1 Technological development

Before we look at the **milestones**[1] in the history of technology, let's clarify what we mean when we talk about *science*, *skill* and *technology*.

- **Science:** the knowledge that we have about the world around us and the universe we live in.
- **Skill/Technique:** this refers to our 'how to' knowledge, for example, how to build a telescope or manufacture a car.
- **Technology:** the set of processes that we apply to solve a problem or satisfy a human need.

The technology of each historical period depends on the level of scientific and technical knowledge that people had at the time. However, scientific advancements don't always lead to immediate technical and technological developments. In fact, it can take years or even centuries for society to make use of a certain scientific discovery.

[1]**milestone:** important moment or event.

Prague astronomical clock

Invention and innovation

Technological development happens through invention or innovation.

- **Inventions** are new devices or procedures that we create in order to solve a problem or satisfy a need. Because such devices or procedures solve problems, they can be considered techniques.
- **Innovations** are improvements that we make to existing processes or devices.

The history of technology is not simply the history of scientific discoveries. Instead, it is the history of how people have come up with solutions to specific problems. In most cases, these solutions take the form of inventions.

A car from 1910

CLIL activities

1 **Answer the questions in your notebook. Then compare your answers with a partner's.**

a. What is the purpose of technology?

b. How important is technology in your life?

2 **Classify the following as *science*, *skill* or *technology*.**

- the printing press
- a train
- neuroscience
- manufacturing a computer
- improvement in aeroplane safety systems
- a steam turbine

3 **Listen to the documentary about Spanish philosopher Ortega y Gasset and the three technological stages. Complete the sentences in your notebook using your own words.**

a. In the technology of chance...

b. In the technology of craftsmanship...

c. In the technology of the technician...

[1]**gathering:** collecting things to use or eat.

[2]**hominid:** family of primates that includes humans and Australopithecus.

[3]**shelter:** place that provides protection from bad weather or danger.

[4]**metallurgy:** technique of obtaining and treating metals.

[5]**goldsmith:** person skilled in the art of creating objects made of gold, silver and other precious metals.

CLIL activities

4 Write definitions of these terms in your notebook.

a. settle

b. social disparities

c. soldering

5 TASK STEAM Work in pairs. Find information about *homo habilis* and *homo erectus*. Compare time spans, geographical locations, physical characteristics and lifestyles. Use a table to compare both. You can include drawings or pictures. Present your findings in class.

6 Listen to the professor giving a lecture about the Neolithic period.

a. What two major events took place?

b. What was the effect of each event?

2 Historical milestones in technology

We divide history into different chronological periods, each one beginning and ending with important historical milestones.

2.1 Prehistory

In this long period of history, humans gradually developed skills and techniques that helped them survive. These include hunting, **gathering**[1], making tools and lighting fires. Prehistory ended with the invention of writing around 3 500 BC.

Homo habilis was the first **hominid**[2] (2 000 000 B.C.) to make tools from stones. They sharpened the stones by striking them against one another.

Due to glaciation, ***homo erectus*** started to build **shelters**[3] and take refuge in caves. These people used fire for light and heat, and for cooking food. This society was based around hunting animals.

The **Neolithic Revolution** (10 000 BC to 3 000 BC) is considered the first and most important period of change in the history of civilisation. Agriculture and livestock farming appeared at this time, allowing people to settle and leave behind the hunter-gatherer lifestyle. The first houses were built and people began to work in specialised jobs (for example, artisans, farmers and traders).

2.2 Ancient history

During this period, large civilisations with complex political structures developed. These civilisations made great economic progress but were marked by social disparities.

- **Writing:** the oldest known writing system dates from 3 500 B.C. in Mesopotamia.
- **The Bronze Age:** **metallurgy**[4] appeared in 3 000 B.C. in Mesopotamia. This was a major development in the history of technology. It led to the creation of new jobs (miners and **goldsmiths**[5]) and revolutionised handcrafts, war and farming.
- **The Iron Age:** the technique of soldering two metals together was first used in Syria around 1350 B.C. However, iron metallurgy developed more slowly than that of other metals because higher temperatures are required to melt it.
- **Development of mechanics and architecture:** between the 4th century B.C. and the year 476 A.D. (the fall of the Roman Empire), new machines were invented, including the first catapults and the Archimedes' screw. Architecture developed significantly at this time. Aqueducts and roads were built, and new architectural structures such as the dome appeared.

