



# THE TECHNOLOGICAL PROCESS

## YOU WILL LEARN TO...



- Understand what technology is and its role in society.
- Identify the factors involved in the evolution and development of technology.
- Distinguish between the different stages of the technological process.
- Design documents using information and communication technology (ICT).
- Evaluate problems arising from technological development and implement solutions.
- Follow health and safety rules during the process.
- Design and make a watering system.



- Why do we have cars? When were they invented?
- How do you think a car is designed? What factors have to be considered?
- Have you ever made a plan or strategy? Tell the class about it.



## Designing a drip irrigation system

Water is essential for life. The quantity of fresh water on Earth is limited. Preserving fresh water is important for drinking water supplies, food production and leisure activities. Water quality can be affected by infectious substances, toxic chemicals or radiation.

Almost 70% of all available fresh water is used for agriculture so we need to optimise methods of watering crops to prevent wasting water through **evaporation**, **run-off** and **infiltration** too far from the roots.

The project in this unit is to design and build a **homemade drip irrigation system** to optimise the consumption of water for plants in a garden or a school vegetable plot.



Flood irrigation



Sprinkler irrigation



Drip irrigation

### What do you have to do?

- ① Work in a group of 4 to 6 students.
- ② Nominate a coordinator or representative for the group; other duties will be shared out among the rest of the group later.
- ③ Look up information about different design solutions for drip irrigation systems.
- ④ Design a drip irrigation system following the process described in the unit, following the stages and creating the documents required.
- ⑤ Build the drip irrigation system you have designed.
- ⑥ Test and check the system.

### Specifications



- ⚙ The system must be able to water six plants with 0.6 litres each per day, that is, each plant receives 0.6 litres per day.
- ⚙ The materials you use should be everyday items with the lowest possible cost, preferably recycled materials (plastic bottles, corks, marbles, cotton, plastic tubes, etc.).
- ⚙ You will propose at least three possible solutions. The group will choose one and you must explain your choice.
- ⚙ You must hand in a project report signed by all the group members.
- ⚙ As an option, you can make a presentation or video of the whole process (from the proposals to the solution).

### Before you begin . . .

### Answer

1. Discuss the project for a few minutes.
2. Agree on definitions for the following terms and write them in your exercise book: evaporation, run-off, water wasted through infiltration, flood irrigation, sprinkler irrigation and drip irrigation.
3. Discuss your definitions in class and agree on them with the help of your teacher.

- <sup>1</sup>**satisfy**: provide something we need  
<sup>2</sup>**system**: a combination of things working together with a common function  
<sup>3</sup>**verification**: evaluation and checking that something satisfies the proposed requirements stated at the beginning of the process



### Understand

- Look at the photo and discuss the questions.
  - What is this object for?
  - How did we satisfy the same needs before it existed?

Discuss and write.

### Key structure

We use the **to**-infinitive to express purpose  
 We use a ... **to**...



### Key concepts

- Technology produces objects and develops strategies that resolve our problems and satisfy our needs.
- The technological process consists of various stages organised to obtain a solution to a problem or need.

## 1. WHAT IS TECHNOLOGY?

**Technology** produces **objects** and develops **systems** or strategies that solve problems and **satisfy**<sup>1</sup> our needs from the simplest to the most sophisticated.

An object can be a tool, machine or household appliance. A **system**<sup>2</sup> can be the way a train station is managed or the way someone who is hurt on a mountain is rescued.

Sometimes the process of resolving the problem is very simple and generally consists of various stages in which one or more people are involved.

The steps are based on a logical series of operations that start with the detection of the need and end with checking the efficiency of the object or system that resolves the problem.

**Technology** is the practical application of knowledge (science) and skills (technology) to create a solution (an object or a technological system) that allows human beings to satisfy their needs or problems.

Here is a possible sequence in the technological process:

Need → Idea → Development of the idea → Construction → Verification<sup>3</sup>

<b>Need</b>	Analysis of the need or problem and the conditioning factors.
	Study of previous cases and their solutions.
<b>Idea</b>	Propose one or various solutions.
	Agree on and choose the best solution.
<b>Development of the idea</b>	Tools, materials and labour needed.
	Prepare a budget.
<b>Construct</b>	Construction and testing.
<b>Verification</b>	Evaluate.
	Write a final report.

The **technological process** consists of a series of stages that lead to the efficient solution to a problem or need.

### Analyse

- What do we use the following objects for?  
 ball point pen    car    vacuum cleaner    money  
 What needs do they satisfy? What other objects satisfy the same needs? Discuss and answer the questions.
- Name and write two technological objects that satisfy each of these needs.
 

a) Listening to music	c) Moving people from place to place
b) Building machines	d) Communicating

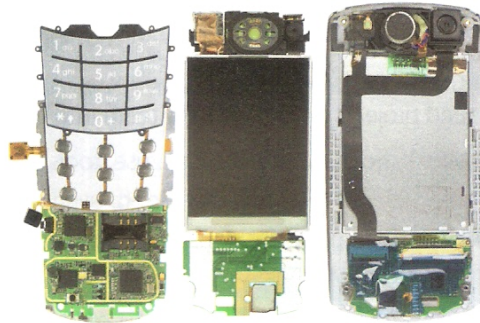
## 2. FACTORS IN THE TECHNOLOGICAL PROCESS

When a **solution** has been found, it is converted into a **technique**. This is a skill - something we know how to do and that is used for future technological solutions. This is the base of **technological evolution**.

Scientific knowledge and its application are needed to obtain an efficient technological solution. The process involves a combination of procedures and resources to obtain a result.



Have you ever resolved a problem? How? Using your knowledge and skills, and following a plan? This is what technology is.



### Analyse

4. What is involved in making a mobile phone? Look at the photo and discuss these questions.
  - a) What is it for? How does it work?
  - b) How big is it? Why is it this size?
  - c) What materials is it made of?
  - d) How much is it? Is this a good price for a mobile phone?

