

# Materials – Thermal conductors

Name \_\_\_\_\_

Class \_\_\_\_\_

**What you will need for this lesson:** some butter, hot water, a plastic bowl, a wooden spoon, a plastic spoon and a metal spoon. You may use a saucepan and a larger wooden, plastic and metal spoons.

You will also need a pen, a pencil and if you have it, access to a computer, tablet or iPad.

## LESSON STARTER

Look at the pictures below. Write in the boxes below each one whether you think it is a conductor (something that allows heat to travel through it) or an insulator (something that does not allow heat to travel through it). Y5 & Y6 children should try and explain their answer.



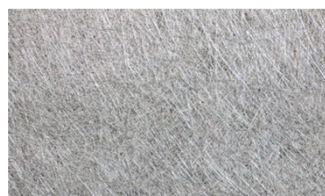












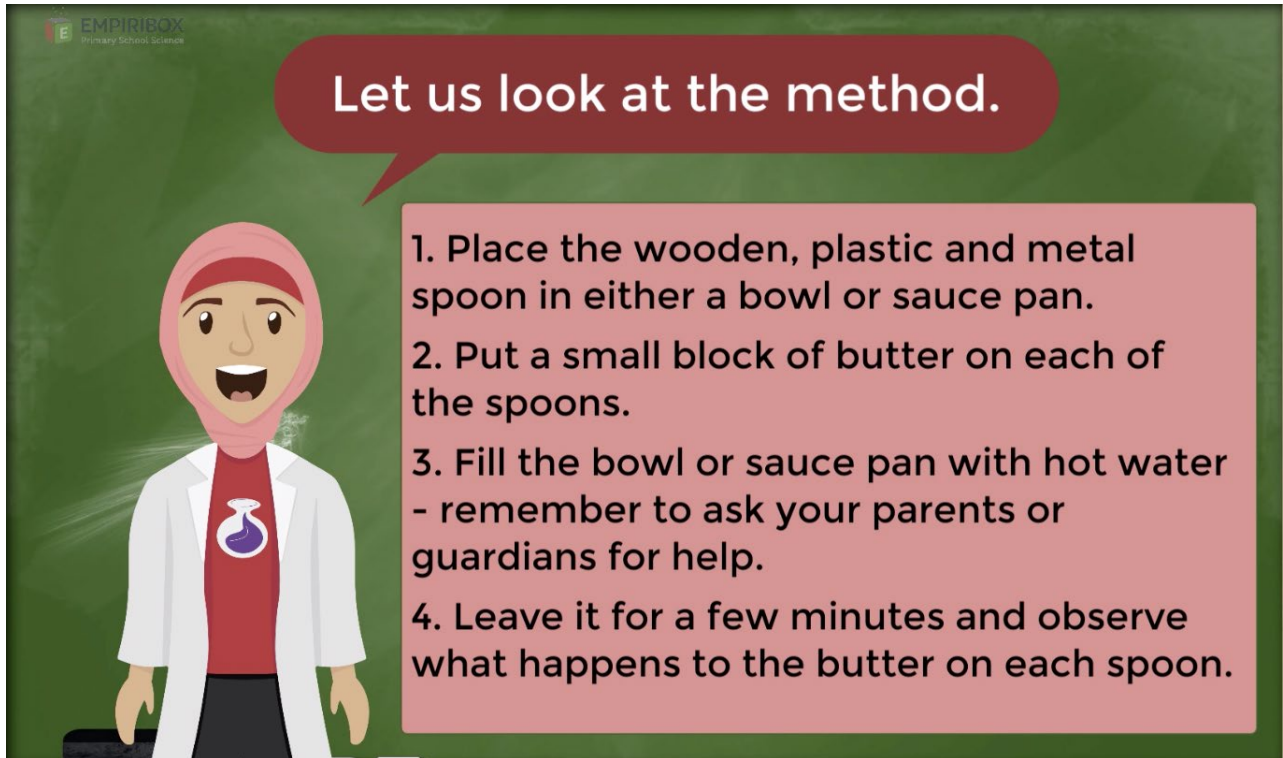




When you've finished, watch the video to see how many you got right.

## THE INVESTIGATION

This investigation uses hot water and so make sure you have an adult to help you pour the hot water into the bowl.



