Technology ESO 1

A CLIL Approach

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Technology ESO 1. A CLIL approach

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Contents

Introduction

This classroom material has been thought to serve as a *Technology Workbook* for the first ESO course. It has been divided into five content sections and two workshop projects, according to the official syllabus.

At the same time, each section has been split into different lessons, including many classroom activities developed through the so-called *Content and Language Integrated Learning* methodology (**CLIL**). Every unit contains different margin *yellow notes* with the most relevant vocabulary.

All the activities have been designed keeping in mind the *revised Bloom's Taxonomy* learning model, which allows students to progress in their knowledge and skills by doing exercises that require from *Lower Order Thinking Skills* (remembering, understanding and applying) to *Higher Order Thinking Skills* (analyzing, evaluating and creating), thereby scaffolding their learning process.

Additional teaching material, not included in this book, is required for the whole-group activities. Although some exercises are to be done individually, group-work is very important to develop social abilities, such as showing respect for other people's opinions.

Project-based learning is the basis of the Technology subject. Most of the class-time should be spent on designing and constructing the proposed projects.

The author.

Section I

The technological process

1 Lesson: The workshop

1.1 Learning objectives

In this lesson you will learn

- what a technology workshop is,
- the layout of your workshop and its components,
- how to describe the plan of a room, and
- how to draw the plan of a classroom.

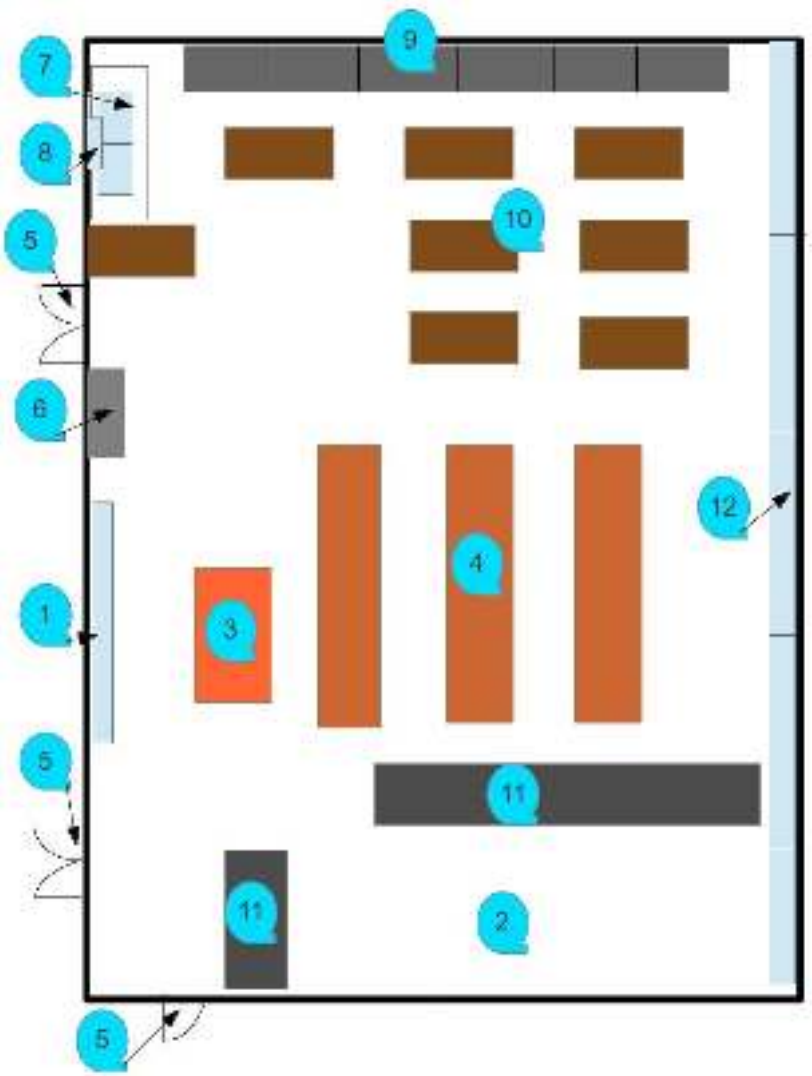
1.2 Knowing the workshop

Workshop, lockers, desk, workbench, tool, panel, sink, cabinet, whiteboard, desk, storage room, chair, classroom, door, window, blinds, marker, paper bin, first aid kit, eraser.

REMEMBER. A *workshop* is a place plenty of tools and machines where we can construct, manufacture or repair different objects. Have a look at the plan of our workshop, try to identify the elements from the following list and complete the table:

Whiteboard, doors, windows, teacher's desk, student desks and chairs, workbenches, sink, lockers, tool panels, medicine cabinet / first aid kit, storage room and tool cabinet.

Number	Element	Number	Element
1	Whiteboard	7	
2		8	
3		9	
4		10	
5		11	
6		12	



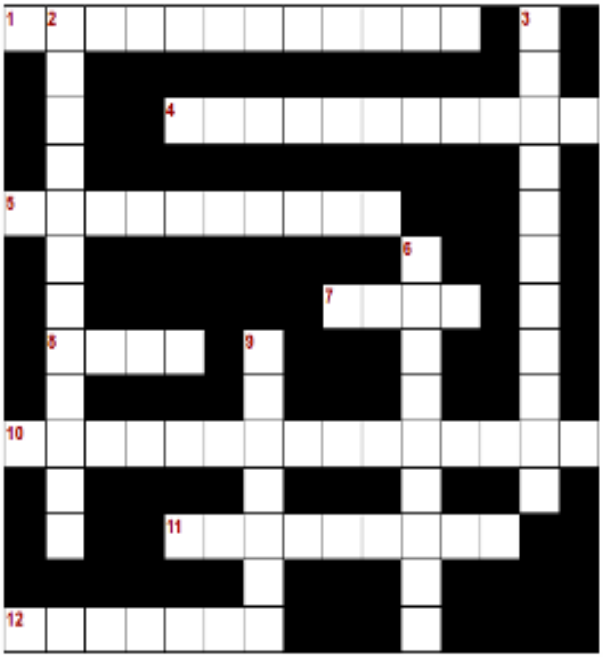
1.3 Tagging the workshop

REMEMBER. This activity must be done in groups of four. Each team has a set of cards with the names of the elements of the workshop written on them. To win, all the cards must be put in the right place, but respecting several rules:

- Every member of a group will be assigned a number (from 1 to 4).
- Students "number 1" take a card. They have to put the card in the right place and come back to their workbenches. Then, students "number 2" have to place the next card, and so on.
- If somebody runs through the workshop, the whole team will be eliminated.

1.4 Self-assessment: crossword

REMEMBER. Complete the following crossword activity.



Across:
1. A piece of furniture with a writing surface for the pupils.
4. A room to keep the materials we need in the workshop.
5. A white surface used for writing or drawing on.
7. A panel for closing the entrance to a room.
8. A basin used for washing.
10. A piece of furniture containing cotton, alcohol, etc.
11. A panel where we place the most common tools of the workshop.
12. Small compartments that may be locked.

Down:
2. A piece of furniture with a writing surface for the teacher.
3. A metal cabinet where we keep some tools.
6. A heavy table at which work is done.
9. (In plural) A framework which contains glass and is placed in a wall to let in air or light.

1.5 Gap-fill

UNDERSTAND. Complete the following gap-fill activity with appropriate words.

The workshop is a special classroom where we _____ and _____ the projects. It has three different areas:

- The _____, where we keep the materials we need for the projects.
- The _____ area, where we practise the lessons and listen to the teacher's explanations.
- The workshop area, with _____, _____ and _____.

1.6 Describing the plan of the workshop

ANALIZE. Have a look a the workshop plan. Write a text describing the location of 5 workshop elements. Use the following structures:

In the top left-hand corner	At the top	In the top right-hand corner
On the left	In the centre/middle	On the right
In the bottom left-hand corner	At the bottom	In the bottom right-hand corner

Example: the tool panels are at the top of the plan.

1.
2.
3.
4.
5.

1.6.1 Other prepositions to describe a position

UNDERSTAND. Think of something that could be:

- Beside the door:
- Over your desktop:
- On your desktop:
- Below the teacher's desk:
- Under your desk
- Behind the computer:
- Near the medicine cabinet:
- Opposite the windows:
- By the tool panels:
- Inside/in/into the storage room:
- In front of the whiteboard:

1.7 My ideal workshop

CREATE. Design the workshop you would like to have. Do not forget to include the elements you know.Use similar symbols to the ones you have in the workshop plan.

1.7.1 Speaking activity

APPLY. Stand up and find a partner. Describe your ideal workshop to each other .

2 Lesson: Health and safety

2.1 Learning objectives

In this lesson you will learn

- the risks we take when we do not observe the workshop safety regulations,
- how to behave in the workshop,
- what we can and cannot do in the workshop,
- how to talk about obligations and recommendations, and
- how important safety regulations are in our country.

Safety, accident, health, danger, hazard, behaviour, work environment, workstation, consequence, injures, kill, burn, tidy up, sweep, slide, pay attention, rubbish.

2.2 Behave yourself

REMEMBER. List three things you shouldn't do in the workshop:

1.

2.

3.

2.3 Actions have consequences

UNDERSTAND. Working in twos, classify the following actions as **dangerous behaviour** in the workshop or a **possible consequence** of a bad behaviour: *running, sliding, speaking very loudly, listening to your music device, to be cut, playing with tools, not paying attention to the teacher's instructions, putting the bags on the floor close to the workbenches, to be hit, to be injured, drinking, not using goggles when necessary, disturbing a classmate and to be burnt.*

Behaviour	Consequences
Running	Sliding

2.4 Be careful!

ANALIZE. All over the classroom you will find different pictures showing non-appropriate behaviour in the technology workshop. Working in groups of three people, match each picture to its description:

1. A student is cutting something while a classmate has his hands on his shoulders. Another student is drinking.
2. A student is using the power drill without paying attention. A classmate is very close to the machine. There is a bucket that should not be there.
3. Two students are playing careless while another student is looking at the glue bottle. Much rubbish on the floor.
4. A boy is on a chair which, at the same time, is on a table. Another boy is flying paper planes.

5. A student is running while the teacher is holding a glass.
6. Two pupils are fighting with rasps and files.
7. A student with a leg in plaster is listening to music while working.
8. A student with long hair is working with the drill. Two classmates are chatting next to him.

2.5 Rules

APPLY. Working in groups of four people, transform the hazards into rules, using obligation/suggestion verbs:

- to be allowed to, Should, have to, must, need to.
- not to be allowed to, Shouldn't or should not, can't or cannot, mustn't or must not.

1. While working, you shouldn't drink in the classroom. You mustn't disturb a classmate when using tools.
2.
3.
4.
5.
6.
7.
8.

2.6 Mixed-up sentence: tidy your workstation up!

UNDERSTAND. When the class is over, we have to clean and tidy up. In order to figure out the correct way, rewrite the sentences in the right order:

//we have first to put the tools back on the panels,// When the class is over,// and finally sweep the floor.// clean the workbench, //put the stools on the workbech, //

Solution:

2.7 Game: dominoes

Apply. Working in groups of four people find out the right sequence of the dominoes about a typical day in the technology classroom.

2.8 Work accidents in Spain

Evaluate. Health and safety at work is a serious matter. Find out on the internet the answers to the following questions:

- How many workers suffered a work accident last year in Spain?
- How many workers were killed?
- Which was the sector (industry, services, construction or agriculture) with more accidents? Which is the least problematic?

2.9 The top five health and safety rules

Create. Working in threes, decide the six most important safety rules for the workshop to be a safe place:

1. *We have to pay attention when the teacher is talking.*

2.

3.

4.

5.

Choose a spokesperson in your group and read out loud your rules. Check if the other groups have similar ideas.

3 Lesson: Safety signs and fire equipment

3.1 Learning objectives

In this lesson you will learn

- how to read and interpret safety signs,
- the location and proper use of safety equipment in your high school,
- what to do in case of emergency (ICE),
- the emergency plan features of your high school, and
- how to describe symbols according to their shapes, colours, sizes etc.

Sign, mandatory, danger, prohibition, emergency, first aid, evacuation simulation and electric shock.

3.2 Safety signs

UNDERSTAND. Have a look a the following health and safety signs:

- First aid and emergency

- Danger

- Prohibition

- Mandatory

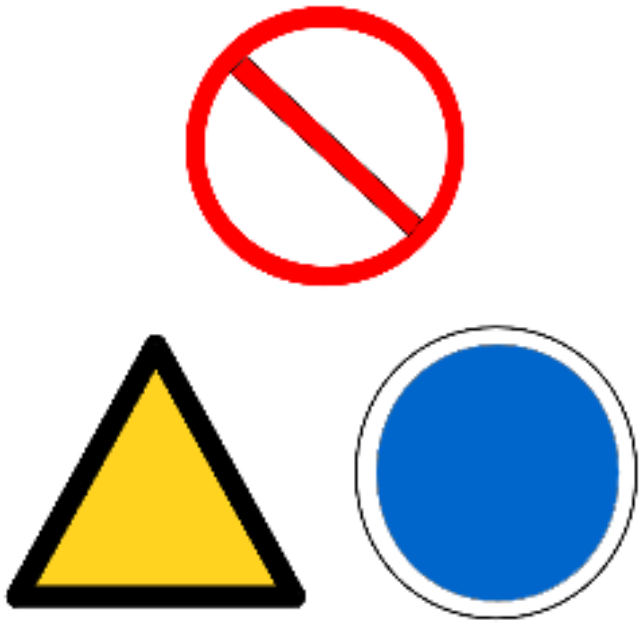
Identify the following signs:

1. Mandatory protection for feet.
2. First aid.
3. Do not drink.
4. Electric shock risk.
5. No smoking.
6. Mandatory protection for eyes.
7. Emergency exit.
8. Radioactivity risk.
9. No making fire.

3.3 Designing signs

APPLY. Using the appropriate template, design the following signs:

- *No running.*
- *Danger! Oil on the floor.*
- *Obligatory protection for wrists.*



3.4 Describing signs

ANALIZE. Have a look at the following vocabulary to talk about geometric figures:

- Shapes: triangle, rectangle, square, circle, etc.
- Colours: yellow, blue, green, red, white, black, etc.
- Layout: background, foreground, edging (or outline), diagonal line, etc.
- Pictogram: boots, gloves, magnets, etc.

Now describe the features of the four types of signals:

- First aid: *They are in the shape of a rectangle. The background is green, while the pictogram in the foreground is white.The edging is white too.*
- Danger:
- Prohibition:
- Mandatory:

3.4.1 Recognise the signal

ANALIZE. The teacher will give you a piece of paper with the description of a safety sign. Stand up and read your text to your classmates. They have to guess what signal you are describing and you have to listen to their signal descriptions and guess what signals they are talking about.

3.5 Describing shapes

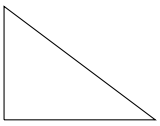
shape, triangle, rectangle, circle, square, corner, side, edge, outline, diagonal, background, foreground, pictogram, acute, obtuse, right, angle, equilateral, isosceles, scalene, hose reel, extinguisher, fire alarm button

UNDERSTAND. Match description and name:

Circle	It has four sides and all of them have the same length. All the angles are right angles
Rectangle	It has three sides, three corners and three angles
Triangle	It has four corners and four right angles. It has four sides. The top and bottom sides are equally long, and so are the left and right ones
Square	It's a curved line whose points are the same distance from a point called the centre

ANALIZE. To describe a polygon, you have to identify the corners, sides and angles (acute, right or obtuse). Now, work in twos and draw and describe the following figures:

- Right triangle: *the larger of the three angles is a right angle. The other two angles are acute.*



- Acute triangle:

- Obtuse triangle:

- Equilateral triangle:

- Isosceles triangle:

- Scalene triangle:

3.5.1 Is it right?

EVALUATE. The teacher will show a figure and will read out loud its description. Working with a partner, decide whether he is right or wrong.

