

Magnets are used for recycling because they can attract certain types of metals from the recycling pile.

The metals that magnets attract are iron, nickel, and cobalt. It can also attract steel because steel has iron in it!

In your investigation, you will use a similar idea in removing iron filings from sand.

Aim

To investigate how a magnet can extract iron filings from sand and to calculate the percentage of iron in the mixture.

You will need:

- eye protection
- a bar magnet
- a small plastic bag
- a mixture of iron filings and sand
- a top pan balance
- a calculator
- two small plastic containers
- paper weighing boat.

Method

1. Measure the mass of the plastic container and record it on the table on page 2.
2. Set the top pan balance to 'zero' with the container still on it. If you are unsure how to do this ask your teacher.
3. Weigh out approximately 10 g of the sand and iron filing mixture and record the exact mass to 2 decimal points.
4. Remove the plastic container from the top pan balance.
5. Put the bar magnet into the small plastic bag and work it through the sand and iron filings.
6. Taking care not to get the iron filings on your fingers, place the iron filings removed from the mixture into the other small plastic container.
7. Repeat steps 5 and 6 until you have removed as many of the iron filings from the mixture as you can.
8. Measure the mass of the sand without the iron filings and record your result in the table.

Student sheet

Record the data from the practical in the table below.

Recorded data	Mass (g)
Mass of plastic container	
Mass of iron and sand	
Mass of sand and plastic container	
Calculated data	
Mass of sand without plastic container	
Mass of iron filings	

1. Describe how you calculated the mass of the sand without the plastic container

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Challenge: Turn your answer above into a number sentence or equation.

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2. Describe how you calculated the mass of the iron filings.

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Challenge: Turn your answer above into a number sentence or equation.

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3. Use the equation below to calculate what percentage of your mixture was made up of iron filings. Remember to keep all of your units in grams.

$$\% \text{ by mass of iron filings} = (\text{mass of iron filings} \div \text{total mass of iron and sand}) \times 100$$

$$\% \text{ by mass of iron filings} = (\dots \div \dots) \times 100$$

$$= \dots \%$$

4. Scientific investigations usually start with a preliminary investigation. This helps researchers select the best equipment for the investigation, and to see how the investigation could be improved. List three ways that this investigation could be improved and put them in order of importance.

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Teaching notes and answers

The investigation can be done as a demonstration or as practical (carry out a risk assessment to decide the most appropriate for your students). Ensure that the mixture has at least 20% of iron filings.

Ask them to compare their results with other groups and take an average.

Can they design a piece of apparatus that would be more efficient at separating the iron filings from sand?

1. Describe how you calculated the mass of the sand without the plastic container

By subtracting the mass of the plastic container from the mass of the sand and container after the iron filings were removed.

Challenge: Turn your answer above into a number sentence or equation.

mass of sand = mass of sand and container - mass of container

2. Describe how you calculated the mass of the iron filings.

By subtracting the mass of the sand from the total mass of the mixture

Challenge: Turn your answer above into a number sentence or equation.

mass of iron filings = mass of sand - total mass of mixture

3. Dependent on the results

4. Student dependent