



ESCAPE 4 FUTURE

MANUAL FOR FACILITATORS



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Manual for facilitators

Escape game "Escape4Future - Chemistry meets Circular Bioeconomy" integrates the inquiry-based learning and gamified approaches. This game is designed to be played by high school students (13-18 y.o.) with the support of one or more facilitators who will setup the experience and deliver the educational contents connected to the escape game.



This Manual for Facilitators provides essential information, insights and practical tips in the planning and delivering of Escape4Future.

What is an escape game? An escape game is a type of interactive adventure game where a group of players must solve puzzles (referred to as enigmas in this context) and complete tasks within a set time limit to achieve a specific objective. The concept typically involves a narrative or theme that enhances the immersive experience.

Players must work together to find clues, decipher codes, and complete tasks to progress through the game. The challenges require critical thinking, teamwork, and creativity.

The goal is to "escape" by solving all the puzzles and completing the mission before time runs out.

Benefits of using escape room format for educational purposes: improvement of the learning process by leveraging fun and motivation, inquire-based learning, consolidation of contents, development of transversal skills.

The **Escape4Future** game was developed collaboratively by GenB project partners, students and teachers from the ITT Montani high school during the 2022/2023 academic year as part of a living lab. The living labs within the GenB project aimed to co-create innovative formats to stimulate young people's awareness and interest a green chemistry and circular bioeconomy.

Objective: Players face a relevant challenge for the modern world - the planet is stuck in pattern of making, using and throwing away products (a linear lifestyle and consumption model), leading to problems like climate change, biodiversity loss, resource scarcity, and an increase in non-renewable fossil-origin waste, such as plastic. Players must solve 6 enigmas connected to each other that address themes of green chemistry and bioeconomy through hands-on experiments or games to find a way out towards a more sustainable and circular lifestyle.

Number of players: max 15-20 players (ideally 5-10 players)

Total duration of the game experience: from 30 to 45 mins, depending on the suggestions provided by the facilitators. Should be noted that facilitators can ease or make the game more challenging observing the skills of the players: it is up to them to balance the clues while keeping a stimulating atmosphere.

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Target participants: high school students (13-18 y.o.)



It can be played with a younger audience providing clues, suggestions or raising questions to facilitate the solution of the enigmas.

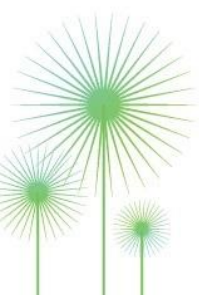
General setting of the escape game:

- The different enigmas can be played in separate rooms or in a big room with separate areas (e.g. 4 separate tables)
- At least 2 facilitators are required to ensure a smooth gameplay
- Also students can be trained to take the role of facilitators
- The facilitators can support players by asking questions, providing suggestions and make this experience more interactive and fun.
- All the materials for the escape game can be downloaded [from this folder](#) and printed. Detailed information about each material and connected enigma is provided below.

List of materials needed

	To buy/to retrieve	To print
<i>Escape4Future Mission</i>	-	<ul style="list-style-type: none"> • 1 A3 page explaining the Mission of the game
<i>Enigma 1</i>	<ul style="list-style-type: none"> • 5 samples of different types of plastics • 5 glasses • Water • Spoons • 5 envelopes 	<ul style="list-style-type: none"> • 1 A4 page with first clue about microplastics and 4 other clues “balance is the key...” to be used in the envelopes that are not containing the crossword
<i>Enigma 2</i>	<ul style="list-style-type: none"> • Pen 	<ul style="list-style-type: none"> • 1 A4 page with 5 different keys (print on adhesive paper or make sure to attach them on the envelopes) • Crossword • Page with crossword solutions
<i>Enigma 3</i>	<ul style="list-style-type: none"> • Moka pot with coffee grounds 	<ul style="list-style-type: none"> • 1 A4 page recipe for the bio-based scrub