3.6 Fire!

ANALIZE. Have a look at the following pictures and explain what they are. Select among *hose reel and cabinet*, *extinguisher* and *fire alarm button*.

EVALUATE. Working in threes, explain why we should not empty the fire extinguisher on purpose (unless there is a blaze!). What could be the consequences?

3.7 Emergency plan

EVALUATE. Working in groups of four, find out if your high school has an emergency plan and if an annual evacuation simulation is programmed. Do you understand it? Do you really know what to do in case of emergency? Can you explain what to do when the fire alarm is activated?

3.8 ICE

ANALIZE. Do you know what phone number you have to dial in case of emergency at home or when you witness an accident?

4 Lesson: Tools

4.1 Learning objectives

In this lesson you will learn

- the name of the tools and machines that we have in the workshop,
- their utility, and
- the risks that we take when using them improperly.

4.2 What's the name?

Remember. Pay attention to the presentation about the workshop tools. Try to memorize and repeat the name of the different tools and workshop equipment.

4.2.1 Master mind

Remember. Each four people group has a set of cards with the names of the tools written on them. There is a complete set of tools on your group's workbench. You have to match tools and cards. Tell your teacher when you have finished. Then, the teacher will show a card (green, yellow or red) depending on the number of mistakes you have. Correct the mistakes until you see the green card.

4.2.2 Naming the tools

Driving, measuring, holding, cutting, joining, protecting, drilling, drawing, marking, shaping, finishing and cleaning

REMEMBER. Working in groups of three people, write down the name of the following tools, machines and equipment in English and in your mother tongue, and indicate their function according to the following list: **driving, measuring, holding, cutting, joining, protecting, drilling, drawing, marking, shaping, finishing and cleaning**.

Coping saw, bow saw, hand saw, backsaw, mitre saw, scissors, cutter, pliers, vice, clamp, screw drivers, hammer, wrenches, adjustable wrench, Allen keys, hammer, mallet, chisel, rasps and files, sandpaper, riveter, glue gun, soldering set, carpenter's brace and manual drill, power drill, gimlet, tape measure, square and ruler, calliper, centre punch, broom and dustpan, file card and goggles

Name	Type	Picture
Coping saw / segueta	*Cutting*	
		
		
		
		
		
		
		
		
		

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If you don't remember the name in English, you can consult the list:

coping saw, bow saw, hand saw, backsaw, mitre saw, scissors, cutter, pliers, vice, clamp, screw drivers, hammer, wrenches, adjustable wrench, Allen keys,

mallet, chisel, rasps and files, sandpaper, riveter, glue gun, soldering set, carpenter's brace and manual drill, power drill, gimlet, tape measure, square and ruler, calliper, centre punch, broom and dustpan, file card and goggles

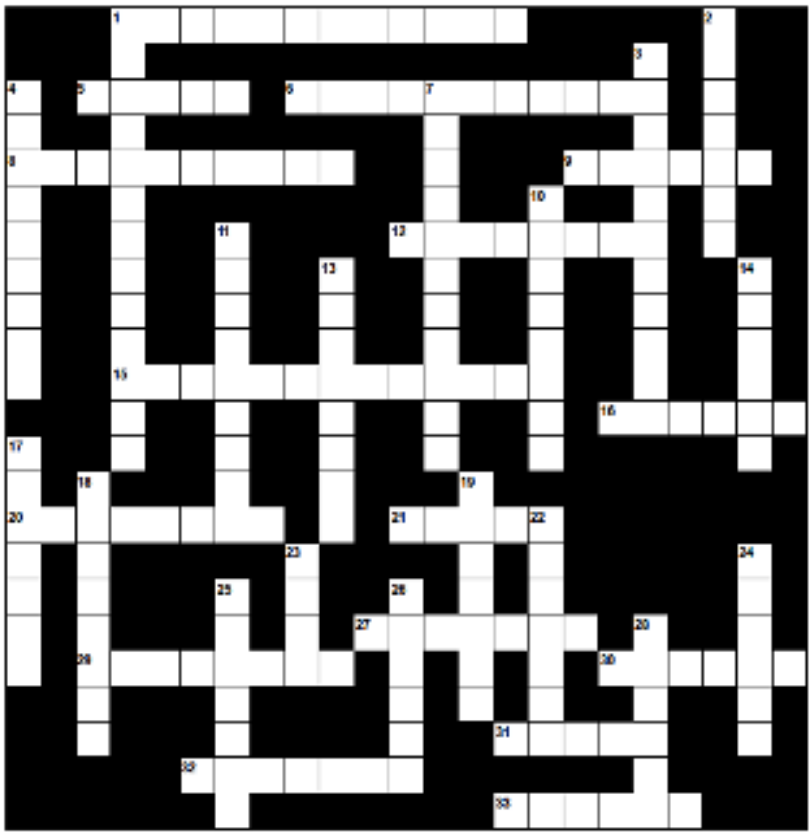
4.3 Tools and risks

ANALIZE. Working in pairs, write the name of different tools that could be associated with the risk.

Risk	Tools
You can catch your fingers	*Pliers*
You can cut yourself	
You can scratch your skin	
You can crush your finger	
You can get burnt	
You can get an electric shock	
Your hair can be caught by it	
You can hit your feet	
You can breath dust	

4.4 Self-assessment: crossword

REMEMBER. Complete the crossword about tools. The clues are their name in Spanish.



Across:
1. Destornilladores.
5. Gato, sargento.
6. Cinta métrica.
8. Taladro eléctrico.
9. Cúter.
12. Calibre, pie de rey.
15. Escofinas y limas.
16. Formón.
20. Tijeras.
21. Reglas.
27. Gafas de protección.
29. Llave Allen.
30. Maza.
31. Escoba.
32. Sierra de costilla.
33. Escuadra.

Down:
1. Soldador.
2. Tenazas.
3. Granete.
4. Segueta.
7. Taladro manual.
10. Ingletadora.
11. Papel de lija.
13. Llaves.
14. Barrena.
17. Recogedor.
18. Carda.
19. Pistola de cola.
22. Remachadora.
23. Tornillo de banco.
24. Alicates.
25. Serrucho.
26. Sierra de arco.
28. Martillo.

4.5 Using tools at home

4.5.1 Must have hand tools

UNDERSTAND. The teacher will project a video twice. Write down the name of the tools that are mentioned.

4.5.2 At home

EVALUATE. What tools do you have at home? Are you allowed to use them? Who is responsible for handwork?

5 Lesson: The technological process

5.1 Learning objectives

In this lesson you will learn

- the purpose of technology,
- the steps of a technology project,
- what a flow chart is, and
- how to describe a process using connectors.

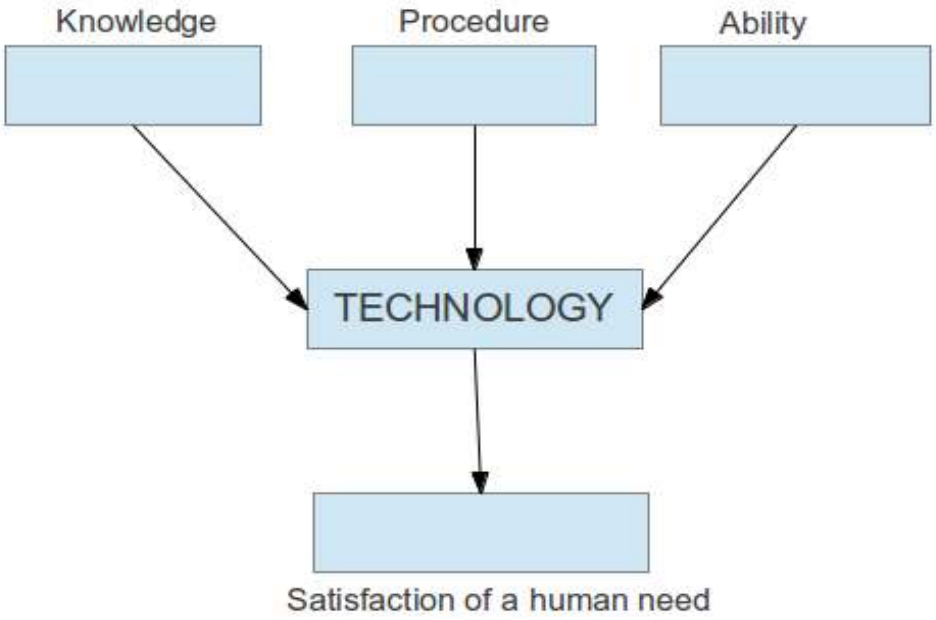
Science, technology, technique, requirement, requisite, need, necessity, brain storming, budget, schedule, design, reconsider, construct, improve, report, evaluate, check, verify, draft, proposal, step, stage, feedback,flow chart, observe, fulfil and achieve.

5.2 What is technology?

UNDERSTAND.

Technology is the application of **science**, **techniques** and **skills** to create solutions that solve human problems or satisfy **human needs**. Technology is the scientific **knowledge** of techniques.

Fill the gaps in the flow chart with the most appropriate word from the list: **final product, science, skills and techniques**.



5.3 Stranded in an island

This mini project is to be done in groups of four people. Imagine we are travelling on a boat in the middle of a storm. Our ship sinks and now we are stranded in a remote and windy island. After exploring the island, we just find the following objects:

- Four batteries.
- Electric wire.
- A bulb with a lamp holder.
- Several sheets of paper.
- Cellophane tape.
- A switch.
- Scissors.
- A screwdriver.
- Terminal blocks.

Batteries, lamp, lamp holder, switch, terminal block, cellophane tape.

5.3.1 Vocabulary

REMEMBER. Look at the following pictures and tag them with the names above:

Picture	Name
	*Scissors*
	
	
	
	
	

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5.3.2 Previous knowledge: an electrical circuit

UNDERSTAND. Write the names of the components we need to make an electrical circuit so that the bulb lights when you switch on the circuit:

UNDERSTAND. What is the function of these components?

APPLY. In your group, make the electrical circuit.

ANALIZE. Can you draw a diagram of the circuit? Do not worry about symbols.

5.3.3 The project

Requirements

UNDERSTAND. Can you identify the need?

ANALIZE. What are the requirements of your need?

- It must be made with using only the components I have
-
-
-
-
-

Individual proposal

CREATE. With the objects you have found in the island, you have to **think of something** for other people to see you. But remember, it is a windy island. **Draw a draft** of your **individual** proposal.

AUTHOR:		DATE:
SCALE:	STRANDED ON AN ISLAND	
WORKING DRAWING: MY PROPOSAL		SHEET N. 1
SECONDARY SCHOOL:		

Group discussion

ANALIZE. **Discuss** the different proposals with the other members of your team.

Construction

APPLY. Now it is time to build the structure that your group has decided.

Verification

EVALUATE. Taking into account the feedback from your teacher and your own observations, think of two things to improve your project:

-
-

5.4 Flow chart: the steps of the technological process

5.4.1 Description

UNDERSTAND. Read the following text about the technological process:

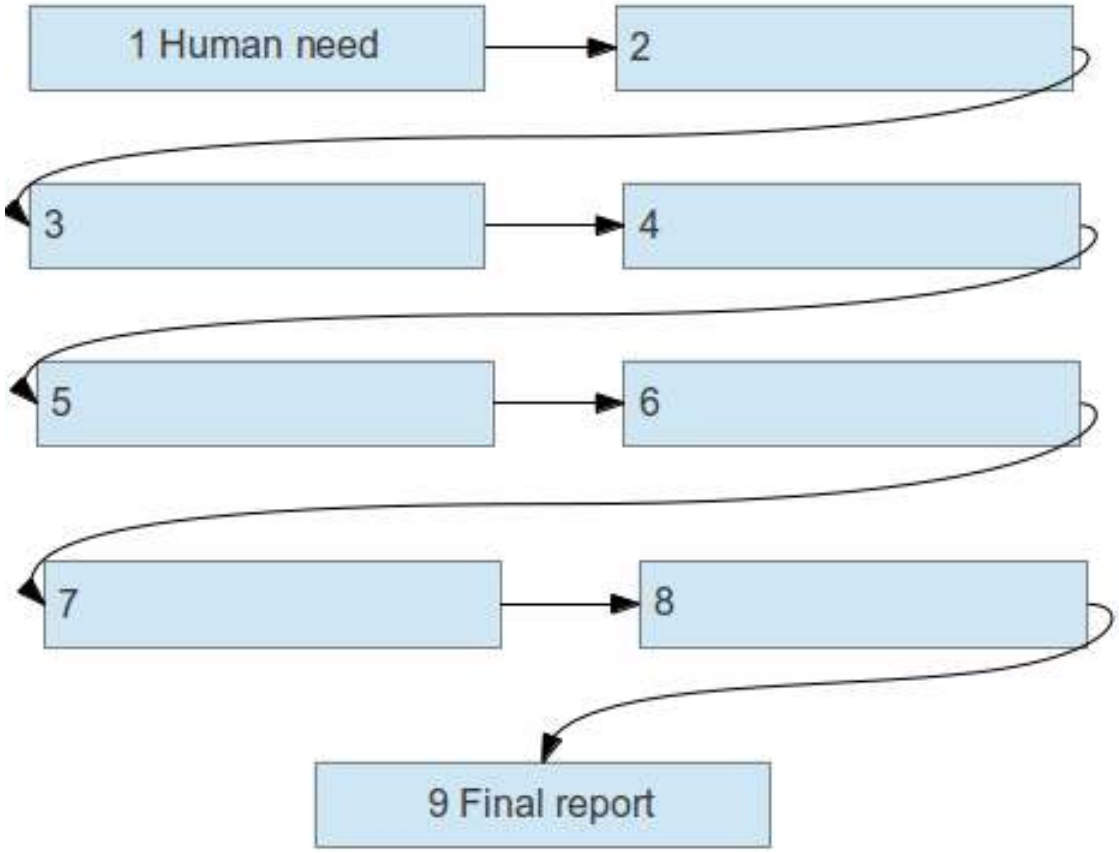
The **technological process** requires a few **stages**:

- The starting point is a **need**. We decide, for instance, to construct a bridge because we have to cross a river or a road.
- Once the **requirements** of the need have been analysed, we have to **propose different solutions** (**brainstorming**), **discuss** them and **choose** the best.
- Once we have decided the solution that best fits our need, we have to **design** our project: prepare plans, choose materials and tools, **budget** and **schedule**.
- Now we have to **construct** and verify our project. If necessary, we can **reconsider** our design to **improve** it. This process is called **feedback**.
- Finally, we write the final **report** and **evaluate** the whole process.

5.4.2 Activities

UNDERSTAND.

