# Creating Eco-Friendly Products:

## A Guide for Young Innovators to Drive Sustainability






This publication is a research result from the Erasmus+ sponsored Project Ecomaker - Production of Prototypes with STEAM Content in MakerWorkshops Against Climate Change

Co-funded by the Erasmus+ Programme of the European Union



# For the teachers

This is a pre-structured self-learning concept for environmentally-friendly product creation. It is best suited for students aged 10 to 14.

Teacher qualification and an elective course curriculum can be found on our website.

Students can either first work through the logbook, get to know everything about eco-friendly product creation or they do the design challenge and acquire the necessary information from their logbook as needed.

In the EcoMaker Design Challenge the students are guided through an Eco Sprint with guiding questions originating in the SCAMPER technique adapted to eco-friendly product creation.
The SCAMPER technique is a creative method that helps develop innovative ideas by transforming existing concepts. For teachers, understanding SCAMPER can empower you to guide students in creating solutions for environmental challenges. Here's how SCAMPER works and how you can apply it in this context

## SCAMPER: A Breakdown

SCAMPER is an acronym representing a series of action verbs that prompt creative thinking. Each letter stands for a different way to approach a problem or idea:

1. S- Substitute: What materials, processes, or elements can be replaced with more eco-friendly alternatives? What production techniques can be altered to a more sustainable one?
2. C- Combine: Can different ideas, or processes be merged to create a more sustainable product? For example, combining solar technology with traditional products to reduce energy consumption.
3. A- Adapt: How can existing products or processes be adapted to become more environmentally friendly? For instance, could an old product design be modified to reduce waste or energy use?
4. M- Modify: What small changes or modifications can make a product more sustainable? This could involve altering the product's size, shape, or design to use fewer resources.
5. P- Put to Another Use: Can a product be repurposed or used in a different way to promote sustainability? For example, could waste materials from one product be used to create another?
6. E- Eliminate: What elements of the product can be removed to make it more eco-friendly? Eliminating components that contribute to highly waste but marginally to the core function is one way.
7. R- Reverse or Rearrange: Can the production process or components composition be reordered or reversed? This might involve designing a product with disassembly in mind, making it easier to recycle at the end of its life. to minimize carbon footprint.

## How to assist students in their EcoMaker

Read the logbook and get familiar with the topics.

The goal for the students is to complete a design challenge, in which they transform their conventional product idea into an eco-friendly product. The students find all the information and instruction they need in this logbook.

The self-learning educational material can best be applied in a weekly elective course over a school semester. In the first lesson students get familiar with their Logbook, get together in groups and start to describe their product idea in a base sprint. In the course of the semester the students will work through the ecoMaker Sprint in which the students will move along the products life cycle to improve it. Each chapter in the Logbook aids a certain step in the design sprint. To work through the design sprint may take one or two lessons depending on the students group size and age. In the end of the elective Course the Students will perform the ideas sprint to

In the beginning, you will prepare the design sprint by printing out the design challenge poster on a large scale and lay out sticky noters and pens to work with the poster. These will be needed every lesson. The logbook shall be made available for each student as well, either on their on tablet or printed out and put together by you.

During the design sprints your role is to stand by, let the students discover their potential and gain with the information given in the logbook. Depending on the autonomy of the students in fulfilling the given tasks you can assist by pointing out the goal in each step of the design sprint and animate the students to follow the given structure.

# Logbook

## WELCOME TO YOUR VENTURE TO ECOFRIENDLY PRODUCTS

This is a book for children, age of 10-14 years. You can learn about **sustainability** of the things you buy and or use. And about the things you create yourself. Do you want to learn how to make a product more **eco-friendly**?



### BE THE EcoMaker YOURSELF

You will create your **own ecoProduct** with the ecoMaker Design Challenge. You can do it in groups or alone.



You will find a lot of information on what makes a product eco-friendly.

This is particularly suitable for physical products. To perform it you need a rough idea of your product. If you are still looking for a product idea, maybe you know some similar products that you can improve.

# Content




**CHAPTER 0: YOUR ECOMAKER DESIGN CHALLENGE ..... 1**

1. BASE SPRINT ..... 2

2. ECO SPRINT ..... 2

3. IDEAS SPRINT ..... 5

**CHAPTER 1. THE LIFE CYCLE OF A PRODUCT AND THE ENVIRONMENT ..... 6**

1.1 WHAT IS A PRODUCT AND WHY DO WE HAVE THEM ..... 6

1.2 THE PRODUCT LIFE CYCLE ..... 8

1.3 EVERYTHING GOES ROUND AND ROUND ... THE ENVIRONMENTAL $CO_2$ CIRCLE .....11





**CHAPTER 2. WHAT MAKES A PRODUCT ECO-FRIENDLY? ..... 13**

2.1 EXAMPLE: DESIGNING AN ECO-FRIENDLY BICYCLE .....13

2.2 THE GOLDEN RULES FOR ECO-FRIENDLY MATERIALS, PRODUCTION & TRANSPORT ....15

2.3 WHAT MATERIALS ARE AVAILABLE AND HOW SUSTAINABLE ARE THEY? .....18

2.4 CREATING AN ECO-FRIENDLY PROTOTYPE .....21

2.5 FINALIZING THE PRODUCT & FURTHER CHECKS .....22





**CHAPTER 3. USING A PRODUCT ECO-FRIENDLY ..... 25**

3.1 A VARIETY OF OPTIONS HELP TO ACT SUSTAINABLY .....25





**CHAPTER 4 MAINTAINING AND REPAIRING A PRODUCT ..... 33**

4.1 WHY SHOULD YOU TAKE CARE OF PROLONGING PRODUCTS' LIVES .....33

4.2 VARIOUS OPTIONS EXIST TO DRIVE SUSTAINABILITY IN YOUR DAY-TO-DAY LIFE!: .....35





**CHAPTER 5. REUSE, RECYCLE, RECOVER... ..... 41**

5. 1 THE R STRATEGIES & THE WASTE HIERARCHY .....42

# Chapter 0: Your ecoMaker Design Challenge

Welcome to the ecoMaker Design Challenge – the sprint that will allow you to unlock the hidden eco-potential of your product.

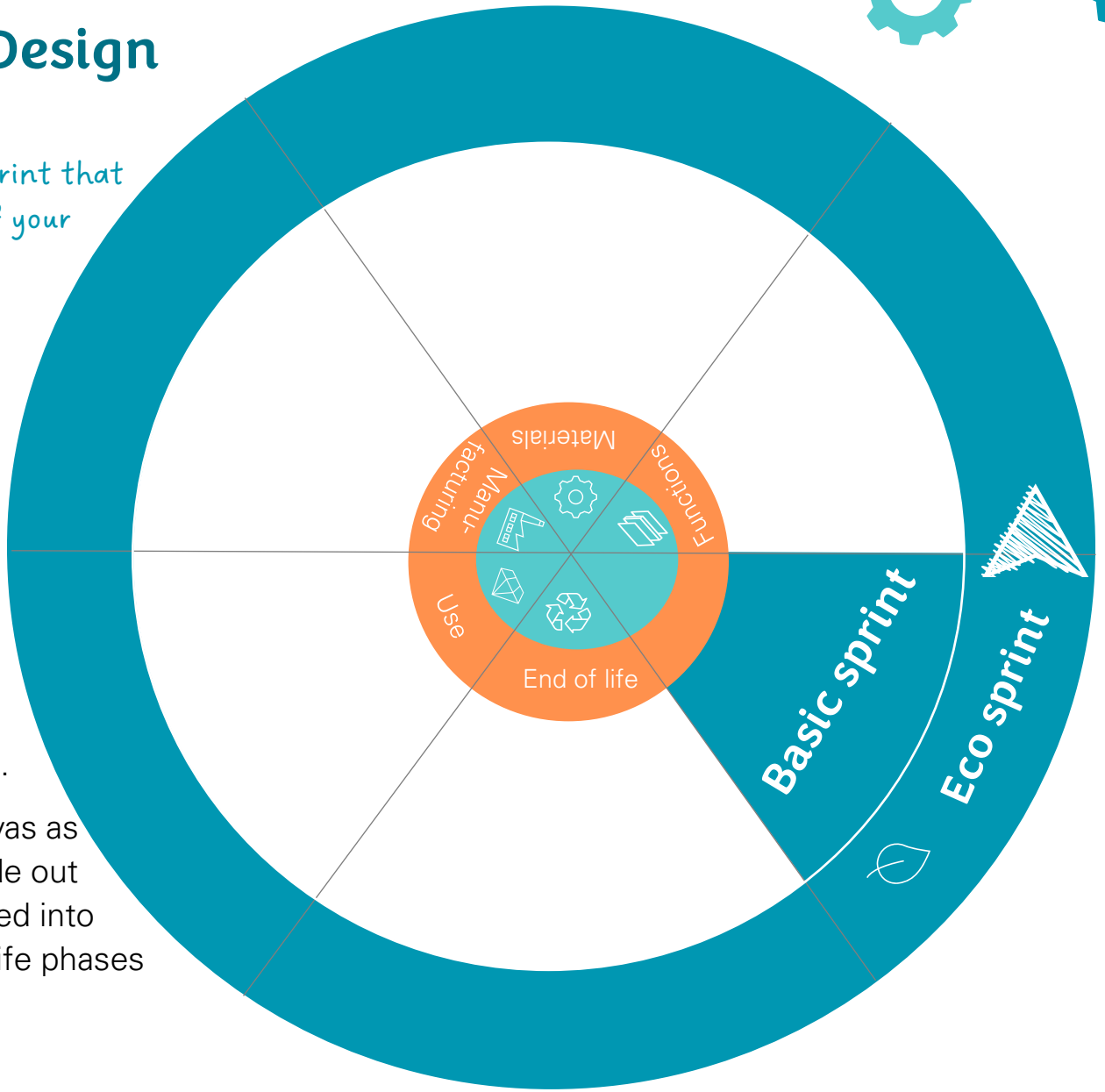
You can perform the ecoMaker Design Challenge independently with the help of your logbook and the free material package