The factors in the technological process:

1. **Knowledge of physical and scientific concepts** is important. The more scientific knowledge we have, the easier it will be to obtain an optimal solution to the problem.
2. **Technical drawing** is used to transmit the idea of an object.
3. **Knowledge of materials and their properties** is essential for choosing the right material for the project.
4. Development of **work techniques** are important for better results (speed, reliability, cost and safety).
5. **Economic factors** are decisive in the progress of technology. They influence the way we make objects and decisions about design and use of materials.
6. **Information technology (IT)** facilitates the management of information, the speed in which it is transmitted and the automation of processes.

All these factors are studied in the technological process. Although these factors do not appear to be related, we shall see by the end of the unit that together they serve to design and construct objects that satisfy our needs.

### Apply

5. Make a list of the knowledge you require and the techniques you will use while making the drip irrigation system.

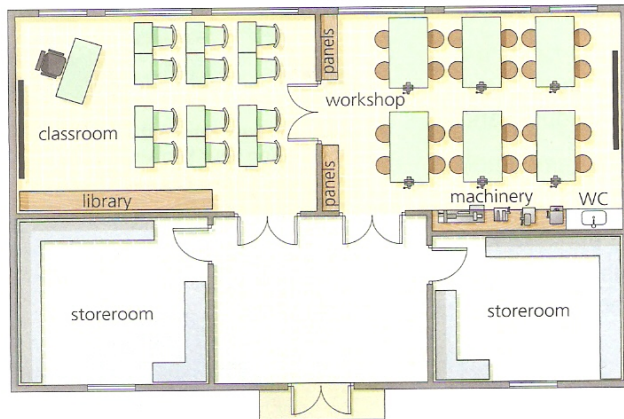


### Key concepts

- The factors involved in the technological process are: knowledge of physical and scientific concepts; technical drawings; materials and their properties; working techniques; economic factors and information technology.

### 3. CLASSROOM WORKSHOP

In the classroom workshop we are going to do two types of work:



- **Problem analysis:** giving ideas to solve problems, discussing solutions in groups, learning things to help us, etc.

- **Hands-on activities:** cutting, sticking, using a **saw**<sup>4</sup> or a **drill**<sup>5</sup> ...

Clearly these are different activities that need different spaces. For example:

- **Classroom:** where we can work on and develop our ideas and projects before we take them into the workshop.

- **Workshop:** where we can use tools, workbenches, high stools and special machinery ...

- **Library:** a place for consulting material which will help us complete our projects.

<sup>4</sup>**saw:** a special tool for cutting wood or other hard materials

<sup>5</sup>**drill:** a special tool for making a hole

<sup>6</sup>**tidiness:** in a tidy, ordered state

<sup>7</sup>**layout:** the way something is arranged

- **Storeroom:** two areas, one for the materials which we will use and another for each group's projects under construction.

#### 3.1. Tidiness and organisation in the classroom workshop

Before starting, we have to look at two important aspects:

**Tidiness**<sup>6</sup> in the classroom workshop is essential in two ways:

- **The layout**<sup>7</sup> of machinery should make it easy to work.

- **Good organisation of the materials and projects** in the storeroom should make it easy to work and avoid accidents.

**Planning** to ensure the best use of our time. Each student within a group will be assigned a task which they must do. The main duties in the classroom workshop are:

Post	Duties
<b>Coordinator</b>	<ul style="list-style-type: none"> <li>■ Agree on and coordinate all the resources and efforts for every member of the group.</li> <li>■ Achieve an efficient group effort.</li> <li>■ Speak <u>on behalf</u> of the group in front of the class and the teacher.</li> </ul>
<b>Materials Officer</b>	<ul style="list-style-type: none"> <li>■ Find and collect the material needed.</li> <li>■ Recycle material you don't use.</li> </ul>
<b>Tools Officer</b>	<ul style="list-style-type: none"> <li>■ Look after the tools.</li> <li>■ Make sure the tools are not lost or damaged.</li> </ul>
<b>Secretary</b>	<ul style="list-style-type: none"> <li>■ Collect, check and organise all the documents.</li> </ul>
<b>Health and Safety Officer</b>	<ul style="list-style-type: none"> <li>■ Make sure that all classroom workshop rules are followed and all machines are used safely.</li> </ul>
<b>Cleaning Officer</b>	<ul style="list-style-type: none"> <li>■ Make sure that all members leave their workspace in a clean and orderly manner.</li> </ul>

#### Apply

6. Think of other duties and/or tasks that might be necessary for each post.

### 3.2. Hygiene and safety rules

If a saw can cut through wood so easily, imagine what it could do to your fingers. Even a small tool can cause serious injuries.

There are a lot of tools in the classroom workshop that can hurt you if you don't use them properly. Don't be afraid, but be careful and pay close attention to what you're doing.

- **Hygiene** is the part of medicine that deals with staying healthy and preventing illnesses. In the classroom workshop there are tools and machines that are useful but also dangerous if we don't use them correctly.
- **Safety** is the prevention of and personal protection from risk when doing an activity.

To prevent accidents in the classroom workshop, always follow your teacher's instructions. You also have to follow the rules in the following table.

Safety rules for tools	Safety rules for <u>tasks</u>
<ul style="list-style-type: none"> <li>■ You must know how to use every tool and machine before starting to work with them.</li> <li>■ Use the right tool for each job. Follow the safety rules for each one.</li> <li>■ Before you use them, make sure the tools are in good working order.</li> </ul>	<ul style="list-style-type: none"> <li>■ Always have a specific task to do.</li> <li>■ Avoid <b>distractions</b><sup>8</sup> and <b>pranks</b><sup>9</sup>. Even if you just give someone a small fright, it can cause a serious accident when a group is working with machinery.</li> <li>■ To work, you have to be in good physical and mental health (to have eaten or slept enough, etc.).</li> <li>■ Learn how to use each tool before you use it. Ask first, then use it.</li> <li>■ Use the right safety equipment if necessary: <b>goggles</b><sup>10</sup>, gloves (to avoid cuts), etc.</li> </ul>

#### Evaluate

7. Work in groups. Each group writes one of the rules we've given you here; then write a sentence explaining why you think the rule is important. Put all the rules and explanations together on a class poster.