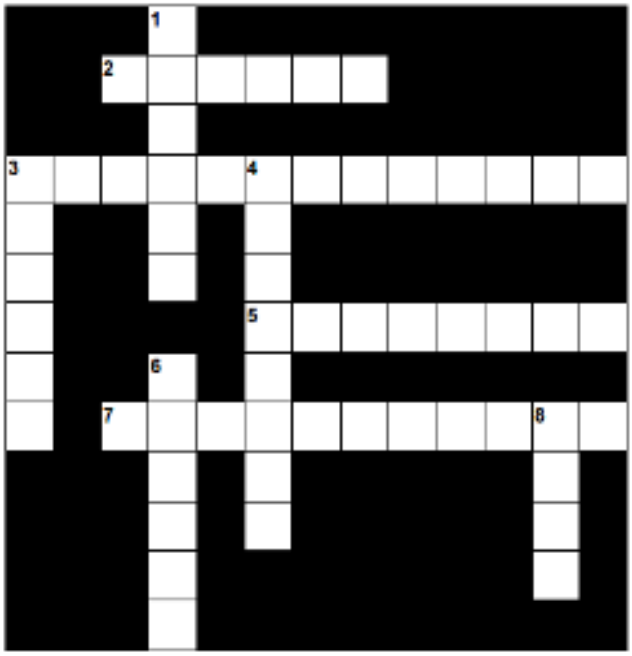
1. The combination of techniques, science and skills is called .....
2. What could be the *need* for the following projects?
   - A fireplace: *to be hot, for example, in winter time*
   - A bike:
   - A mobile phone:
   - A pencil:
   - A desktop:
   - The PS4:
3. Write down at least one specific requisite that the design of the following objects must observe:
   - An electric post: *it must be tall and thin*
   - A door:
   - A basket ball:
   - A chair:
4. Indicate a word meaning:
   (a) To estimate the cost of a project: to ☐
   (b) To give a list of intended events and times: to ☐
   (c) A document where we specify the evaluation of the project: ☐
   (d) The specific characteristics that our project must **fulfil** or **achieve**: ☐
   (e) To **check** that something is OK: to ☐
   (f) A list of ideas generated by the different members of a team: ☐
5. Fill the blanks in the flow chart using the words from the list: **human need, verification and evaluation, final report, budget and schedule, discuss to find the best solution, design the project, propose drafts, construction, study the requirements**.



6. Try to include the **feedback** in the previous scheme. Clue: instead of including another step, link two boxes in the diagram.

5.5 Self-assessment: crossword

Remember. Complete the following crossword related to the technological process:



Across:
2. A drawing from which something may be made.
3. A method for solving problems in which all the members of a group suggest ideas and discuss them.
5. To form an idea of the quality of something.
7. A thing that is needed or a condition that must be fulfilled.

Down:
1. To check that everything is OK.
3. An estimate of the quantity of money needed for an specific purpose.
4. A programme of work to be done or of planned events.
6. A document used to inform about the result of a scientific experiment or a technological project.
8. Necessity.

5.6 Describing a process

5.6.1 Mixed-up sentence

UNDERSTAND. Write the sentences bellow in the right order:

//Secondly, we have to analyse the requirements.//Now, we have to construct and check our project.//The starting point is always a need.//Finally, we must write the final report and evaluate the whole project.//After that, we have to design: prepare plans, choose materials and tools, budget and schedule. //Then, We have to propose different solutions, discuss them and choose the best.//

Solution:

5.6.2 Connectors

UNDERSTAND. Reading the description of the technological process, write the connectors that are used to:

- Introduce the process:
- The intermediate steps:
- The final remark:

5.6.3 How to make a wood badge with your name on it

Imagine you want to make a wood badge and write your name on it.

CREATE. Have a look at the appendix section and answer the following questions:

- What are the materials you need?
- What are the tools I have to use?
- What are the actions I have to perform?
- What are the connectors I am going to use to describe the process?

Apply. Draw a flow chart with the whole process:

Apply. Now, compose a text explaining the whole process:

Section II

Graphic representation

6 Lesson: Drawing tools

6.1 Learning objectives

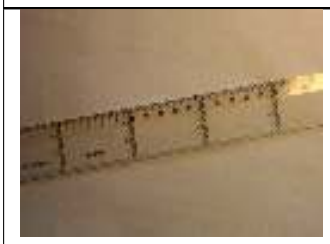
In this lesson you will learn

- the name of the basic drawing tools,
- how to make angles using the set squares,
- how to read elementary math operations,
- how to pronounce the *teen* numbers, and
- how to use the set squares to draw parallel and perpendicular lines.

6.2 Basic drawing tools

Pencil, protractor, compass, set squares, ruler, template, pencil sharpener, pencil case, rubber (eraser) parallel line, perpendicular line, angle, degree, hardness, softness.

REMEMBER. Identify the following drawing tools according to the list: **pencil, protractor, rubber(eraser) compass, template, set squares, ruler, pencil sharpener**.

Picture	Name
	*Ruler*
	
	
	
	
	

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6.3 Using the 30/60 and 45 set squares.

6.3.1 Identifying the angles

UNDERSTAND. Draw a reduced representation of the set squares and indicate the value of their angles.

6.3.2 Drawing angles

Simple angles

APPLY. Draw the following angles with the set squares: 45^o, 30^o, 60^o, 90^o

Complex angles

You can draw many angles combining the angles of the set squares, by either adding or subtracting them. For example, you can get $90^o + 45^o = 135^o$.

APPLY. Now use the set squares to draw the following angles: 135^o, 75^o, 15^o, 120^o and 105^o.

Reading operations

UNDERSTAND. To read additions and subtractions we say:

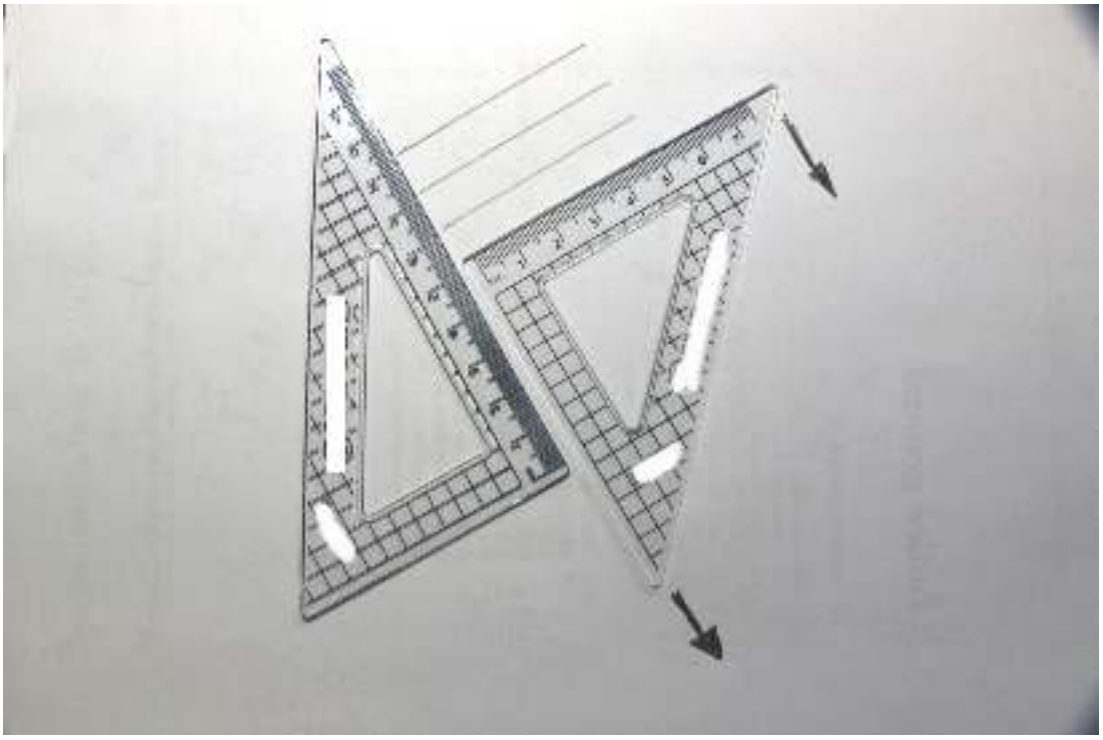
- $9 - 5 = 4$: *nine minus five equals four.*
- $12 + 3 = 15$: *twelve plus three equals 15.*
- $3x6 = 18$: *three times six equals eighteen.*
- $160/2 = 80$: *one hundred and sixty divided by two equals eighty.*

Notice the difference in the syllable stress when pronouncing *eighteen* and *eighty*. Practice saying 13- 30, 14 - 40, 15 - 50, 16 - 60, 17 - 70, 18 - 80 and 19 -90.

APPLY. Now, read out loud the operations you performed to find the angles.

6.3.3 Parallel and perpendicular lines

ANALIZE. Have a look a the following image and try to understand how to draw **parallel** and **perpendicular** lines:

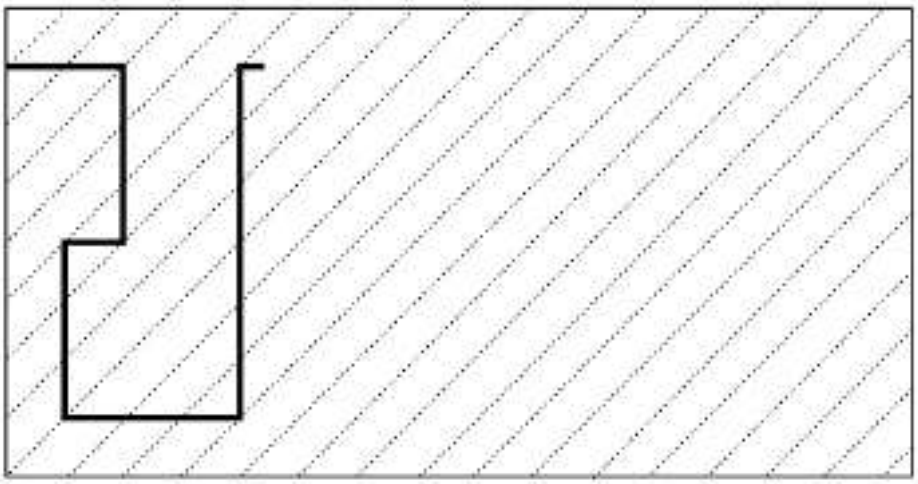


Parallel

APPLY. Now draw 5 parallel lines using the set squares:

Perpendicular

APPLY. Complete the **template** using the set squares. Yo have to repeat the **pattern** three times.



6.4 Pencil hardness

UNDERSTAND. Find out how to classify pencils according to their hardness: 9H, 8H,...,2H, H, HB, B, 2B, ..., 8B and 9B. Which one is the hardest? And the softest? And the medium?

ANALIZE. Choose the true sentence:

- The softer the graphite core, the more black the writing
- The softer the graphite core, the less black the writing

UNDERSTAND. Rewrite the sentences using *the harder* instead of *the softer*.

7 Lesson: Orthographic views

7.1 Learning objectives

In this lesson you will learn

- the difference between artistic and technical drawing,
- how to draw the main views or projections of an object,
- how to use different lines in technical drawing, and
- to identify an object by looking at its views.

7.2 Are you an artist?

UNDERSTAND. Do you know the difference between artistic drawing and graphical representation? Indicate *technical* or *artistic* in these examples:

- The face of a person.
- A plan of the classroom.
- A map of a country.
- A landscape picture.
- The plans to build a plane.

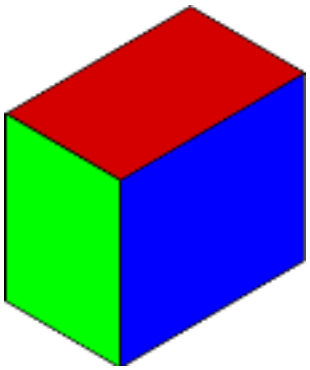
What kind of drawing is the most appropriate for designing projects in technology classes?

7.3 How many dimension?

ANALIZE. Answer the following questions:

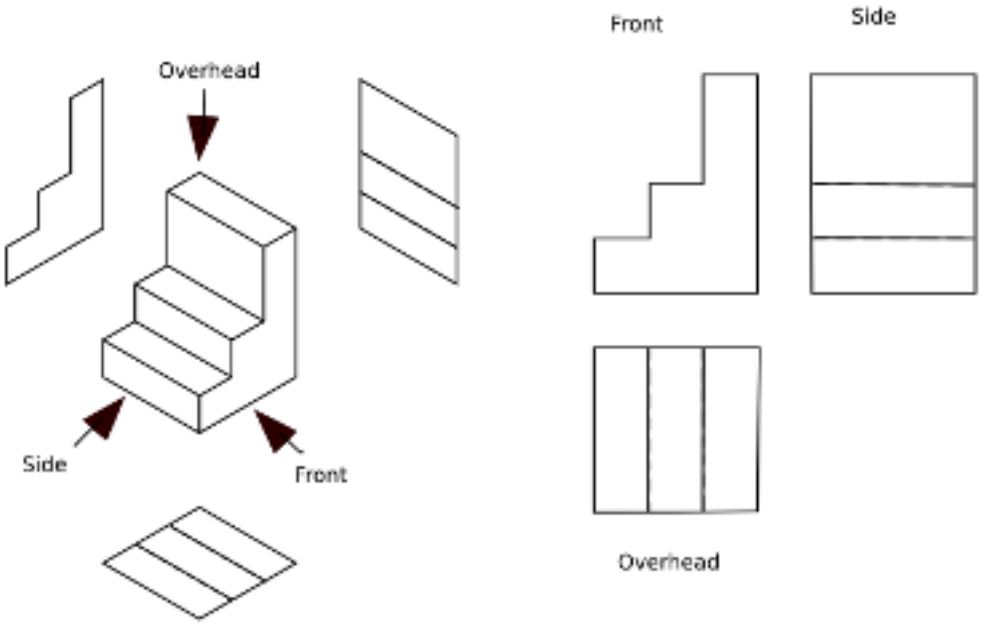
- How many dimensions has got our world?
- What are their names?

UNDERSTAND. Have a look at the box and indicate which dimension corresponds to the length, the width and the height respectively.



7.4 The main views

ANALIZE. Have a look at the following image which explains how to draw the main views of an object:



- How many views are shown?
- What other views are possible? Mark them by and arrow.

7.4.1 Orthographic representation vocabulary

View, elevation, projection, front, overhead, plan, side, edge, symmetry, axe, hidden, solid, discontinuous and dotted line.

REMEMBER. When we say **view** or **elevation** we mean any of the possible **projections** of the object we want to represent in different plans:

1. The **front elevation** is the projection of the main view of the object.
2. The **overhead or plan elevation** is the projection we obtain if we look at the object from above.
3. The **end or side elevation** is the projection we obtain when we look at the object from a side. This elevation can be either left or right.

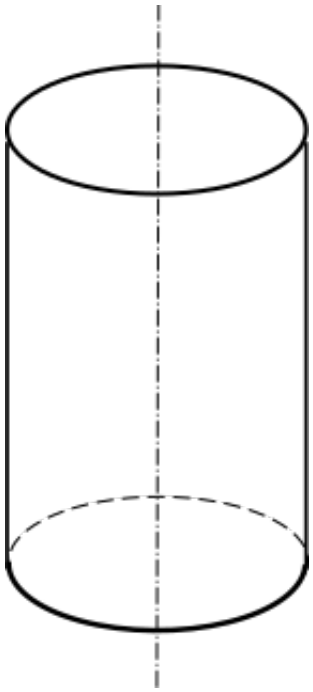
7.4.2 Types of lines

UNDERSTAND. In technical drawing, the kind of line we use is important. Let us see some examples:

1. **Visible edges**: we draw them using a **solid line**.
2. **Hidden edges**: we must draw them using **dash line**.
3. **Symmetry axes** (for circles and cylinders): we draw these lines using dash-dotted lines.

Now have a look a the cylinder and mark

- the edges we see,
- the edges that we cannot see, and
- the symmetry axis.