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	<ul style="list-style-type: none"> • Olive oil • Spoon • Jar • Cookbook • Tablecloth • Plates • Wine flask • Balsamic vinegar 	<ul style="list-style-type: none"> • Coffee card from the deck of 24 cards (see next enigma)
Enigma 4	<ul style="list-style-type: none"> • GenB coffee notebook • Different samples of bio-based products (e.g. Bamboo toothbrush, bioplastics bags, poop paper, wood-based towel, spirulina-based nutraceuticals, cork cup, etc.) • Lock with numbers and colours • Box/basket 	<ul style="list-style-type: none"> • Deck of 24 cards (each card has a specific number on its back. Therefore, they need to be printed on both sides in A4 pages) • 9 coloured A4 pages
Enigma 5	<ul style="list-style-type: none"> • Test tubes • Pipettes • Starch solution 1% • Iodine tincture • Tea • Rancid oil 	<ul style="list-style-type: none"> • 1 A4 page with clue about antioxidants • Tags for the test tubes (print on adhesive paper or make sure to attach them on the test tubes)
Enigma 6	<ul style="list-style-type: none"> • UV lamp • Invisible ink pen • Lock with letters • Box/basket • Bio-based gadgets 	<ul style="list-style-type: none"> • 2 A4 pages with newspaper articles (here and here)

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Getting started

Players are introduced to the Escape Game's mission with the following [introductory A3 poster](#). Facilitators can ask one of the players to read the mission.



Enigma 1: Sink or Float?

Learning objectives: Explore the behaviour of different types of plastic and microplastics in water environment. Understand the consequences of presence of plastics and microplastics in water, on the marine ecosystems.

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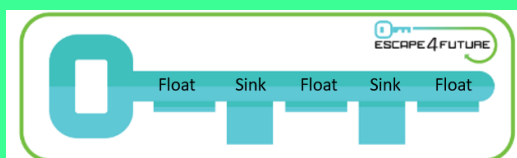
Preparation

Print the first clue (see below and download the [card here](#)):



Set a table with:

- 5 beakers or glasses filled with water.
- In front of each container, place 5 different types of plastic materials with different floating behaviours e.g. common bottle caps (Polyethylene), a piece of pipe (PVC), a small piece from a packaging container (Polypropylene), the neck water bottles (PET), flaps from a compost bag (MaterBi) to be inserted into the cups.
Note: the above-mentioned materials are suggestions, you can use other types of plastics recovered from your bin. Just make sure that these materials float or sink depending on their density (you can easily test it before the event, putting the plastics in cups with water and observing if they float or sink).
- The sequence of floating/sinking behaviours is the key that will identify the correct envelope containing next enigma (see next bullet point). Once students will insert the plastics into the cups, the resulting sequence in order should be the following: Float – sink – float – sink – float (corresponding to the key patterns below).



- Print the different keys and attach them to 5 different envelopes. Place each envelope within sight near the table. Each envelope contains either a clue to solve the enigma, or a crossword that is the next enigma (correct choice). You can download all the [materials here](#)

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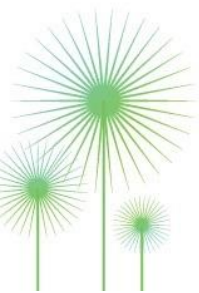
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The problem of microplastics is well known. However, microplastics can sink or float, creating diverse problems.

Description of the player experience: The players will receive a first clue introducing the issue of microplastics in the seas and will find a table set up with 5 beakers or glasses filled with water and 5 different types of plastics (see below) in front of them. Players will add the plastics to the corresponding glass, observing that the different floating behaviours generate a sequence. Comparing this sequence with the keys' patterns, players will find the right envelope containing the next enigma.

- Educational information to be used by the facilitators while playing:**
- Study of the problem of microplastics ending up in the oceans
 - More than 80% of marine pollution originates on land and is caused by human activities. 85% of this pollution is plastic, mainly single-use. Every year up to 12.7 million tons of plastic end up in the world's waters. It is predicted that in the next 15 years, the amount of plastic in the oceans will double, and by 2050, there could be more plastic than fish.
 - In nature, plastic takes hundreds of years to degrade (from 500 to 1000 years), and only 9% is recycled.

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- Plastic can be divided into three categories: floating, sinking, and neutral, depending on whether its density is respectively less than, greater than, or equal to that of seawater. Depending on density, plastic debris are exposed to different currents and follow different paths in the ocean, impacting different ecosystems depending on the depth reached.
- Since salt increases water density, the floating behaviour might vary depending on the salinity of the water. If the water is denser than the object, this last one will float.
- Floating plastic (which together with other waste can aggregate into real "islands") makes up only a small portion compared to the amount found on the seabed, which is also more difficult to recover. Most of the research conducted so far has primarily focused on plastic accumulated on the sea surface, which constitutes a tiny part of the total amount.
- Microplastics are tiny particles that derive from the degradation of plastic (also during use) or are intentionally added to improve product performance (e.g., creams and toothpaste). Microplastics can be ingested by marine animals and end up in their bodies and tissues, entering the food chain (they have been found everywhere: in drinking water, salt, beer, and soil where we grow our vegetables - people could ingest the equivalent of a credit card of plastic per week!). In Europe, the intentional addition of microplastics (e.g., in cosmetics) has been prohibited since October 2023, but not in extra EU-countries.

