

Technology and Digitalisation II ESO is organised into units and projects. The projects bring together content studied in the units.

UNITS

Unit introduction

The opening pages are structured in the following way:

A **list** of the contents and sections in the unit.

The introductory texts have been selected to foster **individual growth** (emotional, social and academic) and to encourage you to respond to the **challenges facing the world today**: the achievement of the Sustainable Development Goals, children's rights, gender equality and digital competence. They'll also help you to develop the personal, academic and professional competences you'll need in the future.

In addition, by going to your **GENiOX Desktop** you can access **Oxford Projects**. You can consolidate your learning with this digital resource, which includes tasks and simulators.

In **Think and discuss**, there are activities that promote reflection on and debate about the contents of the text.

Development

These boxes introduce interesting facts or ask questions based on everyday life, experiments or images. This helps you to deduce what content will be covered in the section.

In the margins, there are **glossary boxes** with definitions of key vocabulary, as well as complementary texts that reinforce or extend the content.

Key content is highlighted.

Activities include **listening** and **speaking tasks**. Activities also cover various **key competences** and all activities cover the STEM and plurilingual competences.

Revision activities

The Revision activities are organised by topic. They include a wide variety of different types of activity that cover the different key competences and all of them cover the STEM and plurilingual competences.

In the **Study skills** section, you'll make a summary of the unit, a concept map and a scientific glossary. You'll be able to use all of these resources to revise the contents of the unit.

Practical skills sections

Technology workshop

Building simple mechanisms

Technological engineering that is built to create a working mechanism that is not a complete one. Current production mechanisms are manufactured by the machines people use in the factories. This workshop will use the technology workshop to create simple mechanisms using materials such as cardboard, paper, wood and nails.

Making pulleys

To make pulleys, you need to use some of the following parts:

- A rope or string
- A wheel
- A pulley
- A support

There are two types of pulley:

- Fixed pulley:** It is used to change the direction of the force.
- Movable pulley:** It is used to reduce the effort needed to lift a load.

The pulley and the pulley wheel

The pulley and the pulley wheel are the two parts of a pulley system.

Keying off

In this case, we use a key to lock the pulley system.

Making gears

Gears make work easier.

- We draw the gear.
- We cut out the gear.
- We use the gear.

Using a pulley

- We draw the pulley.
- We use the pulley.

Working with a computer

Simulating mechanisms

There are computer programs that allow us to experiment with mechanisms. One of them is the virtual **Tablet**. This application simulates the operation of different mechanisms and allows us to see the results of our experiments. In this workshop, we will use the **Tablet** to simulate the operation of different mechanisms and to see the results of our experiments.

With the **Tablet**, we can:

- Simulate the operation of different mechanisms.
- See the results of our experiments.
- Change the parameters of the mechanisms.

Technology workshop

Basic bicycle maintenance

Checking the right side of the chain.

To inspect the right side of the chain, you should:

- Use a screwdriver to adjust the right side of the chain.
- Check the tension of the chain.
- Adjust the tension of the chain.
- Use a screwdriver to adjust the left side of the chain.

Checking the left side of the chain.

To inspect the left side of the chain, you should:

- Use a screwdriver to adjust the left side of the chain.
- Check the tension of the chain.
- Adjust the tension of the chain.
- Use a screwdriver to adjust the right side of the chain.

Adjusting the seat.

As you adjust your seat, you should:

- Place the seat on the seat post.
- Adjust the seat to the correct height.
- Check the seat to the correct height.
- Adjust the seat to the correct height.
- Check the seat to the correct height.

Removing the front wheel.

- Check the front wheel.
- Remove the front wheel.
- Check the front wheel.
- Remove the front wheel.

Reinstalling the front wheel.

- Push the front wheel into the front fork.
- Check the front wheel.
- Adjust the front wheel.
- Check the front wheel.

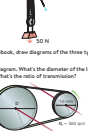
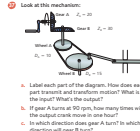
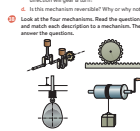

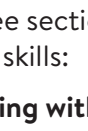
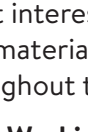
Reinstalling the chain.

- Push the chain into the front derailleur.
- Adjust the chain.
- Check the chain.
- Adjust the chain.

Which parts of my bicycle should I check?