During the ecoMaker Design Sprint you complete three work phases in two hours:

- ▷ 1. Base sprint
- ▷ 2. Eco sprint
- ▷ 3. Ideas sprint

In all three phases you work with the ecoMaker Circle, a poster for labeling and pasting your ideas.

The individual work steps are arranged in the canvas as concentric rings. You work your way from the inside out during the sprint. Each of these rings is also divided into segments that help you see the product in all its life phases (from material harvesting to disposal).



## 1. BASE SPRINT

Material: ecoMaker Design Sprint Canvas + Sticky notes

In the Base sprint you think of your future product and its individual parts and write down all its characteristics on sticky notes. In this way you get an overview of all the spots in your product where untapped eco-potential can be hidden.

Look at each segment in the " Base sprint" ring individually. For all parts, note the manufacturing method, material, function and what will happen to your product during and after use. Stick your notes in the appropriate segment of the Base sprint.

If your product idea is still rather vague, use a common comparable product as a guide. If you can imagine different variants of your product, note the respective characteristics for all variants.

## 2. ECO SPRINT

Material: ecoMaker Design Sprint Canvas + Sticky Notes + EcoMaker Checklist

In the Eco sprint you look for more environmentally friendly alternatives to common solutions and feed your canvas with them in the Eco sprint ring.

Look at each individual note in the "Base sprint" ring one after the other. Take the wheel and go through the questions of the wheel window by window for each note. Start with the material window and work in the direction of the arrow. The window offers you suggestions for possible more environmentally friendly alternatives.

Write down each idea for an alternative and staple it in the Eco sprint ring in the segment above the segment from the Base sprint to which your idea refers. There are no bad ideas, all ideas have to be written down! At this point it is all about mass. You will sort it out later.

# Eco Sprint – EcoMaker Checklist

## 1. Function

**Substitute:** Make sure the products function is unique and cannot be fulfilled by a product you already have.

**Combine**: Integrate multiple functions into a single component to reduce material usage.

**Put to other use:** Think about the products area of application and how this range can be broadened.

**Eliminate**: Remove unnecessary components or features that do not add value or sustainability to the product.

**Reverse:** Redesign the product for ease of disassembly, repair, or recycling.

You will find all the information you need on the optimal material in Chapter 1.

## 2. Materials

**Substitute:** Instead of new materials or components recycle old and functioning ones.

**Adapt**: Choose resources with eco-friendly ones or use less harmful materials.

**Combine:** Try to make the different components out of the same material resource instead of many different materials.

**Eliminate:** Do not add any parts to the product, that are not needed to fulfill the core functions of the product.

You will find all the information you need on the optimal material in Chapter 2.

## 3. Manufacturing

**Substitute**: Replace non detachable joints where possible.

**Adapt**: Adjust processes to reduce waste or energy consumption, or to utilize by-products as inputs for other processes.

**Modify**: Change the manufacturing process to another to minimize waste or pollutants.

**Eliminate**: Avoid steps that do not contribute to product quality or sustainability.

**Reverse:** Remember that your product has to be disassembled for repair and recycling. Add helpful labels and instructions to the product.

You will find all the information you need on the optimal material in Chapter 3.



### 4. Use and Maintenance

**Adapt**: Find ways to make the product easy to adjust for different users or implementations.

**Modify**: Make the product more energy-efficient, durable, easy to maintain.

**Put to another use**: Design the product so it can serve multiple purposes over its lifespan, reducing the need for additional products.

You will find all the information you need on the optimal material in Chapter 4.



### 5. End-of-Life

**Substitute**: Use biodegradable or recyclable materials that can easily be reintegrated into the ecological cycle.

**Adapt:** Make sure the best R strategy possible can be implemented at the products end of life.

**Reverse**: Design for reverse construction and dismantling, where the product or its components can be easily returned and recycled.

**Eliminate**: Remove components that are difficult to recycle or have no end-of-life value.

You will find all the information you need on the optimal material in Chapter 5.

## 3. IDEAS SPRINT

Material: ecoMaker Design Sprint Canvas + ecoMaker logbook

In the Ideas sprint you filter out those environmentally friendly alternatives that suit you and your product.

At the end of this last phase, you will know how to turn your product into an eco-product. You can use the logbook again to find out, from all the eco-friendly ideas, which one is the best.

Think about, which eco-friendly idea you can realize at your maker space´.
Do you have access to all the materials and find the necessary partners to help you in production?
How much will it cost to manufacture your product? Maybe you find answers in the internet, with your teacher or with the staff of your workshop or maker space.

Afterwards you compare your sticky notes from the Eco sprint ring with your requirements and thus you can gradually remove the inappropriate ideas from the poster.

# Chapter 1. The Life Cycle of a product and the Environment

"I WANT TO HAVE IT!" Products fulfill a variety of desires - just imagine Christmas season or your birthday. But what kind of products overall exist?




## 1.1 WHAT IS A PRODUCT AND WHY DO WE HAVE THEM



A product is anything that is made and sold to meet people's **needs or wants.** It can be something you can touch, like a toy, food, or clothes, or something you use, like an app or entertainment.





They are essential for meeting our **basic needs**, which are crucial for our survival, such as:

- **FOOD**
- **WATER**
- **CLOTHING**
- **SHELTER**

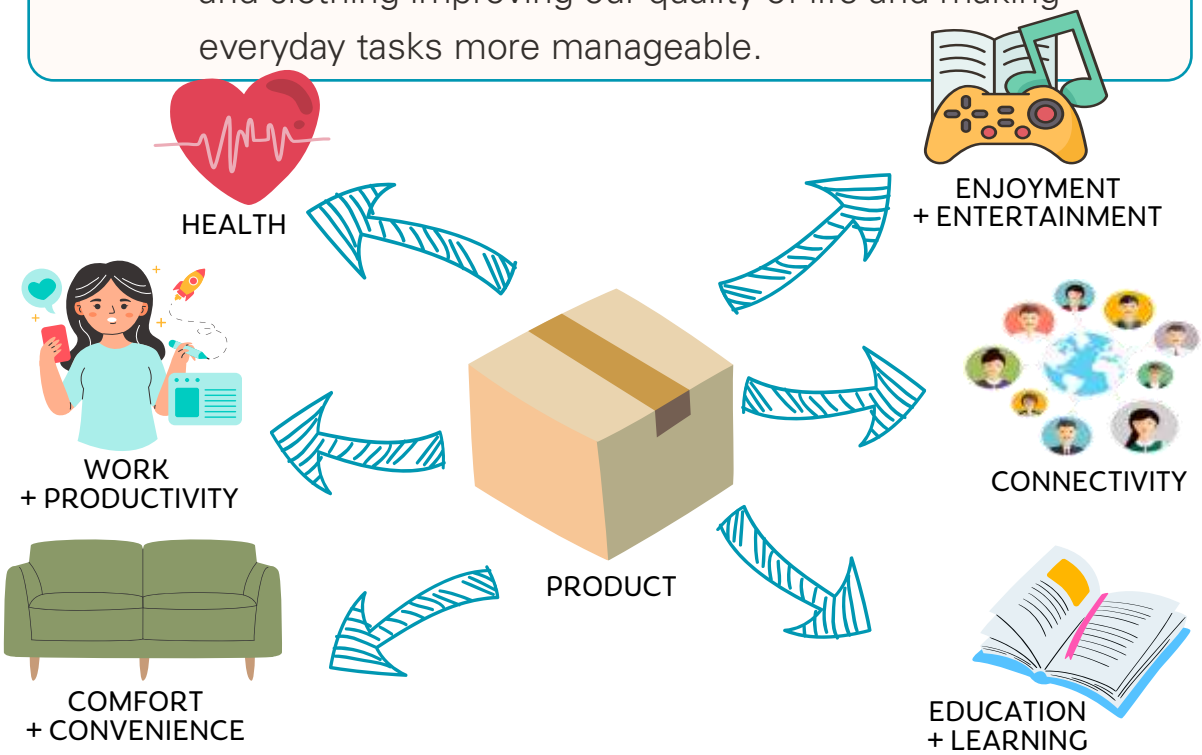
Additionally, products **make life easier** by simplifying and speeding up tasks; for example, washing machines clean clothes more efficiently than washing by hand, and smartphones allow us to communicate and access information quickly.