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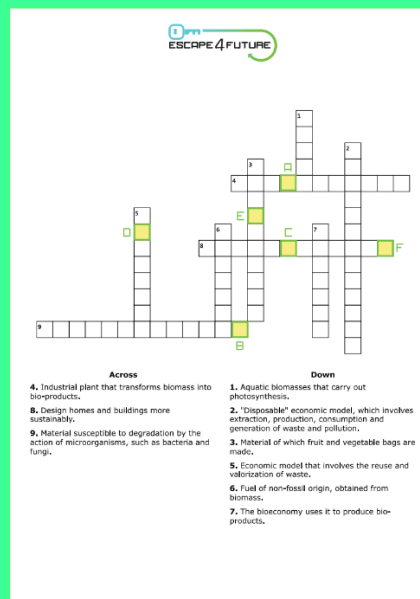
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Enigma 2: Bioeconomy crossword

Learning objective: Familiarisation with the basic concepts of bioeconomy.

Preparation

Print the crossword puzzle that can be [downloaded here](#) and put it in the envelope displaying the right key (see below) as described in the previous enigma. Make sure to provide players with a pen to fill in the crossword.



Note: As a facilitator you can find the solution of the crossword in [this document](#).

Description of the player experience: Concepts of circular bioeconomy will be introduced through solving the crossword puzzle. Once solved, some highlighted letters in the crossword will form a clue word ("recipe"), which will allow players to reach the next station (set up as a kitchen) to tackle the next enigma.

Educational information to be used by the facilitators while playing:

Although during the gameplay there is no time to deepen all the definitions subject of the crossword, some topics can be further discussed after the game, using the materials provided in the GenB toolkit (e.g. biodegradability educational cards). Some insights can be in any case provided by the facilitators during the gameplay.

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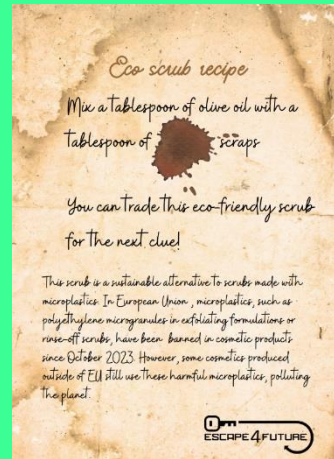


Enigma 3: Hands-on coffee scrub

Learning objective: Learn about the problem of microplastics in cosmetics and how to make a sustainable alternative.

Preparation

- Print [the recipe](#) and hide it in a cookbook. It is suggested to have a vintage cookbook to make the



experience more appealing.

- Set up a table or a room resembling a kitchen. Make sure that the following items are present on your table:
 - Cookbook with the recipe inside
 - Moka pot with coffee grounds
 - Olive oil
 - Spoon
 - Jar for the ecological scrub
 - Optional, to make the set up more appealing: kitchen tablecloth, plates, wine flask and corkscrew, balsamic vinegar, glass.
- Once the players make the scrub, facilitators should trade the eco-friendly scrub for the next clue (coffee card to be printed as explained in the next enigma).

Description of the player experience: Once the players decipher the keyword “recipe” from the previous enigma, they proceed to the kitchen station and search for the hidden recipe in the cookbook. By following the recipe, they will identify the missing ingredient (coffee grounds hidden in the moka pot) on the table. Players must then create the eco-friendly coffee scrub in the jar, which they should trade with the facilitators to get the next clue.

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Educational information to be used by the facilitators while playing:

This scrub is a sustainable alternative to scrubs made with microplastics. In European Union, microplastics, such as polyethylene microgranules in exfoliating formulations or rinse-off scrubs, have been banned in cosmetic products since October 2023. However, some cosmetics produced outside of EU still use these harmful microplastics, polluting the planet.

This enigma stimulates the debate on to the following questions:

- What are microplastics? Where have they been found? (see Enigma 1)
- Can microplastics be intentionally added to products? Why? What are the EU policies to prevent this?

Official source of EU directive: https://single-market-economy.ec.europa.eu/commission-regulation-eu-20232055-restriction-microplastics-intentionally-added-products_en

Microplastics (usually of a size less than 5 mm) are tiny plastic particles manufactured and intentionally added to some products to perform a concrete function, like abrasion or stabilisation.

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Enigma 4: Find the right match!

