Sustainable Use of Resources
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- Earth's resources
  - Agriculture and chemistry
  - Recycling and reducing resources
  - Summary activities
Humans use the Earth’s resources for many purposes, from creating materials such as clothing and buildings, to generating energy such as petrol to fuel cars.

Some resources are considered non-renewable, meaning that when we use them up there won’t be any more.

Others are called renewable, meaning more can be grown or generated.

**Natural resources** can be supplemented by agriculture. Humans can make also synthetic versions of some resources to help reduce the amount of natural resources used.
The Sun is the original source of most energy resources.

Plants store the Sun’s energy through photosynthesis and that energy is transferred up the food chain.

The energy in these resources came from the Sun. Which of these resources is renewable and which is non-renewable?
Oil, coal and natural gas are examples of fossil fuels. They were formed from biological deposits over the course of millions of years.

The amount of fossil fuel on Earth is limited. Fossil fuels are non-renewable because they cannot be replaced and will eventually run out.
Fossil fuels are very important and have many uses.

Can you name some ways in which humans use fossil fuels?

- They are used as fuels for our cars and aeroplanes.
- They are used to generate heat and electricity to power our businesses and homes.
- They can be used to make plastics, medicines, packaging, fabrics and televisions.

We use fossil fuels for just about everything.
Atmospheric carbon dioxide levels
Sustainability

All of the Earth’s natural resources are limited. **Sustainability** is the ability to provide for our needs without damaging the Earth. Humans will always need resources. Our use of resources can be **sustainable** or **unsustainable**.

Unsustainable use of resources can damage the environment and lead to **pollution**.

Using resources sustainably means using them in a way that prevents them from running out, and avoids causing damage to the environment. It can also mean **reducing** how much we use and **reusing** and **recycling** used materials.
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Every year, when the crops are harvested, they remove some of the nutrients from the soil.

Over time, this will affect the soil quality if the nutrients are not replenished.

To replenish the nutrients in the soil, farms can use manufactured fertilisers, which require fossil fuels in their manufacture, or manure, which is naturally occurring and renewable.

What are the advantages and disadvantages of using manufactured fertilisers vs. manure? Which is more sustainable and which is more effective?
How can chemistry improve agricultural processes?

Using knowledge of chemistry in agriculture can make agricultural processes more efficient, which can reduce the use of non-renewable resources.

Fertilisers are made using ammonia, which is created through a series of chemical processes called the Haber Process.

By studying how various conditions affect chemical reactions, scientists can reduce the energy needed for the process and improve the yield. This means creating more desired product using less energy!
Food scientists have a wide range of responsibilities, from making branded ice cream taste more luxurious than supermarket own brands, to making sure we have clean water to drink.

Food scientists use their knowledge of the chemistry of food for a wide range of purposes:

- to develop new chemicals to increase crop production and yield, defend against pests and protect the environment
- to create new and improved flavours
- to process, package, preserve, store and distribute foods and drinks to make them safe, economical, and sustainable.
Supplementing natural products 1

Natural substances exist in nature, in the Earth, rocks, plants and animals. **Synthetic** versions of many substances can be made in a laboratory.

For example, vitamin C is naturally found in oranges. Scientists can make synthetic vitamin C from glucose.

Alcohol is naturally made by fermenting fruit. Scientists have developed a way to make alcohol from ethane using steam, in a process called hydration.
Humans get vitamin B from the food they eat. Synthetic vitamin B is found in vitamin tablets and can be made from coal.

Why are synthetic substances made when natural ones exist?

Natural ingredients could be scarce or expensive. It may be easier and cheaper to produce a synthetic version in the lab.

Sometimes, more of a substance is needed than is supplied naturally. For example, folic acid is used in the body to make and repair DNA. Synthetic folic acid is given to pregnant women to make sure they have enough for their growing baby.
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Obtaining raw materials from the Earth by quarrying and mining causes environmental impacts.

For example, explosives are used to extract limestone from rock in a process called blasting. The noise scares wildlife. Blasting also leaves large craters in the rock face which ruins the landscape.

Much of the limestone is then transported to cement factories near the quarries and the craters can be filled with rubbish and used as landfill sites.
Ways of reducing the use of resources

Metal, glass, ceramics and most plastics are produced from limited raw materials. For example, plastics are made from crude oil, which is a fossil fuel.

Much of the energy used in the processes to form these products also comes from limited resources. For example, coal is used in the extraction of iron in the blast furnace.

Raw materials can be conserved by reducing the amount of resources we use, reusing resources wherever possible or recycling.
Recycling is a good way to reduce the amount of resources we use. Recycling turns waste into usable material again. This means that fewer raw materials are used and less energy is used to process the raw materials.

For example, glass bottles can be recycled. The glass is sorted by colour then crushed into small pieces. Any bits of other materials are removed from the glass and then it is melted. It can then be made into new glass bottles.

What other resources can be recycled?
- paper
- some plastic
- aluminium
- batteries.

What are other benefits of recycling?

Recycling is a good way to reduce the amount of resources we use. Recycling turns waste into usable material again. This means that fewer raw materials are used and less energy is used to process the raw materials.
Almost all metals can be recycled into something new. Metal recycling helps to protect the environment as fewer raw materials are needed.

For example, aluminium extraction happens at about 900°C. This requires a lot of energy and this comes from burning fossil fuels.

Scrap aluminium can be melted down at around 660°C. This means less energy is needed, and therefore we can save some raw materials as well as reducing the amount of carbon dioxide we are releasing.
Price of copper

What does the graph tell us about the price of copper and how it has changed?

Why do you think this has happened?

What will happen to the price in the future, if we continue the way we are?
Reduce and reuse

The most sustainable change is to **reduce** our use of materials. Some products are wrapped in much more packaging than is necessary.

If the packaging cannot be reduced, the next best thing is to **reuse** it. Some packaging materials can be used several times.

For example, you could reduce your use of plastic bottles by reusing and refilling them.

What other things can be reused?
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