

## Brian Cox school experiments

# Do all types of chocolate melt at the same temperature?

Lots of chocolate is stored on shelves in shops. If the shop is too warm will the chocolate melt? If you hold a piece of chocolate in your hand too long it will melt, but do all types of chocolate melt at the same temperature?

Plain, milk and white chocolate have different percentages of cocoa solids, which gives it a different chemical makeup. Different brands of chocolate also have different amounts of cocoa solids. Does this affect its melting point?

In this experiment, students will investigate the melting point of different types of chocolate. The investigation gives an opportunity to develop investigative skills and learn comparative testing.

### Introduction to Brian Cox school experiments

The Brian Cox school experiments are designed to support teachers to carry out experimental science in the classroom, and relate it to real world experiences. Creative and experimental approaches are particularly important for keeping students interested and engaged in science, and for equipping them well for the future, whether or not they pursue a career in science.

Each written resource is accompanied by four videos; two with extra information on how to carry out the experiment and two on how the experiment relates to the real world.

### Learning outcomes:

- Observe that some materials change state when they are heated or cooled, and measure the temperature at which this happens in degrees Celsius (°C).
- Set up simple practical enquiries, using comparative testing.
- Identify differences, similarities or changes related to simple scientific ideas and processes.
- Use straightforward scientific evidence to answer questions or to support findings.

# Do all types of chocolate melt at the same temperature?

Lots of chocolate is stored on shelves in shops. If the shop is too warm will the chocolate melt? If you hold a piece of chocolate in your hand too long it will melt, but do all types of chocolate melt at the same temperature? Does the percentage of cocoa solids affect its melting point?

In this experiment, students heat different types of chocolate in a water bath, to see how long it takes them to melt. You could give them time to come up with a method for testing this themselves, perhaps in a previous class, or give them an exact method to follow.

Hot water for the water bath can be taken from a kettle or wall heater. Cold water should be added to achieve the target temperature of 50°C and then taken to the classroom, in a suitable container, by staff. The container could be stood on an insulated mat in the classroom to minimise cooling during the lesson.

It is essential that you have sufficient hot water for each group readily available at the beginning of the activity. The hot water must be carefully dispensed by a supervising adult into the students' containers, which should be filled to a level so that the foil cases are touching the hot water.

Each group of students could have all the types of chocolate to investigate or you may choose for each group to have only one type of chocolate and compare between groups.

## Health and safety considerations:

- The chocolate must not be eaten;
- students undertake activity on a tray in case of spillage and paper towels should be available;
- only staff are to handle suitably enclosed containers with warmed water;
- avoid splashes to skin, wipe off quickly or use cold running water if splashes occur; and
- have cold running water readily available in case of any incidents.

For up-to-date advice on health and safety, particularly in regard to heating and hot water, please refer to CLEAPSS (England, Wales or Northern Ireland) or SSERC (Scotland) guidelines.

## Suggested sequence of events:

45/60 minutes

- Lead a class discussion to recall prior learning on the topic of changing states.
- Students should predict how long they think it will take for each chocolate sample to completely turn from solid to liquid and record this in their results table.
- Each group attaches each foil pie case to the inside rim of the plastic takeaway tray using paperclips and places a single piece of chocolate (white, milk or plain) into the separate pie cases (each pie case will contain only one piece of chocolate).
- Place the takeaway tray containing the pie cases with chocolate into the larger tray to catch any spillage. Hot water should be added to the takeaway tray so that it touches but does not enter the foil cases (this should be carried out by an adult).
- Students then start the timer immediately after the hot water has been added. Each piece of chocolate must be stirred gently throughout this activity. Students should be careful not to let any water into the pie case by accident.
- Each group records the actual time in the results table that it takes for each type of chocolate to completely melt so there is no more solid chocolate.

## Alternative experiment or teacher demonstration:

### At what temperature does the chocolate melt?

This could be carried out in groups as with the experiment above. However, if you do not have sufficient thermometers, you could do this as a teacher demonstration.

The same basic method as used by the students can be followed:

- Attach a clear plastic cup(s) to the inner rim of clear plastic jug with a large paper clip.
- Pour the water (at 50°C) into the jug so that it surrounds the plastic cup containing the chocolate.
- The thermometer can stand in the melting chocolate while the chocolate is being stirred.
- When it melts record the temperature.
- A larger volume of chocolate, 4-5 pieces, will make it easier to read the temperature.

### Possible extensions:

You could compare melting times of other substances such as butter or ice, or use bars of chocolate with a wider range of different cocoa solids.

### Activity toolbox:

#### Resources per group:

- A large tray with a raised edge to catch any spillages;
- 3 deep foil pie cases (approximately 3cm deep);
- 3 large paper clips;
- 1 clear plastic take away food container or similar (approximately 20cm X 10cm);
- timer (showing seconds); and
- 3 lollipop sticks (to stir the chocolate).

#### For teacher preparation:

- Hot water, no more than 50°C; and
- different types of chocolates (ie plain/milk/white) cut into equal sized pieces.

### Resources for teacher demonstration:

- 3 clear plastic disposable cups;
- 1 clear plastic measuring jug;
- different types of chocolates (ie plain/milk/white) cut into equal sized pieces;
- thermometer; and
- hot water, no more than 50°C.

### Homework or cross-curricular activities

#### Is chocolate a mixture?

Students could investigate the ingredients of different types of chocolate by reading the labels and comparing the contents. They could design their own label for chocolate to make it appealing and make sure they include all the ingredients it contains.



## ACTIVITY

Name ..... Date .....

### Do all types of chocolate melt at the same temperature?

Lots of chocolate is stored on shelves in shops. If the shop is too warm which chocolate will melt first?

If you hold a piece of chocolate in your hand too long it will melt, but do all types of chocolate melt at the same temperature? Does the percentage of cocoa solids affect its melting point?

#### Your task

Find out whether different types of chocolate melt at the same speed.

#### You will need:

- 3 deep foil pie cases (approx. 3cm deep);
- 3 large paper clips;
- 1 clear plastic take away food container or similar (approximately 20cm x 10cm);
- timer (showing seconds); and
- 3 lollipop sticks (to stir the chocolate).

Your teacher will bring you pieces of three different types of chocolate and hot water.



## ACTIVITY

**Do your investigation on the large tray to catch anything that gets spilt.**

1. Predict which type of chocolate you think will melt first and at what temperature.
2. Using the paper clips very carefully clip the foil pie cases to the inside rim of the plastic takeaway tray. All three pie cases will fit into one takeaway tray.
3. Collect equal sized pieces of the three different types of chocolate to be compared and put a single piece of chocolate into each of the three pie cases (each pie case only contains one piece of chocolate).
4. Ask for hot water to be poured into your takeaway tray. The level of the hot water must be deep enough to touch the pie cases about half way up but must not come near or over the top of the pie cases. Start your timers as the hot water is poured in.
5. Carefully stir each piece of chocolate as soon as the hot water has been added to the takeaway tray.
6. Record the time when each has completely melted and note your results.



## ACTIVITY

### Predictions

Percentage of cocoa solids in the chocolate	Time taken to completely melt (minutes and seconds)		Temperature at which chocolate melts (Celsius)	
	Prediction	Results	Prediction	Results
Plain				
Milk				
White				

I conclude that...

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