



11–14 years

# Extracting iron from breakfast cereal





# Introduction

Many breakfast cereals – and other food products such as flour – contain iron as a mineral supplement.

Cereals containing added iron are often known as fortified breakfast cereals. The iron is added in the form of a food-grade iron powder because this does not produce any taste or react with any other ingredients within the product.





# Introduction

The iron is believed to react with our stomach acid before passing to the small intestine. Our bodies contain roughly the same amount of iron as two small nails!

In this experiment, you will extract the metallic iron from a mixture of crushed cereal in water using a strong type of magnet (usually made from neodymium).



# Learning objectives

1. Extract iron from different breakfast cereals.
2. Compare the amounts of iron in different breakfast cereals.
3. Explain the importance of iron in our diets.

# Method

1. Place a few flakes of cereal in the mortar. Hold the magnet close to the flakes to see if they stick to the magnet or are moved by it.
2. Crush the dry flakes into a fine powder with the pestle.
3. Transfer the powder into the sandwich bag. Add enough distilled water to cover the powder. Carefully seal the bag.
4. Allow the cereal to soften and gently shake the contents for a few minutes. If the mixture has absorbed too much water and appears too dry, add some more distilled water.
5. Place the magnet on the outside of the bag. Move the magnet backwards and forwards over the mixture.
6. Carefully turn the bag over, keeping the magnet touching the bag. Squeeze the bag slightly to lift the magnet above the cereal mixture to see what has been collected. You should see tiny iron particles.
7. Compare the amount of iron you have collected with groups who used a different cereal brand.



**1** Add cereal flakes

**2** Test with magnet

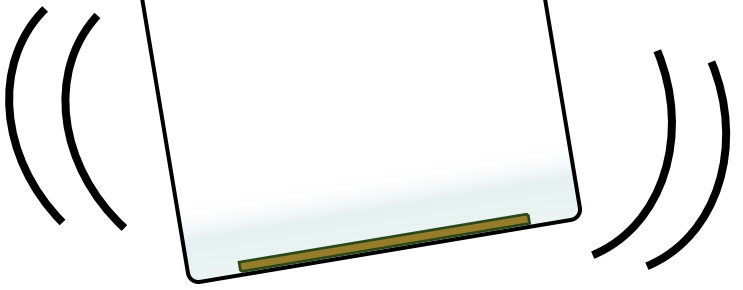
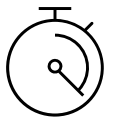
**3** Crush flakes

**4** Transfer powder to sandwich bag

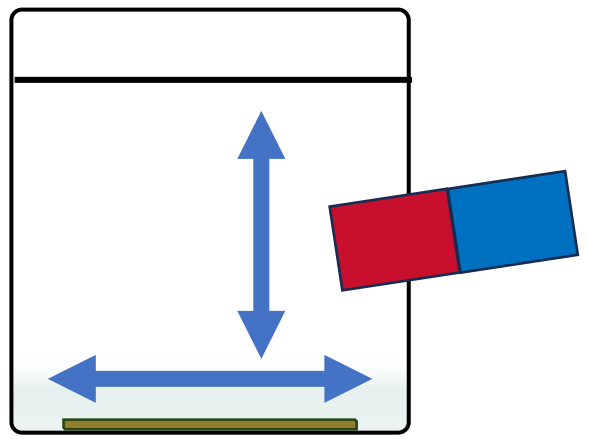
**5** Add distilled water.

**6** Seal the bag

**7** Shake gently for 2 or 3 mins



**8** Separate the iron using the magnet.



**9** Compare with other groups.

**Nuffield practical collection**  
Extracting iron from breakfast cereal  
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# Questions

1.

- Estimate which of the cereals tested contained the most iron.
- Compare your answer to a) with the nutritional information on the cereal boxes.
- Suggest a reason why your answer to (a) and (b) may not be the same.

2. The iron collected from the cereal is in its **elemental** form.

- Define the term '**element**'.
- State which **physical property** of the element iron allowed it to be collected during this practical. Do all metals have this property?
- State **two** other properties of metallic elements.

3. Fortified cereals have iron added to them. You should be able to get all the iron you need from your daily diet.

Kellogg's 'Special K'® , which contains around **14 mg of iron per 100g** of cereal, contains a higher proportion of iron than many other breakfast cereals.

- a) State whether the iron in fortified breakfast cereals is part of a **mixture** or a **compound**. Explain your answer.

According to the NHS, an adult woman between the ages of 19-49 needs a **recommended daily intake** of 14.8 mg of iron.

- b) Calculate the number of portions of Special K® an adult woman would need to eat to consume an equivalent to their recommended daily intake. A portion of Special K® is 30g.
- c) Suggest a reason why you should **not** eat more than one portion of fortified cereal per day.
- d) List as many other foods that can provide dietary sources of iron as you can.

# Questions

4. Iron is essential in our bodies for producing **haemoglobin**. Thalassaemia is a group of inherited conditions that affect haemoglobin production. People with thalassaemia produce no (or too little) haemoglobin. This causes severe anaemia, and patients with this condition require frequent blood transfusions.

- a) What is the role of **haemoglobin** in our blood?
- b) Explain why giving extra iron does **not** help someone with thalassaemia.

Regular blood transfusions can lead to **excess iron** in the body – a condition called iron overload. Medicines such as Exjade and Desferal treat iron overload by binding excess iron in the body and facilitating its release through the urine.

- c) With your partner, research the symptoms of **iron deficiency** and **iron overload**. Use your research to explain why monitoring of iron levels is particularly important for patients with thalassaemia.

# Answers

1. a) Make a judgement on which cereal contained the most iron.
- b) Check this against the nutritional information on the cereal boxes.
- c) Answers may include:
  - Not all of the iron will have been separated from the flakes during the practical.
  - Some cereals may have been easier to separate
  - Some groups may have had more success separating the iron.
  - The amount of iron in each individual flake of cereal may vary throughout the same cereal.
  - The method asks for a 'few flakes' but the actual mass of cereal could vary between the different cereals and the different groups.

# Answers

2.

- a) Elements are the **simplest** form of a substance, made up of the same type of **atoms**.
- b) Iron is magnetic. Not all metals are magnetic – only iron, cobalt and nickel.
- c) Any two from: shiny, malleable, ductile, high tensile strength, electrical and thermal conductors.

# Answers

3. a) The iron in fortified breakfast cereals is part of a mixture. The method of separating the iron from the cereal did not need a chemical change to take place.

$$\text{b) Amount of iron in one portion of cereal} = \frac{14}{100} \times 30 = 4.2 \text{ g}$$

$$\text{Number of portions} = \frac{14.8}{4.2} = 3.5$$

c) Answers may refer to:

- Calorie intake – eating enough cereal to meet the recommended daily intake of iron may result in exceeding the recommended calory intake.
- Other ingredients, e.g. sugar - eating enough cereal to meet the recommended daily intake of iron may result in exceeding the recommended daily intake of another ingredient.
- Balanced diet – consuming one thing in excess is not as healthy as seeking a variety of sources of iron.

d) Red meat, poultry, fish, legumes (beans, lentils, chickpeas etc.), dark leafy greens, nuts and seeds.

# Answers

4.

- a) Haemoglobin helps oxygen to bind to our red blood cells.
- b) Patients with thalassaemia cannot produce haemoglobin – even if they have enough iron in their body.
- c) Iron deficiency and iron overload have many common symptoms, such as dizziness, fatigue, muscle ache etc. This means it is very important to monitor patients and know whether they have too little or too much iron in their bodies.