**DEEP DIVE**

## VARIOUS PRODUCTS SERVE DIFFERENT NEEDS

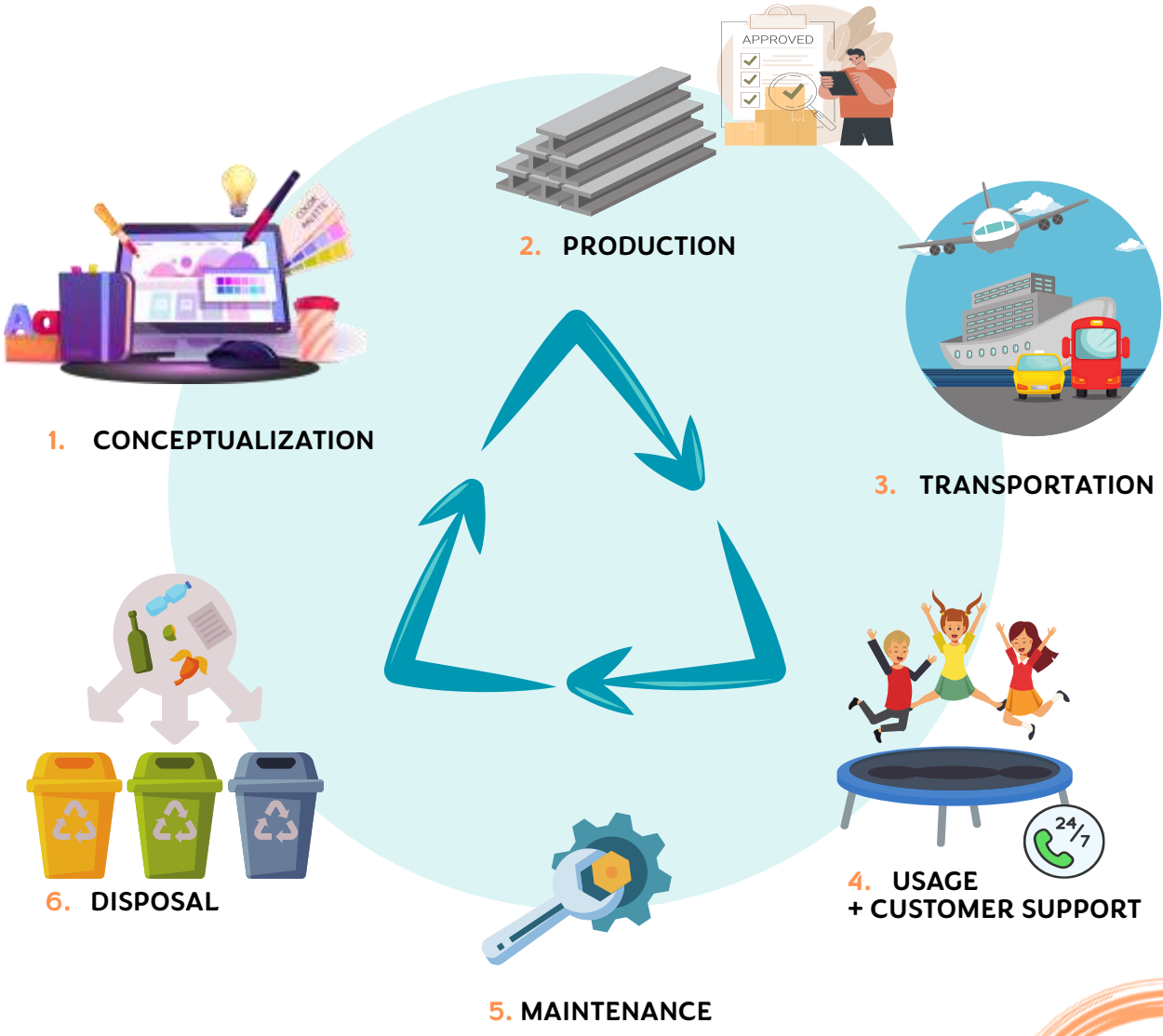
- Products also provide **enjoyment and entertainment**, offering a way to relax and have fun through toys, games, books, movies, and music.
- They contribute to our **health and well-being**, with items like medicines, exercise equipment, and healthy foods helping us maintain a healthy lifestyle.
- **Education and learning** are also greatly enhanced by products like books, computers, and educational apps, which are essential tools for students and lifelong learners.
- Furthermore, products let us **stay connected** with others through phones, email services, and social media platforms, making it easier to share information.
- In the realm of **work and productivity**, products such as office supplies, software, and machinery help people perform jobs more easily.
- Finally, products provide **comfort and convenience** in our daily lives, with items like furniture, household appliances, and clothing improving our quality of life and making everyday tasks more manageable.



## 1.2 THE PRODUCT LIFE CYCLE

### Not only humans go through different phases in life – The rollercoaster ride of a product

When we say that a product has a **life cycle**, we mean that it goes through a series of stages from its creation to its eventual decline and discontinuation. Just like living beings, products have a beginning, a period of growth and maturity, and an end.



## 1. CONCEPTUALIZATION



This initial stage involves conceptualizing the product, designing its features, and developing **prototypes**. Engineers and designers work on specifications, ensuring the product meets the required standards and functionalities. Once the **design** is finalized, the product moves into production.

## 2. PRODUCTION




This stage includes **sourcing** materials, setting up **manufacturing** processes, and ensuring **quality control**. The goal is to produce the product efficiently while maintaining quality.

The environmental impact during production includes the energy used in manufacturing, emissions, waste generation, and the use of hazardous substances. Companies are encouraged to adopt eco-friendly practices, such as using renewable energy and reducing waste.

## 3. TRANSPORTATION

Products are transported all over the world to the user. Vehicles, Ships, airplanes and extra packaging have to be used.



A lot of products need energy to function. But some products need less **energy** than others. That is because they were smartly designed to function properly with less energy. For example, different cars need a different amount of fuel to drive the same distance. Other products need **resources** like water, oil or soap to function.

## 4. USAGE AND CUSTOMER SUPPORT




After manufacturing, the product is used by consumers. During this stage, **technical support and maintenance** are crucial. This includes troubleshooting, updates, and repairs to keep the product functioning properly.

## 5. MAINTENANCE



Over time, the product may require maintenance to **fix** issues or extend its functionality. **Upgrades** might also be developed to improve performance or add new features. This stage ensures the product remains useful and competitive in the market.

## 6. DISPOSAL

At the end of the product's useful life, the focus shifts to its disposal. The life cycle concludes when the product can no longer be maintained or upgraded effectively. This might be due to obsolescence, lack of support, or technical failures. At this point, the product can be **recycled**, some components can be **used again** or the product can be **used for something else**. Like when you use an old yoghurt cup as a planting pot.






**WHAT YOU NEED**

- 1x old yoghurt cup
- Potting soil
- Seeds of your choice

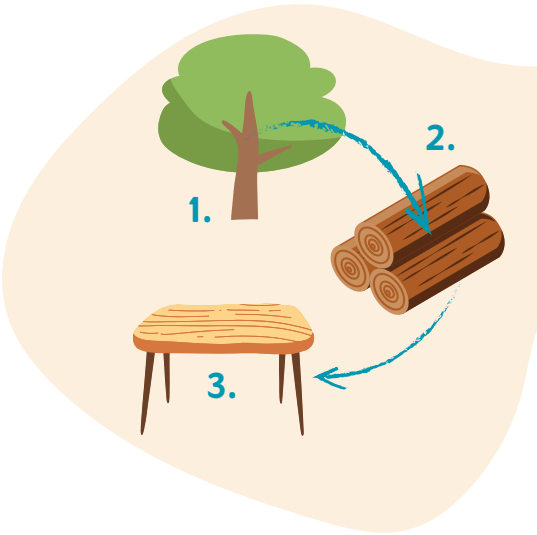
1. Clean the yoghurt cup
2. You can decorate or paint it if you want
3. Put some potting soil in the cup
4. Plant your seed
5. Keep watering regularly

➔ and just like that you have a new decoration & extended a product's life!

## 1.3 EVERYTHING GOES ROUND AND ROUND ... THE ENVIRONMENTAL $CO_2$ CIRCLE

*Have you ever wondered what happens to the environment when products are produced or what effect it might have when they are thrown away?*

When we interact with a product, we interact with nature. We take materials like wood or steel from the earth to build them, We release substances like $CO_2$ or dirt into the air and the water when we use or dispose products.