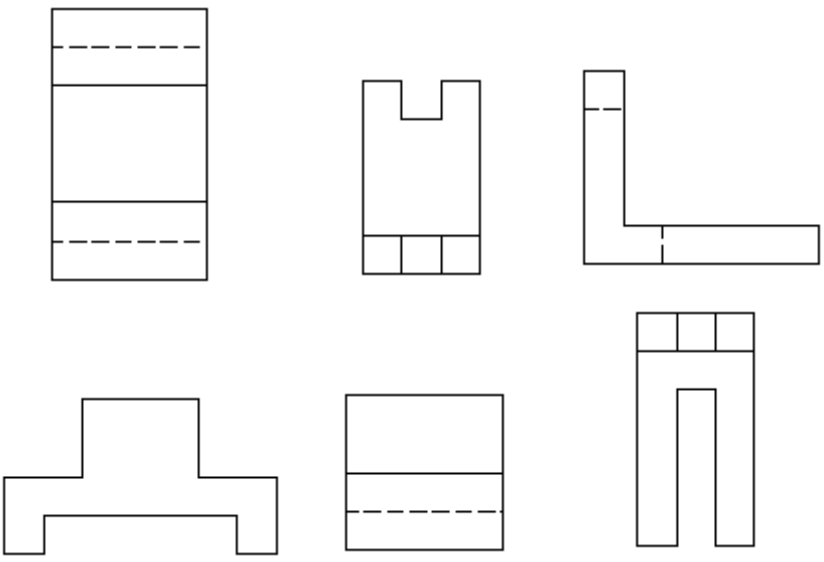


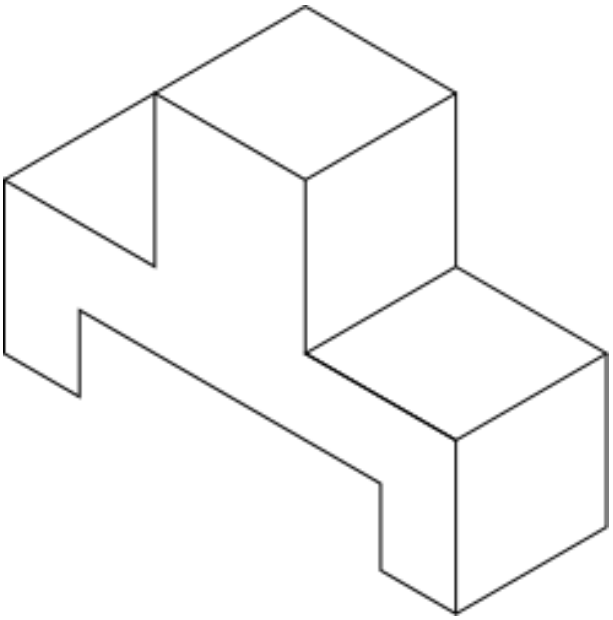
Remember. An *axis* (axes in plural) is an imaginary line that passes through the middle of something, while an *axle* is a physical rod connecting two things, like the wheels in a car. An *axe* (axes in plural too) is a tool to cut logs.

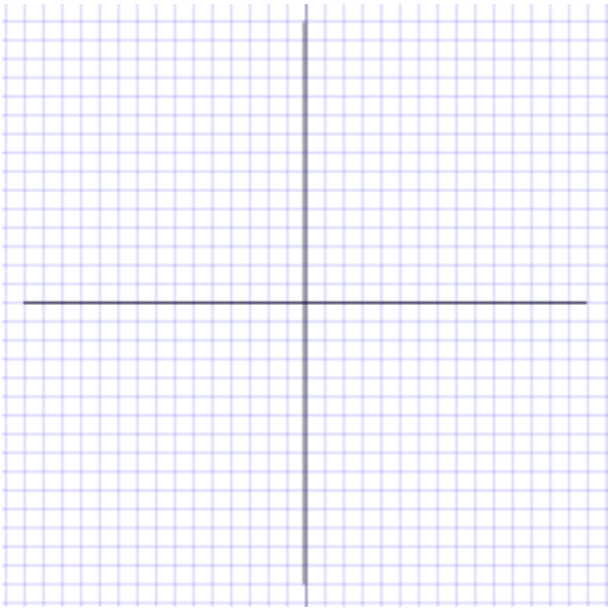
Apply. Reproduce the lines using the ruler:

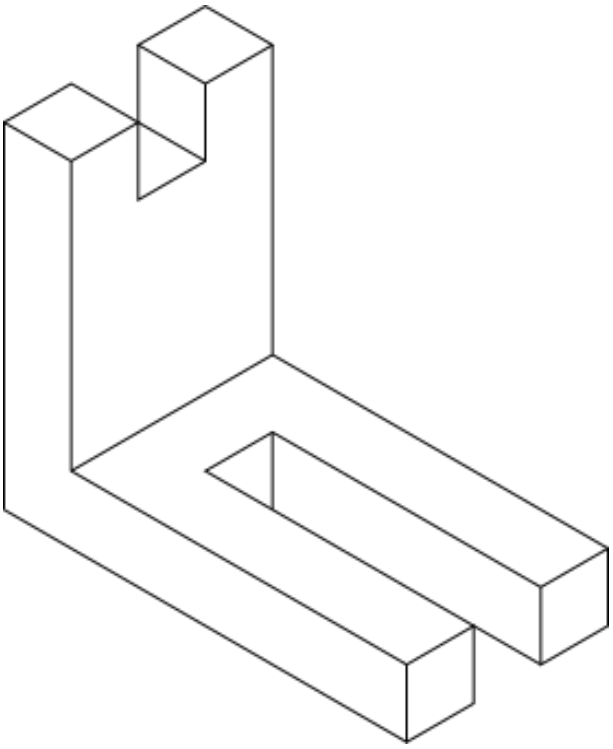
7.5 Drawing practice

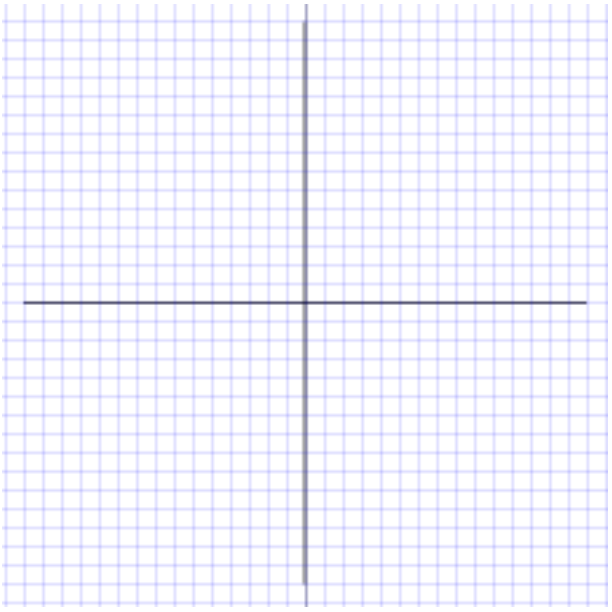
ANALIZE. Identify, from the models, the front, overhead and left side view of the two 3D figures and draw them in the corresponding box:



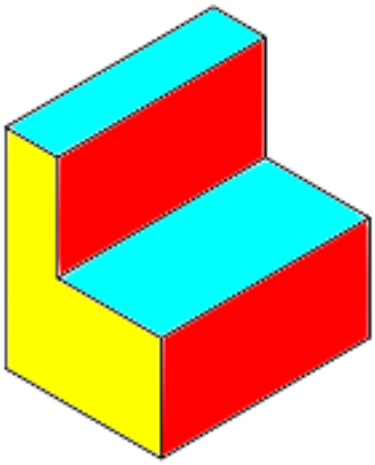


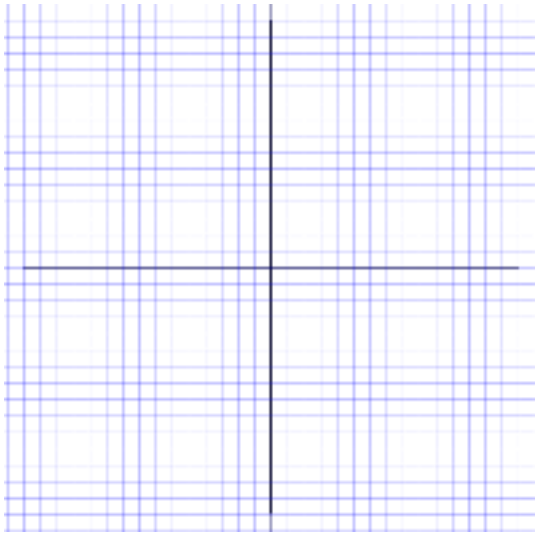


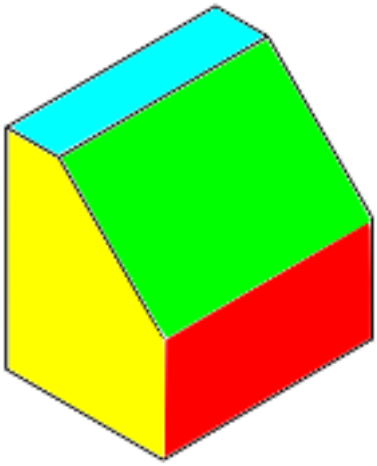


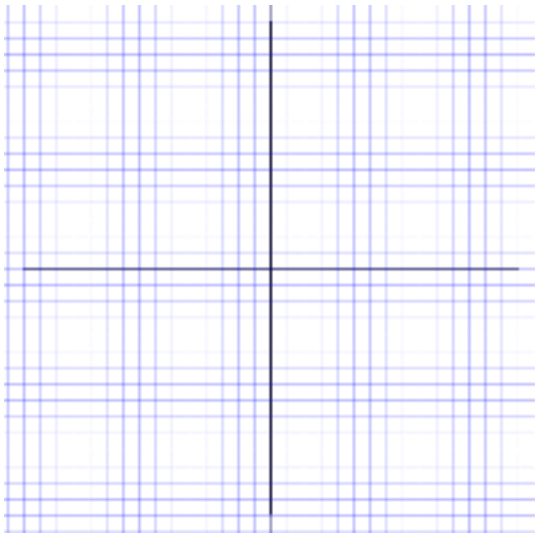


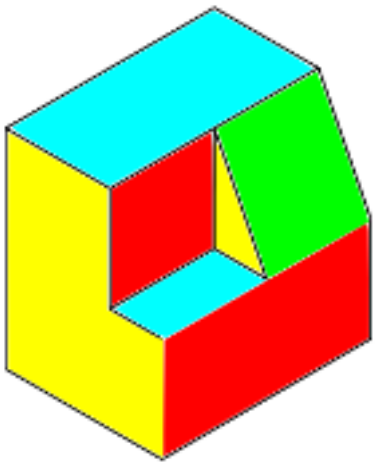
Apply. Draw the front, side and overhead elevations of each figure. Place each view in the proper quadrant and do not start the views where both axes meet. The bottom-right quadrant cannot be used.