#### Apply

8. Cross out the actions that might be dangerous in the classroom workshop: running, working, jumping, drawing, wearing your hair down, pushing someone else as a joke, eating or drinking.
9. Find out about your school's evacuation plan. Make a poster in English with the plan and the rules for your classroom workshop.

#### HYGIENE IN THE WORKPLACE

- Keep your hands clean and dry.
- Inform your teacher immediately of any injury (cuts, burns, small pieces in your eye, etc.).
- Clean and tidy up your workbench while you work: remove tools and put them back in their place if you are not using them.
- Every time you finish a task, clean and tidy up your workspace and the workshop.
- Too much noise can cause aggressive behaviour, it makes it hard to concentrate and it's annoying. Try to work in silence.

<sup>8</sup>**distraction**: something that stops you from concentrating

<sup>9</sup>**prank**: a practical joke

<sup>10</sup>**goggles**: glasses for protecting the eyes



#### Understand

10. Learn about the internal organisation of the workshop. Where are the emergency exits? Where is the safety equipment (fire extinguishers, alarm bell, goggles, gloves, etc.)?


### 3.3. Signs

Signs are the resources (graphic, light, sound or text) that we use to show or highlight an instruction. There are four types of graphic signs: mandatory, warning, emergency and prohibition.

It's important to recognise these signs in the classroom workshop:

**Types of graphic signs**

**Mandatory signs:** show you that you must wear special protective gear to avoid accidents.

  
for your feet

  
for your hands

  
for your eyes


  
for your ears

  
for your head

  
for your breathing

**Prohibition signs:** prohibit certain actions that might put you or your classmates' health in danger.

  
no running

  
do not drink

  
no smoking

  
no naked flames

  
do not extinguish with water

**Warning signs:** warn you about possible dangers of working with a certain tool or substance.

  
dangerous chemical

  
radiation risk

  
flammable material

  
corrosive material

  
explosive material

  
high voltage

  
caution

**Emergency signs:** provide information and help about emergency equipment and exits.

  
first aid

  
this way to first aid

  
first aid station

  
fire exit

  
this way to fire exit

  
fire exit



#### Key concepts

- In the classroom workshop, we can distinguish different areas according to the task we are going to do there.
- Before starting, it is important to assign tasks.
- In the classroom workshop, there are certain hygiene and safety rules that we must follow.
- We must pay attention to the mandatory, warning, emergency and prohibition signs.

#### Apply

11. Draw the following signs in your notebook: hard hats must be worn, fire risk and first aid kit.

#### Understand

12. Listen and complete the table about signs in the workplace.

Type	Background colour	Edge colour	Pictogram colour	Shape
Warning	...	...	...	...
...	Green	...	White	...
...	...	...	...	...
...	...	...	...	Round

13. Think of some examples of signs that use light, sound or text. Tell your partner about your ideas.

## 4. STAGES OF THE TECHNOLOGICAL PROCESS

As a way of practising technological processes, we are going to design a *drip irrigation system*. Let's look at the stages we have to follow.

### 4.1. Approach and analysis of needs and problems

Before we begin a project, we should ask ourselves what are our needs. The more details and data we have, the easier it will be to get the design right and come up with an appropriate solution.

In this case, we can find the needs or problems in the instructions for the final task.

*You are going to design and build a **homemade** drip irrigation system to optimise the consumption of water for plants in a garden or a school vegetable plot.*

Once we have identified the problem, we have to study it in depth.



### 4.2. Collecting information and analysing previous cases

At this stage, we **look for information** about solutions found for problems similar to ours and about technical **aspects**<sup>11</sup> that might **affect**<sup>12</sup> our project.

We should learn about drip irrigation, its advantages and disadvantages, and compare it to other watering systems.

To get this information, we can use gardening books, talk to experts, or look for information in shops or on the Internet.

Once we have all the information, we should analyse and organise it. Then we can choose the data that we think is the most important from each **source**<sup>13</sup>.

Looking for information and studying similar cases allows us to choose different solutions.

We can use the case that is most similar to ours as a **model**<sup>14</sup>. In the following stages, we can make changes to **adapt**<sup>15</sup> it fully to our needs.

#### Apply

15. Think of three properties the following objects have to have:

- a) to protect us from the rain.
- b) to clean dust around the house.
- c) to write.
- d) to hold food.

#### Understand

16. Look for ideas on the Internet that might be useful for your project.



Professional drip

#### Apply

14. Find out information about different types of drip irrigation systems. How do they work? How does the water reach the plants?

<sup>11</sup>**aspect**: a part of a situation or problem

<sup>12</sup>**affect**: have an effect on

<sup>13</sup>**source**: a person or thing that gives us information

<sup>14</sup>**model**: a thing used as an example to copy

<sup>15</sup>**adapt**: change to make something more suitable to our needs

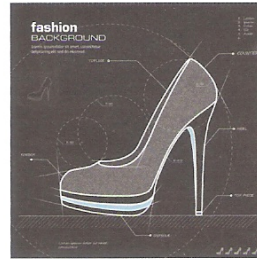


<sup>16</sup>**gather**: bring together, collect

### 4.3. Designing the individual idea

Now that we have **gathered**<sup>16</sup> and analysed all the information, we can start to work on the design. By examining existing models, we can create a new version that satisfies our own needs, introducing small changes or combining ideas that we find interesting.

At this stage, we should try to make our drawings attractive and clear so that they are easy for our classmates to understand.