- Before you use your bicycle, always:
- Check your brakes and their operation. This is necessary for your own safety and the safety of others.
- Check your tires and their operation. This is necessary for your own safety and the safety of others.
- Check your lights and their operation. This is necessary for your own safety and the safety of others.
- Check your gears and their operation. This is necessary for your own safety and the safety of others.
- Check your chain and their operation. This is necessary for your own safety and the safety of others.
- Check your tires and their operation. This is necessary for your own safety and the safety of others.
- Check your lights and their operation. This is necessary for your own safety and the safety of others.
- Check your gears and their operation. This is necessary for your own safety and the safety of others.
- Check your chain and their operation. This is necessary for your own safety and the safety of others.
- Check your tires and their operation. This is necessary for your own safety and the safety of others.
- Check your lights and their operation. This is necessary for your own safety and the safety of others.
- Check your gears and their operation. This is necessary for your own safety and the safety of others.
- Check your chain and their operation. This is necessary for your own safety and the safety of others.

Revision activities

- How many force do we need to lift the load in this case? We are applying a force of 30 N. How much weight could lift? 
- Calculate the output speed of the gear train. In which direction do the gears in the train rotate and at what speed? 
- How fast does the gear train rotate? 
- In your notebook, draw diagrams of the three types of levers. 
- Study the diagram. What is the diameter of the large wheel? What is the ratio of transmission? 
- Study the gear train. Calculate the ratio of transmission. 

1. What is the difference between mechanism and lever?

2. What is the difference between mechanism and lever?

3. How do we calculate the ratio of transmission in levers, pulleys and gears?

4. How do we calculate the ratio of transmission in levers, pulleys and gears?

5. How do we calculate the ratio of transmission in levers, pulleys and gears?

6. How do we calculate the ratio of transmission in levers, pulleys and gears?

7. How do we calculate the ratio of transmission in levers, pulleys and gears?

8. How do we calculate the ratio of transmission in levers, pulleys and gears?

9. How do we calculate the ratio of transmission in levers, pulleys and gears?

10. How do we calculate the ratio of transmission in levers, pulleys and gears?

11. How do we calculate the ratio of transmission in levers, pulleys and gears?

12. How do we calculate the ratio of transmission in levers, pulleys and gears?

13. How do we calculate the ratio of transmission in levers, pulleys and gears?

14. How do we calculate the ratio of transmission in levers, pulleys and gears?

15. How do we calculate the ratio of transmission in levers, pulleys and gears?

16. How do we calculate the ratio of transmission in levers, pulleys and gears?

17. How do we calculate the ratio of transmission in levers, pulleys and gears?

18. How do we calculate the ratio of transmission in levers, pulleys and gears?

19. How do we calculate the ratio of transmission in levers, pulleys and gears?

20. How do we calculate the ratio of transmission in levers, pulleys and gears?

There are three sections that help you work on your practical technological skills:

- Working with technology.** In this section, you'll learn about interesting methods and techniques for working with materials and tools, applying what you've learned throughout the unit.
- Working with computers.** In this section, you'll learn how to use information Technology as a tool to explore, analyse, design, model and digitalise technological objects.
- Technology workshop.** In this section, you'll use procedures and activities to analyse technological objects. You'll learn how to define any technological problem and set up problem-solving processes.

Emerging technologies and sustainability

In this section, you'll see how technological and digital developments are giving rise to new concepts and more environmentally-friendly products. These new concepts and products will revolutionise our lives in the coming years.

Emerging technologies and sustainability

Personal transporters

There are many different types of personal transporters. Some of them are electric bicycles, electric scooters, and electric skateboards. These transporters are becoming more popular because they are convenient and easy to use. They also help reduce pollution and save time.

Electric bicycles

Electric bicycles have a battery and a motor. They can be used like a regular bicycle, but they can also be used to travel longer distances without getting tired. They are a good way to reduce pollution and save time.

Electric scooters

Electric scooters are a good way to travel short distances. They are easy to use and can be folded up for easy storage. They are a good way to reduce pollution and save time.

Electric skateboards

Electric skateboards are a good way to travel short distances. They are easy to use and can be folded up for easy storage. They are a good way to reduce pollution and save time.

Table 1: Comparison of different types of personal transporters

Type	Speed	Range	Weight	Price
Electric bicycle	25 km/h	50 km	15 kg	€500
Electric scooter	25 km/h	20 km	10 kg	€200
Electric skateboard	20 km/h	15 km	8 kg	€150

Work on your key competences

Work on your key competences

A bicycle is a compound machine with multiple mechanisms. In this project, you will be able to recognize and identify the components of a bicycle, learn how to use your bicycle and explain the function of each of its parts.