Eco-friendly means that something is good for the environment, or at least does not harm it. When we say a product, practice, or behavior is eco-friendly, we mean that it is designed to reduce harm to our planet and conserve natural resources.

**Eco-friendly** = anything created to reduce harm to nature and protect natural resources





# TASK

1. Which of the following statements are true about products? *(Select all that apply)*

   - ☐ A) Products are only things you can touch.
   - ☐ B) Products are essential for meeting our basic needs like water
   - ☐ C) Products help us stay connected and entertained.

2. How many stages does a product's journey commonly have?

   - ☐ A) 5
   - ☐ B) 4
   - ☐ C) 6

3. What does it mean when something is described as "eco-friendly"? *(Select all that apply)*

   - ☐ A) It is designed to protect natural resources
   - ☐ B) It minimizes environmental impact
   - ☐ C) It is harmful to wildlife

# Chapter 2. What makes a product eco-friendly?

Now you heard a lot about what products are and what happens within their life. You also heard that certain decision about their design has an impact on the environment. But how exactly is a product eco-friendly made?

*If you were asked to create a product, while considering sustainability - how would you start?*

## 2.1 EXAMPLE: DESIGNING AN ECO-FRIENDLY BICYCLE

Let's explore the life cycle of a bicycle and find out some impacts on the environment a decision of the creators and consumers can have.



Imagine you want to make the best bicycle ever!

The **design and development phase** is like the part where you plan, draw, and build a new bike before anyone else gets to ride it. Here's how it works:



## 1 Coming Up with Ideas



First, you think about **what kind** of bike you want to make.

Maybe it's a fast bike for racing, a sturdy one for mountain trails, or a comfy one for riding around the neighborhood.

You also think about **what people might want** in a bike and what other bikes are out there. From the start, you can think about making the bike environmentally friendly.

For example, you might plan to use parts that can be repaired easily without the help of technicians or create a design that uses less energy to produce. First, you think about **what kind** of bike you want to make.

## 2 Choosing Materials



Next, you decide what your bike will be made of.

➔ Pick **materials** that are good for the environment.

For instance, **recycled aluminum** or **steel** can be reused as well, and **bamboo** is a renewable resource. Carbon Fiber cannot be repaired, but is very strong.

Avoid materials that might harm the environment, like certain paints or chemicals that can pollute water or air. Spraying paint releases more chemicals into the environment than paint brush, but be careful to dispose paints the right way at your local recycling station.



Using eco-friendly materials helps take care of the Earth by saving resources, reducing waste, and protecting nature. There are some rules you can remember about eco-friendly materials:

## 2.2 THE GOLDEN RULES FOR ECO-FRIENDLY MATERIALS, PRODUCTION & TRANSPORT

### 1. Renewable



- **What it Means:** A renewable material comes from resources that can grow back or be replaced naturally, like trees or plants.
- **Why it's Good:** Using renewable materials means we won't run out of them, and they help keep nature balanced.

### 2. Recyclable



- **What it Means:** Recyclable materials can be used again after we're done with them. We can turn them into something new instead of throwing them away.
- **Why it's Good:** Recycling helps save resources and keeps trash out of landfills, making the Earth cleaner.

### 3. Biodegradable and Compostable

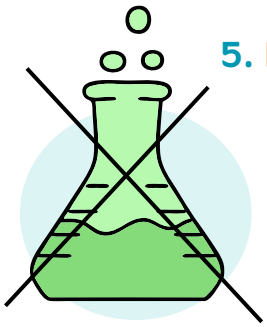


- **What it Means:** These materials break down naturally in the environment and turn into harmless stuff that plants and animals can use.
- **Why it's Good:** Biodegradable and compostable materials don't stay as trash for a long time, so they help reduce pollution.



### 4. Low Environmental Impact During Production

- **What it Means:** It takes less energy and water to make these materials, and they don't release harmful gases or chemicals.
- **Why it's Good:** Using less energy and water helps save the planet's resources and keeps the air and water clean.



### 5. Minimal Use of Toxic Chemicals

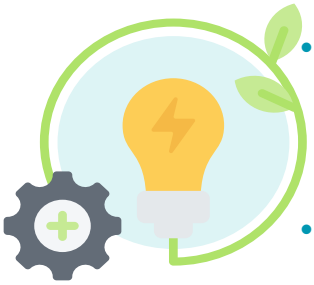
- **What it Means:** These materials are made without harmful chemicals that can hurt plants, animals, or people.
- **Why it's Good:** Using safe materials protects all living things and keeps the environment healthy.

### 6. Durability and Longevity



- **What it Means:** Durable materials are strong and last a long time, so we don't need to replace them often.
- **Why it's Good:** When things last longer, we use fewer resources and create less waste.

### 7. Energy Efficiency in Production and Use



- **What it Means:** It takes less energy to make or use these materials, which means less fuel is burned and less pollution is created.
- **Why it's Good:** Saving energy helps reduce pollution and conserves natural resources.

### 8. Ethical and Sustainable Sourcing



- **What it Means:** Materials are gathered in ways that are fair to people and kind to nature.

- **Why it's Good:** This means no one gets hurt, and the environment stays safe when we get the materials we need.




### 9. Low Transportation Footprint

- **What it Means:** These materials don't have to travel far from where they're made to where they're used.
- **Why it's Good:** Using local materials saves fuel and reduces pollution, helping keep the air clean.

## CHECK list

#1 Renewable? ☐

#2 Recyclable? ☐

#3 Biodegradable and Compostable? ☐

#4 Low Environmental Impact during Production? ☐

#5 Minimal Use of Toxic Chemicals? ☐

#6 Durable? ☐

#7 Energy-efficient Production + Use? ☐

#8 Ethical and Sustainable Sourcing? ☐

#9 Low Transportation Footprint? ☐

## 2.3 WHAT MATERIALS ARE AVAILABLE AND HOW SUSTAINABLE ARE THEY?

Which materials come first to your mind when you want to create your new bike? Let's find out, which options exist by having a look at this GUIDE!

### Aluminum




- Lightweight and recyclable, aluminum has a relatively low environmental impact if recycled.
- However, its extraction process is energy-intensive and can cause environmental damage

### Steel

- Highly recyclable and durable, steel is an eco-friendly option if recycled properly.
- However, producing steel from raw materials is energy-intensive and has a high carbon footprint.

### Glass

- Recyclable and made from abundant materials like sand.
- Its production is energy-intensive, but it can be recycled indefinitely without losing quality.

### Wood

- A renewable resource when sourced from sustainably managed forests.
- However, deforestation for wood production can lead to significant environmental issues.

### Cotton

- A natural, renewable resource, but traditional cotton farming uses significant water and pesticides. *Organic cotton* is a more sustainable choice.




**Leather**

- Durable and long-lasting, but its production involves animal farming and chemical tanning processes, which have environmental and ethical concerns.

**Plastic** (various types, including Polyethylene and Polypropylene)

- Widely used due to versatility and low cost, but most plastics are derived from petroleum and have significant environmental impacts if not recycled.
- *Biodegradable* and *bioplastics* are more sustainable alternatives.

**PLA** (= Polylactic Acid)

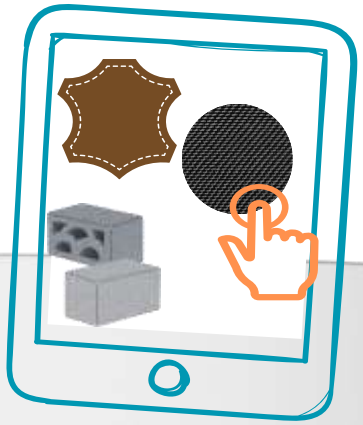
- A biodegradable plastic made from renewable resources like corn starch or sugarcane.
- It has a lower environmental impact compared to petroleum-based plastics.

**ABS** (= Acrylonitrile Butadiene Styrene)

- Durable and impact-resistant but made from petroleum.
- It is not biodegradable, and recycling is more challenging compared to other materials

**PETG** (= Polyethylene Terephthalate Glycol)

- Recyclable and relatively easy to print with.
- It has a lower environmental impact than ABS but is still derived from petroleum.



**Nylon** (Polyamide)

- Strong and versatile but derived from petrochemicals.
- Recycling options exist, but they are less widespread compared to other materials.

**Resins** (Photopolymer)

- Used in SLA (stereolithography) 3D printing, resins offer high detail but are typically toxic and not biodegradable.
- Disposal must be handled carefully to avoid environmental

**TPU** (=Thermoplastic Polyurethane)

- A flexible and durable material, but it is not biodegradable.
- Recycling options are limited, making it less sustainable harm.

**Metal Powders** (various types like Titanium, Aluminum, Stainless Steel)

- Used in metal 3D printing, these materials are recyclable and can produce strong, durable parts.
- However, the energy required for production is high, and the sourcing of metals can have environmental impacts.

