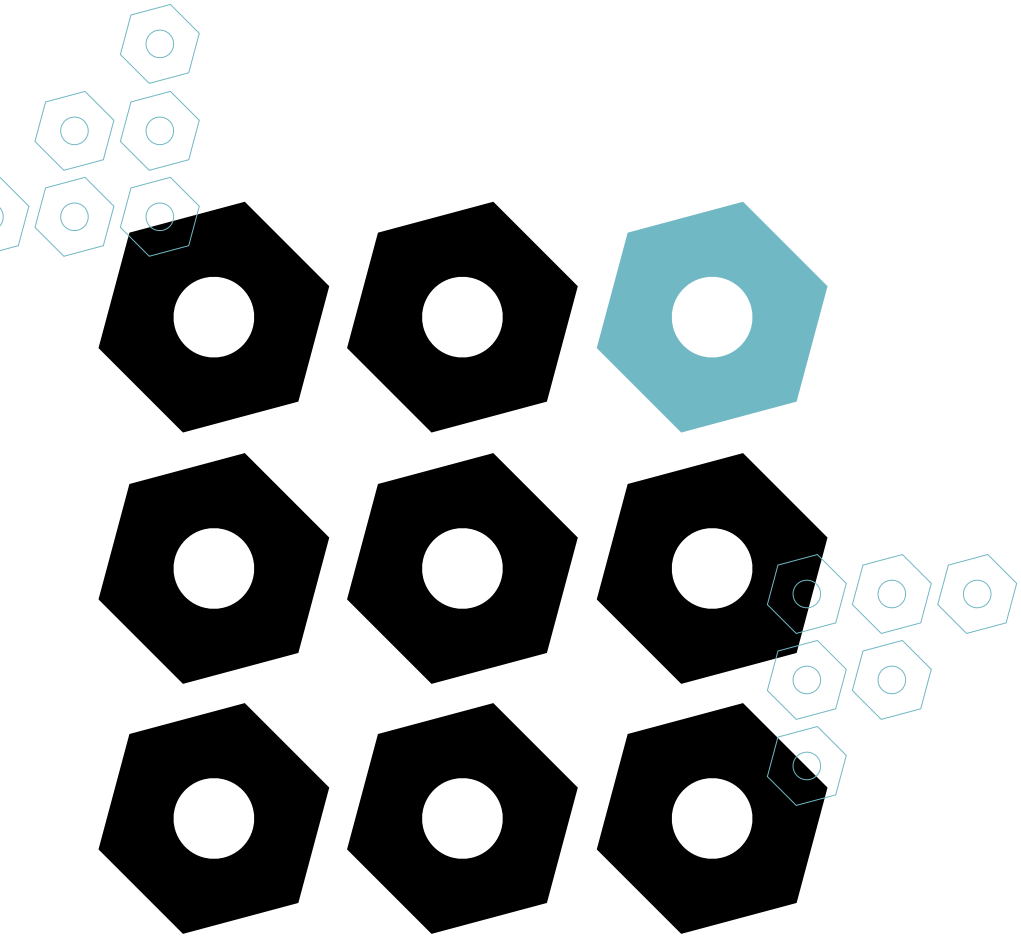
STIMULUS AND AWARENESS

TARGET AUDIENCE 14 to 18 years



MAKE IT WORK! MODULE 1

SHORT SUMMARY During this lesson, students are stimulated to think about design choices for electrical and electronic devices, and they explore the model of the circular economy and the R strategies. They explore why repairing electrical and electronic devices is an important step towards creating a circular economy and how their choices can contribute to this.

Interreg North-West Europe SHAREPAIR
djapo
België partner in ontwikkeling
Vlaanderen verbeelding werkt

STIMULUS AND AWARENESS

DURATION ▸ 50 minutes

LEARNING OUTCOMES

- Students are aware of the impact of design choices on the repairability of electrical and electronic devices.
- Students have insight into the model of the circular economy with regard to electrical and electronic devices.
- Students have insight into the model of the R strategies with regard to electrical and electronic devices.
- Students are able to use the R strategies to explore why repair is a sensible option for electrical and electronic devices.
- Students are aware that repairing electrical and electronic devices is important for the creation of a circular economy.
- Students are aware of the value of 'dormant' electrical and electronic devices in their homes.
- Students understand how their choices with regard to the production, consumption and repair of electrical and electronic devices can contribute to a more circular economy.