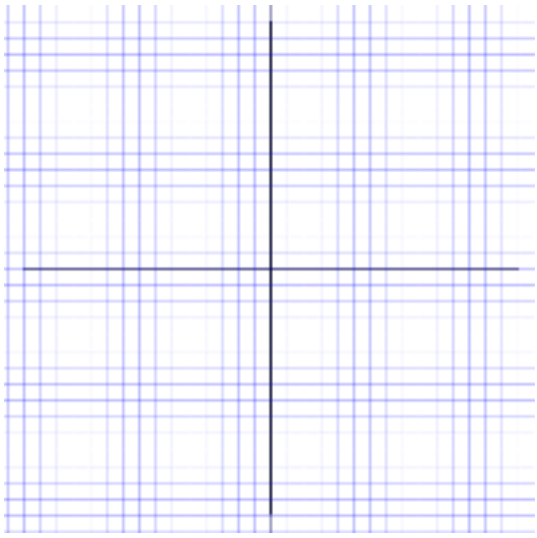


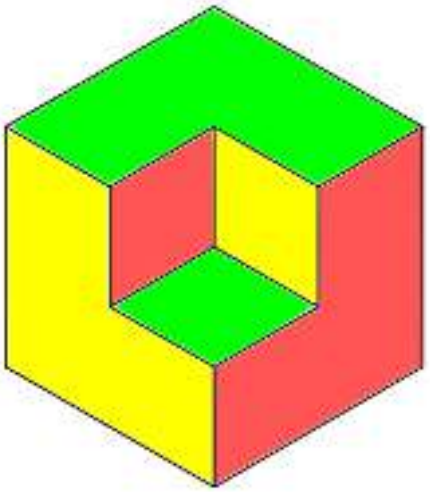


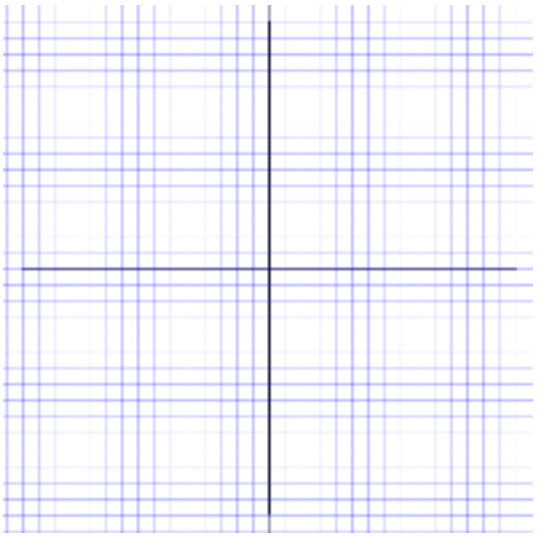


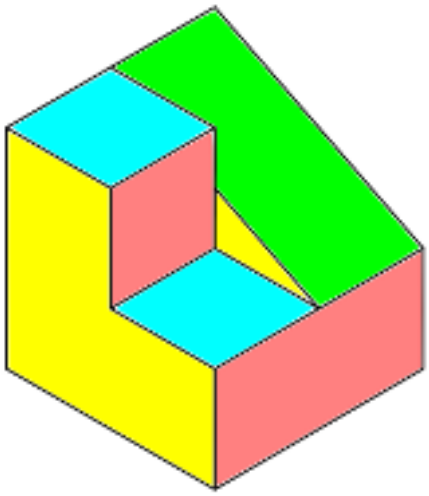


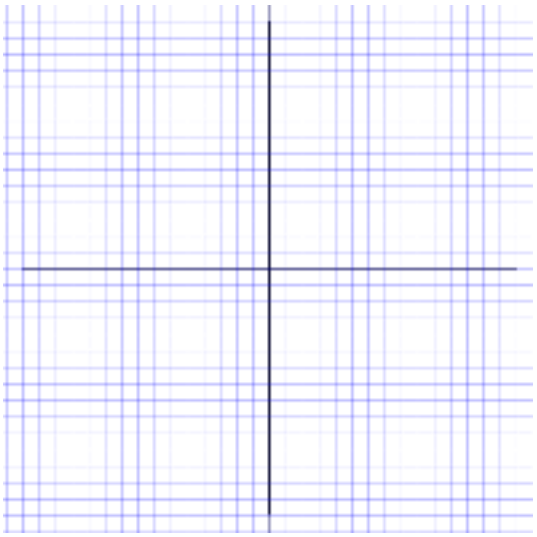


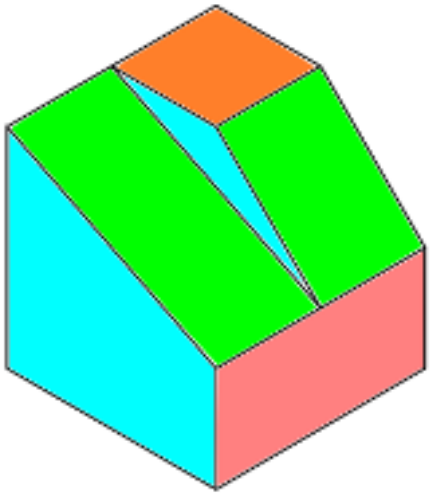


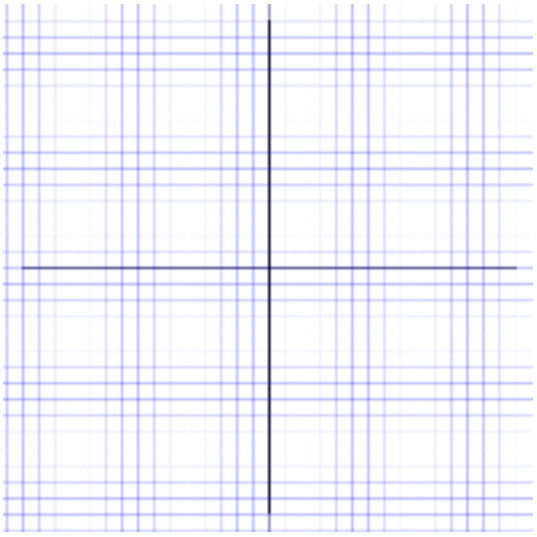






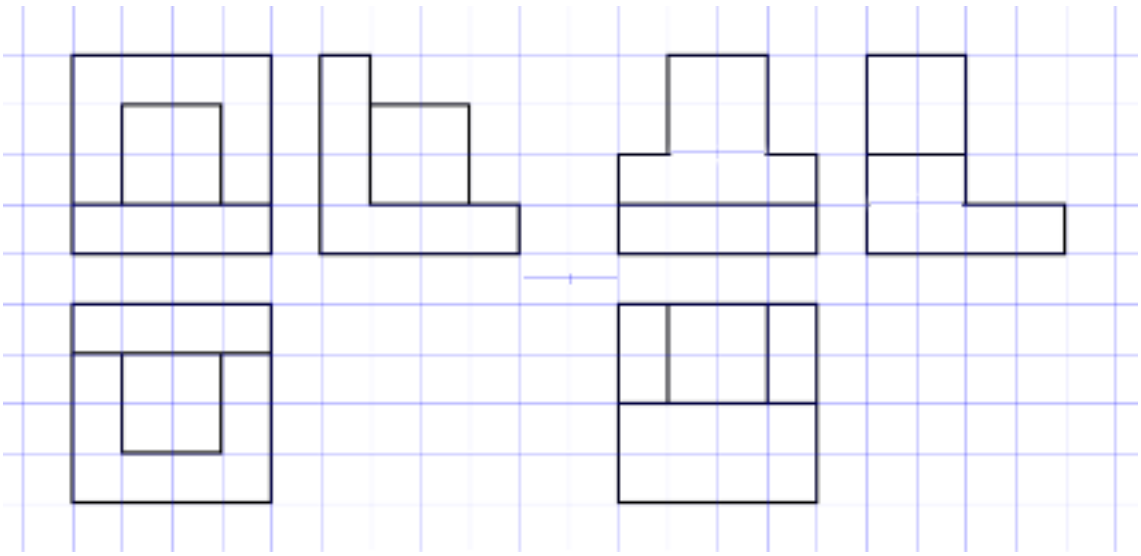




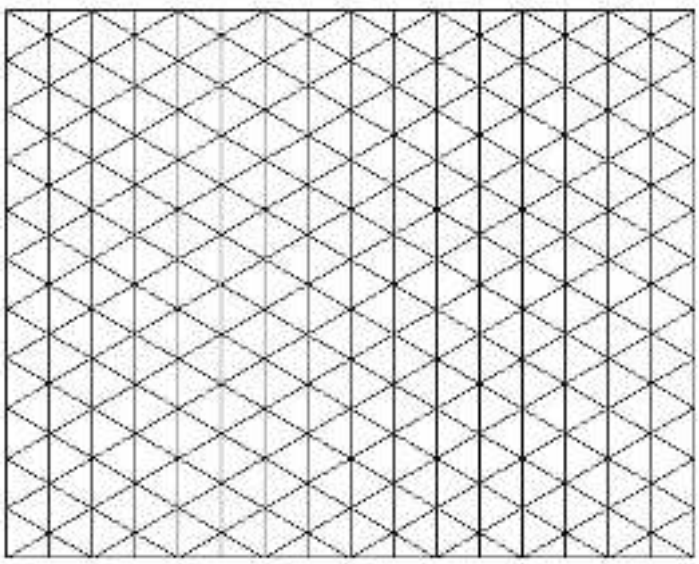


7.6 Reconstruction from its orthogonal projection drawing

ANALIZE. Use coloured plastic cubes to reconstruct these two objects from their views:

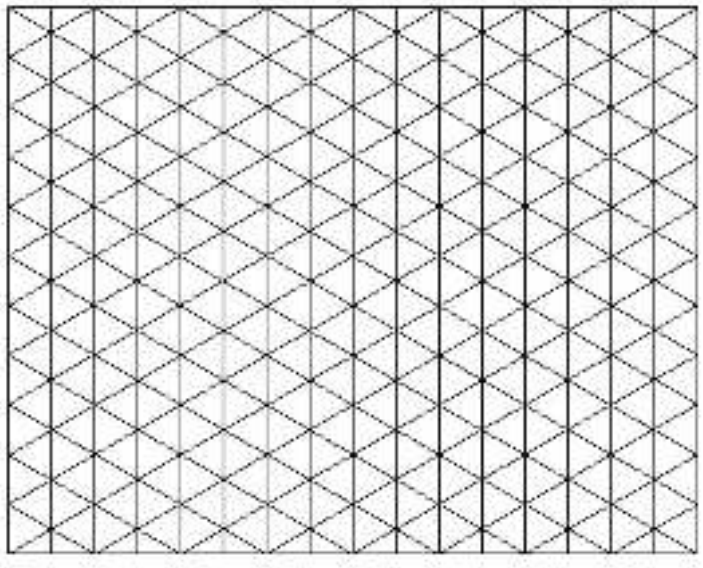


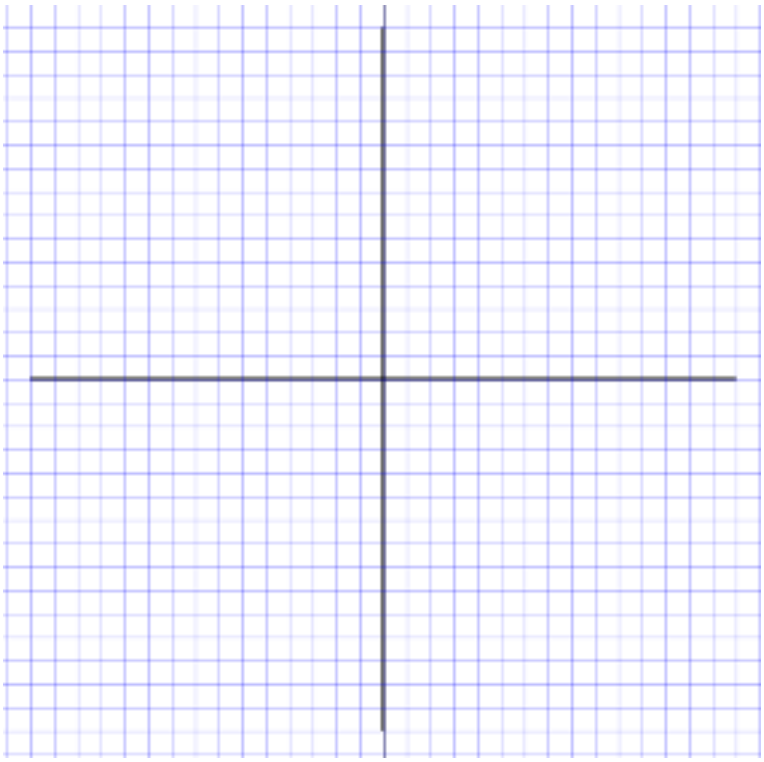
APPLY. Draw a perspective picture of these figures:



7.7 Your figures

CREATE. Design a complex figure and draw the three main views.





8 Lesson: Dimensioning

8.1 Learning objectives

In this lesson you will learn

- how to describe the size of an object,
- how to indicate the dimensions in technical drawing, and
- how to estimate areas and volumes.

8.2 Describing dimensions

Understand. To describe the dimensions of an object we can say:

- It is 10 mm high, so the height is 10 mm.
- it is 25 mm wide, so the width is 25 mm.
- It is 60 mm deep, so the depth is 60 mm.

Apply. Working in groups of three, write the dimensions of the object that the teacher will give you. Read them out loud for the rest of the class.

Estimate the dimension of both the technology workshop and your bedroom. Calculate the area and the volume. Compare your results with the estimations of your classmates.

Dimension	Workshop	Bedroom
Length		
Width		
Height		
Area		
Volume		

Dimension, length, width, wide, depth, deep, height,high, area, volume, estimate, measure, calculate, horizontal, vertical, arrow, edge.

Notice that:

- Area = length x width
  - Bedroom area =
  - Workshop area =
- Volume = length x width x height
  - Bedroom volume =
  - Workshop volume =

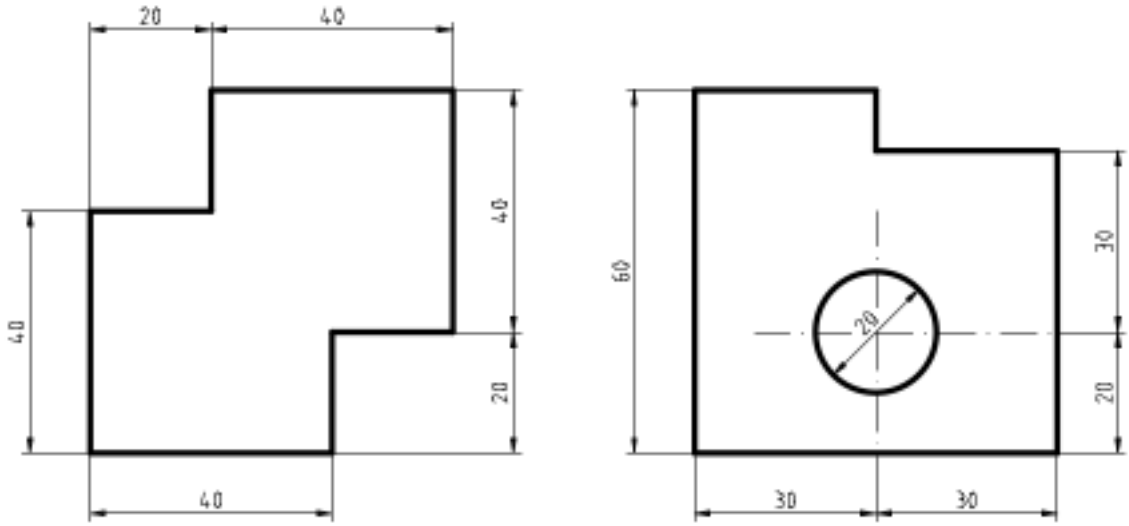
If the dimensions are measured in meters (m), then the area must be expressed in m^2 and the volume in m^3.

APPLY. Now, in groups of four, measure the real size of the workshop. Idea: measure a floor tile a count the number of tiles.

- Real length:
- Real width:
- Real height:
- Real area:
- Real volume:

8.3 Dimensioning rules

ANALIZE. Look at the following example of dimensioning:



Can you guess the dimensions that have not been indicated?

UNDERSTAND. There are several rules we have to follow when dimensioning a drawing:

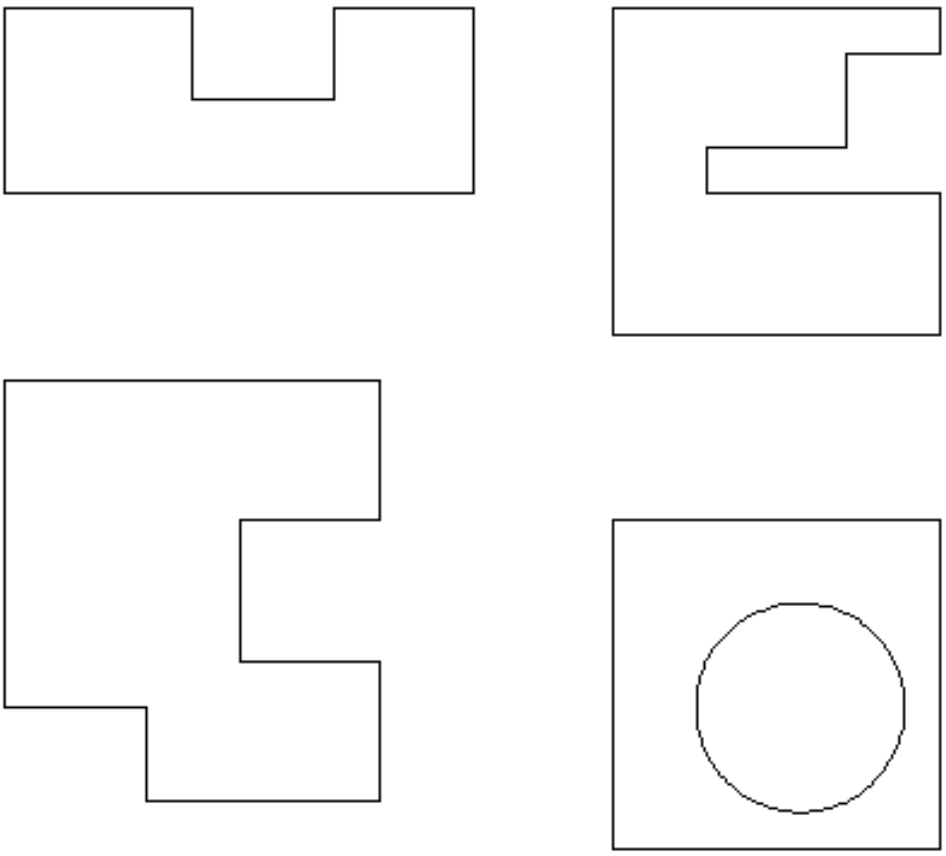
1. We always indicate **the real size** of the object. In some cases it will coincide with the drawing size, but not always.
2. We must indicate the size **in *mm***.
3. The dimension must be written on a **dimension line**:
   - If the dimension line is **horizontal**, we write the dimension **above**, never below.
   - If the dimension line is **vertical**, we place the dimension **on the left**, never on the right.
4. The dimension lines are **ended with arrows**.
5. **Do not duplicate** dimensions.

6. Dimension lines **should not cross** other lines.
7. When possible, dimensions must be **placed outside the body** of the figure.
8. The dimension lines must be separated at least 5 mm from the edges, using **auxiliary lines**.
9. **Avoid** dimensioning the **hidden edges**.

Find, in the dimensioning example, the edges, the dimension lines and the auxiliary lines. Has any dimension been repeated?

8.3.1 Practice

APPLY. Indicate the dimensions of the following figures following the rules when possible:



Section III

Electricity

9 Lesson: What is electricity?

9.1 Learning objectives

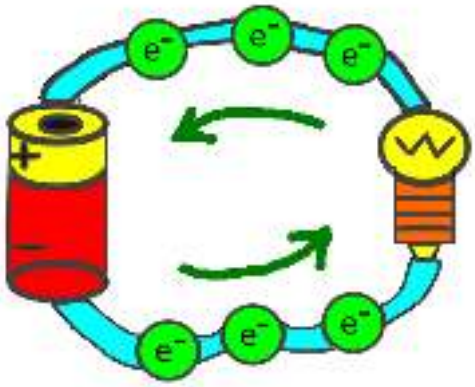
In this lesson you will learn

- what electricity is,
- the components of an electrical circuit and how to represent them,
- the name of electric appliances,
- the advantages and disadvantages of driving an electric car,
- how to mount basic electric circuits, and
- the risks associated with electricity.