**Carbon Fiber Reinforced Polymers**

- Strong and lightweight, often used for high-performance applications.
- While the base polymers may not be sustainable, the long lifespan and recyclability of carbon fibers improve its sustainability profile.

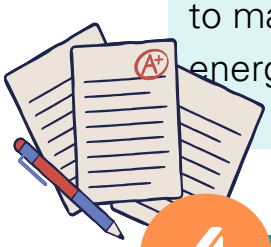
## 2.4 CREATING AN ECO-FRIENDLY PROTOTYPE



### 3 Building a Sample Bike (Prototype)

After that, you make a sample bike, which is like a practice version. You **test** it to see if it rides well, is comfortable, and strong enough. If it doesn't work perfectly, you make **changes** and try again until it's just right.

The better you plan your concept the less prototype you will have to make, to find the best bike. That will safe you time and also energy and resources, when building sample bike.





### 4 Designing the Details

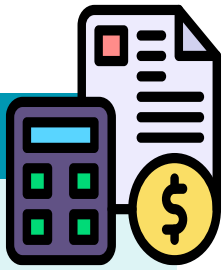
Now, you get into the **details**, like how big the bike will be, what the handlebars and seat will look like, and what kind of tires and gears to use.

You also pick the bike's **color and designs**, making sure it looks cool and **appealing**. The more you and others really like the bike, the longer it will be used and cared for. Design the bike with strong and **high-quality** parts and joints to **last a long time**, so people don't need to buy new bikes often. This helps reduce waste.

Your product like the bicycle is made up of several parts, like the handlebar, the seat or the breaks. Everything is connected by joints like screws.

If the **connections** are very complicated and can only be open with very special tools or if the connections cannot be opened, like parts glued together, this makes it hard to repair a product like the bicycle.

## 2.5 FINALIZING THE PRODUCT & FURTHER CHECKS



### 5 Checking the Costs

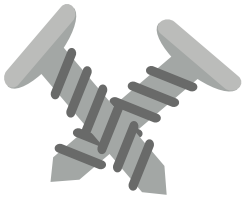
You figure out how much it will **cost** to make the bike, **including all the materials and parts**. This helps you decide how much to sell the bike for, so it's a good deal for you and the people who want to buy it.

A bike that lasts longer and is made from recycled materials might be better for the environment even if it's a bit more expensive. But instead of buying a cheap bike that doesn't last long and cannot be repaired, and than buying another bike, you will only have to buy one ecofriendly bicycle. Over all not so expensive.

## KEY TIPS TO BECOME A GREAT EcoMaker

Let's make it simple to understand how to design products that are easy to fix and recycle.

- **Use Easy-to-Undo Connections**

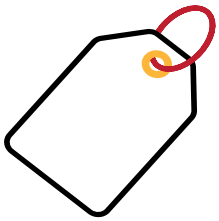


  - **Use Screws or Clips:** Instead of using glue, which can be super sticky and hard to undo, use screws or clips that you can easily remove.
  - **Keep Fasteners Simple:** Don't use too many different types of screws or clips. Just a few kinds are enough!



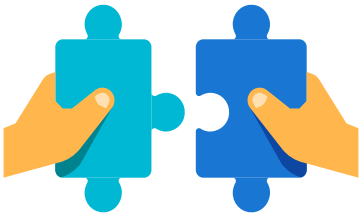

- **Avoid Super Glue**
  - **Avoid Sticky Stuff:** Try not to use glue that won't come off. If you need to use glue, use the kind that you can so ften or wash away.

- **Label Parts Clearly**



  - **Mark the Parts:** Like labeling your school supplies, label parts so you know what they are and how to take them apart.
  - **Give Instructions:** It's like having a map or a guide that shows you how to fix or take things apart.

- **Make it Easy to Take Apart**



  - **Layer the Parts:** Think of it like a sandwich. You can take out the lettuce without messing up the bread and cheese.
  - **Simple Assembly:** Don't make things too complicated! Easy is better.



- **Easy to Open and Fix**
  - **User-Friendly:** Make it easy to open things up and replace parts without needing special tools.
  - **Simple Tools:** If tools are needed, make sure they're ones people commonly have, like a screwdriver.



By following these ideas, we can make products that are easy to fix if they break and easy to recycle when we're done with them. This helps take care of our planet!



# TASK

4. What is one way to make a bike eco-friendlier during the design phase?

- ☐ A) Use as much glue as possible to hold parts together
- ☐ B) Choose materials that cannot be recycled
- ☐ C) Use screws or clips
- ☐ D) Make the bike out of non-renewable resources

5. Why is it important to choose recyclable materials when making a product?

- ☐ A) Recyclable materials are cheaper
- ☐ B) Recyclable materials can be turned into something new instead of being thrown away
- ☐ C) Recyclable materials always make the product last longer

6. What is a benefit of using renewable materials?

- ☐ A) They make the product stronger
- ☐ B) They help keep nature balanced because they can grow back or be replaced
- ☐ C) They are more difficult to source

# Chapter 3. Using a product eco-friendly

So, now you know how to create a product sustainably - but do you know yet how to act sustainably yourself in your daily life?

In today's world, being mindful of how we use products is crucial for protecting our environment. The way we **operate, maintain**, and eventually **dispose** of products can have a significant impact on the planet.

This chapter explores how products can be designed to encourage sustainable use, helping us reduce waste, save energy, and conserve natural resources.

## 3.1 A VARIETY OF OPTIONS HELP TO ACT SUSTAINABLY



### Eco-Mode Settings - enable energy-efficiency fast and easy

Many modern appliances and devices come equipped with special settings designed to save energy and water. These are often called "**eco-modes**" or "**energy-saving modes**."

For example, washing machines and dishwashers often have cycles that use less water and operate at lower temperatures, which saves energy.

By simply choosing these eco-friendly options, users can significantly reduce their utility bills and their environmental footprint.





## User Education and Information - guiding to a sustainable future

It's not always obvious how to use a product in the most eco-friendly way.

That's why manufacturers often provide detailed instructions and tips in **user manuals** or on product **packaging**.

These guides can include simple advice like washing clothes in cold water, which uses less energy than hot water, or turning off electronics when they're not in use. Some products even come with **digital guides or mobile apps** that offer tips and reminders to help users make sustainable choices.

## Feedback Systems - live-data for green awareness



Some products are designed to give feedback to users about their energy or water consumption.

For instance, a **smart thermostat** might display how much energy is being used to heat or cool a home. By showing users their consumption in real-time, these systems encourage more mindful and efficient use.

Additionally, some devices provide **reports** or insights on how to optimize their settings, helping users to further reduce their environmental impact.

## Incentivizing Sustainable Practices

To make eco-friendly choices more appealing, some companies offer **rewards** or incentives.

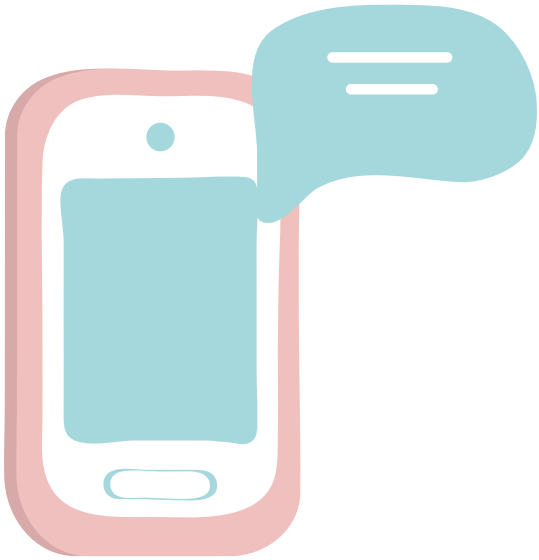
For example, there might be **rebates** for using certain energy-saving settings or participating in a product recycling program.




Additionally, some communities or companies run challenges that encourage participants to reduce their energy use or increase their recycling, often with **prizes** or recognition for those who do well.

## Behavioral Nudges

Products can also be designed to nudge users toward sustainable behavior without requiring much effort.



For example, lights can be designed to **automatically dim** when a room is empty, or devices can switch to power-saving mode when not in use.

These small adjustments can lead to big energy savings over time. **Notifications** and alerts can also remind users to perform regular maintenance, like cleaning filters, which helps products run more efficiently.

## Product Design Features

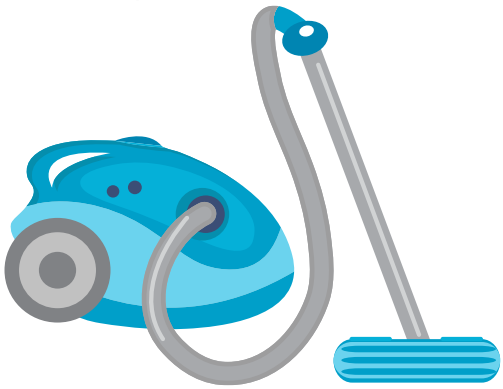


To make it clear when a product is being used sustainably, some designs include eco-indicators—like a green light or icon that appears when a product is in eco-mode.