MATERIALS REQUIRED

- A whiteboard or flip chart
- A number of broken or faulty electrical and electronic devices, for instance a broken bicycle light, a faulty hairdryer, a smartphone with a broken screen, a jammed toaster or printer, etc.
- Tools to disassemble the broken devices, for example screwdrivers
- Stock photo of a person on an e-waste landfill site in Accra, the capital of Ghana (appendix 1)
- Visual linear vs. circular economy (appendix 2)
- Blank diagram of the R strategies (appendix 3)
- Cards with the R numbers (appendix 4)
- Cards with the R strategies (appendix 4)
- Cards with explanations of the R strategies (appendix 4)
- Cards with student-consumers' choices that reflect the R strategies (appendix 4)

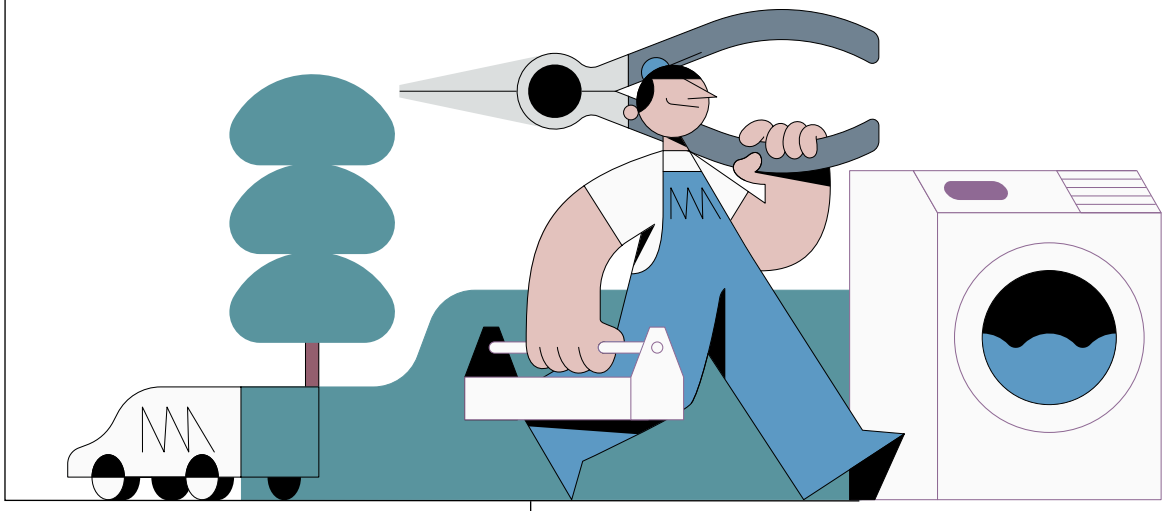
TO DO BEFOREHAND

- Read the Background Information document attentively. This text gives you the what, why and how of the subject and the didactic knowledge and insights you need to work with this module.
- Choose those elements from the module that suit your students best and are most compatible with previous and planned lessons.
- Consider asking the students in advance to bring a number of broken or faulty devices with them to class. If you do, give them a note to bring home for their parents to consent to the disassembling of the devices during class, warning them that the devices may not actually be fixed or may be returned to them in worse state.
- Print the cards with the R strategies (appendix 4) in colour and cut them out.
- Draw or attach the blank diagram of the R strategies (appendix 3) on the board or on a flip chart.

LESSON PLAN

1 – STIMULUS

At the start of the lesson, make the students aware of the many electrical and electronic devices that they and people around them use, for example smartphones, earbuds, smartwatches, laptops, tablets, keyboards, printers, game consoles, e-readers, bicycle lights, e-scooters, coffee machines, hairdryers, blenders, toasters, dishwashers, kettles, washing machines, clock radios, shavers, electric toothbrushes, etc.