Sumerian cuneiform script

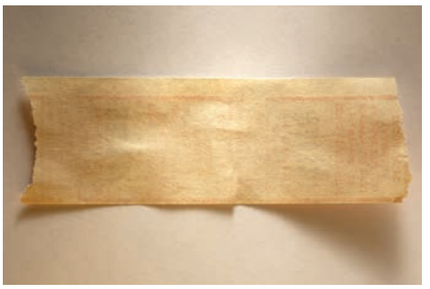
Gold mask

Iron tools

2.3 The Middle Ages

This period began with the Germanic invasions in the 5th century A.D. and ended in the 15th century, with the fall of the Byzantine Empire.

- **Paper** was invented in China in the 2nd century B.C. It wasn't until the 12th century A.D. that paper was produced in Europe.
- The invention of the **compass**[1] and the construction of more modern boats improved **sailing** and **navigation**. In the 15th century, the Portuguese made some major improvements to boats. They designed the long, narrow hull of the caravel — a long, narrow ship that was easier to manoeuvre in the water and made exploration of coasts and of the world possible.



Chinese writing (105 B.C.)

- The **printing press** was the greatest technological revolution of the Middle Ages. Invented in Germany by Johannes Gutenberg in the mid-15th century, it used movable characters, paper, ink and the press. The printing press made it easier to spread knowledge in the form of written texts around the world. The Bible was the first major work published.

2.4 The Early Modern Age

This period began with the fall of the Byzantine Empire and ended with the French Revolution.

- **The steam engine:** the first steam engine was built by Thomas Newcomen in 1712, but it was James Watt who perfected the design in 1782. It was the **driving force**[2] behind the Industrial Revolution.

The steam engine was used in all sorts of industrial machines, leading to major developments such as **mass production**[3] and process automation. In the field of transport, this new technology allowed for the rapid movement of raw materials and people over long distances.

[1]**compass:** instrument used to navigate with a magnetised needle that always points to the magnetic North Pole.

[2]**driving force:** the power or energy behind something in motion.

[3]**mass production:** the production of large quantities of a standardized article by an automated mechanical process.

Gutenberg's printing press (1438)

The steam engine

CLIL activities

7 **Answer the questions in your notebook.**

a. What were the most important inventions of the Middle Ages?

b. What was the main driving force of the Industrial Revolution and why?

8 **Work in pairs. Explain the importance of these technological milestones and the benefits that they brought to society.**

a. Improvements in sailing and navigation

b. The printing press

Thanks to ..., people were able to...

For the first time, it was possible to...

9 **Listen to a podcast about the development of the printing press from the Middle Ages to the Industrial Revolution. Answer the questions.**

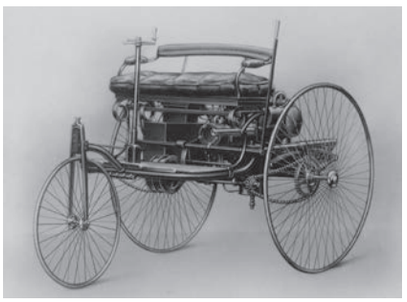
a. What were the disadvantages of Gutenberg's printing press?

b. Why was Stanhope's printing press important?

c. Why was Koenig's printing press a major innovation?

10 **Find information about other inventions in the Middle Ages. Present the information in a diagram.**

[1]**incandescent:** something that gives off light when it is heated.



First vehicle with an internal combustion engine (Benz, 1885).

Transistor

2.5 The Modern Age

This is the period from the end of the French Revolution to the present day. Below are some examples of technological developments from this period.

