There are 70 different types of metals, of which the most widely used is iron.

Every citizen in the UK uses on average 240 steel cans per year.

In 2001 the UK consumed 80,000 tonnes of aluminium for drinks cans alone! Of this 40% was recycled.

The aluminium in empty drinks cans is a valuable material and can be sold for about 45p per kg. Aluminium foil is worth 30p per kg.

Recycling one aluminium can saves enough electricity to run a television for 3 hours!!

Using recycled aluminium uses 25% of the energy of extracting and using virgin aluminium.

Start collecting aluminium cans at school and sell them on to a recycler.
Use the money towards a drinking fountain – and do away with drinks cans for good!

Metals are so widely used because of their diverse properties. Metal can be stretched into thin wires, which is known as being ductile. Metals can be malleable i.e. worked into thin sheets or complex shapes. Some metals can conduct heat and electricity. Some metals are dense and heavy while others are very light.

The indiscriminate disposal of metal waste adds to the mountain of rubbish currently being buried in landfill sites.

Only rarely do metals occur in their pure form (e.g. gold and silver) usually they occur as mineral compounds such as aluminium oxide (bauxite).

Extracting the pure metal from the mineral compounds requires huge amounts of energy and raw materials. This in turn can put pressure on the earth's resources, and, in the case of energy, contribute to global warming.

Some metals present an environmental threat due to their toxicity. For example, a mercury spill in Minimata, Japan resulted in contaminated fish poisoning 18,000 people, resulting in 700 deaths.

The disposal of metal is regulated by several pieces of legislation.

The EC Directive on Packaging and Packaging Waste sets targets for EU member states to recover 50-65% of packaging waste, with a minimum recycling target of 15% for each material type (including metals).

The End of Life Vehicles Directive states that a minimum of 80% of old vehicles are reused or recycled from 2006. The directive also restricts the use of heavy metals in new car manufacture.

The Waste Electrical and Electronic Equipment (WEEE) Directive regulates the disposal of many items with metal components. Of the domestic goods, kitchen appliances ('white goods') contain the most metal – an average cooker is 85% metal while a television is only 6%. The directive requires EU member states to recover an equivalent of 4-6kg of WEEE per citizen, and to recycle 75% of the weight of these products.

Reduce the amount of packaging you consume. Refill a bottle with squash rather than buying a fizzy drink in a can.

Reuse metal wherever you can. For example aluminium foil can be used again and again. Also, if you are throwing out an old piece of metal equipment consider whether your local charity shop could sell it on to someone who could make use of it.

Recycle your metal packaging by sorting it into steel and aluminium and placing in the correct recycling facility. Old metal goods that cannot be repaired can be passed on to scrap metal recyclers.

Aim

These activities focus on two commonly encountered metals: steel and aluminium. The aim is to demonstrate why metal is such a useful material.

You will need

- 2 different types of foil and cans. Make sure there are no sharp edges on the cans. Have other types of plastic, paper and glass packaging to compare and contrast with the metal items.
- Some magnets
- A scale or balance

Activity 1

- Sort the items made of metal from other items. Discuss how to do this, considering whether a material is hard or soft, transparent or opaque, light or heavy.
- Identify whether a can is made of steel or aluminium by looking for the recycling symbols shown opposite and use these to sort the cans.
- Examine the cans in more detail. If a can has a round and shiny bottom then it is aluminium. If a can attracts a magnet then it is steel.
- Use the 'scrunch test' to identify aluminium foil. If a piece of foil is scrunched up, the aluminium foil will stay that way once released, a piece of plastic foil will try and spring back to its original shape.

Activity 2

Metals are useful because they are strong and good conductors of heat and electricity. Aluminium has specific properties that can be investigated in different ways.

Lightness – aluminium has a low density compared to other metals, for example it weighs about one third of iron. Use scales or simple balances to compare the weights of steel and aluminium drinks cans.

Easily moulded into complex shapes – aluminium is a ductile and malleable metal. Get an adult to cut open an aluminium can and a steel can. Make sure that all sharp edges are properly covered with heavy tape. Compare the malleability of each by bending and squashing the material.