Sketch of a high-heeled shoe

#### Analyse

- 17.** Design your solution and draw a sketch. It's important for each member of the group to give different ideas. It helps to have more ideas so that you have more options to choose from.

### 4.4. Coming together and choosing the best solution

To find a group solution to all the ideas, we can draw a table with the main aspects of our projects.

	Student 1	Student 2	Student 3	Student 4
Functionality	...	...	...	...
Aesthetics	...	...	...	...
Construction	...	...	...	...
Economics	...	...	...	...
<b>Total</b>	...	...	...	...

Once we have agreed on the different aspects we want to evaluate, we can grade the design's different parts. We choose the design that gets the most points in total. This kind of evaluation is called **F.A.C.E. value**.

Another good solution is to mix different positive aspects of other designs to make your final design.

#### Analyse

- 18.** In your group, carry out a F.A.C.E. value evaluation. Give points for each sketch including your own. Based on the results, design and draw an outline.

#### Apply

- 19.** Imagine you want to buy a car. Find information about different models and do a F.A.C.E. value evaluation for each one. Take at least four different aspects into consideration: **fuel consumption**<sup>17</sup>, maximum speed, price, safety ...

<sup>17</sup>**fuel consumption**: the amount of fuel (petrol, diesel) a car uses

## 4.5. Developing solutions

Before we start building, we should know how to make each part. We can represent the object we want to build in drawings.

The different types of drawings we should use are:

Drawing	Features
<b>Overview</b>	<ul style="list-style-type: none"> <li>■ <b>Perspectives</b><sup>18</sup> that show the complete object.</li> <li>■ We use them to understand how the project works and what it will look like in the end.</li> </ul>
<b>Plan, side view, elevation</b>	<ul style="list-style-type: none"> <li>■ These views are ideal for presenting technical data about the size and exact shape of the pieces, etc.</li> <li>■ They are very useful to show the <b>measurements</b><sup>19</sup> of pieces.</li> </ul>
<b>Details of pieces and joints</b>	<ul style="list-style-type: none"> <li>■ Using the right perspective, we can answer questions about difficult pieces.</li> <li>■ They are usually drawn in perspective.</li> </ul>
<b>Breakdowns</b>	<ul style="list-style-type: none"> <li>■ These are views of each separate piece. They help us to define each one clearly.</li> </ul>

<sup>18</sup>**perspective**: the appearance of viewed objects with regard to their relative position

<sup>19</sup>**measurement**: the size or length of something

## 4.6. Planning group work: Progress Status Sheets

To plan our project well, we need to know which jobs to do at the same time and what materials and tools we will need for each stage of the project. It's useful to know who will do each task and how long it will take to do so that we can synchronise each phase. To sum up, in this stage of our project we should have a document that explains **what** will be done, **who** will do it, **how and when** it will be done, and **how long** it will take. For this we use a Progress Status Sheet like this.

Term:	Group:	Date:	Sheet no.	
<b>Project:</b>				
Piece (sketch attached)	Materials and tools required	Jobs to do	Person	Estimated time
	<b>Materials</b> <ul style="list-style-type: none"> <li>■ Piece of <b>chipboard</b><sup>20</sup> 20 cm x 20 cm</li> </ul> <b>Tools</b> <ul style="list-style-type: none"> <li>■ Ruler</li> <li>■ Set square</li> <li>■ Protractor</li> <li>■ Saw</li> <li>■ Round rasp file</li> <li>■ Sandpaper</li> </ul>	Measure Mark Cut File Sand Glue		
			<b>Total</b>	

<sup>20</sup>**chipboard**: sheets of wood made from small pieces of wood

### Apply

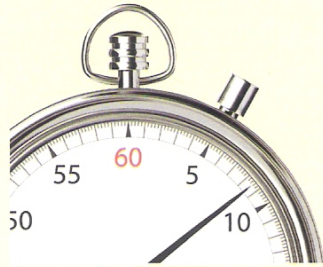
**20.** Choose an everyday object (a pair of scissors or a pencil sharpener) and make drawings of it using the four drawing types given in the text.

### Create

**21.** Draw all the views and breakdowns of the solution you have chosen for the drip irrigation system project.

**22.** Make a Progress Status Sheet from the drawings you have made for your project.

### PLANNING YOUR TIME



Calculating time is very important, not only in order to have an idea of how long we will take to complete the project but also to calculate labour costs. Even for projects involving only one person you have to plan all the operations to make the best use of your time.

### USE OF MATERIALS

You can save material and avoid unnecessary cuts if you put pieces together that have the same cut lines. Match straight edges or corners to the straight edges and corners of the sheet of wood.



Remember to use tools and adhesive correctly. Any extra material can be used in the future.

## 4.7. Making a production estimate

Production estimates calculate the cost of a project before it begins. This way, we can decide if our project is profitable as we have designed it, or if it would be better to choose other materials or models to bring costs down.

We make a note of the materials we are going to use. We calculate the quantity we need, keeping in mind the breakdowns and the Progress Status Sheet. Then, we multiply the result by the unit price to get our budget.

No.	Quantity	Material	Unit price	Total price
1	x 2	Pieces of chipboard 40 cm x 40 cm	€1.20 unit	€2.40
2	¼ tube	Wood glue	€1.20 tube	€0.30
3	4 dm <sup>2</sup>	Sheet of corrugated cardboard	€0.60 dm <sup>2</sup>	€0.24
4	150 cm	Adhesive tape	€0.006 cm	€0.15
5	x 12	Lollipop sticks	€0.03 unit	€0.36
<b>Total w/o VAT</b>				€3.45
<b>VAT (21%)</b>				€0.72
<b>TOTAL</b>				€4.17

To calculate this estimate for the materials you must add labour costs, which is the total time you think it will take to complete the project multiplied by the amount we want to charge per hour. Remember to include VAT.