Analysis

1. What are the parts of a bike? What are their functions?

2. Look at your bike and identify the different mechanisms.

3. Classify the mechanisms by type, function and purpose.

4. Look at the picture and match each name to the name of the parts.

Table 2: Classification of bicycle mechanisms

Mechanism	Type	Function	Purpose
Chain	Power	Transmits force from the pedals to the rear wheel	Propulsion
Front derailleur	Shift	Changes the gear ratio	Changing speed
Rear derailleur	Shift	Changes the gear ratio	Changing speed
Pedals	Power	Converts human energy into mechanical energy	Propulsion
Brakes	Control	Slows down or stops the bicycle	Safety
Seat	Support	Supports the rider's weight	Comfort
Handlebars	Control	Controls the direction of the bicycle	Steering
Wheels	Power	Rolls on the ground to move forward	Propulsion

Developed

1. Write a list of all the moving parts of a bike and identify them according to their motion type: linear, rotary or oscillatory. Describe each part in terms of its function and explain how it contributes to the overall operation of the bicycle.

2. Make a presentation showing the mechanisms that make up a bicycle. Follow these steps:

- Divide the parts of the bike into groups: wheels, handlebars, seat, frame, pedals, chain, gears, brakes, and bearings. Use images from the Internet or your own photos.
- Draw a diagram of the bicycle showing the location of each part.
- Label each part of the bicycle and explain its function.
- Describe the motion of each part and explain how it contributes to the overall operation of the bicycle.
- Write a short paragraph about the bicycle and its importance in our lives.

Final Project

1. Read these comparative descriptions of fuel costs and calculate the cost of each type of fuel.

2. Calculate the cost of each type of fuel.

3. Compare the cost of each type of fuel.

The Learning situation in **Work on your key competences** enables you to put the contents you've studied into practice in an integrated manner, as well as allowing you to relate them to the Sustainable Development Goals.

Throughout the unit there are **LS** activities, which are connected to the Learning situation.

On your **GENiOX Desktop** there's a **Task guide**, which includes the self-assessment rubrics.

Projects and the guided project

At the end of the book, you'll find three projects that bring together what you've learned in various units. These paced projects will allow you to use your **creativity** and **imagination** within a **project methodology** framework.

The guided project is designed so that you can apply **project methodology** to the **design and construction of a car**.

PROJECTS

Technology and digitalisation

Do you remember what the purpose of technology is?

- Why are projects an important part of it?
- What stages must we complete when we do a project?

Throughout history, humans have used technology to satisfy their needs, creating objects that make their lives easier. From counting beads to digital resources, the project method plays a vital role in the development of these solutions.

Technology is key to understanding how our digitalised society works. It uses scientific and technical knowledge to meet specific needs. It is crucial to understand how we use technology in a responsible, sustainable manner, understanding its impact on the environment and our health, and promoting equality and respect for others.

Projects like the ones described throughout the book bring all of these elements together. We aim to give you a comprehensive idea of what the foundations for the projects presented here, which are for more ambitious and aim to consolidate the knowledge you've acquired throughout the year. When doing these projects, think about the SDG you've learned about throughout the course, and follow the project method, though you may wish to vary it slightly as necessary.

• Analyse: Idea: Development of the idea: Construction: Checking: Testing

These projects are quite challenging, and they require individual effort as well as good teamwork. For each project, you'll need to apply knowledge you've learned in several different parts of the book. The projects are carefully planned so that we can ensure your progress towards developing key competences.

The three projects are on topics covered in different units of the book:

- **What does disease include** contains content from units 1, 2, 3, 4, and 7.
- **Following in the Footsteps of Leonardo** includes content from units 1, 2, 3, 4, and 8.
- **Smart Traffic Light** includes content from units 1, 2, 3, 4, and 5.

Project

Smart Traffic Light

Design and build a programmable traffic light

PROJECT AIM

The aim of this project is to design and build a programmable traffic light.

Your traffic light must be different from conventional traffic lights with an original design.

It must include a sensor, lights and sounds.

It should have an on-board program and display its operating information on a computer screen.

Optional: It could include some type of artificial intelligence, such as voice activation.

• You can also add a screen that displays traffic and weather information or environmental assessments.

The project must include assembly instructions and a manual describing how the electronic circuit and control program work.

PROJECT STAGES

Research and analysis

- 1 Analyse the traffic of your city.
 - What problem does it cause?
 - How is it controlled?
 - Is it still a real problem today?
 - Is the city designed for cars or pedestrians?
 - Discuss this statement by your group: One way to promote sustainable urban mobility is to improve how bicycles and e-scooters access schools.
- 2 Draw a block diagram or flowchart, showing a traditional traffic light sequence and write a list of components necessary to make a scale model of that traffic light.
- 3 Use a simulation program, such as Tinkercad, to test the electronic system and control program of a traditional traffic light.