Resists corrosion – aluminium resists corrosion due to a thin protective film of aluminium oxide that forms on its surface when it is in contact with the atmosphere. Bury an aluminium can, a steel can, a paper bag, and an apple core outside (remember to mark where you left them!) and compare the corrosion on each after one month. This illustrates what happens if a can is disposed of incorrectly, and will not break down naturally. Remember to wear strong rubber gloves when carrying out this experiment.

Discuss why these properties mean metal is used for so many different things.

Activity 3

Discuss the journey of an aluminium can and follow it on a map. The rock containing aluminium is mined, for example in Australia, Africa or S. America. From Australia it is then refined and transported to Scandinavia. Here the metal is extracted, using lots of electricity. The metal is transported to Germany and rolled into sheets. Then it is taken to a factory in England and rolled into thinner sheets. Then it is taken to another factory to be made into cans. Then it is filled with drink and finally taken to a shop.

Aluminium

Aluminium packaging often bears this symbol. If it doesn't then aluminium cans can often be identified by their rounded and shiny bottom while aluminium foil will remain compacted if it is scrunched up. Aluminium is not magnetic, is very light, and cans are quite easily crushed. Typically used for fizzy drinks and aerosols (check with your recycling facility before putting these in).

source: Alupro

Steel

Steel cans will often bear this symbol. Steel cans are harder and heavier than aluminium ones. The so called 'tin can' refers to the extremely thin layer of tin that the can is coated in to prevent corrosion. Steel cans are magnetic.

Reusing metals

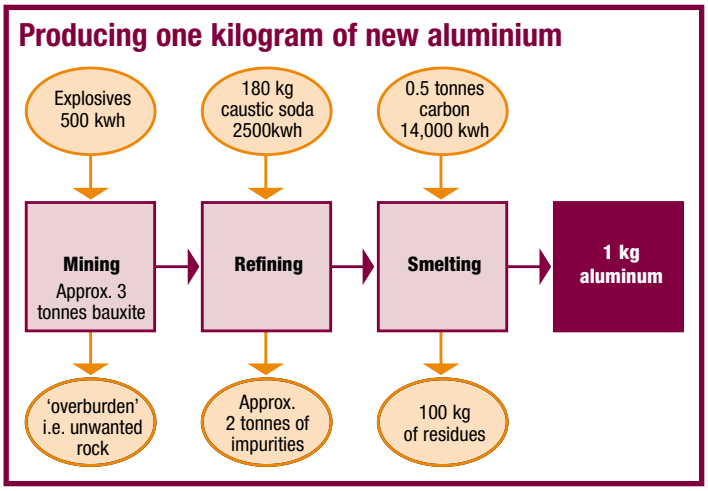
Here are some great ideas for reusing metals.

- Make a plant pot from an old tin can. Soak the can in water for a few hours and remove the paper label (remembering to recycle it of course!). Decorate the tin in any way you like. Get your teacher to punch some holes in the bottom of the tin so water can drain out. Add soil and a plant!
- Use old CDs (especially those unwanted internet CDs) to make drinks coasters. The outer coating of a CD is plastic, but inside is metal
- Collect some large tin cans from your school kitchen and make stilts. Punch two holes on either side near the bottom of the can and thread through some strong twine and tie the ends together. Turn the can over and you've got stilts!

Aluminium occurs naturally in mineral compounds such as bauxite. It takes a lot of time and energy to produce the pure aluminium used in products such as drinks cans or aeroplane parts. Overall, to make one tonne of new aluminium requires about 4 tonnes of bauxite and other materials, along with 17,000 kWh of electricity. There are three main stages in the process.

Mining

The rock containing aluminium, bauxite, is mined using an opencast strip method, mainly in Australia, West Africa and the West Indies. Although the topsoil is stripped and then replaced there is considerable damage caused to the local environment by the large open mines.



Refining

The Bayer process is used to produce alumina (Al_2O_3) from bauxite. First, the bauxite is washed, ground and dissolved in caustic soda (sodium hydroxide) at high pressure (30 atmospheres) and at high temperature (240°C). The undissolved impurities are filtered out. The solution is pumped into a tank (the precipitator). Fine particles of alumina are added causing pure alumina to form and settle out as the liquor cools.

