



McChocs

Dear Head of Research

Hope you had a good holiday! As you will remember sales of McChocs have been falling because people say that they taste funny. While you were enjoying yourself, your research department claims to have found the solution to our problem.

The research team has checked every stage in the manufacture of McChocs and believes that the problem is in the final cooling stage. They sent the note below to the McChocs crisis group meeting.

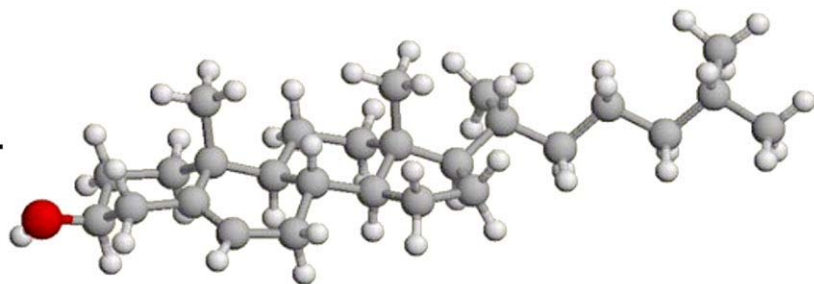
Memo to the McChocs Crisis Group

From the McChocs Research Team

RE: Wrong type of crystals

The taste of chocolate depends on the release of flavour **compounds** to the mouth and nose, but there is more to eating chocolate than just taste. As you are all aware the chemicals in the product mostly determine the taste of chocolate. However, the taste experienced by the consumer also depends on the **texture** of the chocolate and the way it melts.

Chocolate contains tiny **crystals** that are too small to see. It is these crystals that effect the texture of the chocolate and the temperature that it melts at. The problem in McChocs is that the wrong types of crystal are being formed. Careful observation of the crystals **melting** under a microscope has shown that there are five or six different types, each one with a different **melting point**.

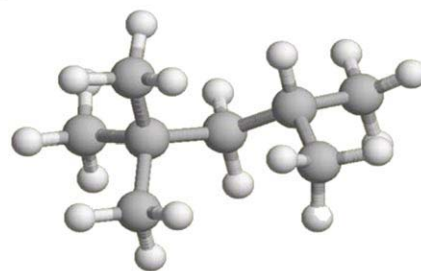


Type V Crystal

For the chocolate to taste good it should be mainly type V crystals. These have a higher melting point than most of the other types. We have been able to prepare chocolate that we think has mostly type V crystals using a new cooling technique.

We have called this new chocolate McChocs version 2.

We recommend that a test be carried out to check which types of crystal are present in the chocolate by accurately measuring the melting points of McChocs and McChocs version 2.



Type II Crystal

We also believe that further research could help improve the chocolate. If the two types of chocolate have lots of different types of crystal in them then the graphs of **temperature** change versus time as they are heated up should be different.



McChocs

Initial Report

The crisis group would like a short report from you now. As you know the crisis group has people from accounts and marketing on it who do not know very much science, so please could you explain what the underlined words in the memo mean when you use them in your report.



The group has also raised some questions that they would like you to answer:

- 1 How could you measure the melting point of the two chocolates?
- 2 Are there any safety precautions that need to be taken?
- 3 How can McChocs be made to melt in the mouth but not in the hand?
- 4 Sketch what you think the melting graphs for McChocs and McChocs version 2 might be.



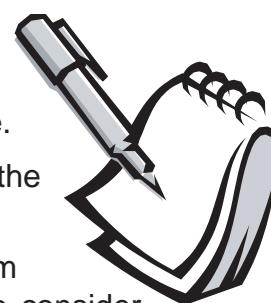
Experiment

- You will be shown how to make McChocs and measure its melting point. Use the instructions provided to make McChocs version 2 and measure its melting point.
- If you have time collect data to plot graphs of how the temperature of the chocolate changes with time as it is heated up.

Final Report

We want you to produce a final report that:

- 1 Presents the results of your experiment including graphs if possible.
- 2 Explains your results and makes a recommendation as to which is the better way of making the chocolate.
- 3 Explains the science behind the problem so that the marketing team can use this in their new advertising campaign. You might also consider suggesting possible names for the form V crystal and McChocs version 2.
- 4 Tells the finance department whether they will need to change the cost of McChocs.



Please let me know whether you will be submitting a written report or making a presentation to the next crisis group meeting.

Good luck

Haley McChake

Chief Executive McChakes Confectionary



McChocs

Further Instructions



Instructions for making McChocs version 2

- 1 Put liquid chocolate into a boiling tube. Place in a bath of cold water. Stir until the chocolate temperature drops below 25°C.
- 2 When the chocolate starts to crystallise, remove the tube. Put it into a hot water bath. Wait until the temperature reaches 30°C.
- 3 Return the tube to the cold water bath. Put a temperature sensor in the chocolate (ready for the quality test). Cool it to 20°C, and let it crystallise completely.

Melting point quality test

The melting point of chocolate tells you about its quality. Good chocolate melts just below the temperature of your mouth (37°C). This gives it a pleasant texture.

Follow the instructions to measure the melting point accurately.



You need:

- Solidified chocolate (around a temperature sensor) in a boiling tube
- Test tube rack
- Hot water from the tap
- Beaker or bowl, to make a water bath
- Paper towels
- A way to keep the sensor upright
- Datalogging equipment

- 1 Plug the temperature sensor into the data logger (or computer) so that you can read the temperature. Start recording the temperature.
- 2 Place the tube in a beaker or bowl of warm water (approximately 45°C).
- 3 Gently try to stir the chocolate. As soon as you can move the probe easily, the chocolate around it has melted. Note the final temperature.

