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Unit 1: Science and scientific processes

We are learning how to:

- define science and technology.

Science and technology

What is science?

Science is the study of nature and the environment. The word 'science' comes from the Latin *scientia*, meaning 'knowledge'. In science, **observations** and **experiments** are used to describe and explain natural occurrences. The knowledge gained is never complete, but is always being added to through further research and experiments.

The various branches of science are categorised as either social sciences or natural sciences. All your activities and research will be confined to areas in the natural sciences.



FIG 1.1 A scientist at work

Activity 1.1

Finding out about different sciences

Here is what you should do:

1. Fig 1.2 identifies some natural sciences.

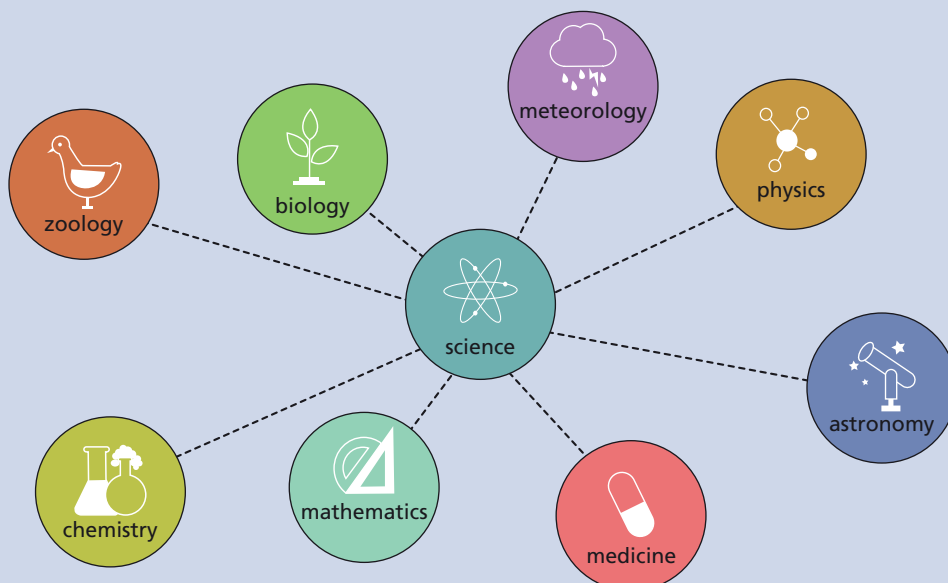


FIG 1.2 Some branches of science

In a group, discuss what is studied in each one of the sciences.

2. Match each branch of science with one area of study from the list below:

- healing
- living things
- objects beyond the Earth
- quantity
- animals
- the atmosphere
- behaviour of matter
- structure of matter.

What is technology?

The word '**technology**' comes from the Greek word *techne*, meaning 'art' or 'skill'. Technology is the **application** of knowledge gained from science in practical ways – to solve problems and improve the quality of life. Using technology, people are able to control and adapt to their natural environments. Our development and use of tools, the building of ships, and the invention of medical devices such as X-ray and MRI scanners are all examples of technology.

How does the scientific process work?

Science is not just about collecting facts to describe the natural world and its origin. It seeks to understand and then provide models for how the world works. Despite its usefulness, science has numerous limitations. For example, although science can provide guidelines to help in the recovery from the passage of a hurricane, it is unable to stop the action of a hurricane. These limitations are used as stepping stones for acquiring even more knowledge with which to address new issues – an example is the creation of hurricane braces to attach roofs more securely to houses.



FIG 1.3 A doctor using an MRI scanner

Fun fact

The first wristwatch was made by Patek Philippe in 1868.

Key terms

science system for studying the physical and living worlds based on experiments

observation collecting information via the senses

experiment the process of conducting a scientific test

technology the use of knowledge gained from science experiments to improve the quality of life

application putting scientific information to special use

Check your understanding

1. Explain the difference between science and technology. Give some examples of scientific discovery and of technological developments.

2. Find out what made each of the following scientists famous:

- Thomas Edison
- Richard Leakey
- Isaac Newton
- Jane Goodall
- Marie Curie
- John Dalton
- Maria Goeppert-Mayer
- Albert Einstein
- Louis Pasteur.

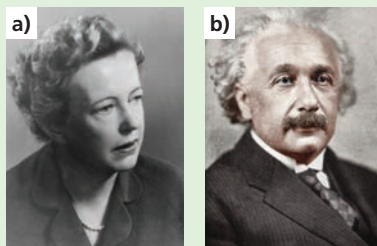


FIG 1.4 Famous scientists:
a) Maria Goeppert-Mayer and
b) Albert Einstein

Impacts of science and technology

We are learning how to:

- make use of science and technology to solve community-based issues.

Impact of science and technology on daily life

Science and technology influence life today in a huge variety of ways. Imagine your day:

- You are awoken at 6 a.m. by the music from your clock radio. You jump down from your bunk bed and into your bedroom slippers. You rush to the bathroom, turn on the light and the heater and have a shower. You iron your shirt, get dressed and comb your hair while looking in the mirror.
- Then you go to the kitchen, grab the remote control and turn on the television. You switch on the coffee maker and toaster, and while your coffee is brewing and your bread is toasting you select your cutlery and crockery. You go to the fridge and find the ingredients for your packed lunch.
- After breakfast, you clean up the kitchen, change the water in your pet bird's cage and put out the rubbish as the bin lorry passes.