Design a can crusher

Recycling aluminium is good for the environment and can be a useful way to raise funds. By crushing and reducing the volume of an empty can, schools can lower storage space and collection costs. D & T lessons are the perfect vehicle for pupils to design and produce their own can crushers to be used in schools. Can crushers need to be:

- easy to use
- easy to clean
- tough and robust
- easy to empty
- safe

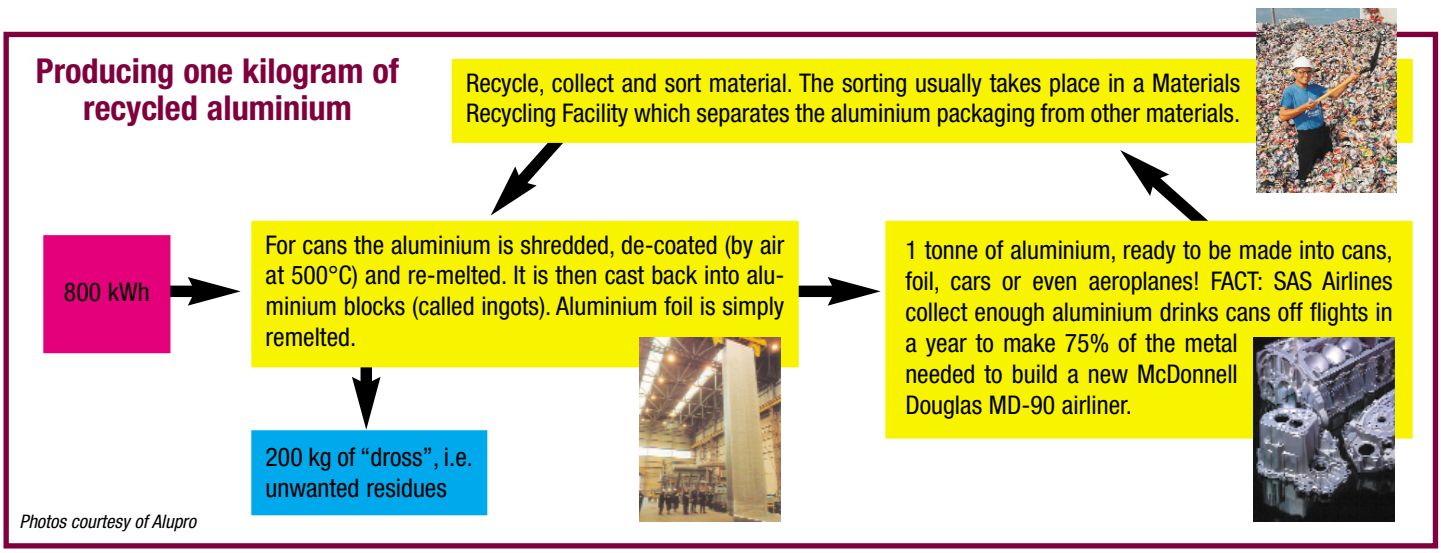
By carrying out this task pupils will achieve many of the requirements set out in the Programme of Study at Key Stage 3. These include "respond to design briefs and produce their own design specifications for products" (1b) and "test how well their products work, then evaluate them" (3b).

Smelting

The alumina is dissolved in cryolite (sodium aluminium fluoride), to lower its melting point, and held in a large carbon-lined container at about 980°C. Positively charged electric rods of carbon (anodes) are dipped into the molten alumina. An electric current is then passed through the alumina at low voltage (about 5 volts) but at about 150,000 amps. The molten aluminium collects at the bottom of the tank and can be siphoned off. As this process needs a lot of electricity it normally takes place in countries that have access to cheap, normally hydro, electricity. So for example the aluminium used in the UK is usually smelted in Scandinavia.

Recycling Aluminium

Recycling aluminium requires less than 25% of the energy needed to produce the metal in the first place. There is also no loss of quality as aluminium can effectively be recycled continuously. However, about 15% of the material is lost with every recycle. All of the stages in the recycling process can take place in the UK.