Extension: the design phase

The most effective way to stimulate your students is to have them disassemble and, if possible, repair a device themselves.

Consider bringing in an expert for the technical part of the lesson, for example by inviting a repairer through the RepairConnects platform.

Read on for a number of ways in which you can visualize disassembling and repairing products in the classroom.

First experience

Take a closer look together with the students at a few broken or faulty electrical and electronic devices, for example a broken bicycle light, a faulty hairdryer, a smartphone with a broken screen, a jammed toaster or printer, etc. Ask the students to disassemble the devices and find out what needs to be done to repair them. Time the assignment at fifteen minutes and then ask for their first findings and experiences.

- What steps do you have to go through to repair the device?
- Was it necessary to disassemble the device or not?
- Did you manage to disassemble the device?
- If so, was it difficult to disassemble the device?
- If not, what made it difficult to disassemble the device?
- Were you able to repair the device? Why or why not?
- Why do you think devices are so difficult to disassemble and repair?

Reverse engineering

If you have at least 25 minutes of additional time, you could ask the students to disassemble the devices to find out how they work.

Make sure you have enough screwdrivers, pliers and other repair tools, and then divide the students into pairs. One student in each pair tries to disassemble the device step by step, while the other tries to create a schematic representation of how the device works. They could do this by drawing a diagram on a flip chart, taking pictures and making a digital poster with the photos, making a video, etc. You could ask the students to chart a specific flow in certain devices, for example the flow of water in a coffee machine, of air in a vacuum cleaner, of sound in a CD player, of electricity in a blender, etc.

The pairs then present their diagram, drawing, poster or video to the class. You could also turn this into a quiz.

- What do you think this part does?
- How does ... cause ...?

The design phase of smartphones

If you do not have broken devices in the classroom or prefer not to have students work with devices during class, you could ask the students to look online, on YouTube for example, for 'how to' videos or tutorials on disassembling their own smartphone, and ask them to report back to the class. Most smartphones are glued shut and are difficult or even impossible to disassemble. Ask for the students' first findings and experiences.

- How long does it take on average to disassemble a smartphone according to the videos?
- What brands have posted official 'how to' videos online?
- Are there big differences between the brands? If so, what differences?

- Repair time
- Complexity
- Risks
- Cost
- Availability of repair tools

VIDEO

Or you could show the class a 'how to' video on disassembling an iPhone yourself, and ask students to compare it with a similar video for a type of smartphone that is easier to disassemble. For example, compare this unofficial video on how to repair an iPhone (26'11") with this official video by Fairphone (7'53"). Fairphone shows in this video how to disassemble its device and replace parts. Their smartphones have been designed to allow complete disassembly and replacement of almost all parts.

Explain that during the **design phase** of products, manufacturers of electrical and electronic devices often choose to glue them shut. This makes it more difficult for consumers to disassemble the device and replace parts, and therefore to repair broken or faulty devices. This stimulates consumers to purchase a new product, which drives up sales for the manufacturers. For example, if the battery of a smartphone is no longer charging but the smartphone is otherwise still working properly, the consumer will consider just replacing the battery. But if this is impossible or the price of a new battery is almost as high as the price of a new smartphone, the consumer is likely to choose to buy a whole new phone.

- How does this make you feel?
- Do you think there is anything you can do about this?

Then briefly ask students to share their more general experiences with electrical and electronic devices. Choose the questions you want to discuss and keep the conversation focussed.

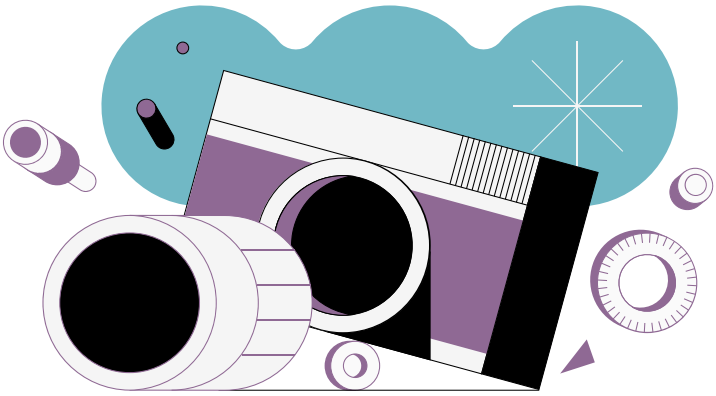
- What electrical and electronic devices do you have at home? What kinds of devices are they?
- Do you share certain devices with others? Why or why not?
- What devices do you own? Which ones do you use often?
- How long have you been using this device? How long do you plan to use it? How long do you think this device will last?
- Do you have devices you no longer use? Why don't you use them anymore? What do you do with these devices?
- Are you or your parents thinking of buying a new device? Why or why not?

