similar way to blanket insulation but is a rigid construction. Reflective insulation, such as the foil blankets used to prevent people developing hyperthermia, reflects heat energy back to its source. Students can make a prediction as to which type of insulation will work best.

You can do this experiment in two ways – with ice cubes or warm water.

If using ice cubes in the experiment, the insulation will slow the flow of heat from the warm air to the ice cube. The poorer the insulation, the quicker the flow of heat and the quicker the ice cube melts. In this version of the experiment, you could think about insulation preventing the house from getting too hot in warm weather. The cavity walls slow down the heat from the outside of the house moving to the inside.

If using warm water, the insulation will slow the flow of heat from the warm water to the air outside the house. The poorer the insulation, the quicker the water will cool. In this version of the experiment, you could think about insulation helping the house get too cool in cold weather. The cavity walls slow down the heat from the inside of the house moving to the outside.

When comparing the different types of insulation, you could also discuss the ways of installing it. The foil is very thin but potentially more delicate. The foam board is probably thicker but obviously rigid and may need to be cut to certain shapes. The blanket can take the shape of the space it is in, but fibres could break off during insulation and be inhaled/get in eyes.

## Activity

### Materials for house:

- Large box with lid (shoe box)
- Smaller box that fits in large box and leaves a gap
- Small plate/dish that fits in smaller box
- 4 ice cubes (or glass beaker and a thermometer)
- Cling film (for optional window)
- Scissors and tape (for installing window)

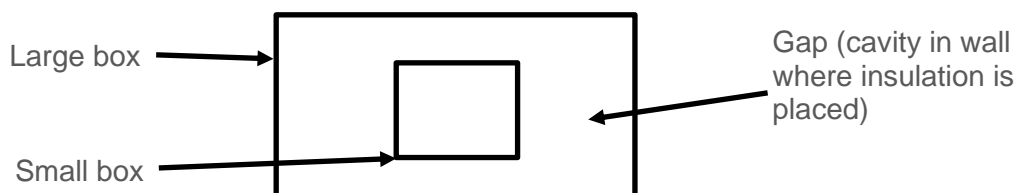
### Materials for insulation:

- Polystyrene (foam board insulation, slows down heat loss by slowing air movement)
- Cotton wool (blanket insulation, slows down heat loss by slowing air movement)
- Foil (reflective insulation, reflects heat back in the direction it's come from)
- Air (no added insulation, this is your control which you can compare the above insulations against)

### Experiment steps:

- 1) Pupils can complete the template on page 3 if they are doing the ice cube version of the experiment, or the template on page 4 if they are doing the warm water version of the experiment.
- 2) Predict which insulation material you think will be best.
- 3) Place the small cardboard box inside the larger cardboard box. The gap between the two boxes acts like the cavity in a cavity wall.

View of model house from above.



- 4) Fill the gap between the two boxes with one of the insulation materials.
- 5) Place the ice cube on a small plate in the centre of the small box.
- 6) Place the lid (roof) on top of the larger box.
- 7) Time how long it takes for the ice cube to melt. You'll have to lift the lid to check the ice cube, or you could cut out a square from the lid and replace it with some clingfilm to act as a window.
- 8) Once the ice cube has melted, pour water away and dry the plate.
- 9) Record results on the table in the relevant template.
- 10) Repeat 2-7 with different materials.
- 11) If ice is not available, then a beaker of warm water can be used, and the temperature change over 10 minutes can be measured. The beaker will need to be at the same temperature for each material e.g. 50°C. Please be aware that boiling water on cold glass can cause the glass to break so it's best to use warm water.

## Ice cube experiment worksheet

Investigate which insulation is the best at slowing down the melting of the ice cube. You can use what you learn to help with the design of your sustainable home.

Prediction: Which material do you think will be the best insulator and why?

Material	Time to melt (s)

What do your results show you?

Which insulation/combination of insulation would you like to use in your sustainable home?

## Warm water experiment worksheet

Investigate which insulation is the best at slowing down the cooling of the water. You can use what you learn to help in the designing of your sustainable home.

Prediction: Which material do you think will be the best insulator and why?

Material	Temperature at start (°C)	Temperature after 10 minutes (°C)

What do your results show you?

Which insulation/combination of insulation would you like to use in your sustainable home?