



Stage 3: Melting materials

Learning Objectives:

- To observe that some materials change state when they are heated and measure the temperature at which this happens in degrees Celsius ($^{\circ}\text{C}$)
- To conduct a fair investigation

Stage Overview:

After learning about the role that dairy products play in a balanced diet in the last stage, at this stage, the children learn about states of matter and reversible and irreversible changes by conducting an investigation to compare the temperature at which two dairy products change state. Opportunities for working scientifically and meaningful Maths are built in throughout the lesson.

Materials for the warm up activity:

- Parachute or bed sheet
- A small amount of ball pool balls

Materials for each group for the investigation:

- 100ml block of ice cream (frozen) x2 different brands or flavours
- A thermometer
- 2 wide funnels
- 2 measuring cylinders
- Stop watch
- Time graph template

Presentation notes:

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| Slide 2: States of matter | <ul style="list-style-type: none">- Introduce states of matter and explain that all materials are solids, liquids or gases.- Ask the children to think of a few examples of each state of matter and address any misconceptions. |
| Slide 3: Solids | <ul style="list-style-type: none">- Solids can be held and do not change shape or flow like liquids.- They always take up the same amount of space and do not spread out like gases.- They can be shaped or cut. |
| Slide 4: Liquids | <ul style="list-style-type: none">- Liquids cannot be held easily.- Liquids can flow and change their shape depending on the container that they are in.- They always take up the same amount of space.- Make sure that the children understand that although materials such as sand or flour can be poured and appear to flow like liquids, they are |

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| | actually solids because they are made of lots tiny solid particles. |
| Slide 5: Gases | <ul style="list-style-type: none"> - Gases do not have a fixed shape and can spread out to fill up whatever container they are in. - They are often invisible. - Now that you have been through the definitions, challenge the children to think of some more examples of each state of matter to add to the list. |
| Slide 6: Physical changes | <ul style="list-style-type: none"> - Explain that sometimes materials change state. If a change can be undone or reversed then this is known as a physical or reversible change. Challenge the children to think of some examples of this e.g. water freezing. |
| Slide 7: A physical change | <ul style="list-style-type: none"> - Share the process of water freezing as an example of a physical or reversible change. |
| Slide 8: Demonstrating changes of state | <p>Give the children a practical example of this idea with a game:</p> <ul style="list-style-type: none"> - Stand the children in a circle, holding the parachute. - Place all of the ball pool balls into the middle of the parachute. - Explain that all the particles are close together- they are representing a solid which cannot change its shape. - Then ask the children to gently wiggle the parachute so the balls are moving slowly. Explain that now, as they have added energy, the particles are moving and representing a liquid which can spread out and change its shape- like liquids do when they are poured out of a container. - Finally, ask the children to shake the parachute vigorously causing the balls to bounce off the parachute. Explain that now you have added even more energy and the particles are moving even faster and are even further apart. They are now a gas which can spread out fill the available space. - The children could apply their learning on states of matter by using the 'Morfo booth' or 'Chatterkid' iPad applications to create animations by adding faces to a solid, liquid and gas and making them 'speak' to describe their properties. |
| Slide 9: Planning our investigation | <ul style="list-style-type: none"> - Explain that we are going to be designing a fair investigation to find out the temperature at which two different types of ice cream (dairy products) fully change state. - Challenge the children to think about how they could do this in their groups. |
| Slide 10: Fair testing | <ul style="list-style-type: none"> - Take feedback and explain that for our investigation to be a fair test, we need to change one variable (the type of ice cream) and keep absolutely everything else the same. - Explain the method that you will be using: the two types of ice cream will be in separate funnels, held over measuring cylinders. At regular timed intervals, the children will take the temperature of the two ice creams and measure how much of the ice cream has changed state from solid to liquid and been collected in the measuring cylinder. They will repeat this process until all of the ice cream has changed from a solid to a liquid. - Ask the children to think about which variables they will need to keep the same (amount of ice cream, starting temperature of the ice cream, the time intervals, position in the classroom etc.) - Write a list of these variables on the board to remind them during the investigation. |

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| Slide 11: Preparation | <ul style="list-style-type: none"> - Ask the children to predict which ice cream will take longer to melt - Model how to draw a results table to record their results. - Remind the children to take care when handling the hot water. - Remind the children to measure temperature and volume of liquid carefully and model how to do this. |
| Slide 12: Setting up the investigation | <ul style="list-style-type: none"> - The children should work in groups to carry out their investigation, using the list of variables that need to be controlled to help them. - The children could use 'Google Science Journal' application to record the different stages of their investigation with observation notes, images and videos. |
| Slide 13: Time graphs | <ul style="list-style-type: none"> - Ask the children to examine their results. Are they how they expected them to be? How are they different? Explain that they will be plotting a time graph to help them interpret their results. - Time graphs enable us to examine how a variable changes over time. We will be looking at the amount of ice cream that has changed state from solid to liquid over time. - Share top tips for how to draw a time graph. - Model how to draw axis and plot data points and ask the children to complete their own graph to show their results. - You could also ask the children to present their data in a graph using graphing software such as 'Create-a-graph'. |
| Slide 14: Writing a conclusion | <ul style="list-style-type: none"> - Ask the children to look carefully at their graphs and explain what they show. - Ask them to write a short paragraph to explain what they have discovered about the melting points of different ice creams. Encourage them to look at the ingredients list for the two types of ice cream. Do they notice anything that might help to explain their results? - Extend them to think about other dairy products such as butter. Why do they think that different dairy products require different amounts of energy to change state? |

Links to the National Curriculum:

| Subject | Topic | Objective |
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| Science | States of matter | <ul style="list-style-type: none"> - Compare and group materials together, according to whether they are solids, liquids or gases - Observe that some materials change state when they are heated or cooled, and measure or research the temperature at which this happens in degrees Celsius (°C) |
| | Working scientifically | <ul style="list-style-type: none"> - Setting up simple practical enquiries, comparative and fair tests - Making systematic and careful observations and, where appropriate, taking accurate measurements using standard units, using a range of equipment, including thermometers and data loggers - Gathering, recording, classifying and presenting |

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| | | <p>data in a variety of ways to help in answering questions</p> <ul style="list-style-type: none"> - Recording findings using simple scientific language, drawings, labelled diagrams, keys, bar charts, and tables - Using results to draw simple conclusions, make predictions for new values, suggest improvements and raise further questions - Identifying differences, similarities or changes related to simple scientific ideas and processes - Using straightforward scientific evidence to answer questions or to support their findings. |
| Maths | Statistics | <ul style="list-style-type: none"> - Interpret and present discrete and continuous data using appropriate graphical methods, including bar charts and time graphs |
| Computing | | <ul style="list-style-type: none"> - Select, use and combine a variety of software (including internet services) on a range of digital devices to design and create a range of programs, systems and content that accomplish given goals, including collecting, analysing, evaluating and presenting data and information. |