Value added tax

The money we earn on the project will be the difference between the production cost we've calculated and the retail price – the price we sell it for.

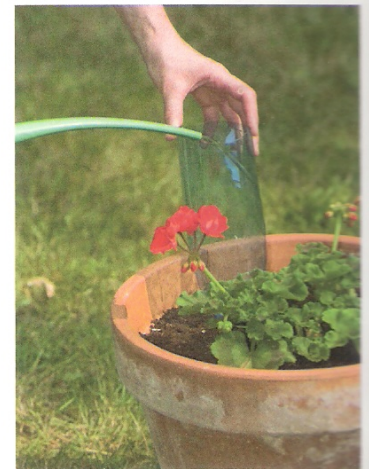
## 4.8. Building and testing

Good design and planning will make construction easier and quicker. In the construction stage we should follow these steps:

First, we will make the main structure of the object. Then, we will add other smaller pieces and details, following a logical order.

If you have to change the design of a piece during construction, you should report this in a *modifications map*.

It's also a good idea to have a *building report* to keep track of what you do every day, what problems came up, what solutions you found and ways you could improve the work.



### Understand

23. Copy and complete the following sentence. A 60 cm x 80 cm sheet of wood is \_\_\_\_\_ cm<sup>2</sup>, which is \_\_\_\_\_ dm<sup>2</sup>. If the price of the wood is €0.10 per cm<sup>2</sup>, what is the total price of the sheet?

### Apply

24. In your group, make a production estimate for your project.

25. Build your project and calculate how much water our irrigation system uses in one minute.

## 4.9. Evaluating and checking

At this stage in the process, we need to analyse the result in detail. To do this, we look at different aspects of our product that will help us to improve it. Here are some possible questions, but you can probably think of many more.

- **Appearance:** Analyse the aesthetic aspects of the object. Could you improve it? Is it appropriate for the environment that it is designed for? Will people use it?
- **Use:** Does it work? Is it easy to use?
- **Materials:** Are they reusable? Could they be reusable? Could you make the same object with cheaper materials? Is it easy to produce the object with these materials?
- **Durability:** How long will the object last? Is it likely to break easily?
- **Maintenance:** What do you need in order to keep the object in good condition?
- **Safety:** Are there any risks associated with using this object? Are any of its parts flammable or poisonous?
- **Possible modifications:** Based on your answers to these questions, we should go on to improve our design.

### Apply

26. Think of a product and write three more questions about the quality of the product. If it were an item of clothing, what questions would you ask?

### Create

27. Give a presentation of your project to the class. Explain in detail the most important features. Imagine you were presenting to a possible buyer. Therefore, your presentation should be professional.

### Evaluate

28. Using F.A.C.E. values, evaluate all the class projects.

## 4.10. Writing a building report

Using all the documents written during the construction process, we write a report on the construction of the object. We need to add the following documents:

- **Front page for the project:** names of all the group members, name of the school, group, year and title of the project.
- **Table of contents:** a list of the report contents and page numbers.
- **Incident report:** a description of the problems you had and how you solved them.
- **Instructions on how to use and maintain the object.**

The report is used to explain the processes you followed. The idea is that someone else could understand and repeat the project.

We write the building report at the end, but it goes first in the final project report.

We can write a plan for recycling / reusing the materials used in the project, once it's finished, and add it to the report.



Testing an irrigation system



### Key concepts

The technological process consists of the following stages:

- Approach and analysis of needs.
- Collecting information and analysing previous cases.
- Designing the individual idea.
- Coming together and choosing the best solution.
- Developing solutions.
- Planning group work.
- Making a production estimate.
- Building and testing.
- Evaluating and checking.
- Writing a building report.

### Apply

29. Hand in a clean and neat building report with its table of contents, numbered pages and additional information (plans, progress status sheets, estimate, etc.). Don't forget to sign it.

## 5. MATERIALS FOR TECHNICAL USE

<sup>21</sup>**packaging**: material around things to protect them

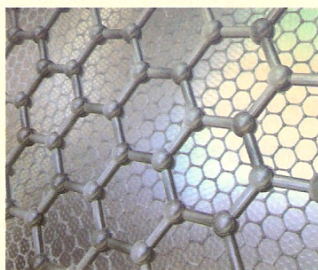
<sup>22</sup>**raw material**: the basic material from which a product is made

<sup>23</sup>**thread**: long thin pieces of cotton or wool

<sup>24</sup>**fabric**: material made from weaving






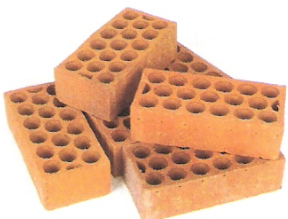
<sup>25</sup>**clay**: earth that when mixed with water can be made into different shapes

### GRAPHENE, A NEW MATERIAL



Graphene is a very resistant material, 200 times harder, thinner and more transparent than steel. According to the scientist James Hone, to make a hole in a sheet of graphene that is the thickness of cellophane, we would have to use a pencil with the full weight of an elephant balancing on top of it. This material is also flexible, it conducts electricity and it is **waterproof**<sup>26</sup>.

<sup>26</sup>**waterproof**: doesn't let water in

Material	Sources	Applications
<p><b>wood</b></p> 	We get this from the thicker parts of trees.	Furniture, industrial paper, construction, wall and floor covering, decoration, for fuel ...
<p><b>plastic</b></p> 	We get this from oil, coal, natural gas, vegetable matter and animal proteins.	Pipes, <b>packaging</b> <sup>21</sup> , containers, covering for cables ...
<p><b>metal and alloy</b></p> 	We get this from minerals in rocks.	Structures and pieces of machinery, tools, electronic components, joints ...
<p><b>textiles</b></p> 	We get this from vegetable, animal and mineral raw <b>materials</b> <sup>22</sup> .	In the form of <b>thread</b> <sup>23</sup> for making different <b>fabrics</b> <sup>24</sup> for different purposes: clothes, carpets, curtains ...
<p><b>stone</b></p> 	We get this from different forms of rocks, from huge blocks to sand.	Construction material and decoration.
<p><b>ceramic</b></p> 	We get this from shaping <b>clay</b> <sup>25</sup> and cooking it at high temperatures.	Construction material like bricks, dishes, basins and decorative elements.