Do not forget...

- Use rechargeable batteries or a solar panel to power your control system.
- Use recycled materials and design your traffic light so that you can reuse components in other projects.

In this project, you're going to...

- Design an electronic traffic control system that includes various sensors and actuators.
- Write a control program.
- Build a scale model of the system.
- Present the results to the class.

Don't forget...

- Use rechargeable batteries or a solar panel to power your control system.
- Use recycled materials and design your traffic light so that you can reuse components in other projects.

Individual and collective action

- The circuit will use the traffic light to make awareness of traffic pollution problems.
- The light must be suitable for people with sight and hearing problems.
- Include a sensor for recycling and recycling each component.
- Use sustainable energy sources.

SELF-ASSESSMENT

Go to your **GENDEX** Dashboard and complete this self-assessment table.

Not completed	Light system in the workshop stage	Completed	Proficiently	Progress	Completed
1	2	3	4	5	6
7	8	9	10	11	12
13	14	15	16	17	18
19	20	21	22	23	24

Go to the end of the necessary documentation for the development of this project. The project is about the concrete details of the project: how to build the traffic light.

GUIDED PROJECT

Design and build an automobile

An automobile is a self-propelled vehicle equipped with an internal combustion engine, four wheels and with an electronic system that allows it to be controlled.

Completing this project will help you to:

- 1 Become familiar with the mechanics of transmission and engine transformation that are used in some machines.
- 2 Design and incorporate into your project, control circuits that meet the rotation of a DC electric motor and that is automatically wired to activate.
- 3 Use metals and plastic materials and find out about their physical characteristics, as well as the techniques and processes involved in their transformation.
- 4 Make cardboard and aluminium supports to scale in order to accurately represent the object that is going to be built.
- 5 Analyse the pros and cons of automobile use, particularly the way that it affects the environment.

1. Introducing the task

To design and build a steering-controlled car for the transportation of people.

Features of the task

- The car should be powered by a 4.5V battery and it should be able to move safely and smoothly.
- It should have two main directions (forward and backward).
- It should have a steering system with stub axles that turn in parallel, moved by an electric motor, and which should stop automatically when the wheels reach a predefined limit in terms of the turn radius.
- It should have a wired remote control that will facilitate both controlling the drive direction and the turning of the car.

Improvement proposal (optional)

Install a headlight system, and a light and sound signal system for reversing the vehicle.

Design and incorporate a hub for the constructed vehicle chassis.

Symbols used in your book

Some sections and activities in this book are specifically designed to develop the **key competences** and to **focus** on aspects of your **individual development** and the **challenges of today's world**. The symbols below help you to identify these sections and activities.

Remember that Biology and Geology mainly works on the STEM competence. This means that all of the activities in this book develop that competence, as well as the plurilingual competence.

KEY COMPETENCES

- Linguistic competence
- Plurilingual competence
- Competence in Science, Technology, Engineering and Mathematics (STEM)
- Digital competence
- Personal and social competence and learning to learn
- Civic competence
- Entrepreneurial competence
- Cultural awareness and expression

FOCUS ON

- Children's rights
- Gender equality
- Physical and emotional wellbeing
- Digital competence
- The world of work
- The Sustainable Development Goals

OTHER SYMBOLS

- Learning situation
- Speaking activity
- Group activity and cooperative learning
- STEM task (interdisciplinary activity)
- Downloadable material

The GENiOX Desktop

The **GENiOX Desktop** is a digital space where you can access your **digital book**, as well as a wide range of **resources** in different formats (such as video, HTML and PDF). These will help you with the tasks and processes that are the basis of your learning: observation, analysis, consolidating and expanding your knowledge, study skills and exam revision.

Unit presentation

Oxford Investigation, which works on the contents digitally through tasks, animations and simulators

Animations that help you to visualise processes and mechanisms in a dynamic way

Simulators that allow you to work in a virtual laboratory

► **Experiment video** of the Science practical

Digital revision activities to test your knowledge in an interactive format

PDF Concept maps, dictionary worksheets and scaffolding worksheets

Weblinks to expand your knowledge and find information for research tasks

The Sustainable Development Goals (SDGs)

The UN launched the Sustainable Development Goals (SDGs) in 2015 for its member states to adopt. The SDGs aim to end poverty, reduce inequality and injustice and tackle climate change for everyone in the world.

Go to your **GENiOX Desktop** to learn about the objectives associated with each Sustainable Development Goal.