Current, electric, electrical, light, movement, sound, heat, electron, circuit, power, battery, wire, cable, copper, switch, push button, device, appliance, lamp, buzzer, motor, bell, series, parallel, measure, symbol, energy, source, short circuit, insulate

9.2 What is electricity?

UNDERSTAND. Electricity is a form of **energy**. Electrons move through the wire of the **circuit** and create **electric current**. Electric current can produce light, sound, movement or heat. But electricity can also be very **dangerous** if we are not careful.



Identify in the drawing the electrons, the wire, the battery and the bulb. What element is missing in this circuit?

Pay attention to the difference between an *electrical engineer* (right) and an *electric engineer*, which is wrong because it means that the engineer will run on electricity! However, we can say both electrical and electric machine, circuit or current.

9.3 At home

ANALIZE. Working in pairs, answer the questions:

1. List at least 10 objects that need electricity:

2. What appliances have you got at home?

3. Imagine you had no electricity at home. What problems would you have?

9.4 Be careful

ANALIZE. Electricity can be dangerous. Let us identify some of the risks associated with it. In groups of four, answer the questions:

- Have you (or anybody you know) ever got an electric shock? What happened?

- What is the proper way to unplug the power cord?
  - Pulling the cord
  - Pulling the plug
- What do we have to do when a cable is damaged?
  - Fix it with insulating tape
  - Disconnect it immediately and repair or change it (with the help of an adult!)
- Think of problems that a short circuit can cause:

- What would happen if you were taking a bath and the hair drier or the radio fell into the water?

- What do we have to do with a mobile phone in case of storm if we are not at home?

- Is it a good idea to swim outdoors when there is a storm?

9.5 Basic rules

CREATE. In groups of four, decide five things we should never do when working with electricity:

- *Avoid dealing with water close to an electric machine*
-
-
-
-

9.6 The electric circuit

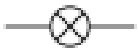
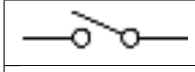
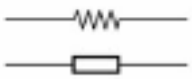
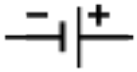
REMEMBER. **Electric current** flows in a closed path called **electric circuit**. An electric circuit is a device that uses electricity to perform a task, such as run a vacuum, power a lamp, heat a room or sound a buzzer.

9.6.1 Elements of an electric circuit

1. Energy **source**: it could be a **battery** but we can also **plug** some devices.
2. The path for the electrons: the **wire** or **cable**, made of plastic cooped **copper**.
3. Control elements to stop and start the current: **switches** and **push buttons**.
4. **Receptors**, which transform the electric energy in another type of energy:
    - **Lamps** transform electricity into light.
    - **Motors** transform electricity into movement.
    - **Resistors** transform electricity into heat.
    - **Buzzers** and **bells** transform electricity into sound.

9.6.2 Electrical symbols

ANALIZE. In twos, write the name of the symbol according to the list: *switch, motor, battery, resistor, buzzer* and *lamp*.

Symbol	Name
	
	
	
	
	
	

9.6.3 Circuit representation

APPLY. Using the electrical symbols, draw diagrams for the following electric circuits. Don't forget to include the battery in each circuit.

1. A motor controlled by a switch.

2. A series circuit with lamp and a motor both controlled by the same switch.

3. Draw a parallel circuit with a lamp and a motor, both controlled by the same switch.

4. Draw a series circuit with a motor and a buzzer and two lamps, all of them controlled by the same switch.

5. A circuit with a buzzer in series with a lamp and this combination in parallel to a buzzer. Include one switch only.

6. A parallel circuit with a buzzer and a resistor controlled by two different switches.

7. A circuit with a motor in series with a lamp and this combination in parallel to a buzzer. Use one switch only.

8. You've got a battery, 3 bulbs, a switch and some electrical wire. Connect the components:

   - In a series circuit.

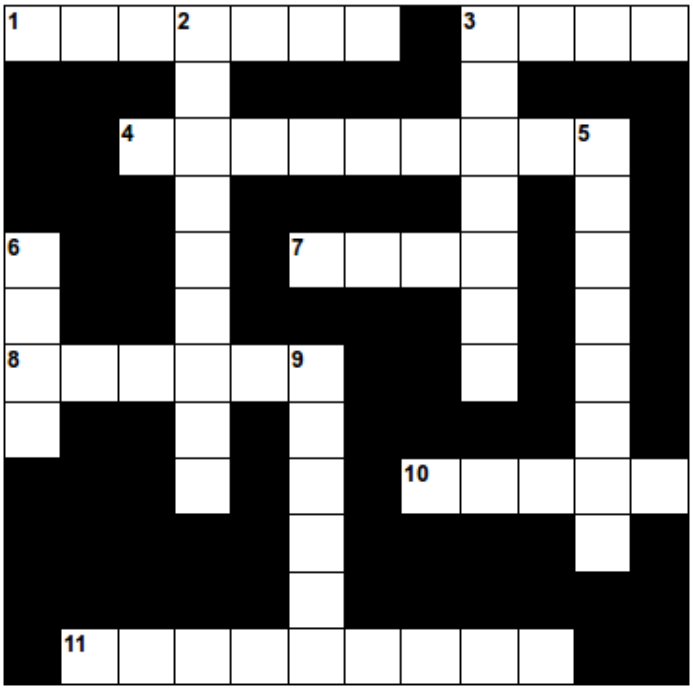
   - In a parallel circuit.

   - Two bulbs in series and this combination in parallel to the other bulb.

9.7 Self-assessment

9.7.1 Crossword

REMEMBER. Complete the following crossword about electricity.



Across:
1. A path of connected electrical components.
3. A rounded glass container with a thin thread of metal inside that produces light when an electric current goes through it.
4. A material that electricity cannot go through.
7. A thin metal thread with a layer of plastic around it, used for carrying electric current.
8. A small device that controls and turns on or off an electric current.
10. A device that changes electricity into movement and makes a machine work.
11. A device that produces electricity.

Down:
2. A material that allows electricity to pass through it.
3. A device that produces electricity to provide power for bulbs, motors, etc.
5. A electrical component that controls the current in an electrical circuit and produces heat when electricity flows through it.
6. A very thin wire that melts when too much electrical current flows.
9. A device for putting the bulb.

9.7.2 Matching device and function

Remember. Complete the table with a device from the list that matches the indicated function: *motor, bulb, buzzer and resistor*. Draw their symbol too:

Function	Device	Symbol
Transforms electricity into sound		
Transforms electricity into motion		
Transforms electricity into heat		
Transforms electricity into light		

9.8 Electric cars

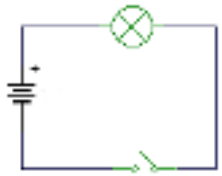
Evaluate. Whole group debate: would you like to have an electric car or would prefer a car running on fuel? Find arguments in favour and against each type of car.

9.9 Making electric circuits

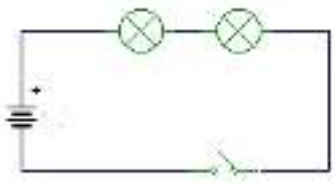
Apply. Working in groups of four/five people mount the following circuits. First, check that you have all the necessary elements and tools. If not,

tell the teacher.

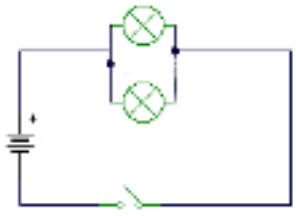
1. Circuit 1 (simple):



2. Circuit 2 (series):



3. Circuit 3 (parallel):



ANALIZE. Do both lamps illuminate the same in the three circuits? Write your observations:

Section IV

Materials

10 Lesson: Types of materials

10.1 Learning objectives

In this lesson you will learn

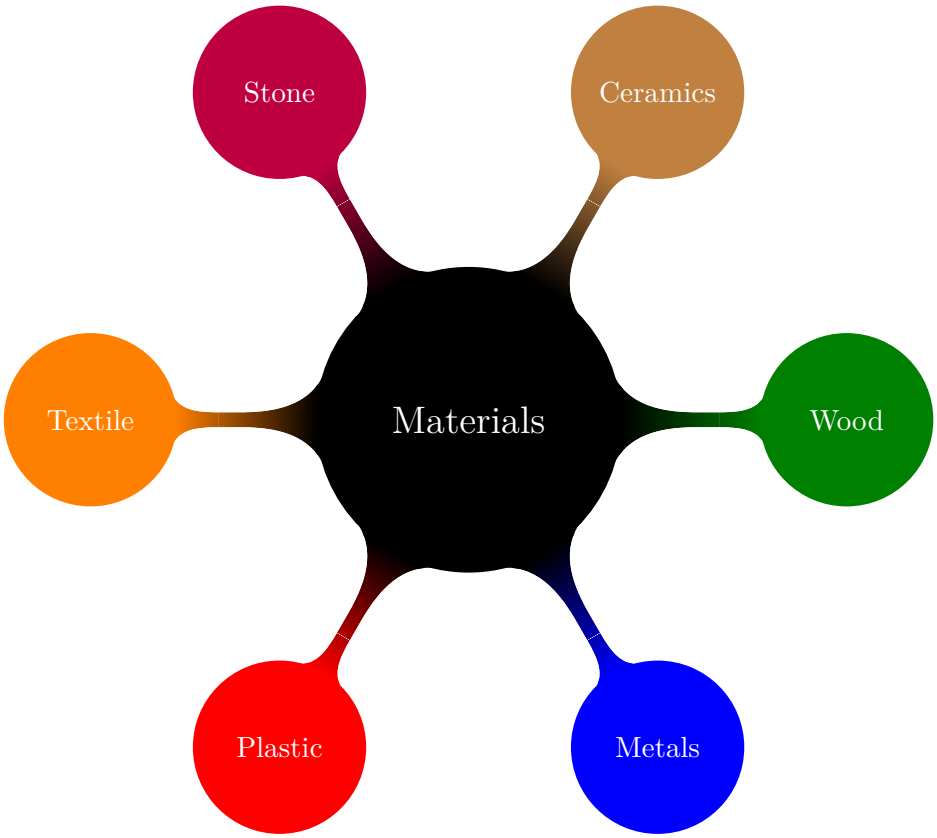
- the origin and types of materials that can be used to build objects,
- the processes that materials have to go through to be used, and
- some clues to know when to use either *to make* or *to do*.

Material raw, processed, vegetable, mineral silk, wood, wool, cotton, metal, iron, copper, stone, ceramic, plastic, textile

10.2 What is our workshop made of?

ANALIZE. Working in groups of four, have a look at your classroom and identify as many different materials as possible. Classify them according to the mind map on the next page.

Object	Materials

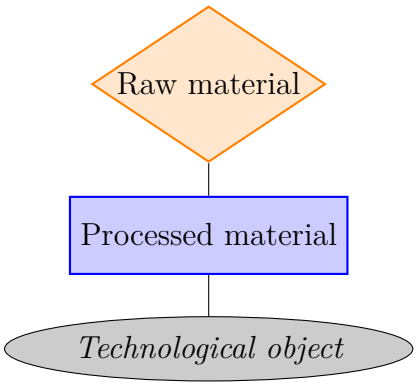


10.3 Processing materials

UNDERSTAND. **Raw materials** are obtained from nature and must be transformed into **processed materials** before we can use them to make **technological objects**. They can be classified according to their origin as

- animal (like wool or silk),
- vegetable (line wood or cotton), and
- mineral (like iron, copper or stone).

Have a look at the following scheme about the transformation of raw materials into technological objects:



Now classify the words from the list according to the previous scheme:

Threaded rod, bird cage, handkerchief, fabric, clay, brick, wall, trunk, petrol, tyre, rubber

- Iron, threaded rod, bird cage.
- Silk, handkerchief, fabric.
- Clay, brick, wall.
- Door, tree trunk, wood.
- Petrol, tyre, rubber.

Raw material	Processed material	Technological object

10.4 Do you recognise it?

ANALIZE. Each group has a board with with the names of different materials. The teacher says the name of an object and shows a picture of it. The group must write the name of the object in the box where the name of the material used to make it is written.

10.5 Mixed-up sentence

UNDERSTAND. Rewrite the sentences in the right order:

//Raw materials must be processed, chemically or physically, // These materials can have mineral, vegetable or animal origin. // to make technological products, // To begin with, we need raw materials. // which satisfy different human needs. // to change their properties before they are ready to be used //

Solution:

10.6 Make or do things?

REMEMBER. The difference between *to make* and *to do* can be tricky for non-native speakers. The best way to know when to use them is to read a lot. However, a few rules can be applied.

- We use *to make* to talk about creating or constructing: *to make a design for the project, to make a chair.*
- We use *to do* to talk about work or task: *to do the homework.*

Now complete the sentences with either *make* or *do*. Use the correct tense.

As homework, the teacher told us to ..... the plans of a car. As I did not ..... the homework, the teacher was very upset and I had to ..... the project designed by another student.

11

Lesson: Wood

11.1 Learning objectives

In this lesson you will learn

- about the types and properties of natural and manufactured wood,
- how to talk about the properties of a material, and
- the name of the home furniture pieces.

11.2 Types of wood

11.2.1 Trees

Remember. Working in groups of four people, write the name of all the trees yo know. Use the dictionary if necessary.

11.2.2 Types of wood

ANALIZE. In the technology workshop you can find many different types of wood. In groups of three people, walk around and fetch different examples of boards and strips.

Now, draw and describe profusely three of them, indicating at least the following properties:

- Colour: yellow, reddish, brown, etc.
- Hardness: hard or soft.
- Weight: heavy or light.
- Thickness: thick or slim (thin).

- Object 1:

- Object 2:

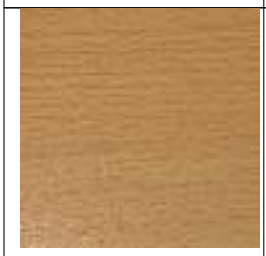
- Object 3:

Natural Wood

ANALIZE. Have a look at the different pictures of materials. Try to guess the name of each type of wood. If necessary, you can search for information on the Internet.

Choose among *pine, cherry, oak* and *beech*.

Board, strip, cherry, oak, beech, mahogany, furniture, panelling, flooring, barrel, pale, reddish, light coloured, hard, soft, heavy, light, thick, slim and durable

Picture	Name & translation	Properties	Applications
		Reddish, very durable	Furniture, panelling, flooring
		Pale yellow, hard	Furniture, chairs, tables, tools
		Light coloured, hard, heavy	Furniture, doors, barrels
		White or pale yellow	Furniture

Other natural woods

ANALIZE. Find out the properties and applications of the following woods:

- Mahogany:

- Poplar:

- Fir:

ANALIZE. Draw a few pieces of wood furniture you have at home and write their names. Indicate the room where you can find them. Do you recognise any type of wood?

Prefabricated wood

Hardboard, plywood, fibreboard, chipboard, box, fence, veneer, chip, fibre, timber, synthetic, press, compress, extrude, thin, DIY and humidity

ANALIZE. Complete the table with the following types od prefabricated wood: *hardboard, plywood, fibreboard* and *chipboard*.

Picture	Name & translation	Properties	Applications
		Manufactured wood panel made from thin sheets of wood veneer glued together. Sensitive to humidity	Furniture, boxes, fences, panels, veneer
		Manufactured from wood chips and a synthetic resin, which is pressed and extruded. Also called **particle board**	Furniture, doors
		It is made out of exploded wood fibres that have been highly compressed. Also called **HDF (high density fibreboard)**. Flexible, easy to work	Furniture, construction
		Also called **MDF (medium density fibreboard)**. Made out of wood fibres.	Wood speakers, wood veneers

11.3 What wood?

EVALUATE. Indicate a proper wood to make:

- A kitchen spoon or a kitchen cutting board:
- A panel to place tools:
- The handle of a hammer:
- A chair:
- A garden dog house:
- A door:
- The board of a table:
- Paper pulp:
- Luxurious furniture:
- A pallet:
- A fence:
- The frame for a window:
- A timber cottage:

Different answers are possible.