Types	Properties	Machines and tools
<p><b>Hardwood trees:</b> oak, cherry</p> <p><b>Softwood trees:</b> pine, spruce</p> <p><b>Derivatives:</b> cardboard, tissue paper, card</p>	<ul style="list-style-type: none"> <li>■ Dense</li> <li>■ Permeable</li> <li>■ Electrical insulator</li> <li>■ Thermal insulator</li> <li>■ Reusable</li> <li>■ Biodegradable</li> <li>■ Renewable</li> </ul>	Saw, drill, files and rasp files, sandpaper, hammer, screwdriver, glue ...
<p><b>Natural:</b> cellulose, latex</p> <p><b>Synthetic:</b> thermoplastic (polystyrene, nylon), thermosetting polymers (polyurethane), elastomers (rubber, Neoprene)</p>	<ul style="list-style-type: none"> <li>■ Malleable</li> <li>■ Ductile</li> <li>■ Mechanical strength</li> <li>■ Electrical insulator</li> <li>■ Thermal insulator</li> <li>■ Impermeable (waterproof)</li> </ul>	Scissors, files, glue ...
<p><b>Ferrous:</b> contains iron, like steel</p> <p><b>Non-ferrous:</b> doesn't contain iron, like copper, aluminium</p>	<ul style="list-style-type: none"> <li>■ Hard</li> <li>■ Tough</li> <li>■ Ductile</li> <li>■ Electrical conductor</li> <li>■ Heat conductor</li> <li>■ Impermeable</li> </ul>	Circular saw, drill, soldering iron ...
<p><b>Natural:</b> wool, cotton</p> <p><b>Synthetic:</b> nylon, Lycra</p>	<ul style="list-style-type: none"> <li>■ Elastic</li> <li>■ Resistant</li> <li>■ Impermeable</li> <li>■ Durable</li> </ul>	Scissors, sewing machine ...
<p><b>Pure:</b> marble, granite</p> <p><b>Blends:</b> glass, cement</p>	<ul style="list-style-type: none"> <li>■ Hard</li> <li>■ Dense</li> <li>■ Compact</li> <li>■ Impermeable</li> <li>■ Resistant</li> <li>■ Thermal insulator</li> <li>■ Electrical insulator</li> </ul>	Tools used for cutting, polishing, painting...
<p><b>Thick:</b> earthenware</p> <p><b>Fine:</b> stoneware, porcelain</p>	<ul style="list-style-type: none"> <li>■ Impermeable</li> <li>■ Thermal insulator</li> <li>■ Electrical insulator</li> </ul>	Oven, paint, varnish ...

### Understand

30. Look for information about the properties 'hard' and 'fragile' and make notes.

Can something be both hard and fragile? Give an example.



### Key concepts

- Technical materials and their properties are factors that influence the technological process.
- There are very different types of materials with very different properties that we have to keep in mind when putting them to use.

## 6. THE INFLUENCE OF TECHNOLOGY ON SOCIETY

We can only understand the history of humanity in terms of the process of evolution within human societies. This process brought about different **models of society** that each **marked a turning point**, and all have one thing in common: the change from one kind of society to another has always been the consequence of **new technology**. This might refer to a new way of working, a new source of energy, a new manufacturing system, etc.

This table shows some types of society from history, the change in technology and the objects or systems they developed.

Type of society and characteristics	New technology that marked a turning point	Objects or systems developed
<b>Hunter-gatherer societies</b> <ul style="list-style-type: none"> <li>■ Group leadership</li> <li>■ Clans and tribes</li> <li>■ Nomadic</li> <li>■ Hunting parties</li> </ul>	The ability to shape a stone and make tools. 	Use of natural objects (bones, stones). Breaking rocks (wedges). Making hand axes and spears.
<b>Horticultural societies</b> <ul style="list-style-type: none"> <li>■ Social groups</li> <li>■ Settlers</li> <li>■ Villages</li> <li>■ Surplus goods</li> <li>■ Specialised work</li> </ul>	Development of agriculture and use of farm animals. 	Use of seeds and planting. Domestic animals. Making boats, bricks and the wheel.
<b>Agricultural and urban societies</b> <ul style="list-style-type: none"> <li>■ Centred in cities</li> <li>■ Trades</li> <li>■ Feudal societies</li> <li>■ Religious power</li> </ul>	Start of writing and use of ploughs. 	Ploughing, catapults, parchment, horseshoes, paper, domes, windmills, glasses, clocks and printing.
<b>Industrial societies</b> <ul style="list-style-type: none"> <li>■ Capitalist and working classes</li> <li>■ Economic changes (capitalism, communism)</li> <li>■ Political changes (democracy, dictatorship)</li> </ul>	Use of machines and steam engines. 	Pencils, microscopes, thermometers, steam engines, batteries, electric motors, photography, cars, radios and aeroplanes.
<b>Post-industrial societies</b> <ul style="list-style-type: none"> <li>■ Telecommunications</li> <li>■ Globalisation</li> <li>■ Middle classes</li> <li>■ Consumer society</li> <li>■ Standardisation</li> <li>■ New energy sources</li> <li>■ Sustainable development</li> </ul>	Invention of transistors. 	Nuclear reactors, satellite communications, personal computers, mobile phones, genetic engineering.

### Understand

31. Which type of society do these inventions belong to: submarine, boat, harpoon, the International Space Station, gun powder?

