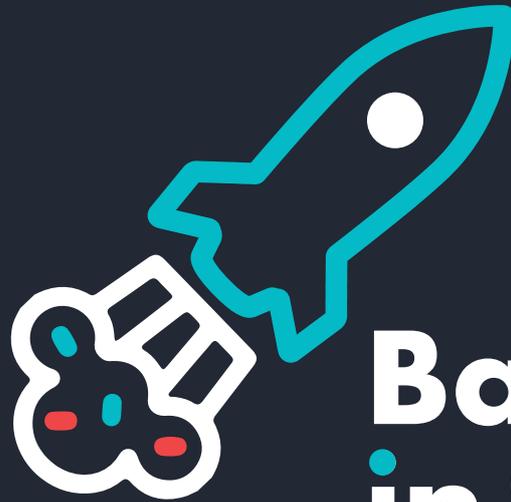




The Ark



Baking in Space

Bake to The Future Creative Activity Pack

By **Dr. Niamh Shaw**
with recipes from
Andrew Smyth

Commissioned and produced by
The Ark in collaboration with
British Council Ireland



Hello and welcome,

I'm Niamh Shaw and I'm an artist and a scientist. I started off as a scientist and then wanted to explore my creative side and became an actor. Then I came full circle and now bring the science and art that I love together - and also my love of all things to do with space!

I came up with the idea for the show, *Baking In Space*, with Andrew Smyth in 2016. Andrew is a baker and an engineer who specialises in space topics. He was a finalist in a BBC television show called *The Great British Bake Off* in 2016. We met and realised that we both wanted to make a show about space, science and baking - and we wanted it to be interesting and creative too. We both think that you can see science and engineering in everything, even in baking! That's how our show *Baking In Space* came to be.

The show is in four sections and this Creative Activity Pack has four sections to match it. I wrote it so that it is full of ideas for you to explore creativity, science and baking for yourself. You can do as many of the activities as you like before or after seeing the show. For the recipes, remember to be safe in the kitchen and ask a grown-up for help if you need it.

We would love to see what you come up with. The easiest way to share your creations with us is to ask a grown-up to share photos of them on Facebook, or Instagram or Twitter and use the #BakingInSpace hashtag. Andrew and I and all the *Baking In Space* team will keep an eye out for your pictures and we'll share some of them in the shows.

I hope that you enjoy all the special activities that we have prepared for you and I'm looking forward to seeing photos of what you create!

Dr Niamh Shaw

A Message from Earth



In 1977, Voyager Spacecrafts 1 & 2 were sent out into space heading nowhere in particular. On board were placed two golden records containing images and sounds of life back on Earth, intended to share what life is like on Earth with any extra-terrestrial life who might find them.

What is special about the Earth that you would share with people from another planet?

Write down 5 FASCINATING FACTS ABOUT EARTH that you would share with life forms on other planets:

1.
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2.
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3.
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4.
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5.
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Creating a Message from Earth

- Write a short message to extra-terrestrial beings, telling them about life on planet Earth. What objects or animals here on Earth are so special that visitors from other planets should know about them?
- With your favourite colouring pencils, crayons or pencil, include in your message a drawing of objects, food, people or animals that you think make Earth special.

Use the next page to do this if you like.

GUESSING GAME:

- Now, act out what is in your drawing, without showing the drawing to anyone.
- See if they can guess what it is.
- Was the other person able to guess correctly?
- Take turns acting out and guessing.

Acknowledgement: Parents, you can check out this activity from the European Space Agency's Education and Resources Office ESERO 19 Special Life resource at esero.ie.



Name:

Age:

Title of my drawing:

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Orbiting Earth



How would you describe what gravity is?

FASCINATING FACTS

- 1 Gravity is a very useful force – it holds everything together.
- 2 It keeps us on the Earth, and keeps the Earth and the other planets revolving around the Sun. Without it, everything would float around.
- 3 Every object in the world has this pulling force of gravity – the bigger the object, the greater the force.
- 4 Earth is so big and heavy that its force of gravity is very great.
- 5 The nearer things are to each other, the greater the force of gravity between them.
- 6 Because the Moon is much smaller than the Earth – it is about the same width as Australia – it is not nearly as heavy as the Earth, and so gravity is much weaker there. In fact, it is only about one-sixth of gravity on Earth.

Thinking Time

When you let go of something, in what direction does it go?

What makes it go in this direction?

This is because of the force of gravity pulling everything to the centre of our planet.

It's how your pens and pencils stay on your desk.

And how pillows stay on your bed.

How your toys stay on the floor or on your shelves (if you are tidy!)

And how your dinner plate stays on the table.

In fact, when you think about it, gravity keeps your house clean!