All the information you need is out there on the internet – somewhere! We tell you where to look.

Ollie Recycles
www.ollierecycles.com/uk
A child friendly website full of games, puzzles and information. Ollie and his friends show you around and teach you more about the 3Rs – Reduce, Reuse and Recycle. Click on 'Recycle' in the 'Explore' section to find facts and figures about steel and aluminium, including what we use them for and how they can be recycled. There are also quizzes to test your knowledge and a curriculum checklist for teachers.

Cash for Cans
www.cashforcans.co.uk
All you need to know about aluminium recycling, including how to use this to raise money for your school. Take an interactive tour around Europe's largest aluminium can recycling plant from where you can even download video clips of the process in action. Also on the site are games, downloadable desktops and screensavers, and printable posters and information packs.

UK Aluminium Packaging Recycling Organisation
www.alupro.org.uk
A really useful website with sections on diverse aspects of aluminium recycling. There's a searchable database for finding your nearest recycling facility, education resources, downloadable images, information on how community schemes can raise money from scrap aluminium, and much, much more.

Steel Can Recycling Information Bureau
www.scrib.org
More cans, this time made of steel. Did you know that steel cans have been used for food packaging since 1810, when Nicholas Appert responded to Napoleon's challenge to invent a method of preserving food for the French army? There is a children's zone with games and information and you can submit questions to find out more about steel can recycling.

Waste Online
www.wasteonline.org.uk
The place to go for information sheets on the recycling of aluminium, steel packaging and lots more. Good background information for teachers and also useful for research work by secondary students.

Junk to Gems
www.junktogems.org.nz
An inspirational and attractive site showing art made from junk by both children from New Zealand and a selection of British artists, some of whose work utilises reclaimed iron, steel washing machine drums and lager cans. Why not use this site as a starting point to do a similar art project in your own school? There are also printable posters on the recycling of steel, aluminium and other materials.

Use It Again
www.useitagain.org.uk
A website designed to help make it easy for you to 'do your bit' in the battle to reduce waste. Click 'How can we do our bit?' and then 'Recover' and 'Recycle' to find a relatively simple text, suitable for upper Key Stage 2 pupils, about steel and aluminium and how they can be recycled.

School Science
www.schoolscience.co.uk
A site about school science and its applications which contains a number of sections on copper, covering such things as its uses, the mining and extraction of copper and copper recycling.

Focus on Guinea

Location	Guinea is on the west coast of Africa
Population	7.5 million
Capital	Conakry
Geography	The majority of the country is a flat coastal plain, rising to a hilly interior.
Main river	Niger

Guinea and aluminium

A West African country and former French colony, Guinea has a rich collection of wildlife in its forests and savannah, and rich reserves of natural resources including iron ore, diamonds, gold, uranium and bauxite.

Guinea has 4 topographical regions: Lower Guinea (coastal plain with lagoons and mangroves), The Fouta Djallon Highlands (to the east where the major rivers Niger, Senegal and Gambia rise), Upper Guinea (savannahs which are home to a variety if wildlife including many monkeys, hyena, hippopotamus and poisonous snakes), and the Forest Region (tropical rainforest of teak, mahogany and ebony to the southwest).

Guinea's economy is highly dependent upon mining, especially iron ore and bauxite, the raw material for aluminium production. Guinea is the world's second largest producer of bauxite, after Australia, and this accounts for 12% of the country's GNP, more than 90% of its exports. However, only a small percentage of the population are employed in the mining sector, with 80% of Guinea's workforce employed in agriculture.

The preferred mining method is strip mining (or open cast) where covering vegetation is removed and after explosive charges are used to loosen the seams of bauxite, the ore is extracted by mechanical diggers.

This mining technique can be extremely disruptive to the existing wildlife, and poses a threat to the habitats of rare monkeys and birds that inhabit Guinea's forests.

Three conglomerate companies dominate the bauxite mining. Each of these conglomerates is made up of multi-national mining companies. A lesser proportion is controlled by Guinea itself.

Source: Encyclopedia Brittanica; United Nations Third World Forum; New Internationalist.