## 7. TECHNOLOGY AND THE ENVIRONMENT

Technology helps us to solve problems. Unfortunately, sometimes these inventions can harm the environment. To evaluate this problem, we need to think about two stages in the technological process:

- **Approach and analysis of the need or problem:** Is the problem or need real? Are we being influenced by other people or by advertising?
- **Evaluation and testing the product:** In our F.A.C.E. value evaluation, what is more important: economic or social and environmental factors?

As a society we should come up with a solution that favours sustainable development.

**Sustainable development** is development that meets the needs of the present so that future generations will be able to meet their needs.

**Sustainable development policies** work in five areas:

- Clean technologies.
- Waste management policies.
- Environmentally friendly agriculture.
- Tourism that doesn't harm the environment.
- Cleaner and greener urban areas.

They have clear **objectives**:

- End the overuse of natural resources.
- Stop climate change by reducing harmful emissions.
- Reduce inequality in society.

Here are some of their **proposals**:

- Use bioethanol and biodiesel as fuel.
- Do more research into hydrogen fuel cells and nuclear fusion.
- Use hybrid engines.
- Use clean energy.
- Promote the importance of recycling.
- Consumer education.

### Analyse

33. Some people believe that we should go back to using technology from the beginning of the 20th century. Do you think this is possible? What would we have to give up? Would you be willing to do this? Discuss in class.



Millennium development goals

### Understand

32. Visit the webpage:  
<http://www.uri.org/millenniumgoals/>

Get into six groups. Each group takes one of the millennium development goals. Answer these questions.

- a) What is the goal about? What are the problems?
- b) What can you do to achieve the goal?
- c) What technology could help achieve it?



## Preparing documents for the project



Once you've finished making your drip irrigation system, you'll make a document describing the entire process. In this unit, we have seen documents that you have to make at different stages. Use a word processing programme. Include a cover page, a table of contents and a spreadsheet for your production estimate.

### STRUCTURE

#### 1. Cover page

- Name of school
- Name of project
- Name of the group members
- School year
- Date

#### 2. Table of contents

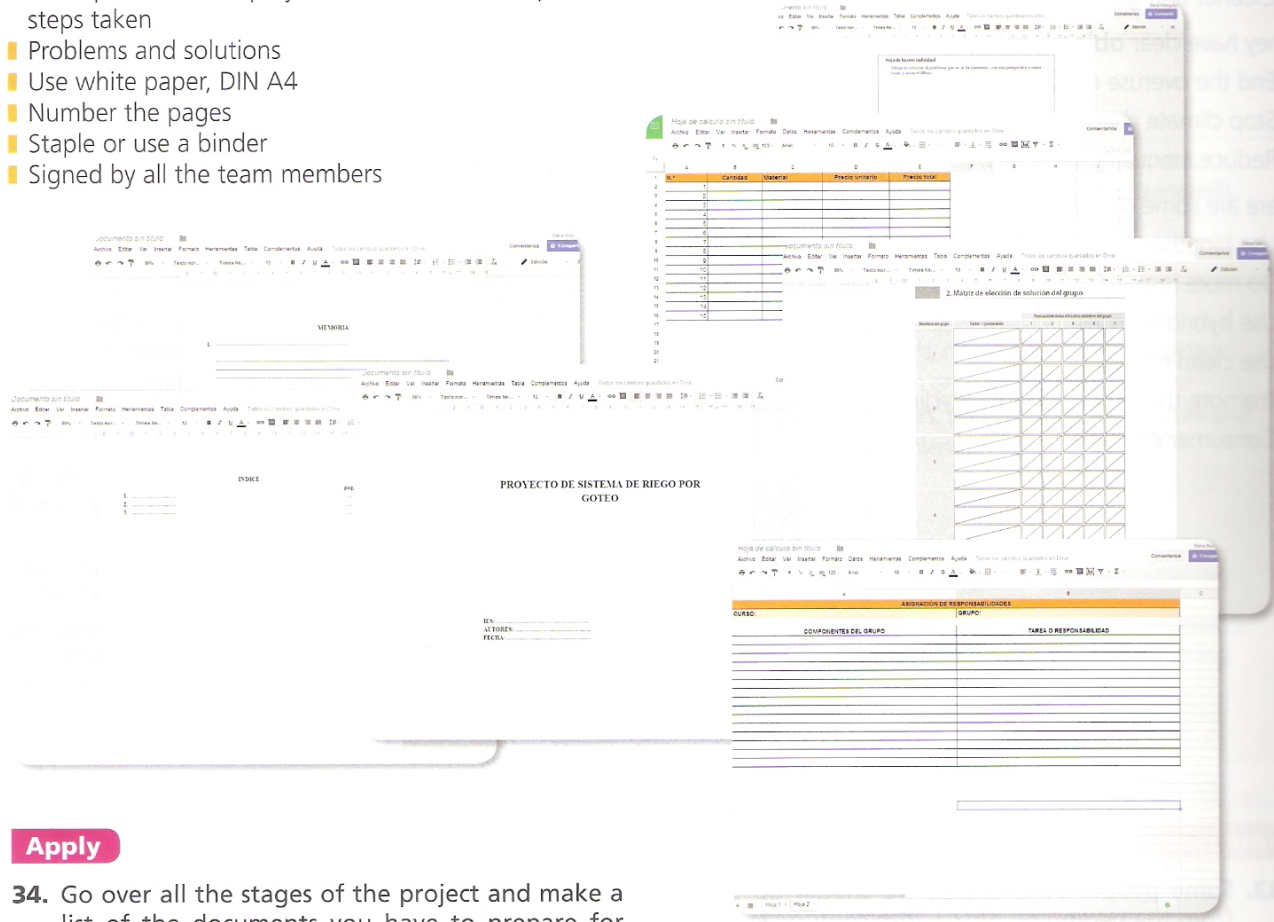
- Sections and page numbers

#### 3. Building report

- Description of the project and the most important steps taken
- Problems and solutions
- Use white paper, DIN A4
- Number the pages
- Staple or use a binder
- Signed by all the team members

#### 4. Enclosed documents

- Names of people and their duties
- Procedures
- Production estimate
- Bibliography
- Drawings and plans
- Breakdowns
- Details
- Modification map



### Apply

34. Go over all the stages of the project and make a list of the documents you have to prepare for each stage.

## CREATING A PERSONAL COLLABORATIVE ICT ENVIRONMENT

Technology can help us work in groups and develop large parts of our project. The first thing we need is a personal collaborative ICT environment, which will allow us to work throughout the academic year, searching for, creating and sharing information and documents for the group, the rest of the class and the teacher.

