



Activity One

Activity Name	1. All about iron
Learning Aims	<ul style="list-style-type: none"> ○ Appreciate the difficulties and challenges of life in the mining communities of the Brendon Hills in late Victorian and Edwardian times. ○ Learn about the physical properties of iron and its uses.
Links to National Curriculum	<p>History</p> <ul style="list-style-type: none"> ● Local history study ● Knowledge and understanding of events, people and changes in the past <p>Science</p> <ul style="list-style-type: none"> ● Grouping and classifying materials ● Unit 3E Magnets and springs <p>Art and design</p> <ul style="list-style-type: none"> ● Opportunities to respond to the school's location and local cultural influences
Resources required (for class of 30)	<p>Magnetism experiment</p> <ul style="list-style-type: none"> ● 1 bag of iron filings ● 1 sheet acetate ● Overhead projector ● 2 small magnets ● Blu tac ● Variety of metallic objects ● Plastic tray <p>pH experiment</p> <ul style="list-style-type: none"> ● 3 types of soil, including one sandy to demonstrate iron rich soil ● Test tubes ● Soil testing worksheet from resource section ● pH indicator solution ● Pipettes ● Protective gloves <p>Worksheets</p> <p>1a Blacksmithing pictures; 1b Uses of iron worksheet; 1c Soil testing worksheet</p>

Continues on next page



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Activities	<p>1. Uses of iron</p> <ul style="list-style-type: none">○ Refer to the Uses of iron worksheet (1b). Pupils do detective work in their local school, village or town to identify objects made out of iron. They then draw or take photographs of the objects.○ Please note it is the teachers' responsibility to ensure they are supervised when looking for these objects. <p>2. Experiments showing the properties of iron</p> <p>Magnetism experiments Perform the following experiments with iron filings.</p> <p>Experiment 1 Pour some iron filings onto a piece of acetate on the overhead projector. The image projected on the wall shows how the filings become magnetised and align themselves with the magnetic field lines.</p> <p>Experiment 2 Place the two small magnets with N end facing using some blu-tac and demonstrate repulsion of the "like" fields.</p> <p>Experiment 3 Place a variety of objects on the bags of iron filings and work out which has the strongest magnetic field.</p> <p>Experiment 4 Pour iron filings into the tray. Make pretty patterns in the tray by placing the magnets under it.</p> <p>pH experiments Please refer to the Soil testing worksheet from the resource section. Test three different soil samples to show differences in:</p> <ul style="list-style-type: none">● pH● texture● colour <p>3. Earth pigment drawings Create a piece of artwork using earth pigments from your local area.</p> <p>4. Homework Make a list of all the objects made from iron</p> <ul style="list-style-type: none">● In your home● On your journey to school● At school● When you go on holiday <p>Discuss what would happen if you took these objects out of your daily routine. What could you use instead?</p>



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Teacher information

1. THE USES OF IRON

Iron ore is the raw material found in the ground. It can be used to produce other things.

The main purpose of the iron ore mined in the Brendon Hills and smelted at Ebbw Vale was to produce railway rails.

They were sold throughout the United Kingdom and exported to British colonies. Until the USA rolled its own rails for the first time in 1844, Ebbw Vale wrought iron rails were sold there too.

Wrought iron rails wore out very quickly, which is why after initial reluctance, all railway companies changed over to steel rails, which were much more resistant to wear.

Cast Iron -

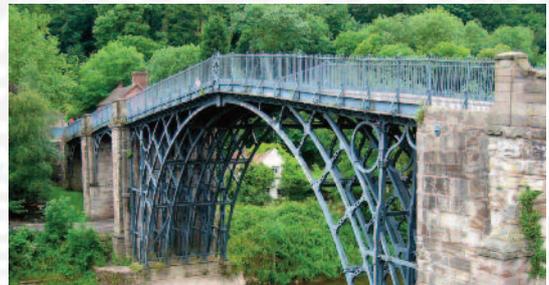
- It is produced from a blast furnace.
- It can be melted and poured into a mould.
- It has been produced since the 15th century.

Pig iron - this is the basic material which comes straight from the furnaces.

It is called pig iron because the moulds the iron flow into look like suckling pigs!



