Iron has many properties and one is that it can **rust**. In order for iron to rust it needs certain conditions. In this experiment we aim to find out what the conditions are.

### Rusty Nail: an experiment

You will need...

- 3 clean nails (not rusty!)
- 3 clean, empty jars
- Some water
- Some oil
- A kettle

What to do....

1. Boil the kettle and then leave it for at least 1 hour to let the water cool down again.
2. In the meantime, half fill one of the jars of with ordinary cold water from the tap and place a nail inside the jar. (Number 1)
3. In another jar, place a nail with no water at all. Make sure it is as dry as you can make it inside this jar. We only want air inside this one. (Number 3)
4. After the kettle has cooled, fill the final jar with this water until it is almost full. (We use boiled water to minimise the amount of dissolved oxygen in the water.) Then, put a nail in the jar. Finally, we add a layer of oil on top of the water. This will float above the water line and prevent more oxygen from dissolving in the water. (Number 2)
5. Your experiment is now set up—leave all three containers for 1-2 weeks and notice what happens.
6. Write your results in the table below.

### Iron Rust Experiment

<table>
<thead>
<tr>
<th>Conditions within the jar (air, water, air and water)</th>
<th>Did it rust? (yes, no, a little)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Rusting is an example of **corrosion**. It is a chemical process which occurs when iron or steel reacts with **oxygen** and **water**.

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### Rusty Nail: The Results

Only the nail in jar number 1, containing both air and water rusts.

*Jar number 2 contains only water and the nail does not rust.*

*Jar number 3 contains only air and the nail does not rust.*

<table>
<thead>
<tr>
<th>Conditions within the jar (air, water, air and water)</th>
<th>Did it rust? (yes, no, a little)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number 1—air and water</td>
<td>Yes</td>
</tr>
<tr>
<td>Number 2—only water</td>
<td>No</td>
</tr>
<tr>
<td>Number 3—only air</td>
<td>No</td>
</tr>
</tbody>
</table>

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### Why does this happen?

**Corrosion**

Metals can oxidise in air. They react with oxygen and form metal oxides. Rusting is a specific type of corrosion that happens to iron. You need both water and oxygen present for it to happen. The rusting process can be described using the word equation below:

\[
\text{iron} + \text{oxygen} + \text{water} \rightarrow \text{iron oxide (rust)}
\]
The British Iron Industry: sparks, presses, & molten metal

See a glimpse into a twentieth-century iron foundry and create movement based upon real footage.


Watch: In the resources folder, watch the film entitled 'pathe news ironworks 1930s'. This 3-minute silent, black and white film from the 1930s shows workers in a British iron foundry.

Things to think about:
• What actions or movements do you find striking? (Our favourite movement is when people use tongs to pass some red hot iron through holes.)
• Watch the film a couple of times and collect the movements and actions you like. That could be movements of a machine, of the metal, or of people.

Listen: In the resources folder, listen to the piece entitled 'The Iron Foundry Mosolov'. Warning! This sounds best when played quite loud but it doesn't sound conventionally "nice".

Things to think about:
• What do you think the music is for? Why do you think it was written? [real answer at the bottom].

Actions: can you use the actions you saw in the film to create a piece of movement to the music?
Remember in a factory, the same things happen over and over again, so you'll have to make your movements fit the music and be exactly the same when you repeat them.

Iron is a metal: and it is very heavy. So it was very appropriate when heavy metal band Metallica performed a version of this piece with the San Francisco Symphony Orchestra in 2019! Listen to it in the resources folder.

Idea Generator...

Travel - how are you going to use all the available space? How are you going to get from one part of it to another?

Turn - are you going to face the audience all the time?

Jump - use the space above the floor too!

Gesture - what will your hands and face be doing?

Pause - stopping and waiting at certain points can be effective and dramatic.

Fall - you don't have to be standing up all the time.