- **Electricity:** the first electric battery was the voltaic pile (1800). It was followed by the first electric motor, which was invented by Michael Faraday in 1821. In 1879, Thomas Edison invented the **incandescent**[1] light bulb. These inventions were the starting point for the development of electrical technology, which eventually replaced steam technology.

- The **internal combustion engine:** French engineer Étienne Lenoir built the first engine that used a mixture of gas and air as a fuel. Later, in 1885, Karl Benz built the first car equipped with a single-cylinder petrol engine. This marked the beginning of the automobile industry.

- The **transistor** was invented by the American physicists John Bardeen, Walter H. Brattain and William B. Shockley in 1947. This was the beginning of a new industrial revolution. Thanks to the transistor, it was now possible to manufacture much smaller electronic devices, making the large vacuum tubes used previously obsolete. The invention of the transistor also marked the start of the information, communication and aerospace age.

- The **Internet** and **information technologies** have laid the foundations for a new revolution. The ways in which information is created, modified and transmitted has been revolutionised. These technologies have also changed how we establish human relationships and how we use objects. For example, we can activate smart light bulbs by speaking thanks to voice recognition technology. The integration of the Internet and artificial intelligence into objects and devices is known as the **Internet of Things.**

CLIL activities

11 **In your notebook, draw a timeline of the different periods of history, indicating the historical event or invention that marked the end of one period and the beginning of the next.**

12 **Work in pairs. Explain the importance of these technological milestones. Write a list of the benefits that they brought to society.**

a. The internal combustion engine

b. The transistor

c. The Internet

The ... gave rise to/led to/meant that...

The ... was an important milestone because...

13 **Listen to a salesperson talking about smart fridges. Answer the questions.**

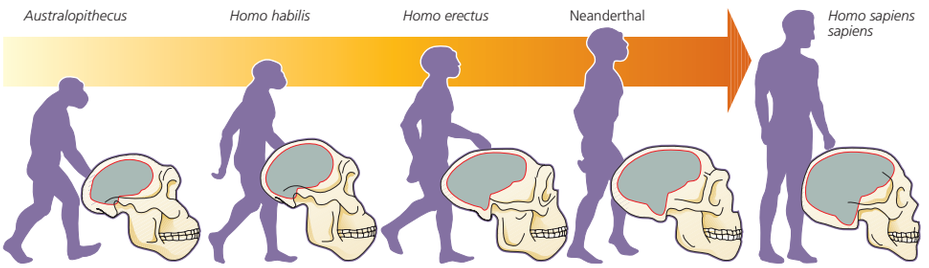
a. How can smart fridges help users?

b. Do you think they could be useful in your home? Why or why not?

3 Social models

In nature, we can find examples of social groups made up of many individuals coming together to achieve particular goals (to hunt, to defend themselves, etc.). Such social groups (for example, bees, termites, wolves, primates) share the following characteristics: (1) they are organised hierarchically; (2) their social evolution takes place slowly, if at all, over time; (3) the individuals have specialised roles; (4) they possess instinct.

Humans are also social beings, but with a characteristic that sets them apart from other animals: the ability to evolve socially. This is due to the unique evolution of the human species, as well as to humanity's capacity to pass knowledge down through the generations (culture) and each individual's ability to change their role in the social structure.



Humans have evolved and have become more intelligent over time.

3.1 Hunter-gatherer societies

In these societies, man used stone to make tools. The table shows some of the main characteristics of hunter-gather societies.

Technological period	Historical period	Energy source
Chance	Neolithic Period	Mechanical energy produced by humans
Social structure	**Economic/ employment structure**	**New technologies**
• Group leadership • Familial relationships (tribes, clans) • Nomadism	• Hunting in groups • Fruit gathering • No surpluses	• Stone and bone tools (axes, spears, arrows, brushes, needles) • Group hunting techniques

- **Group leadership:** the leaders were the wisest members of the group and the most skilled at hunting and making tools.
- **Clans and tribes:** because their weapons were very basic, individuals came together in groups of between 50 and 100 to hunt.
- **Nomadism:** hunter-gatherers didn't practise agriculture, so when natural resources in an area had run out, they would move to a new location.