11.4 DIY

UNDERSTAND. Find out the answers:

- What is a DIY shop?
- What kind of things can we buy there?
- Do you know any DIY shops nearby?

12 Lesson: Metals

12.1 Learning objectives

In this lesson you will learn

- the importance of metals in history,
- the most used metals and their properties,
- what steelworks is and
- how to choose proper metals for a technology product.

12.2 Warm up: do we wear metals?

Remember. Think of different metal objects that are present in the classroom:

Metallurgy, siderurgy, steelworks, stainless steel, iron, cast iron, corrode, rust, carbon, alloy, mixture, magnet, chassis, kitchen, cutlery and pans

12.3 Metals

UNDERSTAND. The history of metals is fascinating. Although known since the Stone Age, the Bronze and Iron Ages supposed an incredible step forward for humankind. Iron is by far the most common metal. The industry of iron and steel is called *siderurgy* or *steelworks*. For the rest of metals, the industry is called *metallurgy*.

12.3.1 Iron based metals

Complete the table with: stainless steel, iron, cast iron, steel.

Picture	Name & translation	Properties	Applications
		Good magnetic properties, it corrodes easily	To make steel, magnets
		Alloy: mixture of iron and carbon. Hard and brittle	Drain covers
		Alloy: Iron with a small quantity of carbon. Very hard and though	The most used metal: frames, tools, chassis, etc.
		Alloy: steel and chrome. It doesn't corrode or rust with water. Also called inox steel	Kitchen tools, cutlery, pans, etc.

12.3.2 Other metals

Tin, tinplate, brass, copper, gold, lead, silver, zinc, aluminium, titanium, bronze, aircraft industry, prostheses, jewellery, trinket, medals and coins

Complete the table with: tin, tinplate, brass, silver, copper, lead, gold, zinc, aluminium, titanium and bronze.

Picture	Name & translation	Properties	Applications
		Reddish, it corrodes, ductile	Electric wire, pipes
		Light metal, grey	Power lines, window frames, kitchen tools, foil (to preserve food)
		Heavy, toxic, grey	Batteries
		Light, very hard. It doesn't corrode	Aircraft industry, prostheses,
		Reddish. Alloy: copper and tin. It doesn't corrode	Bells, sculptures

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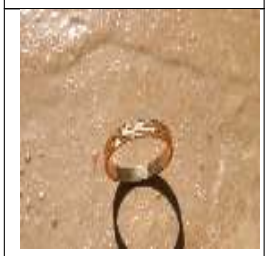
		Soft, malleable	Electronic soldering, tin plates
		Made of steel covered by tin. It doesn't oxidise	Food preservation
		Yellow, similar to gold. Alloy of copper and zinc	Jewellery
		Grey, expensive	Medals, jewellery
		Yellow, very bright and expensive. It doesn't corrode	Medals, Jewellery, coins, valuable items
		Not very hard, brittle, bluish grey	Galvanisation and alloys

12.4 Reinforcement: what metal?

UNDERSTAND. Indicate what metal or metals would you use to make:

- The legs of a table:
- A spoon:
- A locker:
- A pipe:
- A kitchen bowl:
- A bike frame:
- A coin:
- A bolt for a door:
- A frame for glasses:
- A sculpture:
- A can to preserve food:
- Trinket (cheep jewellery):
- Expensive jewellery:
- Something very heavy (like a plummet):
- A drain cover:
- A walking stick or cane:

12.5 Extension: steelworks

Siderurgy, ironworks, steelworks, gangue, ore, mineral, converter, blast furnace

UNDERSTAND. Siderurgy, also known as ferrous metallurgy, ironworks or steelworks is the industry where iron mineral is smelted (hit at high temperature to get the metal) and iron, cast iron and steel products are made. Explain the following concepts:

- Mineral, gangue and iron ore:

- Blast furnace:

- Bessemer Converter:

12.6 Extension: the history of metals

ANALIZE. Find out on the internet when the Bronze and the Iron Age started and explain how ancient societies evolved with the use of metals:

Section V

Structures

13 Lesson: Structures

13.1 Learning objectives

In this lesson you will learn

- to appreciate famous buildings with awesome structures all over the world,
- to identify the types of structures,
- to describe the structure of a modern house,
- to describe wooden structures,
- to talk about a place where we have (not) been to, and
- to appraise our natural environment and local architecture.

13.2 Famous structures in the world

Remember. Whole class activity: do you know the name of the following structures and where they are located?

Picture	Name	Place
	City of arts and sciences	Valencia
		
		
		
		

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13.2.1 Have you ever been to?

APPLY. Stand up and ask this question to your classmates: Have you ever been to .....? The answer can be:

- Yes, I was there last summer, in March, a few years ago...
- No, but on my next summer holiday I am going to visit....
- No, I have never been to that place

13.2.2 My town

EVALUATE. Describe a particular building located in your town. You can add a picture or a drawing. Find out a little bit about its history.

13.3 Types of structures

Structure, mass, frame, lattice, vaulted, truss, triangulated, pneumatic, suspension, building and bridge

ANALIZE. Have a look around you and you will notice that there are different types of structures. Complete the table writing the name of the structure type: mass, frame (or lattice), suspension, shell, vaulted, pneumatic and truss (triangulated).

Picture	Structure type
	
	
	
	
	

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13.4 Mini-book: my favourite buildings

REMEMBER. In pairs, and using the mini-book template provided by your teacher, stick pictures of famous monuments on the left pages and describe them on the right pages: its name, where it is located, type of structure, how old it is, who designed it...

13.5 The structure of a house

UNDERSTAND. Complete the table with the words from the list: *column, slab, foundations, pillar, joist, beam.*

Column, slab, foundations, pillar, joist, beam, support, roof, floor, thick, weight, concrete, surface and ground.

Definition	Name
The structures below the surface of the ground that support a building	
The baseplate where the solid wall elements are positioned	
A long, thick piece of wood, metal, or concrete, especially used to support weight in a building or other structure.	
A long, thick piece of wood, metal, or concrete, used in buildings to support a floor or ceiling. They are small beams.	
A strong column made of stone, metal, or wood that supports part of a building	
A tall, circular and vertical stone post, used as a support for a roof	

Look around you and try find some of these elements (not all of them are visible once the house has been finished).

13.6 The Turia river bridges excursion

ANALIZE. Close to our High School, we have got the Turia river natural park. Walk around and take (or draw) pictures of the different bridges you will find. Try to guess the materials they are made of and observe carefully their structure.

14 Lesson: Stresses

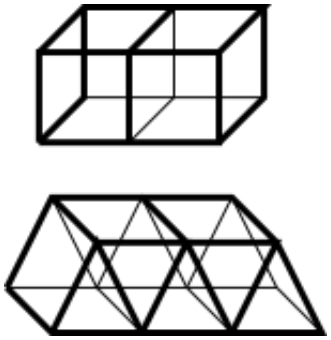
14.1 Learning objectives

In this section you will Learn

- to identify the different types of stress that structures support, and
- what the tallest buildings in the world are.

14.2 How much weight on it?

Apply. In groups of four, make the following structures and put some weight on it. You will need a set of straws and insulating tape.

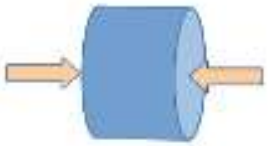
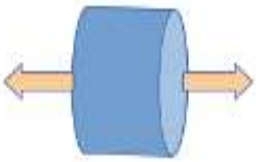
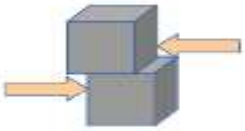
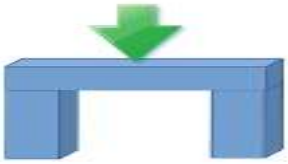


Analize. Which is the most resistant? Why? What happened to the straws?

14.3 Stresses

Stress, traction, torsion, bending, shear or cutting, compression, architect and skyscraper

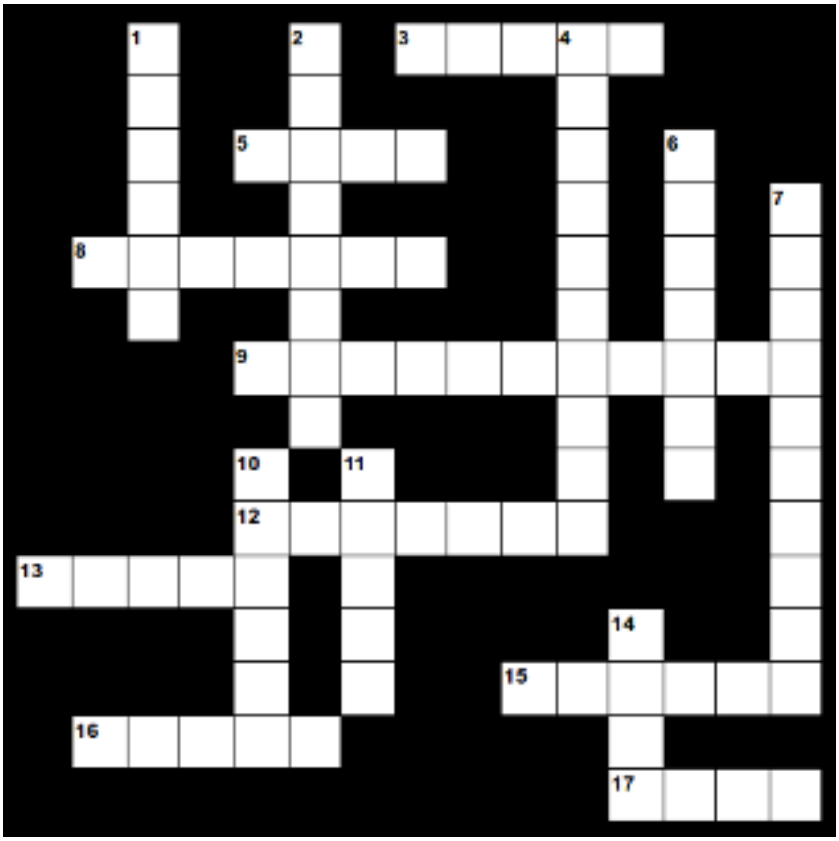
UNDERSTAND. When talking about materials, stress is the internal tension that an object suffers when a force is applied to it. Complete the table with the name of the appropriate stress: *traction, torsion, bending, shear (cutting)* and *compression*.

Drawing	Name
	
	
	
	
	

Identify the main stress that the following objects suffer: *a beam in a bridge, a pillar in a house, the cord that holds a lamp, a drill bit and the graphite core of a pencil.*

14.4 Self-assessment crossword

REMEMBER. Complete the crossword about structures and stress:



Across:
3. Triangulated structure.
5. Structure that can be made by piling up similar materials into a particular shape, such as a dam or a pyramid.
8. Structure made of several arches placed side by side.
9. Stress resulting when opposite forces are applied to the same body.
12. Stress resulting when two forces try to twist an object.
13. Cutting stress.
15. A tall, circular and vertical stone post, used as a support for a roof.
16. A long, thick piece of wood, metal or concrete used in buildings to support a floor or ceiling. They are small beams.
17. A long, thick piece of wood, metal, or concrete, especially used to support weight in a building or other structure.

Down:
1. A strong column made of stone, metal or wood that supports part of a building.
2. Stress resulting when two forces try to stretch a body.
4. Structure used in some bridges like the famous Golden Gate.
6. Stress resulting when an long object loads a heavy weight.
7. The structures below the surface of the ground that support a building.

10. Internal tension.
11. Structure used in modern blocks of flats.
14. Flat piece of solid substance used in modern buildings to construct the ground floor.

14.5 The tallest skyscrapers

ANALIZE. Find on the Internet information about the three tallest skyscrapers in the world. Answer the following questions: Where are they located? How many floors do they have? When were they built? Who was the architect? Do you like them? Stick a picture of them.

14.5.1 My town

EVALUATE. What is the tallest building in your town? Is there any limitation on the height of buildings? Would you like that there were taller structures in your town?

Section VI

Machines and Mechanisms

15 Lesson: Simple machines

15.1 Learning objectives

In this lesson you will learn

- what machines are,
- what simple machines are and how they work,
- the lever law and
- how to describe common objects as simple machines.

15.2 Warm up: what machines make my life easier?

Remember. Name five machines that you - or your family - usually use. What function do they have? List them in order of importance:

15.3 Simple machines

Machines make our life easier. A machine is a tool containing one or more parts that uses energy to perform an action. Machines usually have a combination of several mechanisms. However, some machines only have one mechanism, and they are called *simple machines*.

Machine, inclined plane, wheel, lever, pulley, compound pulley,rope, hoist, wheelbarrow, nutcracker, fishing rod, fulcrum, winch, crane, effort and resistance.

15.3.1 The inclined plane

UNDERSTAND. Have a look at the following picture:

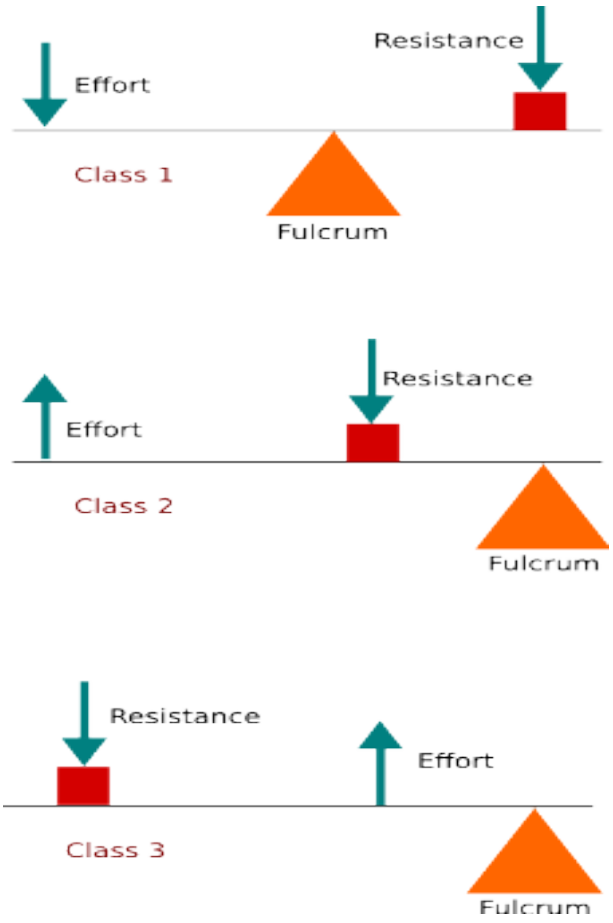
Using an inclined plane requires less effort over a longer distance. A knife, or any blade, can be seen as a simple machine similar to an inclined plane.

ANALIZE. Think of three different applications of the inclined plane.

15.3.2 The lever

UNDERSTAND. A lever is a simple machine with a beam connected to ground by an element called fulcrum, that serves as pivot. Levers are classified by the relative positions of the fulcrum and the effort and the resistance:

- Class 1: The fulcrum is in the middle, the effort is applied on one side of the fulcrum and the resistance on the other side. The effort can be greater or smaller than the resistance, depending on the relative distances to the fulcrum.
- Class 2: The resistance is in the middle, the effort is applied on one side of the resistance and the fulcrum is located on the other side. The effort is always smaller than the resistance.
- Class 3: The effort is in the middle, the resistance is on one side of the effort and the fulcrum is located on the other side. The effort is always greater than the resistance.