Additionally, some products have interactive interfaces or apps that guide users through **eco-friendly settings** and options, making it easy to make the right choices.

## Supporting Sustainable Behavior

A key aspect of encouraging sustainable use is maki ng it easy for people to maintain and repair products. Products that are easy to take apart and fix are less likely to be thrown away when something breaks.



For instance, a vacuum cleaner with a replaceable filter and clear instructions for how to change it can stay in use for much longer.

Some products are designed with **upgradable** parts, allowing users to update their devices to keep them efficient and functional.



## Promotion of Sustainable Practices

Marketing plays a crucial role in encouraging sustainable use. When companies highlight the eco-friendly features of their products, it not only attracts environmentally conscious customers but also educates others about the benefits of making sustainable choices.

**Collaborations** with environmental organizations can further enhance this message, lending credibility and spreading awareness.



## BUT HOW CAN I MAKE A CHANGE OR ENCOURAGE OTHERS?

Here are some short **illustrative examples** to help clarify how products can encourage sustainable use.

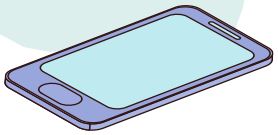


### ECO-MODE SETTINGS

Example: A dishwasher with an "Eco" button that, when pressed, uses less water and energy by washing dishes at a lower temperature. This mode is perfect for lightly soiled dishes, reducing both water and energy consumption.

### USER EDUCATION & INFORMATION

Example: A smartphone app for an electric car that provides tips on extending battery life, such as using regenerative braking and maintaining a steady speed. The app also shows charging station locations, encouraging efficient trip planning.



### FEEDBACK SYSTEMS

Example: A smart thermostat displays real-time energy use and compares it to previous weeks. It suggests lowering the heating by 1°C, showing potential savings in both cost and energy.

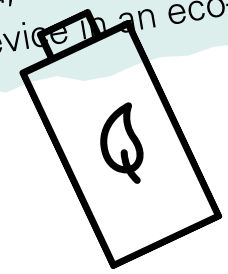
### INCENTIVIZING SUSTAINABLE BEHAVIOR

Example: A utility company offers discounts on energy bills for customers who enroll in a green energy program. By choosing renewable energy sources like wind or solar, customers reduce their carbon footprint.



### PRODUCT DESIGN FEATURES

Example: A laptop with a power-saving indicator that lights up when the screen brightness is lowered and the power-saving mode is activated, reminding users that they are using the device in an eco-friendly way.



### BEHAVIOURAL NUDGES

Example: A refrigerator that beeps and lights up when the door is left open for too long, reminding users to close it quickly and conserve energy




### PROMOTION OF SUSTAINABLE PRACTICES

Example: A clothing brand markets its jackets made from recycled materials, highlighting the environmental benefits and durability. The brand partners with environmental groups to plant a tree for every jacket sold

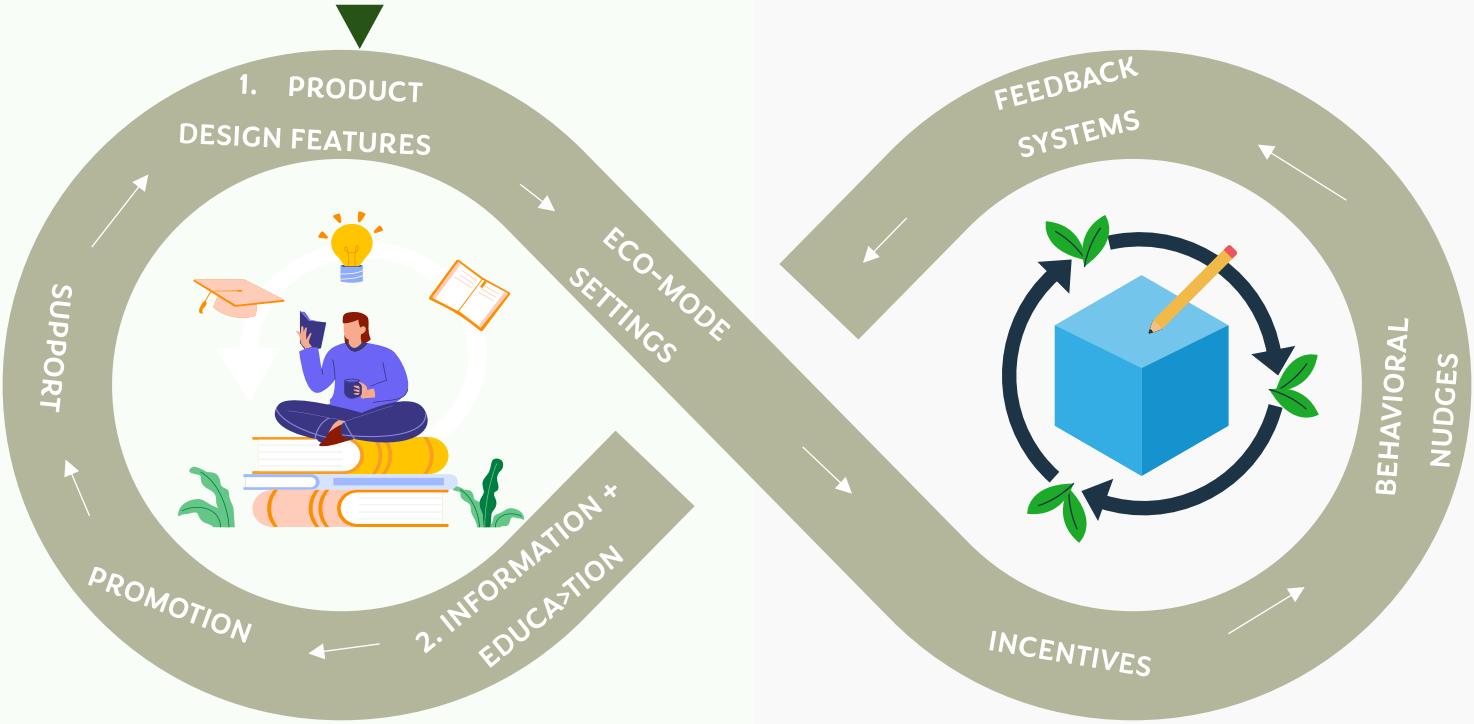




### SUPPORTING SUSTAINABLE BEHAVIOR

Example: A vacuum cleaner designed with easy-to-replace parts, such as filters and brushes. The manufacturer provides online tutorials for simple repairs, encouraging users to fix rather than discard the product.

1st loop: What a sustainable product brings itself ("Internal product characteristics")




2nd loop: What others do to help driving sustainability ("External support")

# TASK

7. What is the main advantage of using the "Eco-mode" settings on dishwashers or washing machines ?

- ☐ A) It reduces the cleaning time
- ☐ B) It uses less water and energy
- ☐ C) It enhances the cleaning power

8. How do feedback systems in smart products like thermostats encourage eco-friendly behavior?

- ☐ A) They give suggestions on more efficient settings
- ☐ B) They allow users to control the device remotely
- ☐ C)They send alerts when it is time for maintenance

# Chapter 4 Maintaining and repairing a product



As we have already learned, a product has a life cycle. However, it does not always follow the same path. We can choose options that products live longer – Can you think of ways?

## 4.1 WHY SHOULD YOU TAKE CARE OF PROLONGING PRODUCTS' LIVES

Maintaining products is very important because it helps them:

- last longer,
- work better,
- stay safe,
- and save money.



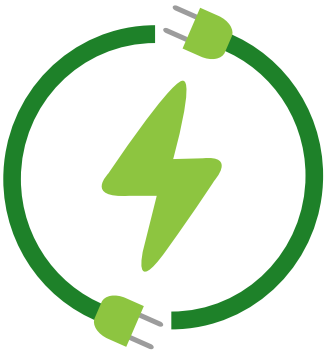

Think about a bicycle again. If you regularly oil the chain, pump up the tires, and check the brakes, your bike will ride smoothly and safely for a long time.

But if you ignore these simple tasks, the bike might start to rust, the tires could go flat, and the brakes might stop working. Then, you might need to get new parts or even a new bike, which costs more money and creates more trash.

When we take care of our things, they don't break down as quickly, which means we don't need to buy new ones so often. This is not only good for our wallets but also good for the planet because it creates less waste.

Products that are well taken care of also work better.

For example, a clean and well-maintained air conditioner cools your room faster and uses less electricity. This means lower electricity bills and less energy wasted, which is good for the environment. Similarly, keeping your computer clean and free of dust helps it run faster and prevents it from overheating.



*Consumables* are items that we **use up** and need to **replace** regularly to keep our products working well. For example, the **oil** for the bike chain or the **soap** to clean. But also **batteries**, **ink cartridges**, and **air filters** are all consumables.