Technological innovations: objects such as bones as stones were used as found in nature. Sharp **flakes**[1] were broken off larger stones to make **flint**[2] tools, hand axes, **spears**[3], harpoons, bow and arrows, spear throwers, etc.

[1]**flake:** small, flat, thin piece of material.

[2]**flint:** hard grey rock. A form of quartz.

[3]**spear:** weapon consisting of a long wooden shaft and a sharp-pointed head.

CLIL activities

14 **Write definitions of these terms in your notebook.**

a. evolution
b. hierarchy
c. instinct

15 **Copy and continue the sentences in your notebook. Compare your answers with a classmate's.**

a. Humans have evolved as they have become...
b. Different periods of history have been characterised by...
c. The transition from one period to the next has always been the result of...

16 **Listen and answer the questions.**

a. What is the Levallois technique?
b. What is a spear thrower?
c. How were spear throwers used?

3.2 Agricultural societies

In these societies, agriculture replaced hunting and gathering. The table shows some of the main characteristics of agricultural societies.

Technological period	Historical period	Energy source	Social structure	Economic/ employment structure	New technologies
Chance	Neolithic Period	Mechanical energy produced by humans	• Social classes • Sedentism • Villages	• Surpluses of food • Specialisation of labour • Social inequalities • Bartering	• Polishing stones • Crop and livestock farming

[1]**surplus:** excess of production or supply.

Village

- **Social groups:** the appearance of **surpluses**[1] reinforced the political and religious class, who consumed these surpluses.
- **Sedentism:** thanks to farming techniques, people could settle in one place. Villages and permanent homes built of mud bricks appeared.
- **Surpluses and specialisation of labour:** because of surpluses, not everyone had to work on basic subsistence tasks. Labour became specialised (for example, craftsmanship, hunting, building, etc.).

Technological innovations: polishing stone, sowing and planting crops, domesticating animals, boats, the wheel.

3.3 Agricultural and urban societies

Technological innovations in these societies include writing and ploughing.

Technological period	Historical period	Energy source	Social structure	Economic/ employment structure	New technologies
Chance and craftsmanship	Prehistory	• Mechanical energy produced by animals • Wind energy • Water • Wood	• Centralisation: empires • Social groups	• Trade routes • Private property • Slavery	• Writing • New farming methods • Metallurgy
	Middle Ages		• Decentralisation: feudalism • Religious power	• Feudal rents • Taxes	• Limited innovations in farming and weaponry

- **Centralisation:** villages grew in size and became cities. **Trade routes** gave greater access to the latest technologies and large empires appeared.
- **Decentralisation:** after the fall of the Roman Empire, feudalism developed. People were protected by a powerful landowner called a lord. In return, they worked for the lord and were loyal to him.
- **Religious power:** monks helped to preserve existing knowledge.

Technological innovations: plough, yoke, glass, catapult, parchment, windmill, clock, watermill, dome, gunpowder, screw, printing press, etc.

CLIL activities

17 **Read the questions and discuss.**

a. Why is the technology of craftsmanship more like evolution than invention?

b. Do technology of chance and technology of craftsmanship still exist today?

18 **Listen and answer the questions.**

a. What were guilds and when did they exist?

b. What were apprenticeships?

c. Why did guilds disappear?

19 **Do research on Ancient Greece or Rome. Summarise how they were organised as agricultural and urban societies. Share your information in groups.**

3.4 Industrial societies

Mechanisation and the steam engine characterised industrial societies. The table shows some of the main characteristics of industrial societies.

Technological period	Historical period	Energy source	Social structure	Economic/ employment structure	New technologies
Craftsmanship and engineering	Modern Age	• Wood • Coal • Oil • Hydraulic energy	• Bourgeoisie • Working class • Emigration	• Mercantilism • **Trade unions**[1]	• Mass production • Steam engine
	Contemporary Age		• Capitalism • Communism • **Dictatorship**[2] • Democracy	• Specialisation of economic activity • Financial markets • **Unemployment**[3]	• Electricity • Combustion engine • Automatisation

- **Class distinctions:** industrialism led to social divisions between factory owners and ordinary workers. Trade unions were created to protect workers' rights. Many people moved from rural areas to cities.
- **Political and economic changes:** new social, economic and political systems appeared (for example, capitalism, communism and dictatorships).