Beams and columns - cast iron is used to make these strong structural elements





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Wheels - usually cast in one piece



Window frame - as found on public phone boxes in the UK



Wrought Iron

- is produced using pig iron
- can be rolled or smithed
- it is easy to work
- it rusts less than steel
- it has been produced for the last four thousand years

Bar iron - this is the basic material used by blacksmiths to be made into other objects





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Rails

The main product of the Brendon Hills ore



Chains



Hand tools - individually made by blacksmiths



Plate iron - this is riveted to make iron cladding, boilers, tanks and ships





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Corrugated iron



Steel

- today this is the most important form of iron
- bulk steel manufacture became possible in 1856 as a result of the Bessemer steel making process

Steel bars



Iron oxides

Used as pigments for

- painting - burnt sienna, burnt umber, and yellow, red, purple, and brown ochres are still found in paint boxes today. These pigments were first used in pre-historic cave paintings. Black oxide is used as an anti-corrosive paint on the Eiffel Tower.
- glazing
- cosmetics



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Paintings

This is an example of earth pigments used for cave paintings.



2. THE PROPERTIES OF IRON

Summary of the properties of iron

- The 6th most abundant element in the universe (Fe)
- Makes up 5% of the Earth's crust
- Most abundant element on Earth (due to an iron - nickel core)
- But only 4th most abundant on the earth's crust
- Iron melts at 1150°
- It is magnetic
- Only meteorites are solid iron, and they're very rare

What is magnetism?

A magnet is a metallic object that produces a magnetic field. The magnetic fields are lines of force that are produced from the North end of a magnet and flow towards the South end so opposites attract (N to S or S to N) but like repel (S to S or N to N).

When an object containing iron (and some other metals including nickel and

zinc) is placed near a magnet it will be attracted to it and become a 'temporary magnet' because the electrons (miniscule particles in the object) will align with the magnetic field lines producing tiny N and S poles which are attracted to the magnet.

Electricity is created by the movement of electrons inside a wire and they can be moved by passing a magnet along the wire. This can be demonstrated using a Faraday Torch (a magnet moved up and down inside a coil of wire to produce an electric current which is then stored and can be used to light the bulb or LED).

Brief history of magnetism

- Magnetism was first discovered in China where naturally occurring magnetic 'lodestone' was noticed to always point the same way when hanging on string.
- In the 11th century it was discovered that you could make iron magnetic by heating and cooling it in a north south alignment.



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- In the 1600s William Gilbert experimented with magnets and electric fields and showed the earth to be a magnet due to an iron core.
- In the 1830s Michael Faraday began his experiments into electromagnetism and produced an electric current by moving a magnet along a wire.

Iron filings are tiny bits of iron produced from the iron industry after grinding or filing iron products. They can be used in gunpowder and fireworks but their main use is in science experiments to show the magnetic properties of iron.

Magnets today

- Magnets are used to generate electricity
- They are in computers, televisions, space shuttles and cars
- In Japan a Maglev train floats on a track due to the magnetic repulsion and can travel up to 343 miles per hour
- Magnets are used to sort materials such as tins and cans at recycling centres (steel food tins are magnetic, aluminium drinks cans are not)
- Small magnets on the fridge hold notes
- Compasses use a magnetised needle that always points towards magnetic North

- Even the strip on the back of a credit card is magnetised

Soil pH

The pH scale measures how acidic or alkaline something is. Sandy soils tend to be more acidic, whereas clay soils tend to be more alkaline.

Brendon Hill is the narrow eastern end of a belt of country rich in mineral lodes such as iron. They follow the structure of the country rock which is mostly slate and sandstone.

Sandy Soil

Sandy soils have a gritty texture and are formed from weathered rocks such as limestone, quartz, granite, and shale.

Clay Soil

When clay soils are wet they are very sticky, lumpy and pliable but when they dry they form rock-hard clots.

Loamy Soil

Considered to be the perfect soil, Loamy soils are a combination of roughly 40 % sand, 40% silt and 20% clay.

☞ For more information about the iron smelting process please refer to the Watchet West Pier Teachers' Pack.

☞ For more information about the origins of iron ore in the Brendon Hills please refer to the Geology of the Brendon Hills activity in the Incline Teachers' Pack.