## A SHORT HISTORY OF CONSUMABLES

Using rechargeable batteries instead of disposable ones can save money and reduce waste.

Refillable ink cartridges for printers are another great example because they can be used over and over again instead of being thrown away after one use.

**TIPP**

Designing products that use fewer consumables, we can reduce waste, lower costs, and protect our environment.

## 4.2 VARIOUS OPTIONS EXIST TO DRIVE SUSTAINABILITY IN YOUR DAY-TO-DAY LIFE!:

### 1. Rechargeable and Refillable Options:

One of the most effective ways to reduce the use of consumables is by using rechargeable and refillable options.



### ELECTRONICS

For example, many electronic devices, such as cameras and flashlights, traditionally use disposable batteries.

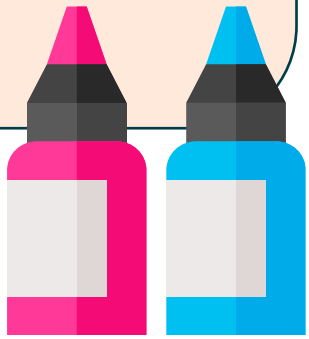
These batteries end up in landfills once they are depleted, creating waste and environmental hazards.

→ To combat this, we can use **rechargeable batteries** instead. These batteries can be recharged hundreds of times, significantly reducing the number of batteries we need to buy and dispose of.

### PRINTING

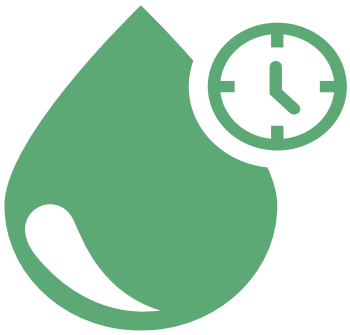
Similarly, in the printing industry, **refillable ink cartridges** are becoming more popular. Unlike single-use cartridges, which are discarded after one use, refillable cartridges can be refilled multiple times.

➔ This reduces the amount of plastic waste and the environmental impact associated with manufacturing new cartridges.



## 2. Long-Lasting Consumables – the right choice for saving money and time

Designing consumables to last longer is another important strategy. Products like air and water filters, vacuum cleaner bags, and razor blades can be made from more durable materials, extending their lifespan.



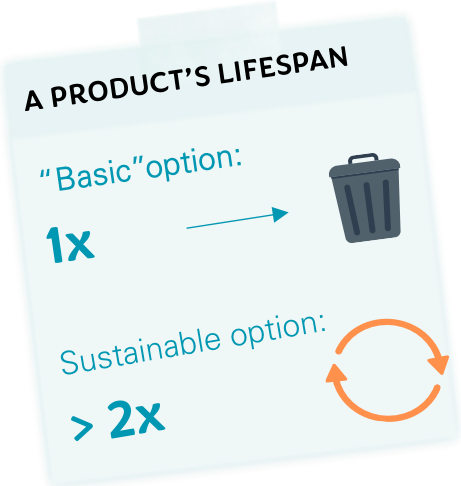
For example, some vacuum cleaners now use **long-life filters** that only need to be replaced every few years, rather than every few months. This not only reduces waste but also saves consumers money.





## 3. Multi-Use and Reusable Components

Reusable components are another way to cut down on consumables. For example, **reusable coffee pods** can be filled with fresh coffee grounds and used multiple times, unlike single-use pods that are thrown away after each use.




Similarly, **reusable containers** for food and beverages help reduce the need for disposable packaging, which often ends up as litter or landfill waste.

In some cases, parts of a product can be designed to be cleaned and reused. For example, **washable air filters** in air conditioning systems can be removed, cleaned, and reinstalled, eliminating the need to purchase new filters regularly.



### 4. Reducing the Amount Needed

**Efficiency** is key to reducing the use of consumables. Efficient design can minimize the amount of consumable materials needed.

For instance, modern printers are designed to use less ink per page, and efficient washing machines use less detergent and water per load.



In addition, technology can help optimize the use of consumables. Sensors in soap dispensers, for example, can dispense just the right amount of soap, preventing overuse and waste.

### 5. Alternative Materials

Choosing eco-friendly materials for consumables is another important consideration. Products made from **biodegradable** materials, like plant-based plastics, break down more easily in the environment than traditional plastics. For example, some packaging materials are now made from corn starch, which decomposes more quickly and safely.

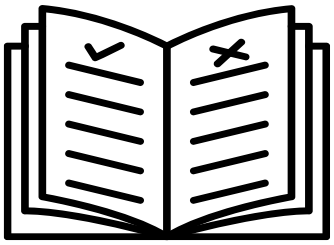
Using **non-toxic** and **safe** materials is also crucial. For instance, many cleaning products now use natural ingredients that are less harmful to the environment compared to traditional chemical cleaners.

### 6. Reducing Packaging



Minimizing packaging is another way to reduce the use of consumables. Using less packaging, or packaging made from recyclable or biodegradable materials, helps reduce the environmental impact. Offering consumables in bulk is another strategy, as it reduces the frequency of packaging disposal and the associated environmental costs of producing and transporting packaging materials.

## 7. User Education and Encouragement

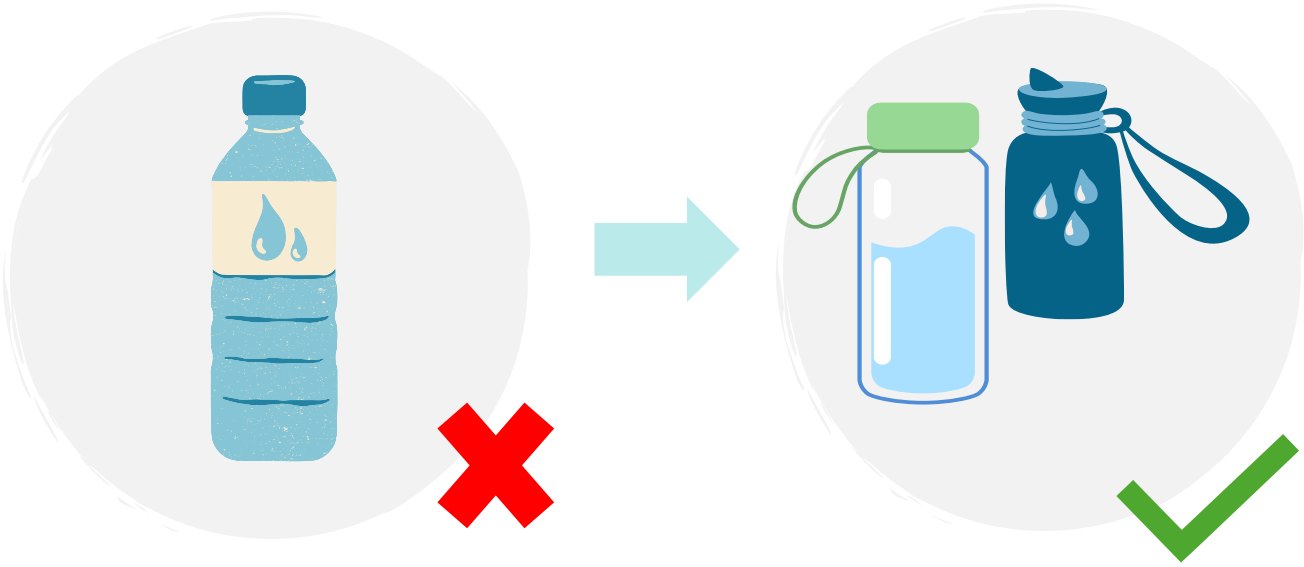


Educating consumers on how to use consumables efficiently can make a big difference. Clear instructions on the correct amount of product to use can help prevent waste.

For example, providing guidelines on the correct dosage of laundry detergent can prevent overuse, which not only saves money but also reduces water pollution.




Encouraging consumers to make sustainable choices is also important. For instance, promoting the use of refillable water bottles instead of single-use plastic bottles can significantly reduce plastic waste.

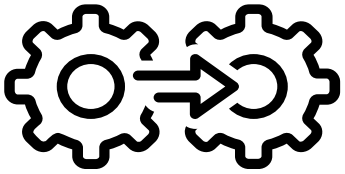


## 8. Integrated Systems

Integrated systems are products designed with built-in, reusable consumables.

For example, some modern vacuum cleaners use permanent, washable filters instead of disposable ones.

This integrated approach not only reduces the need for replacements but also simplifies maintenance for users.



## MAKING PRODUCTS MORE SUSTAINABLE – KEY IDEAS

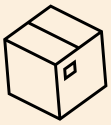

Rechargeable or refillable


Long-lasting


Multi-use or reusable


Check the option for integrated systems


Reducing the amount needed for the product (e.g. less washing detergent)


Less packaging – check whether it is needed


Including enough information to educate buyers



# TASK

9. Why is regular maintenance of products important?

- ☐ A) It makes the products last longer
- ☐ B) It makes the product look newer
- ☐ C) It increases the product's resale value

10. Which of the following is an example of a long-lasting consumable?

- ☐ A) Disposable batteries
- ☐ B) Single-use coffee pods
- ☐ C) Long-life vacuum cleaners

11. How do reusable components contribute to sustainability?

- ☐ A) They make the products more expensive
- ☐ B) They reduce the need for disposable items, lowering waste.
- ☐ C) They increase the amount of energy a product uses.