- The latest software doesn't work on my laptop.
- The battery in my tablet is not charging.
- The screen of my smartphone is broken.
- My smartphone camera is not as good as I would like it to be.
- The toaster at home doesn't get hot anymore.
- The coffee machine at home indicates that the water reservoir is empty even though it is full.
- My bicycle light is not working, even after I replaced the battery.

- How many times did your family buy a new device last month or last year? Why?
- Did you consider any options other than buying a new device? If so, what options? Why did you eventually decide to buy a new device?

TIP MODULE 3

Encourage the students to write any questions they have about the topic on a flip chart. Tell them you will discuss these questions during a future class.



2 – CORE

2.1 – Circular economy

Show the stock photo of a person on an e-waste landfill site in Accra, the capital of Ghana (appendix 1).

- Where do you think this is?
- Why do you think this person is doing this?
- What does this have to do with your use of electrical and electronic devices?
- How does this make you feel?

VIDEO

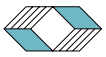
Consider showing the trailer of the documentary 'The E-Waste Tragedy' (2'45") or this BBC excerpt (4'06") about Agbogbloshie, a neighbourhood in Accra, Ghana's capital, which is home to one of the largest electronic waste dumps in the world. Large Western international companies dump their waste here, severely damaging the Ghanaian environment and worsening Ghanaian living conditions. Residents, including children, live there in degrading conditions among e-waste hoping to make more money than in agriculture.

Explain that electrical and electronic devices form the largest waste stream in the EU. Worldwide, it is growing three times faster than the world's population, making it the fastest growing waste stream. In the EU, less than 40% of the waste from these devices is being recycled. For the world as a whole, the percentage is only 17.4%. The waste that is not recycled is often illegally exported to African and Asian countries where this normally toxic waste is dumped and incinerated. The chemicals that are released in the process are a health hazard for local residents and for the environment, and accompanying high greenhouse gas emissions contribute to climate disruption.

- How does this make you feel?
- Can we agree that this is not a desirable situation?
- What would the desirable situation look like?

Explain that the circular economy is a model to continue using materials and products in the economy while optimally retaining their value. By contrast with a linear economy, where raw materials in products ultimately disappear out of the material cycle and are discarded, the circular economy tries to retain the value of materials and products. Products are designed in such a way that they (or the materials they contain) can be used again and again, for example by repairing them, selling them at high second-hand value or upgrading them. If this is not or no longer possible, the products are optimally recycled and, if necessary, broken down into their constituent materials. This keeps extracted raw materials in the economy and closes the material cycle, like in a natural ecosystem.

- Why do you think retaining the value of materials and products is so important?
- What could 'retaining the value of materials and products' mean? (intensive extraction, production, …)
- What similarities do you see between an ecosystem and a closed material cycle? And are there any differences?



DIFFERENTIATION

Consider explaining that the production of electrical and electronic devices often requires intensive extraction of frequently rare, non-renewable resources, such as gold for the manufacture of smartphones. This is harmful both for the environment and for the quality of life of the often-exploited people who mine these raw materials in unsafe, unhealthy conditions. The deposits of the materials required are mainly located in countries in the global South, where foreign private mining companies abuse the low wages and the governments' failure to properly regulate mining. Mining companies are disrupting local communities by acquiring mining concessions without the local population's consent, buying land very cheaply, and using technologies that involve the use of toxic chemicals such as cyanide, which then enter the groundwater and pollute local ecosystems, agriculture and drinking water. Local resistance to these practices often leads to bloody mining conflicts and violations of human rights.