**Let us look at the method.**

1. Place the wooden, plastic and metal spoon in either a bowl or sauce pan.
2. Put a small block of butter on each of the spoons.
3. Fill the bowl or sauce pan with hot water - remember to ask your parents or guardians for help.
4. Leave it for a few minutes and observe what happens to the butter on each spoon.

After 5 minutes or so see what's happened to your spoons of butter and write it up below:

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**Please remember to be very careful with hot water and always ask an adult to help you!**

### What we learned!



Metals are good thermal conductors because the molecules within metals are very tightly packed together so they can transfer heat very quickly from one molecule to the next one. As you have found out, plastic and wool do not transfer heat and so are called thermal insulators.

## WORKING SCIENTIFICALLY

Our next focus is about working scientifically. All scientists apply these principles whenever they are investigating anything and we've divided them into different skill units.

**Find the section your teacher has asked you to focus on and answer the questions in the relevant section.**

**A. Planning or**

**B. Presenting and analysing data or**

**C. Evaluation**

## A. PLANNING

Every scientist wants to solve a problem and so takes the following steps

1. **Decides on a question that needs answering.** e.g. will the temperature of the water affect the melting speed of the butter?
2. **Decides what the independent variable (the thing that is changed) might be in order to work out the answer to the question** e.g. we will have 3 different parallel experiments and we will change the temperature of the water in each one.
3. **Decides what the dependent variable might be (how to measure the differences in each different example)** e.g. we will measure the time it takes for the butter to melt with different water temperature
4. **Last of all decide what elements have to stay the same in order to make it a fair test** e.g. each investigation should have the same components except for the temperature of the water

**Now using this knowledge, see if you can answer the questions below!**

Write below one or more examples of a question you might want to find the answers.

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**Year 3, 4, 5, and 6 pupils** - What might be the independent variable you would use in your investigation, in other words what would be the things that you would change to investigate your question?

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**Year 4, 5 and 6 pupils** - What would be your dependent variable, in other words what would you measure to record the difference?

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**Year 5 & 6 pupils** - What was your control variable, in other words what did you keep the same to make sure that it was a fair test?

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**Now go and carry out your investigation!**

## B. PRESENTING & ANALYSING DATA

When scientists carry out investigations, it is really important that they capture data to make sure they can then answer the questions that they have set themselves. The scientist on the video has asked you to complete the following:

**Year 3 & 4 pupils – You are carrying out experiments to answer the following question:**

*Does the material of the spoon affect the time it takes for the butter to melt?*

What kind of data would you capture to show what happens and why?

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**Year 5 & 6 pupils – You are carrying out experiments to answer the following question:**

*Does the temperature of the water affect how quickly the butter melts?*

What kind of data would you capture to show what happens and why?

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**Now carry out your investigation!**

## C. EVALUATION

Evaluating how an investigation went as well as the data that comes from a science experiment is a really important part of science. It may be that you feel your experiment could have been done better or more thoroughly and it is important to understand this.

Answer the questions below:

**Year 3, 4, 5 & 6 pupils:** Did your experiment work?

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**Year 3,4, 5 & 6 pupils:** Why? Try and explain your answer using diagrams if it helps.

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**Year 5 & 6 pupils:** Try and explain how you know it did or didn't work.

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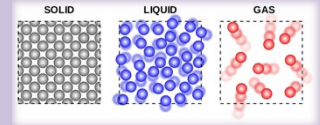
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## The science behind the investigation



We know that the molecules in solids are tightly packed together. This means that they are better **thermal conductors** than either liquids or gases because the heat can transfer more quickly from one particle to the next. Heat makes these molecules start to move around and so the molecules bang into one another transferring the heat as they move.



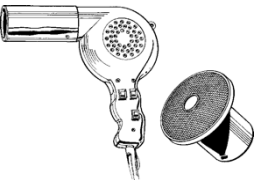


Some solids are much better conductors of heat than others. Metals are the best thermal conductors because as well as their tightly packed molecules, they have special electrons inside them called delocalised electrons, which speeds up the transfer of the heat from one electron to the other even more quickly. To add to this heat likes to travel from warm places to cold.

Materials that are not good at transferring heat are called **insulators**.