# Chapter 5. Reuse, recycle, recover...

What happens if a toy, a smartphone or the fridge at home is damaged and you cannot repair it anymore?



In the previous chapter, you learned about repairing products. But what if a product is too damaged to be repaired? This is known as the product's end of life. It means that an item has served its purpose and can no longer function as it was originally intended. When a smartphone or any other product reaches the end of its life, it's important to decide what to do with it next.

Instead of Repairing you can Reuse, Remanufacture, Repurpose, Recycle a product at its end of life or Recover valuable materials and energy.

**These are the R Strategies**

The R strategies help us make less trash, which means fewer big piles of garbage, less pollution, so a cleaner world for everyone.
If we don't produce everything from scratch and use the R strategies we help to keep our air, water, and soil clean and healthy for people, animals, and plants.



## 5. 1 THE R STRATEGIES & THE WASTE HIERARCHY

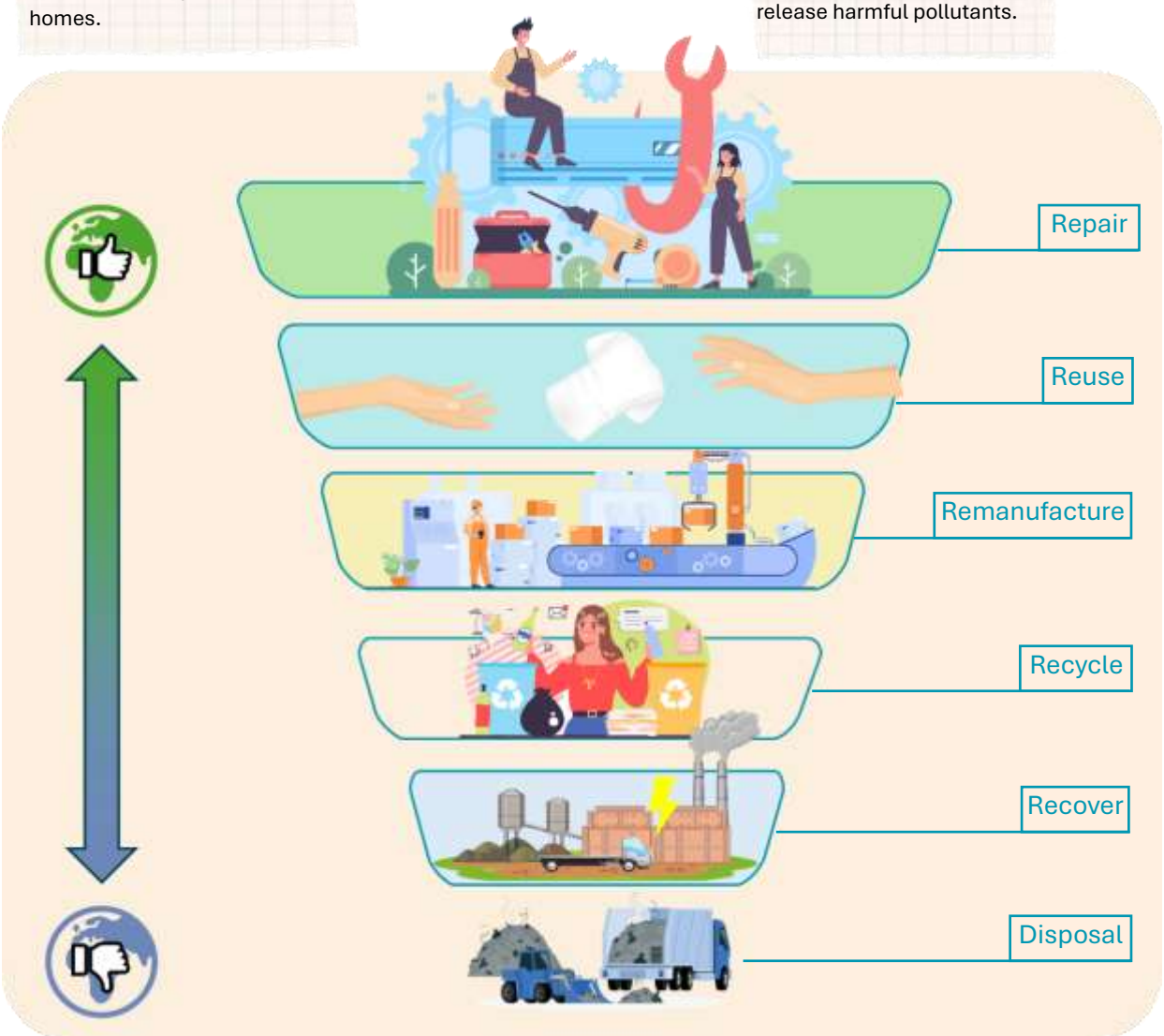
**Reuse**
"Use things again instead of throwing them away."
If you outgrow a shirt, you can pass it to your little brother or

**Remanufacture**
"Using some parts old but functioning parts to build something new"
Turn an old cardboard box into a cool fort or a spaceship for your toys.

**Recycle**
"A Product is separated into its single materials and they are getting turned into something new.". At a special recycling center a washing machine can be separated into steel, copper, aluminum, and plastics.

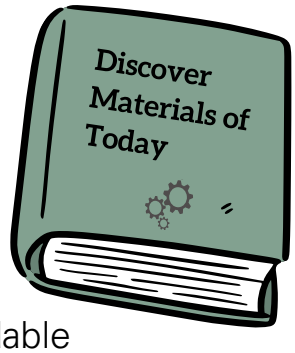
**Recover**
"Turning waste into energy."
Burning old, non-recyclable trash in a special facility to create electricity or heat for homes.

**Disposal**
"Burying waste in the ground."
Old things are underground where they decompose and release harmful pollutants.




So you see, the best thing to do, if repairing is not possible, is to Reuse, Remanufacture, or Recycle and Recover your product.

As an eco-friendly product designer, you can do a lot to make sure your product doesn't just get thrown away.

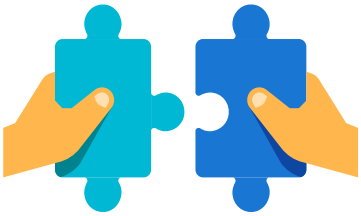



## Choose Recyclable Materials:

Pick materials that can be recycled easily, like certain plastics, metals, or paper, so they can be turned into something new instead of ending up in the trash.

You learned about recyclable materials and biodegradable materials in chapter 2.

## Make Parts Easily Detachable:



Design your product so that the parts can be taken apart easily. This way, if one part breaks, it can be replaced, or the parts can be recycled separately.

How to make a product easily detachable you can reread in chapter 2.

## Label the Most Valuable Parts and Materials:




Mark the important parts of your product that are best for remanufacturing or recycling. This helps people know what to do with them when the product is no longer useful.

## Think About Reusing Parts:

Get creative and think about how the working parts of an old product can be used to build something different and new. This way, nothing goes to waste.

## Give Instructions for the End of Life:



Give clear instructions on how to take care of the product when it's time to stop using it. This could be advice on where to recycle it or how to take it apart.

## Include Tips for Reuse:

Offer ideas on how the user can repurpose the product once they're done with it. Maybe it can be turned into something else useful or fun!



# TASK

12. What do we mean, when we say 'disposal'?

- ☐ A) Throwing trash into the recycling bin
- ☐ B) Repairing a product that is broken
- ☐ C) Sending trash to a landfill, where it gets buried

13. What is part of the R strategies (select all that apply)?

- ☐ A) Reuse
- ☐ B) Recover
- ☐ C) Request

14. What is one way to design an eco-friendly product for easy recycling?

- ☐ A) Make parts easily detachable
- ☐ B) Avoid giving any instructions for disposal
- ☐ C) Use as many different materials as possible

# IMPRINT

This publication is a research result from the Erasmus+ sponsored Project Ecomaker - Production of Prototypes with STEAM Content in MakerWorkshops Against Climate Change

Co-funded by the Erasmus+ Programme of the European Union

SZKOŁA PODSTAWOWA NR 50
Z ODDZIAŁAMI INTEGRACYJNYMI
IM. ŚW. JADWIGI KRÓLOWEJ POLSKI
W BIAŁYMSTOKU

Design by Jana Krömpel, Icons by Freepik

© 2024

https://eco-maker.edufor.eu/

TASK Solutions:

1.B)C), 2.C), 3.A)B), 4.C),5.B), 6.B),7.B),8.B), 9.A),
10.C), 11.B), 12.C), 13.A)B), 14.A)