Also explain that the production process from raw material to device has a negative impact on living environments and communities. Highly toxic chemicals are released during the production of more complex electrical and electronic devices such as smartphones and laptops which can be harmful to workers and often end up in our groundwater and drinking water. Moreover, producing devices often requires more energy than using them. Many brand-new products will therefore have a considerable carbon footprint even before the consumer has switched them on for the first time. Add to this the greenhouse gas emissions that result from transporting materials and products to the other side of the world, and it is clear that every newly produced device has a strongly negative impact on the disruption of our climate.

VIDEO

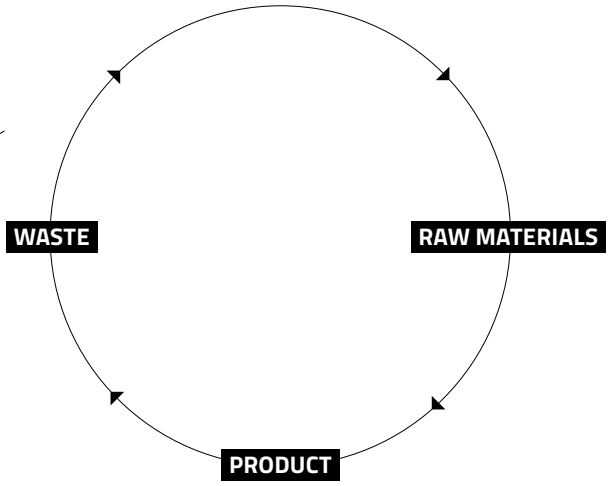
Consider showing the trailer of the documentary 'Death By Design' (1'46").

DIFFERENTIATION

Visualize the difference between the abstract concepts 'linear' and 'circular' by drawing an arrow and a circle or loop on the whiteboard and, together with the students, positioning concepts such as 'raw material', 'product' and 'waste' on them. You can also replace these concepts by more concrete examples such as 'cobalt', 'smartphone' and 'e-waste'.

- Can you position the words in the shape of an arrow?
- Which word comes first? Why?
- What happens after this arrow? Where does this arrow point?
- What word would you place at the end of the arrow?
- What do you think that means? Can you think of examples?
- Can these words also be placed to form a different shape? How?
- Can these words be positioned in the shape of a circle or a loop?
- What connections can you see between the words if we position them like this?
- What happens once the circle is complete?
- Is it possible to design this circle or loop in some different way? Why or why not?

Consider showing the illustration comparing the linear economy to the circular economy (appendix 2).



VIDEO

Consider showing this video by the Ellen MacArthur Foundation (3'48") explaining the circular economy and how society can re-think progress.

DIFFERENTIATION

If your students are able to work independently and you have more than 50 minutes, then you could decide not to do this part of the lesson collectively. Instead, consider 'flipping the classroom' by dividing the students into groups, each of which is asked to present one reason for a circular economy (see the Background Information document 1.3.1) to their fellow students.

2.2 – R strategies

Display the blank diagram of the R strategies (appendix 3) on the whiteboard or on a flip chart. Explain that if we want to transition from our current linear economy to a circular economy, we will have to deal with products and materials in a different way. The R strategies show how and in what order of priority we can deal with products and materials to ensure that the raw materials in the products retain maximum value, waste products are kept to a minimum and the environmental pollution and greenhouse gas emissions remain as low as possible. Ask the students to pin the R strategies to this diagram in the right sequence – from most to least circular solution.

Shuffle the cards with the R numbers, the R strategies, their explanation and the individual choices (appendix 4) and place them in a bowl in the middle of the classroom, or distribute them to the students to play quartets. Explain that they can form ten sets of four cards each.

- The green cards have the names of the R strategies.
- The purple cards illustrate the sequence of the R strategies according to their impact.
- The blue cards explain what the R strategies mean.
- The orange cards illustrate the R strategies by giving examples of choices by student-consumers.