Learning objective: Explore bio-based products and their related feedstock.

Preparation

- Buy a lock with numbers and colours ([link here](#)): this will serve to insert your chosen code to solve the enigma.



- Print 24 cards (download the [cards here](#) including the coffee card mentioned in the previous enigma) containing information on various renewable biological raw materials (feedstocks). Each card has a specific number on its back. Therefore, they need to be printed on both sides.
- Print the 9 coloured A4 sheets (download the [sheets here](#)) where 9 bio-based products will be placed.
- Select 9 of the 24 biological feedstocks mentioned on the information cards. For each of the selected feedstock, find one associated bio-based product. A suggestion of possible matches is provided below, but you can unleash your imagination based on the products you have at your disposal:

Feedstock	Bio-based product
Coffee	GenB notebook
Bamboo	Bamboo toothbrush/GenB bottle /GenB speaker / GenB charger
Thistle	Bags in MaterBi
Poo	Notebook from elephant poo
Wood	Towel
Spirulina	Pills and pasta
Cork	Wine cork/GenB bottle pouch/GenB USB cork cover
Food waste	Plates and cutlery
Hemp	3D printing filament

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- Set the table with the coloured sheets, placing one bio-based product on each sheet.



- For the next enigma, prepare a box or basket closed with the lock and put the following materials inside (all the details are explained in the next section):
 - Print the clue to be added in the box/basket ([download it here](#)).



- Prepare tea leaving the infusion for at least 10 minutes; recover some rancid oil (you can fry oil several times). Put some tea and some oil in 2 separate sealed jars (pay attention not to spill the materials in the box/basket).



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Description of the player experience: Once they receive the coffee card from the previous enigma, players move to another table where they find similar cards with other feedstocks. On the table, there are 9 bio-based products derived from different feedstocks, each placed on a coloured A4 sheet. Players need to match each bio-based product with the correct card (selected from the 24 cards) displaying the related feedstock. They will result in pairs of numbers (from the back of the information cards) and colours. Looking around, they will notice a box/basket secured with a lock that requires a combination of 5 pairs colour-number. Using the combinations obtained from the matching activity, they will open the box/basket containing the materials for the next enigma.

Educational information to be used by the facilitators while playing:

Although there isn't time during the gameplay to explore all the bio-based products and their related feedstock in depth, this topic can be further discussed after the game using the materials provided in the GenB toolkit. The BioArt Gallery and the Bioeconomy Village Exhibition can also be used in combination with the escape game for additional learning. Facilitators can provide some insights and curiosities during the gameplay to enhance the experience.

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Enigma 5: Stop the time!

Learning objectives: Explore the use of renewable biological waste products to combat aging and promote healthier and longer lives. Explore the value of antioxidants and their importance in diet to prevent various diseases.

Preparation

- Set a table with 2 test tubes to pour the solution and the reagents for the experiment.



- Print the tags ([download them here](#)) and stick them on the test tubes.



- Buy a stabilised 1% starch solution online or in shops selling wine products.
- Buy iodine tincture in any pharmacy.
- Pour 5 ml of starch solution into each test tube.
- The next steps for the facilitators are explained in the player experience section.

Note: since iodine tincture may differ depending on the producer, it is suggested to test it in advance to fine-tune the right doses.

Description of the player experience: Once the players open the box/basket from the end of the previous enigma, they find a clue and sealed jars with tea (as examples of antioxidant waste) and rancid oil (as an example of non-antioxidant waste). They need to bring them to the facilitators to solve the next enigma. The facilitators have a table set up with test tubes filled with reagents. Upon receiving the materials, the facilitators add one drop of iodine tincture to each test tube and mix carefully. Then they add the tea and oil

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samples to their respective test tube, drop-by-drop, up to 4ml. Players observe the reactions when the reagents are added to the tea/oil samples. They need to identify the waste with the highest antioxidant



power, which will cause the solution to decolorise. The test tube with the most antioxidant activity will reveal a date (2019) that players will use to tackle the final enigma.

Educational information to be used by the facilitators while playing:

This practical experiment allows for the evaluation of the antioxidant power of found waste materials (tea bag and used oil) by combining them with reagents that "simulate" the aging process (oxidation). This enigma will introduce the theme of using renewable biological waste products to combat aging and live healthier and longer lives.