### Your challenge!

Below are pictures of items found in your homes. Can you say which materials they should be made out of? If you can, explain whether they need to be thermal conductors or insulators.

|   | What material<br>Should it be made from? | Conductor or<br>insulator? | Why? |
|---|--|----------------------------|------|
|  |  |                            |      |
|  |  |                            |      |
|  |  |                            |      |



## Research opportunity

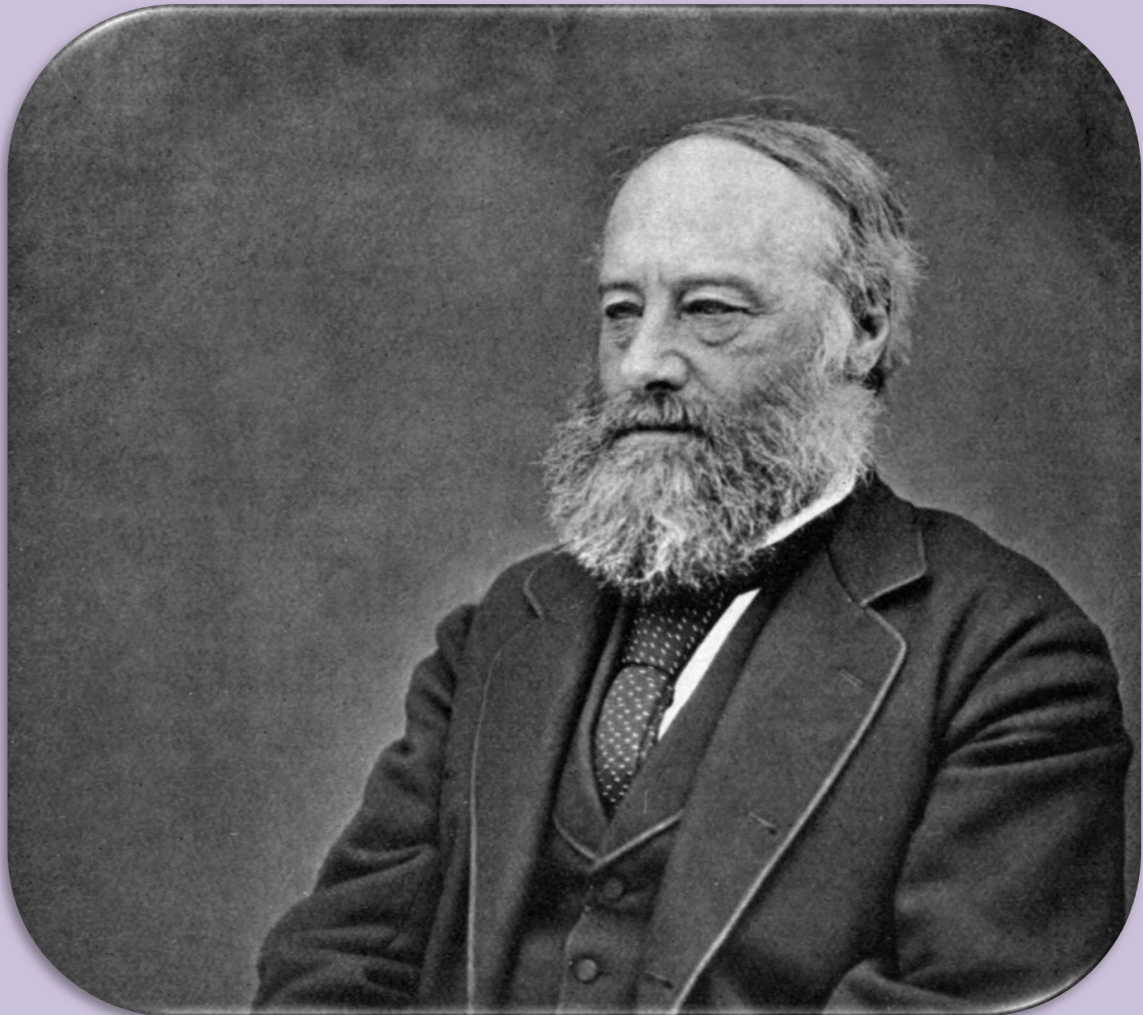
Find out whatever you can about James Prescott Joule and create a fact file about him.

Where was he born?

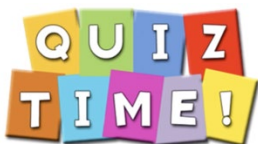
When was he born?

Where did he study?

What important scientific knowledge did he find out and how?



What was your score?



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