Ask the students to draw a card each in turn and read it out loud, and then go around the classroom to ask each other questions to find their 'match'. Or play any other game that involves the students putting together a quartet with one card per colour, and ask them to pin these to the right place in the diagram. Ask in-depth questions while they do this and help the students to pin all the quartets to the right place the diagram.

TIP

Ask the students to read the examples on the orange cards first and ask whether they can relate to the choices that the characters on these cards make, how these choices make them feel, etc. Discuss which choices they think will make a greater contribution to a circular economy.

- Have you ever done anything like this yourself? How did that make you feel?
- Do you think it is a wise choice? Why or why not?
- What would you do or do differently yourself in this situation? Why?
- Do you think the climate impact of *choice X* will be lighter than that of *choice Y*? Why?
- Do you think that *choice X* retains the value of raw materials more than *choice Y*? Why?

3 – CONCLUSION

Ask every student to describe an old or replaced, repaired, recycled etc. electrical or electronic device of their own on a post-it, using the following questions:

- Where do you think your old device is now?
- Are the device or the materials in it still being used? Why or why not?

The students stick their post-its on the diagram (appendix 3) beside the R strategy that corresponds to what has happened to their old device. It is not a problem if students do not know where their post-it belongs. Students who do not know where to hang their post-its should place them beside the diagram. Then discuss the post-its and the corresponding R strategies.

- Which R strategy has the most post-its? Why is that, do you think?
- What happens to these devices?

Point to the REPAIR R strategy in the diagram.

- What post-its are beside this R strategy? Why? How many devices does this represent?
- (If there are few post-its there) Why do you think there are so few post-its for this R strategy?

Make connections with the choice described on the orange card for the REPAIR R strategy (appendix 4).

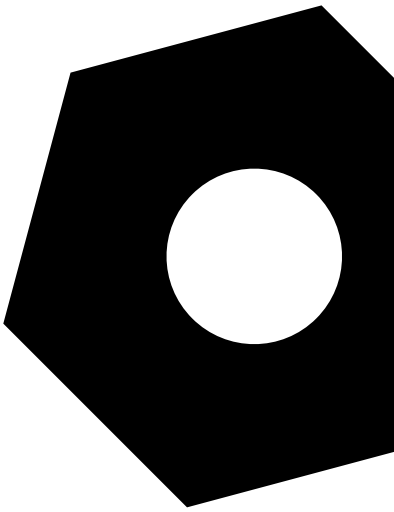
- Why would … do this? What would you do in this situation?
- Have you ever repaired a device or had it repaired? What kind of device was it? Where was it repaired and by whom? Was it difficult or easy? Why? Was it expensive? Why?
- Have you ever consciously chosen not to have a device repaired? Why?

Look at the post-its beside the diagram and discuss in the group whether or not they belong to any of the R strategies. Hang the post-its in the right place.

- Are there any devices on post-its beside the diagram?
- What post-its don't correspond to any R strategy? (for example an old smartphone that has been in a drawer for years) Why not?

Explain that the raw materials in broken, worn or dated electrical and electronic devices usually do not return to the material cycle because households tend to keep such devices in a drawer indefinitely. Devices in households that are no longer in use and whose raw materials are lost to the circular circuit are called 'dormant devices'.

- What is the difference with dumping a device in landfill? What do you think is worse?
- What could you do to ensure that the materials in your dormant devices return to the material cycle?