Starch helps detect iodine by turning water blue. Various antioxidants, particularly vitamin C present in many food wastes, reduce iodine, resulting in the colour change of the starch solution from deep blue to colourless. Similarly, typical plant antioxidants react with free radicals, which can induce genetic mutations and cause degenerative diseases as well as aging itself. Free radicals are byproducts of our respiration, inherent to our physiology, but their presence in our body is also influenced by pollution, ionizing radiation, and smoking. Antioxidants react with free radicals, inactivating them and preventing them from causing damage. Vitamin C is called "ascorbic" acid because it prevents a disease called "scurvy", which sailors often contracted in the past because they couldn't eat fresh fruits and vegetables. It's no coincidence that the World Health Organization recommends consuming 5 servings of fresh fruits and vegetables daily: they contain our precious health allies!

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Enigma 6: Letter from the past

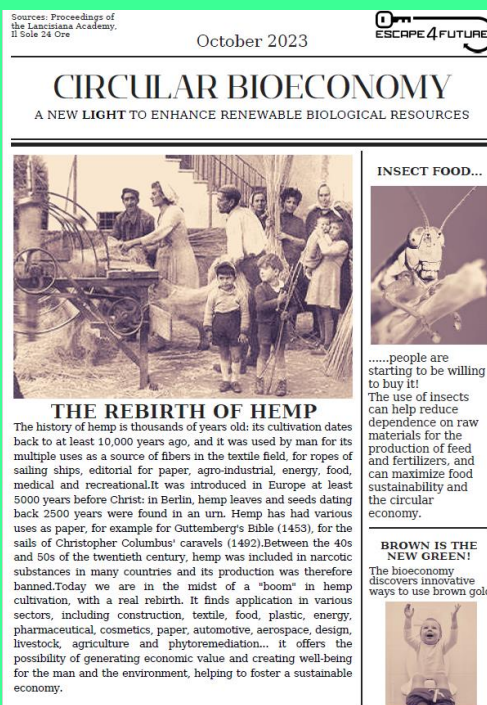
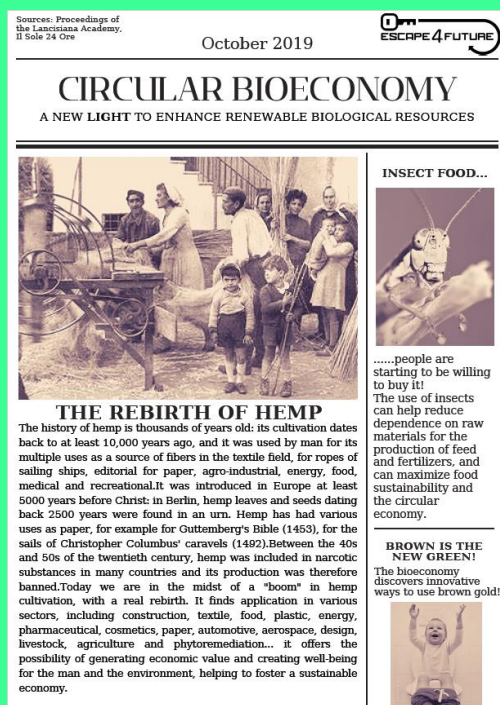
Learning objective: Learn how hemp, insects and manure can represent new resources in the bioeconomy.

Preparation

- Buy invisible ink pen.
- Buy a UV lamp to help players find the hidden word.



- Print the 2 newspaper articles (download the material from [here](#) and [here](#)) respectively and attach them near the table from the previous enigma.



- On the article dated as the same date as players had found in the previous enigma (2019), write the word "green" with the invisible ink pen.

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- Buy a lock with letters ([link here](#)) that will open the final box using the word “green”.



- Prepare a box/basket with bio-based gadgets.

Description of the player experience: The players will find two newspaper articles containing key hints for accessing a hidden message using a UV lamp. This message will unlock the final lock of the game, revealing a box containing bio-based gadgets as a reward.

Educational information to be used by the facilitators while playing:

Although there isn't time during the gameplay to delve deeply into how hemp, insects and manure can serve as new resources in the bioeconomy, these topics can be further explored after the game, using the materials from the GenB toolkit. The BioArt Gallery and the Bioeconomy Village Exhibition can also be used in conjunction with the escape game for additional learning. Facilitators can provide a few insights and curiosities can be in any case provided by the facilitators during the gameplay to enhance the experience.

Lessons learnt after several playing sessions

- The game was also adapted for primary school students by simplifying the contents and facilitating the solution of enigmas with additional clues and guiding questions.
- The optimal number of players is 10. However, the game has been played with more participants, who took a more passive role as observers (e.g. parents).
- Some enigmas from the escape game, like enigma 4, can be played as stand-alone activities.
-

Credits

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