Identifying the class of a lever

ANALIZE. Try to guess the class of the following levers, depending on the fulcrum location. Write the name of the simple machine, according to the list: seesaw, bottle opener, wheelbarrow, nutcracker, broom and scissors.

Lever	Name	Class
		
		
		
		
		
		

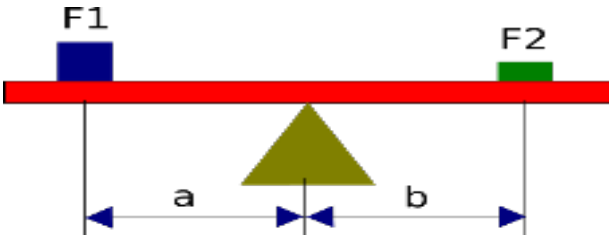
ANALIZE. Could you guess what sort of lever a fishing rod is? Justify your answer by doing a drawing:

The law of the lever

Discovered by *Arquimedes*, the law of the lever can be enunciated as follows: *the ratio of output to input force is given by the ratio of the distances from the fulcrum to the points of application of these forces.*

Mathematically can be expressed as $\frac{F_1}{F_2} = \frac{a}{b}$ or

$$F_1 \times a = F_2 \times b.$$



15.3.3 Activities

APPLY.

1. On a seesaw there is a fat man who weighs 100 kg and a slim man who weighs 25 kg. If the distance from the fulcrum to the fat man is 50 cm, what will be the distance from the fulcrum to the slim man to balance the seesaw? Draw a diagram indicating where the fulcrum is and the relative distances between both men.

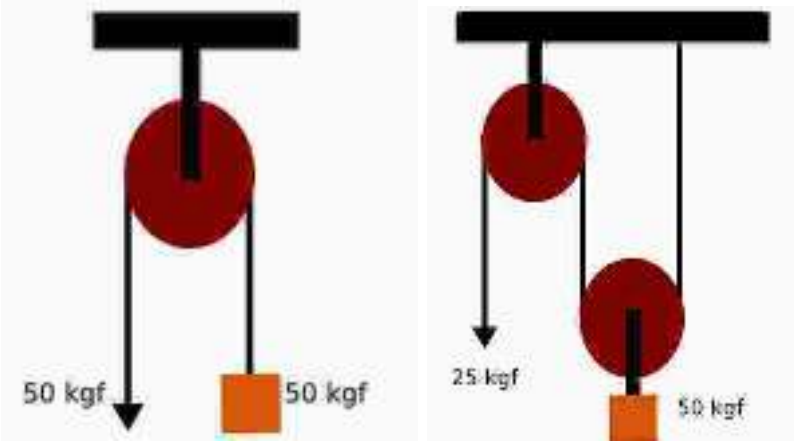
2. John wants to move a 400 lb. rock with a 5 ft. 9 in. crowbar. He puts the fulcrum 9 inches from the rock. How much force must he use to move the rock?

3. In a nutcracker a walnut is placed 5,0 cm from the fulcrum. To crack the nut in that position you must apply a force $f = 120\ N$. What is the force you must apply if the nut is placed 15 cm from the fulcrum?

15.3.4 The pulley

UNDERSTAND. A pulley is a wheel and axle with a rope attached. A pulley changes the direction of motion and work seems easier.

A fixed pulley only changes the direction of the force we have to apply, but it does not reduce the effort we need to raise an object. However, compound pulleys (combination of several pulleys) reduce the effort. We can find this sort of pulleys in lifts.



As we can see, a movable pulley is balanced when the effort F we have to make is half of the resistance R we have to lift: $F = \frac{R}{2}$. However, when using a compound pulley, we have to pull the rope 2 m if we want the resistance to be lifted 1 m up.

ANALIZE. Think of five different devices where a pulley could be found:

Activity

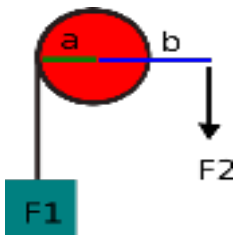
APPLY. What effort do you need to hoist a bucket that weighs 80 kg with a fixed pulley? And with a movable pulley? If the height is 2 m, how much rope should we pull in both cases? Draw both systems.

15.3.5 Winch

UNDERSTAND. A winch is a machine with a handle that can be used to raise things just making a small effort. We can find it, for example, to lift water buckets out of a well. Make a nice drawing of it:

Cranes usually use winches moved by an electric motor.

ANALIZE. Have a look at the following scheme representing a winch. What other simple machine can be used to explain how winches work?



VII

Workshop projects

16 Workshop organisation

16.1 Working groups

The workshop is the place where you have to design and construct your projects, in groups of 3, 4 of 5 people. Your teacher will decide on it. You must get used to working with different classmates, as it happens in the real world, where we cannot choose our colleges.

16.1.1 Notebooks

Each student has an individual project notebook, which is included in this workbook. In addition, the group will also have a team notebook that must be completed by the whole group. This notebook will be handed out by the teacher, and the group will be responsible for its custody.

16.1.2 Lockers

Each group will have a locker to keep its stuff (except the tools). At the beginning of the class, the teacher will hand out the keys. The locker must be locked at the end of the class and the keys must be handed in to the teacher.

16.1.3 Workbench and tool panel

Each group will be assigned a workbench and a tool panel. It is strictly forbidden to take tools from other panels. The group will check that its panel has all the tools before starting the work and after tidying up once the class is over.

16.1.4 Responsibilities

Every team member will have a specific responsibility. However, it is very important that you know that the whole group is responsible for the assigned work.

The specific responsibilities are:

- Secretary: responsible for writing in the group notebook.
- Spoke person: in charge of explaining the group's work to the teacher and to the rest of the class.
- In charge of material: they have to ask the teacher for materials in case you run out of them.
- In charge of the tool panel: they must check that the tool panel is OK, both at the beginning and at the end of the class.
- Health and safety: they have to watch out that everyone in the group is working in a safe way.

16.1.5 Cleaning tasks

Cleaning is an important matter when working in the workshop:

- Throughout the class, the workbench must be a tidy and clean place. If not, the teacher will tell the health and safety responsible.
- Every member of the team must clean and tidy. It is the responsibility of the health and safety responsible to tell the teacher if a team member does not help.
- When the class is over, all the team must keep cleaning before leaving the workshop area until everything is OK.

16.2 Workshop tasks

Workshop classes require to fulfil a strict procedure:

- At the beginning of the class, all the students must sit down in the classroom area.
- The teacher will ask the spoke person to tell the group plans for the class.
- When the teachers says "the class is over", all the members of the group must start cleaning the workspace.
- Once the cleaning is over, everybody must sit in the classroom area, never stand by the door.
- The teacher will check that everything is OK. Then, you will be allowed to come out.

16.2.1 Cleaning procedure

Although cleaning seems to be an easy task, there is a procedure that we have to follow when the class is over:

- We have first to put the tools back on the panel and the rest of the stuff in the locker.
- We check that the bench vice screw is not completely tightened.
- Then, we clean the surface of the workbench.
- After that, we put the stools on the workbench.
- Finally, we sweep the floor and trow the rubbish into the bin.

17 Project: Wooden/paper structure

17.1 Motivation

The objective of this project is to design and construct a **wooden/paper structure** such as a tower, a chair, a picture frame, etc. You can design a scale model of a real structure.

17.2 Specification

1. The structure must fit into the locker.
2. The structure must be rigid, so it cannot be a mechanism.
3. You have to use wood (plywood, strips, etc.), but other materials are allowed.
4. It can have both permanent and fastener joints.

17.3 Examples

Have a look at this example of wooden structure. Do you recognize it?

17.4 My proposal: ideas sheet

Design your **proposal**: drawing, materials, etc.

AUTHOR:		DATE:
SCALE:	PROJECT:	
DRAWING: MY PROPOSAL		SHEET N.
SCHOOL:		

AUTHOR:		DATE:
SCALE:	PROJECT:	
DRAWING: MY PROPOSAL		SHEET N.
SCHOOL:		

17.5 Project evaluation

17.5.1 Picture of the project

17.5.2 Testing the project

Observations about the final product:

17.5.3 Main troubles and solutions

Troubles

Solutions

17.5.4 Improvements

My ideas to improve the project are:

17.5.5 Individual contribution to the project

Indicate the degree of participation of each team member, according to your view:

Member	Completely	Quite	Not too much	Nothing

17.5.6 Other observations

Write a final remark about the project:

18 Project: Electric quiz board

18.1 Motivation

Games are ideal tools to learn and play at the same time. The objective of this project is to design and construct an **electric quiz board game** using the equipment of your technology workshop.

18.2 Specification

1. The **board** must have at least ten questions/answers pairs. Pictures are allowed for both questions and answers.

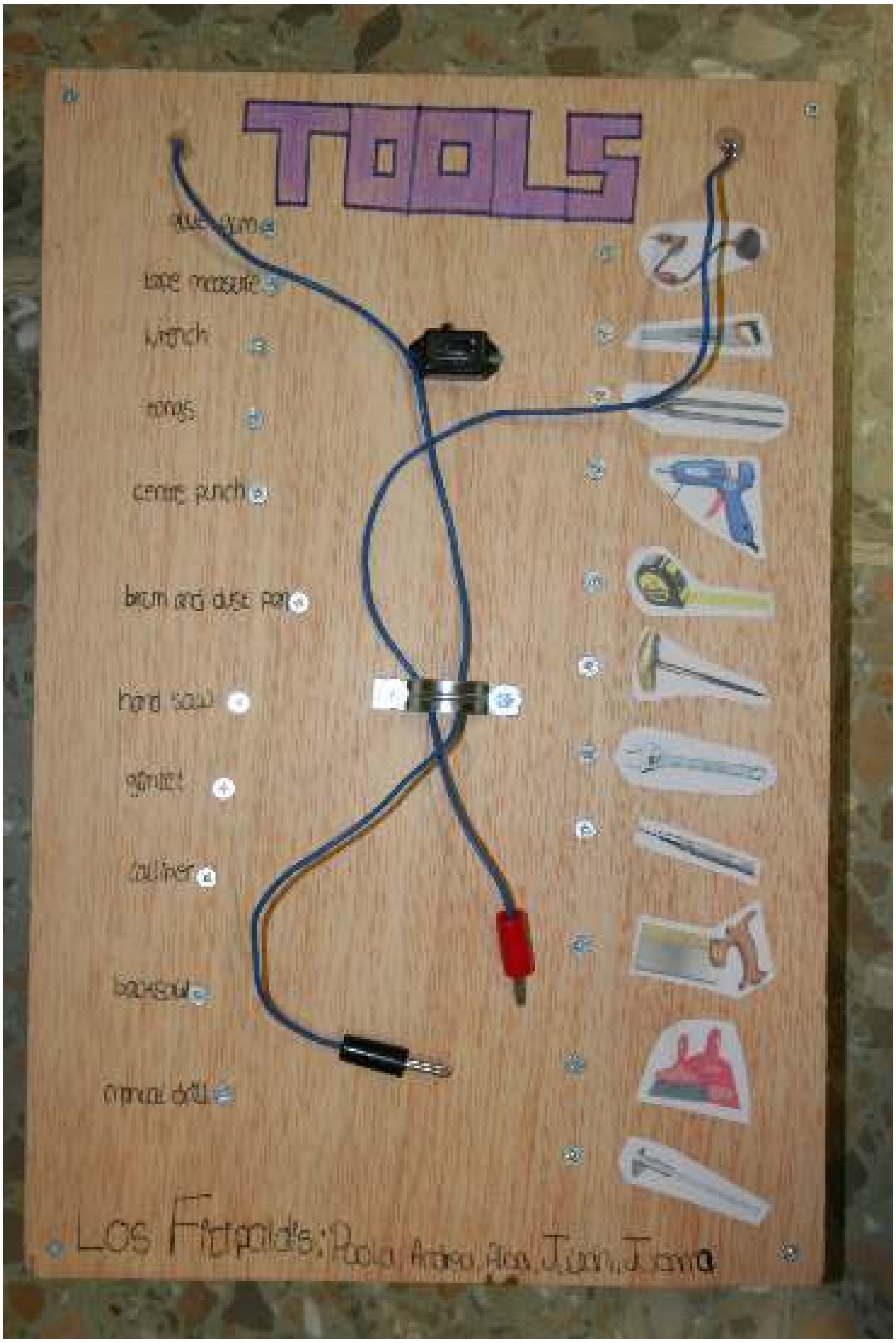
2. To play, we have to match questions to answers. If the matching is right, a **buzzer** will sound.

3. To match questions to answers you have to use a pair of **probes**, made of rigid electric wire.

4. The board must be made of **plywood** (5 *mm* thick). The board may be any shape, but it must fit into the locker. The board must be supported by four legs, which have to be made of **wood strip**.

5. The quiz questions may be related to any topic you like.

18.3 Example


TOOLS
tape measure
wrench
tongs
centre punch
hand saw
calliper
backsaw

18.4 My proposal: ideas sheet

Design your **proposal**: drawing, materials, etc.

AUTHOR:		DATE:
SCALE:	PROJECT:	
DRAWING: MY PROPOSAL		SHEET N.
SCHOOL:		

AUTHOR:		DATE:
SCALE:	PROJECT:	
DRAWING: MY PROPOSAL		SHEET N.
SCHOOL:		

18.5 Project evaluation

18.5.1 Picture of the project

18.5.2 Testing the project

Observations about the final product:

18.5.3 Main troubles and solutions

Troubles

Solutions

18.5.4 Improvements

My ideas to improve the project are:

18.5.5 Individual contribution to the project

Indicate the degree of participation of each team member, according to your view:

Member	Completely	Quite	Not too much	Nothing

18.5.6 Other observations

Write a final remark about the project:

19 Key vocabulary for projects

19.1 Introduction

Although the vocabulary shown in this appendix has been studied in the previous units, you need it to complete the project reports. Translate it into your mother tongue.

19.2 Operations

To chisel off	
To cut	
To draw	
To drill	
To drive	
To fasten	
To finish	
To glue	
To stick	
To heat	
To hit	
To hold	
To join	
To loosen	
To tighten	
To mark	
To paint	

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To punch	
To rivet	
To roll	
To sand	
To saw	
To screw	
To shape	
To smooth	
To strip	
To hoist	

19.3 Materials

Metal	
Aluminium	
Brass	
Copper	
Bronze	
Tin	
Iron	
Stainless steel	
Steel	
Wood	
Chipboard	
Fibreboard	
Hardboard	
Plywood	
Timber	
Plastic	
Flat bar	
Threaded rod	
Strip	

19.4 Components

1. Hardware

Fastener	
Bolt	

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— continued from previous page —

Nut	
Screw	
Washer	

2. Electricity

Battery	
Bulb	
Buzzer	
Cable	
Holder	
Motor	
Resistor	
Switch	
Wire	

3. Mechanisms

Axle	
Belt	
Bevel-gear	
Cam	
Chain	
Cogwheel	
Gear	
Pinion	
(Compound) Pulley	
Rack	
Reduction system	
Wheel	
Worm-gear	

Teacher Feedback

Date	Initial
Classroom work	
Homework	
Content progress	
Language use	
Other comments	

Date	First term
Classroom work	
Homework	
Content progress	
Language use	
Other comments	

Date	Second Term
Classroom work	
Homework	
Content progress	
Language use	
Other comments	

Date	Third term
Classroom work	
Homework	
Content progress	
Language use	
Other comments	

Date	Final
Classroom work	
Homework	
Content progress	
Language use	
Other comments	