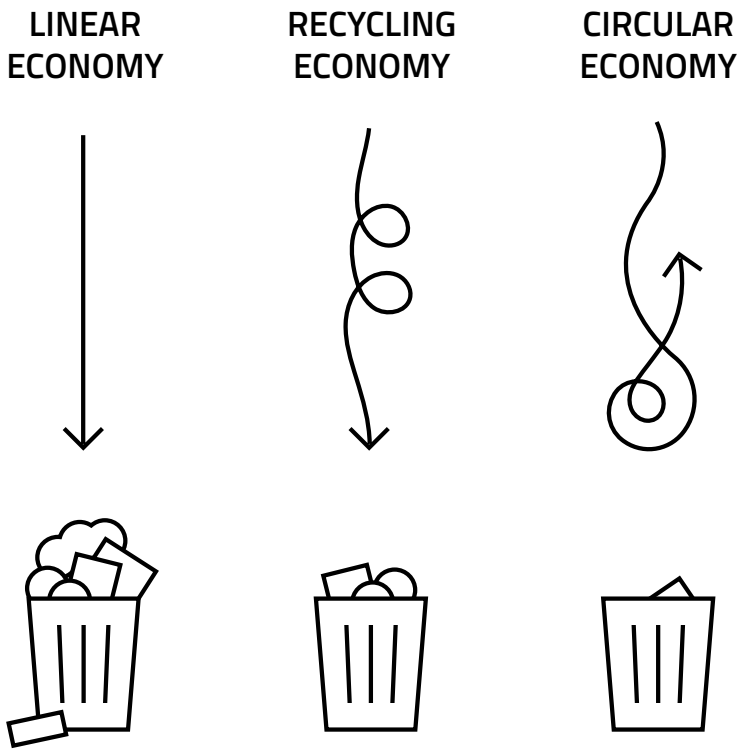


TIP MODULE 2 MODULE 3 MODULE 4 MODULE 5

After this lesson, you could explore perspectives, opinions and emotions concerning electrical and electronic devices with your students (module 2), or have them explore why they should return their dormant devices to the material cycle or how best to do this (module 3), what the underlying causes (and consequences) of this could be (module 4), and/or ask them to devise some form of action, for example collecting dormant devices at school or in the neighbourhood (module 5).