Technological innovations: photography, electric motor, telegraph, combustion engine, telephone, car, radio, plane, steam engine, etc.

[1]**trade union:** association of workers whose objective is to demand better working conditions and wages.

[2]**dictatorship:** form of government in which one person or a small group possesses absolute power.

[3]**unemployment:** normally occurs when a person is actively searching for employment but is unable to find work.

3.5 Knowledge and information societies

The transistor was the main technological development in these societies. The table shows some of the main characteristics of such societies.

Technological period	Historical period	Energy source	Social structure	Economic/ employment structure	New technologies
Engeneering	Contemporary Age	• Renewable • Non-renewable	• Capitalism • Democracy • Social dynamism	• Economic globalisation • Unemployment • Services sector • Improved quality of life and access to technology	• Telecommunications • New energies • The Internet • Mobile devices • Information and Communication Technology (ICT)

- The **telecommunications boom** led to economic globalisation and new ways of working. Unemployment has become a serious economic problem.
- **Mass production** has led to improved quality and increased production.

Technological innovations: microchip, computer, smartphone, etc.

Ford assembly line, Detroit (1913)

CLIL activities

20 **Work in pairs. Discuss and answer the questions.**

a. Which technological innovations mentioned in this section are still in use today?

b. Which are no longer used?

21 **Can different types of societies exist at the same time? Discuss with a partner.**

I think/don't think that...

In my opinion...

22 **Listen to the documentary about end of the Renaissance. Answer the questions.**

a. When did the trade system end?

b. What happened to urban areas because of industrialisation?

c. What were the consequences of mass production?

[1]**raw material:** natural resource used and transformed in the production process.

[2]**R&D&I:** acronym that stands for Research, Development and Innovation.

Factors that determine new relationships and social and economic uses

Industrial standardisation

As industry becomes more complex, criteria must be set for the different stages of the production process, from obtaining **raw materials**[1] to producing and selling the end product. These criteria are defined in a series of guidelines or standards. Companies that apply these standards receive a certification, giving them a strategic advantage over their competitors.

Globalisation

Communication technologies, the Internet and access to information have encouraged the globalisation of economies and markets. This has led to a growing interdependence between countries, cultures and societies.

New energies and natural resources

New energies have appeared in an effort to limit the environmental damage caused by use of fossil fuels.

Natural resources are found in nature. Humans use technology to transform them into products that help us survive and make progress.

There are two types of natural resources: **renewable and non-renewable resources.** If non-renewable resources are over-exploited, that is, if we use them more quickly than they can be replaced, they'll run out and we may never be able to use them again. We therefore need to find and develop **alternative technologies** that pollute less.

United Nations

4 Sustainable development

Sustainable development allows us to meet people's needs without damaging the environment or exhausting natural resources. In 2015, the UN General Assembly adopted the 2030 Agenda for Sustainable Development. Participating countries agreed to meet 17 sustainable development goals by the year 2030.

Computer applications and R&D&I

The use of **computer applications** in **R&D&I**[2] has led to significant progress in terms of productivity and quality control. **Genetic engineering techniques** have been used in research related to food, medicine and biology, helping scientists to discover the causes of some diseases and to develop new vaccines.

CLIL activities

23 Write definitions of these terms in your notebook.

a. renewable
b. non-renewable
c. sustainable

24 Listen to the teacher talking about AENOR. Answer the questions.

a. What is AENOR?
b. What is a standard?
c. What are standards used for?
d. What example is given?

25 Work with a partner. Think about the characteristics you'd like the society of the future to have. Discuss your ideas with the rest of the class.

I think the most important characteristic of a future society would be...

If I could choose, I'd like a future society to have/be...