All of these aspects of life are influenced by science and technology, which have also contributed to the development of motor vehicles, telephone lines, lifts, space rockets and water-treatment plants and, on a smaller scale, items like washers for tap heads, aglets (metal or plastic tube fixed around each end of a shoelace) and paperclips.



FIG 1.5 Some of our daily activities

Activity 1.2

Group work for class presentation

Here is what you should do:

1. Interview an elderly person and find out how life was for them growing up: the type of recreation activities there were, food, houses, communication, etc. Compare their lifestyle with that of today.
2. Compare how telecommunication services worked in the past and how they have been developed to what they are today.
3. Compare the transport service, from horseback to space travel.
4. Consider the invention of gadgets (for example, a bottle opener) to make work easier.

Despite all these advantages of scientific and technological progress, there can be disadvantages. The demand for paper, wood and rubber reduces the number of trees. Fuels for cars and factories cause pollution. Medication can be accompanied by side effects. The important thing to note here is that technological solutions to scientific problems must be applied carefully and with the proper precautions.

Science and technology are also applied widely in medicine, agriculture, defence, economics, leisure and exploration. It does not seem that there is any barrier to the current rate of technological advancement.

Check your understanding

1. List two advantages and two disadvantages of the smartphone.
2. List two advantages and two disadvantages of modern cars.

Fun fact

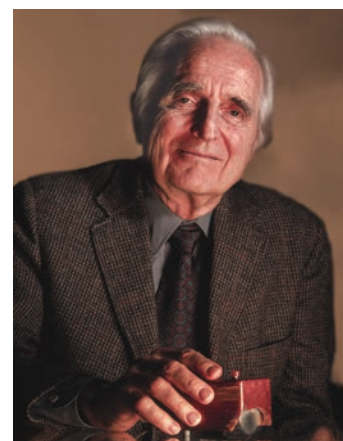


FIG 1.6

In 1968, the first computer mouse was introduced by Douglas Engelbart at a Computer Expo in the USA.

Scientific skills

We are learning how to:

- use scientific skills to carry out an experiment using the scientific method.

The scientific method

Scientists carry out their work or research in an organised, or systematic, way called the **scientific method**. Why is it necessary for scientists to be so organised?

To become a scientist, you need to develop a number of skills to enable you to carry out research that gives accurate results. Inaccurate results give a false picture of the subject under research. It is therefore important for scientists to be very careful and organised.

The table below gives five scientific skills and their definitions. You will develop these skills as you work through this course.

Skill	Definition
Hypothesising	Suggesting a possible explanation for things in a way that can be tested
Planning and conducting experiments	Carrying out a process to answer a specific question
Collecting data	Gathering numerical information
Recording and reporting	Ensuring data is written down securely and then presenting it in tables, diagrams or charts so that it is easily understood
Analysing data	Looking for patterns and information within sets of data

TABLE 1.1 Scientific skills

Scientists use all the skills listed in Table 1.1 when they conduct experiments.

Experimenting scientifically

You will carry out an experiment on piercing balloons. Scientists always have a reason for carrying out an experiment. Now think of what you will do and why – suppose you place sticky tape on the balloon and pierce through the tape, what **prediction** can you make?



FIG 1.7 An agricultural scientist at work

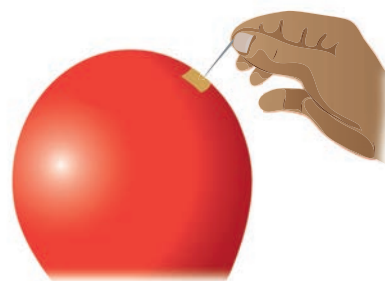


FIG 1.8

When the experiment is completed you will write a report, so you must be extremely observant during the experiment.

Before conducting an experiment, it is important that you check that:

- everything you need to use is available and close at hand
- you have carefully read and understood all instructions.

Activity 1.3

Here is what you need:

- balloons
- clear sticky tape
- a straight pin
- scissors.

Here is what you should do:

1. Inflate two balloons fully and tie each one at the neck.
2. Pierce one of the balloons with the pin. Do not let go of the pin. Carefully observe what happens.
3. Place sticky tape on the other balloon so that there are no air pockets between the tape and the balloon.
4. Pierce this balloon through the tape. Do not let go of the pin. Carefully observe what happens.
5. Record what you observed with both balloons.
6. Provide suggestions to explain what you observed.

Check your understanding

1. Why did you have to hold on to the pin?
2. Why was it important that there were no air pockets between the tape and the balloon?
3. What caused the first balloon to burst so quickly?
4. Was the behaviour of the air in both balloons the same or different?
5. Give a reason to support your answer.

Fun fact

The microwave oven was invented by a researcher who, when he walked past a radar tube, found that the chocolate bar in his pocket melted.

Key terms

scientific method the systematic manner of conducting experiments

hypothesising making statements in such a way that they can be verified

planning formulating an orderly set of events which may lead to achieving a goal

analysing explaining the reason for the method used and the steps taken to limit errors

predicting stating expected outcomes based on experience