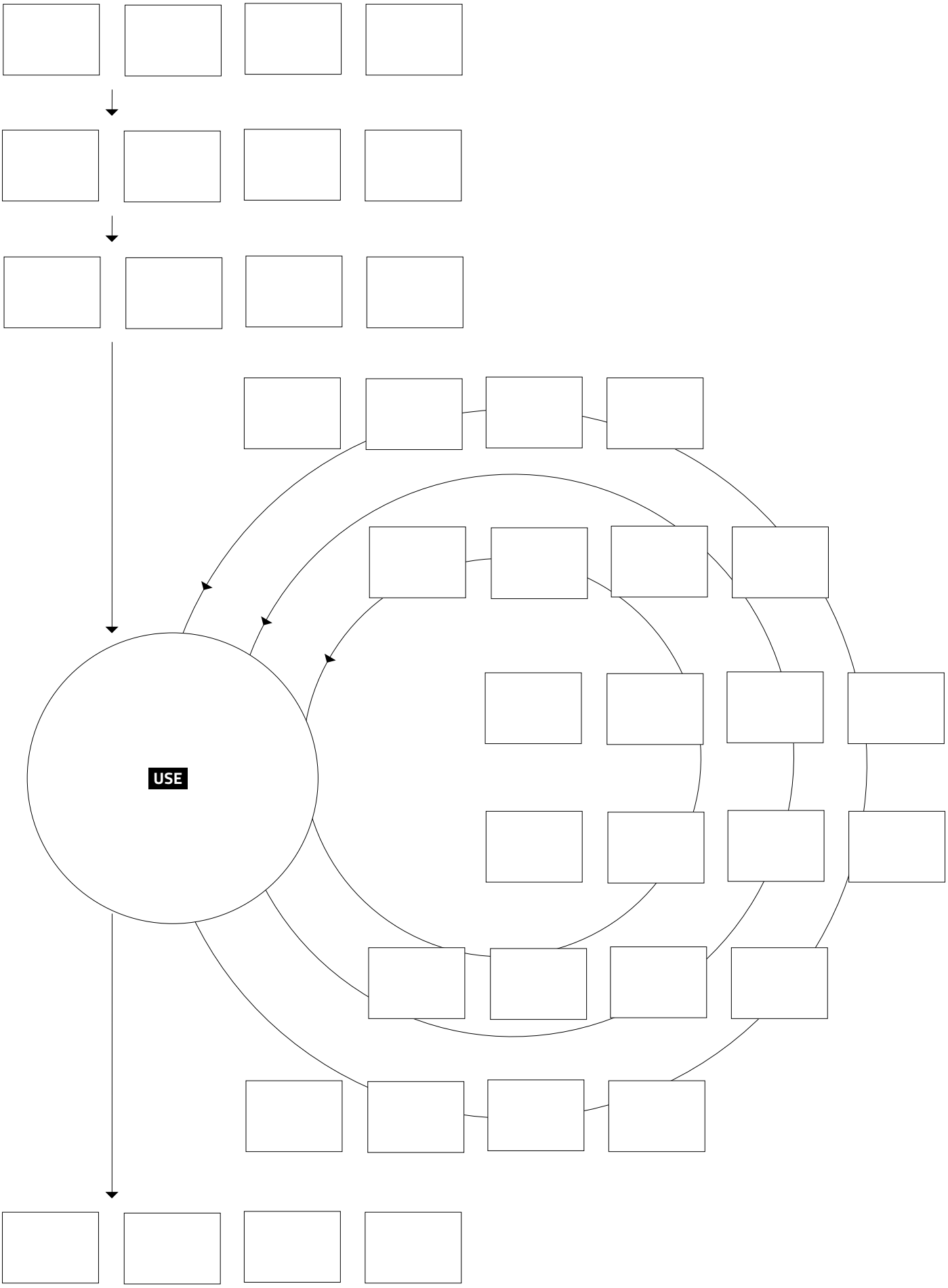
APPENDIX 1

APPENDIX 2



Source: https://vlaanderen-circulair.be/nl/kennis

APPENDIX 3



Based on https://www.rvo.nl/onderwerpen/r-ladder/

APPENDIX 4

R0	**Refuse**	Making a product unnecessary by doing without it.	There's a new iPhone model on the market with a much better camera. Amir wants to take better pictures, but his current older iPhone with camera is still working perfectly. He decides not to buy the newer model and to keep using his old smartphone until it breaks.
R1	**Rethink**	Using a product more intensively, for example by sharing it or making it multifunctional. Or by designing a product differently, by increasing repairability or making greater use of recycled material.	Emma would really like to buy the latest Harry Potter game, but she doesn't have a PlayStation. She's spotted a discounted PlayStation online, but then remembers that her friend Kiara, who lives two streets away, has a PlayStation and that the game can be played in multiplayer mode. They decide to put together the money for the game and play it every Friday evening on Kiara's PlayStation.
R2	**Reduce**	Manufacturing a product more efficiently, for example by using fewer resources or materials, or using it more efficiently, for example by reducing how much energy it consumes.	Meyra's parents are getting very high energy bills every month. They discuss with their teenage children how they can reduce their energy consumption. They decide to switch off all devices (TV, laptop, phone charger, etc.) when they are not being used instead of leaving them on standby.
R3	**Reuse**	Reusing a discarded product in good repair for the same purpose.	Samira's laptop is broken. It's too expensive to have the device repaired, but she doesn't want to buy a new laptop either. She decides to buy a second-hand laptop instead.
R4	**Repair**	Repairing and maintaining a broken product to prolong its use.	The cable of Meskerem's earphones is broken. She looks online for repair options and decides to have the cable repaired at a local Repair Café.
R5	**Refurbish**	Renovating and modernizing an old product.	Olivia's grandma gave her a used old lamp. She renovates the lamp and turns it into a modern vintage lamp for on her bedside table.

R6	**Remanufacture**	Using parts from a discarded product in a new product for the same use.	The water reservoir in Liam's Senseo coffee machine is broken, but his neighbour has an old machine somewhere that he no longer uses. Liam replaces his broken water reservoir with his neighbour's and then the machine works again.
R7	**Repurpose**	Using a discarded product or its parts in a new product with a different use.	Yassin buys a vintage TV in a thrift store and turns it into an aquarium with lights.
R8	**Recycle**	Processing materials while preserving the same quality (high-grade) or creating lower quality (low-grade).	Nathan's laptop is broken and it can't be repaired. He brings the laptop to a recycling centre, where the high-grade materials are extracted from computers to be reused as raw material for new products.
R9	**Recover**	Burning materials with energy recovery.	Nathan's laptop is broken and can't be repaired. He brings the laptop to a recycling centre, where the recyclable plastic parts are recovered from computers to be used as raw material for new products.

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