Salt (for cooking)

Contents

Acknowledgements

This resource was originally amended and adapted by the University of Reading to support outreach work delivered as part of the Chemistry for All project.

To find out more about the project, and get more resources to help widen participation, visit our Outreach resources hub: rsc.li/3CJX7M3.

Demonstration taken from Explorable.com Lifting Ice Cube Experiment. Available from: https://explorable.com/lifting-ice-cube-experiment (accessed 10 October 2022).

Activity 1 has been adapted from Heston Blumenthal's RSC Kitchen Chemistry book.

Guidance notes

This session should take approximately one hour to complete in full. It was initially created for 11–14 year-old learners but can be adapted for other age groups.

Download the PowerPoint presentation, technician notes and student workbook that accompany this resource from rsc.li/3RGEmQt.

Read our health & safety guidance, available from rsc.li/3IAmFA0, and carry out a risk assessment before running any live practical. Remind learners they should not eat in the lab.

The safety equipment suggested is in line with CLEAPSS requirements. For non-hazardous substances, wearing lab coats can help to protect clothes. The safety rules might be different where you live so it is worth checking local and school guidance.

Learning objectives

- Explain some effects of using salt in cooking.
- Describe health concerns associated with salt in the diet.

Introduction (5–10 minutes)

Use **slides 3–12** of the PowerPoint to introduce the uses of salt in cooking and the health risks that salt can present. The notes on each of these slides provide additional information.

Move on to **slide 13** and introduce the demonstration 'The effect of salt on ice/water equilibrium' to show learners how the presence of salt in a solution affects the freezing and melting point of the water and ice. This demonstration can be left to run while the learners complete Activities 1 and 2 and the results can be looked at in the plenary. Ask learners to record their observations and then discuss these as a class at the end of the session.

In Activity 1, learners work in pairs to investigate how the concentration of salt in a solution affects the boiling point of the solution.

The method for the practical is provided in the student workbook.

In Activity 2, learners work in the same pairs to investigate the effect of salt solution on the colour of green vegetables and compare this with the effect of vinegar and bicarbonate of soda.

Find specific safety advice for the chemicals used in this project in the technician notes.

Career links

Watch the video on **slide 11**, also available from rsc.li/3YmUIFS, to introduce Robert. He is an associate principal scientist who builds computer models to predict the reactions and interactions between different chemicals to influence the taste and texture of Mondelēz's chocolate and biscuits.

Use **slide 20** to introduce Claire, a flavourist and innovation director. She uses her chemistry knowledge to develop flavours and technologies to make new food and beverage products. The video is also available at: rsc.li/40V9mkh.

Demonstration: the effect of salt on ice/water equilibrium

Equipment

- Glass of ice-cold water
- Ice cubes
- String
- Salt

Method

1. Drop an ice cube into the ice-cold water.
2. Touch the string to the top of the ice cube.
3. Sprinkle salt over the ice cube and string and then leave until the plenary session.
4. In the plenary session try lifting the string, which should be attached to the ice cube, and ask learners to record their observations.

Discuss and explain (see plenary notes) to the class at the end of the session.

Activity 1: how is the boiling point of water affected by salt? (20 minutes)

In this activity, the learners will look at how the boiling point is affected by the amount of salt in the salt water.

The method to be used by the learners is outlined in the student workbook and **slide 15** of the PowerPoint shows how the apparatus needs to be set up.

There are three different salt concentrations to be investigated.

- Solution A has a salt concentration of 0%, made using 10 ml tap water and no salt. This will act as the control for the experiment.
- Solution B has a salt concentration of 18%, made using 10 ml of tap water and 1.8 g salt.
- Solution C has a salt concentration of 36%, made using 10 ml tap water and 3.6 g salt.

Divide the learners into pairs and allocate one of the three methods to each pair to ensure the three different salt concentrations are investigated. If there is limited equipment, or a large number of learners, these activities could be done in groups of three or four.

Each pair of learners should test one of the solutions and gather the results for the other two solutions from two other groups.

You should then discuss the results as a class. Use **slide 16** of the PowerPoint to show the expected boiling points of the three solutions.

Answers

(a) The salt increases the boiling point of the water.

- Adding 1.8 g of salt raises the boiling point of the water by approximately 3°C.
- Adding 3.6 g of salt raises the boiling point of the water by approximately 6°C.

(b) The two masses of salt being investigated here are both higher than the amount you would be likely to add during cooking. The amount of salt used in cooking is only likely to increase the boiling point of the water by about 0.1°C.

Activity 2: colour changes (20 minutes)

In this activity, the learners will compare the effect on the appearance of green vegetables when they are boiled using solutions of salt, white vinegar and sodium hydrogen bicarbonate (bicarbonate of soda). They will cook their vegetables for five minutes in each of the solutions and compare the appearances in terms of colour and state.

The method to be used by the learners is outlined in the student workbook and **slide 18** of the PowerPoint shows how the apparatus needs to be set up.

There are three different solutions to be investigated.

- Solution D is made using 100 ml tap water and 18 g salt.
- Solution E is made using 100 ml tap water and 2 g bicarbonate of soda.
- Solution F is made using 90 ml tap water and 10 ml distilled white vinegar.

There are three different green vegetables to be tested: peas, green cabbage and green beans.

Learners should work in the same pairs (or groups) as they did in Activity 1.

Allocate a different green vegetable to each pair. Each pair uses all three different cooking solutions to prepare their allocated vegetable.

Once the learners have collected results for their vegetable, they should share their findings with other pairs until they have collected results for all three vegetables.

You should then discuss the results as a class. Use **slide 19** of the PowerPoint to show the expected results for the green peas. Note: the images included here only show the results for the peas but the results for the cabbage and beans should be similar.

Answers

(a) The solution containing the white vinegar is acidic and causes the vegetables to look yellow and faded rather than bright green. The solution containing the salt is neutral and keeps the green colour of the vegetables. The solution containing the bicarbonate of soda is alkaline and causes the vegetables to become slightly softer and be much brighter green than they were.

(b) The effects on colour should be similar for all the green vegetables. This answer may vary depending on your learners' findings.

Plenary (15 minutes)

Finish the demonstration, discussing and explaining the effect of salt on ice/water equilibrium.

Demonstration: the effect of salt on ice/water equilibrium – explanation

The melting point and freezing point of (pure) water is 0°C. Above 0°C water is a liquid and below 0°C water is a solid (ice).

When you put the ice into the water, the temperature where the ice and water are in contact is 0°C, so the ice starts to melt and the water starts to freeze. As both the ice and the water are at 0°C, the rate of melting and freezing are balanced (equilibrium).

We have seen today how adding salt to water raises the boiling point of water.
The opposite happens with freezing: when salt is added to water it lowers the freezing point of the water.

Adding salt to the surface of the ice lowers the freezing point, so the ice melts.

The temperature where the ice and water are in contact is now below 0°C. To restore the balance (equilibrium), the salt recrystallises out of the water and the water (which is now below its freezing point) refreezes around the string, allowing you to lift the ice cube out of the water by the string.