You could do it together: two or more people can collaborate to become a machine. Maybe someone in your family could join in with you? If so, remember to let them contribute their ideas too!

Perform! Perform your piece in front of your family. You could even film your performance, if you wish.

Review: Did your performance go as planned? What are you pleased with? How could you improve it?

Answer: a ballet!
**Fishing for coins: a magnet game**

Make a magnet ‘fishing’ rod to test to find out which coins are attracted to a magnet.

**What to do:**

- Make a fishing rod out of the stick and the string. Do this by tying one end of the string to one end of the stick.
- Tie the magnet to the other end of the string. As your fishing ‘bait’.
- Lay out a coin one at a time on the table in front of you.
- Make a prediction, do you think this coin will stick to your magnet?
- Test it and record your answer by placing the coin in the right circle below.

**You will need:**

- a magnet, such as a fridge magnet
- Approximately 20 different coins
- string (or thread)
- a stick (or long pencil)

**Did you know…**

Coins are made from a mix of metals but it is the iron content of coins that makes some of them attracted to a magnet.

![Diagram showing a Venn diagram with three categories: Definitely attracted to the magnet, Not at all attracted to the magnet, and A little bit attracted to the magnet.]

- Definitely attracted to the magnet
- Not at all attracted to the magnet
- A little bit attracted to the magnet
The Iron Man likes to eat metal things, like iron. Can you think of the names of 5 metals? Listen to chapter 2 of the Iron Man again to help you. Write down the names of the metals in the circles below.

Did you Know...
Metals conduct (transfer) heat and electricity. Copper is particularly good at conducting and has been used in electrical wires since 1820. Useful stuff!

Design the Iron Man a tasty meal out of the metals you have thought of above. What would he like to eat? Simmered silver or tin toast? Write about the meal below.

On the menu for the Iron Man today is....
A little bit like the Iron Man, people also need iron in their diets. Iron is important in making red blood cells, which carry oxygen around the body. A lack of iron can lead to a deficiency called anaemia. Learn how much iron are in some common food stuffs with these printable cards.

<table>
<thead>
<tr>
<th>Food</th>
<th>Iron</th>
<th>Vitamin C</th>
<th>Calcium</th>
</tr>
</thead>
<tbody>
<tr>
<td>raw spinach</td>
<td>2.7mg/100g</td>
<td>28mg/100g</td>
<td>99mg/100g</td>
</tr>
<tr>
<td>raw carrot</td>
<td>0.3mg/100g</td>
<td>5.9mg/100g</td>
<td>33mg/100g</td>
</tr>
<tr>
<td>raw beef</td>
<td>2mg/100g</td>
<td>0mg/100g</td>
<td>12mg/100g</td>
</tr>
<tr>
<td>raw pink salmon</td>
<td>0.4mg/100g</td>
<td>0mg/100g</td>
<td>7.0mg/100g</td>
</tr>
</tbody>
</table>

Information on nutrition values obtained from www.nutritionvalue.org
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### Metal on the Menu

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<table>
<thead>
<tr>
<th></th>
<th>pepperoni pizza</th>
<th>vegetable soup</th>
<th>carbonara pasta</th>
<th>beef stew</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Iron</strong></td>
<td>2.0mg/100g</td>
<td>0.5mg/100g</td>
<td>1.3mg/100g</td>
<td>1.1mg/100g</td>
</tr>
<tr>
<td><strong>Vitamin C</strong></td>
<td>2.8mg/100g</td>
<td>6.8mg/100g</td>
<td>0.4mg/100g</td>
<td>5.8mg/100g</td>
</tr>
<tr>
<td><strong>Calcium</strong></td>
<td>217mg/100g</td>
<td>14mg/100g</td>
<td>68mg/100g</td>
<td>12mg/100g</td>
</tr>
</tbody>
</table>

Information on nutrition values obtained from [www.nutritionvalue.org](http://www.nutritionvalue.org)