We can use the Internet, Google apps and services, software and Microsoft programs, or open source software (FreeOffice, Linux) that work on the computers at school and at home.

We will need the following elements:

- **A personal email account:** it should be something like name.surname1.surname2@gmail.com



- **Cloud software and storage:** with our Gmail account, we can use Google Drive; these are virtual storage and computer applications that allows us to work in groups.



- **A word processor and spreadsheet, presentations and photo editing programs:** again, Google Drive offers us apps. There are also open source programs (FreeOffice) or Windows Office.

## LibreOffice The Document Foundation

- Later, we will use social media like **social networks, blogs and webs.**



If at any stage you're not sure how to do something, search the Internet. There are lots of videos explaining how to set up and use accounts.

### Apply

35. Set up a Gmail account like name.surname1.surname1@gmail.com
36. Use Google Drive to:



## Google Drive

- Create and delete folders for your project.
- Store and manage files: upload, download and delete files from your computer.
- Create two types of documents: text and presentations.
- Share the documents with other members of your group.



37. Look for information about genetically modified food. How was technology used to create it?



38. Make a list of at least five human needs that technology has not found a solution for.

39. The latest mobile phones include a lot of services. Make a list of the ones you know and write the advantages and disadvantages of each one.

40. Copy the table into your notebook. Write a list of the needs these objects meet.

Telephone	Washing machine	Clock	Running shoes	Bicycle
...	...	...	...	...

41. Make a list of vehicles that satisfy our transport needs. Copy and complete the following table into your notebooks. Give points (1–6) for each aspect.

Vehicle	Speed	Cost per km	Emissions levels
...	...	...	...

42. Draw two everyday objects that you use to do the same job but which are very different from each other. Write some sentences to explain how they are different and how efficient they are.

43. What properties do the following objects have to have? Listen and match the descriptions to the objects. Write the properties for each object.

- a) a tent
- b) a cord for bungee jumping
- c) a hardhat
- d) the glass door on an oven

44. Write three things that you should do in the classroom workshop so that the next group that comes in will be able to work efficiently.

45. Draw a plan of the classroom workshop and illustrate its layout. How could you improve space?

46. Write the names of each person in your group and make a list of the duties of each person.

47. Make a poster in English explaining health and safety rules for the classroom workshop.

48. Read the following statements. Are they true or false? Give reasons for your answers.

- a) Before starting to work, we should find out the correct way to do something.
- b) Protective elements are always necessary.
- c) Ventilation, temperature and lighting are not important in the workplace.

49. Make a poster of the different types of signs: mandatory, warning, emergency and prohibition.

50. Find out what these signs mean:



51. Read the following situation and answer the question. Give reasons for your answer.

A worker refuses to follow the safety rules at his company. He says that the hardhat makes him too hot and he doesn't want to wear it. What do you think the company should do?



52. Write five things you would include in an emergency plan for your classroom workshop.

53. Make a poster detailing safety instructions for one of the machines or tools in the workshop. You can also indicate how not to use something (e.g. using a screwdriver as a lever).

54. Make a drawing of a floor lamp. Try to include all the different parts.

55. How do you calculate the time it takes to finish a project in the classroom workshop? How does this time affect the production estimate?

56. Do you think that the marketing and sales stage should be included at the end of the technological process? Or, do you think it should be a separate process?

57. Make a production estimate for a drawbridge made of wood, using the following unit prices for the materials:

- half a sheet of plywood (€1.20/unit)
- 300 x sticks (€0.02/unit)
- a tube of glue (€2.00/unit)
- 4 x hinges (€0.30/unit)
- 40 x nails (€0.01/unit)
- 16 x screws (€0.02/unit)
- 2 m cord (€2.00/roll of 20 m)

58. When you use surplus material from another project, does it have a price? And a cost? Why?

59. To make something from wood, we can either buy two sheets of 40 cm x 30 cm at €0.25 per dm<sup>2</sup> each or we can buy one sheet of 60 cm x 80 cm at €0.001 per cm<sup>2</sup>. Which option would be cheaper?

60. Make a list of materials, tools and procedures you need to make a skateboard.

61. Make a list of the materials, tools and procedures you need in order to reheel a shoe.

62. Make a list of the materials, tools and procedures you need to hang a picture on the wall.

### STUDY TECHNIQUES

■ Write a summary using the key concepts boxes in the unit. Include everything you think is important.

■ Draw a mind map of the concepts in the unit. Use the following structure to get started:

#### The technological process

consists of different stages ...

...

#### The classroom workshop

activities are organised ...

...

#### Materials for technical use

...

■ Make a technical dictionary with the terms that you think are the most important. Include: planning, strategy, project, technology, science, technical, views, breakdown, estimate ... and add any others you think necessary.

## FINISHING THE FINAL TASK



### Designing a drip irrigation system



As a final task in this unit, after you have finished building and presenting your drip irrigation system, we suggest that you check some things and give a group presentation with slides. This should serve as an instruction manual and should include the following information:

1. The drip irrigation system.
2. The number of litres of water the system supplies before needing a refill.
3. Possible improvements for the future.
4. Post use: Possibilities of recycling and reusing the materials you've used.
5. Contact information in case of any technical questions.