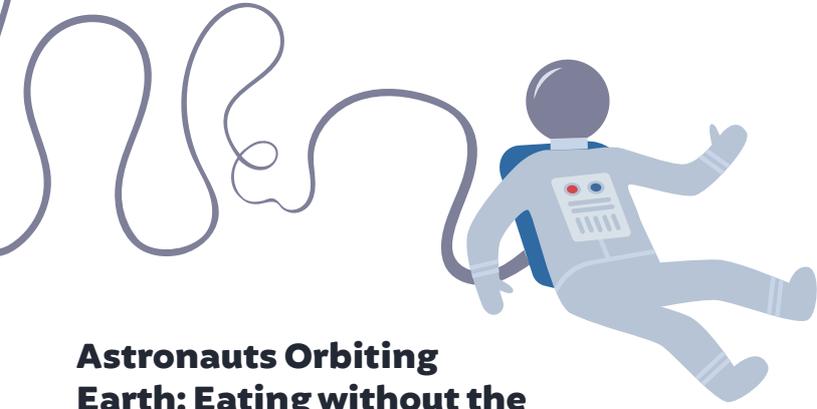
Imagine if there was no gravity on Earth – how messy would your house be?



THE EATING EXPERIMENT

- Get a blank piece of paper (A4 printer paper will work well) and write your name on the sheet and the day of the week.
- For one day, place the sheet of paper underneath you everywhere you eat. Bring it **WHEREVER** you go and put it under you whenever you're eating – your breakfast, lunch, snacks, and tea.
- How messy is it at the end of the day?

Thanks to gravity, all your crumbs and spillages drop to the sheet of paper instead of floating off into the air, making your mess easy to clean!



Astronauts Orbiting Earth: Eating without the effects of gravity

How do you think the astronauts cope with their food mess when they eat?



A MESSY SPACECRAFT

This time, get two sheets of paper and label them at the top - one is named 'TOAST' and the other is named 'WRAP'. Write your name on them and the day of the week.

For this experiment you will need:

- A slice of white/brown bread
- A wrap (or tortilla)
- Peanut butter or jam or whatever is your favourite spread

Method:

- 1 Toast the bread in a toaster or under the grill.
- 2 Spread peanut butter on the toast.
- 3 Taking the wrap, spread about the same amount of peanut butter on it.
- 4 Place the 'TOAST' paper underneath you and eat the toast, being sure to catch all the crumbs on the paper.
- 5 Place the 'WRAP' paper underneath the wrap and eat it, being sure to catch any crumbs on the paper.
- 6 Compare the number of crumbs on the TOAST page and WRAP page - which has more crumbs?
- 7 Based on your findings, which type of bread do you think astronauts use in space? Why do you think that is?

FASCINATING

FACTS

- 1 Why do we see pictures of astronauts bouncing around, 'weightless' inside their spacecraft? Is this because there is no gravity in space?
- 2 No! THERE IS GRAVITY IN SPACE (or otherwise the spacecraft would just float off into the universe!).
- 3 The astronauts appear to float because of 'weightlessness' inside the spaceship. The spacecraft and the astronauts are both moving together under the influence of gravity.
- 4 This is called 'freefall' or 'weightlessness'.
- 5 The nearest feeling we get to this on Earth is being in a lift which goes down very quickly, or a rollercoaster going down quickly, or being in an aeroplane which hits an air pocket and goes down very suddenly.



On board a spacecraft orbiting Earth, the astronauts have the sensation of weightlessness and, because of this, everything floats in the air around them. This also happens when they are eating. The food astronauts eat can't have crumbs, or else the crumbs will float away and potentially damage very expensive and important equipment in the space craft. Aren't we lucky on Earth to have gravity to help us keep our houses clean?



BAKING EXPERIMENT

HONEYCOMB MOON



This is a picture of honeycomb made in the shape of the Moon - you can make one too.

Ingredients:

150g caster sugar
70g golden syrup
1 ½ tsp bicarbonate of soda

You'll also need:

A lined 8 inch diameter tin with tall sides and preferably a removable base (or a smaller tin with scaled down quantities)

A large whisk

A heavy-based large saucepan, preferable with a metallic base

Greaseproof baking paper/non-stick liner

As you lift off to orbit, you'll have a magnificent view of the Moon. For this recipe, you'll be creating your very own edible Moon, complete with delicious craters! The more creative the better, you could even make an edible apollo lander to sit on top...

Method:

1 Add your golden syrup and caster sugar to the large saucepan. Make sure you've lined all the base and sides of your tin with greaseproof paper or reusable silicone liner paper.

2 Put on a medium heat on the hob and gently swirl as the sugar dissolves. Don't stir the mixture as this can cause it to crystallise. Try to just swirl it gently if possible! Make sure the 1 ½ tsp of bicarbonate has no lumps and is in a small bowl ready to be added.

3 Be careful with the next step as hot sugar can burn very easily! When all the sugar is dissolved and the mixture has turned a slightly darker amber colour, remove it from the heat and quickly add the bicarbonate of soda. Quickly, but gently, whisk it then immediately pour into the lined cake tin.

4 You'll see the mixture inflate and grow in size before deflating again, forming large craters, just like the moon. You can experiment with how long you whisk to see what happens to the size of the craters. Generally, less whisking means larger craters!

5 Leave to completely set until the tin is cool to the touch. To clean the saucepan, just fill it with hot water and leave it for half an hour and the sugar will dissolve off!



FASCINATING FACTS



When the bicarbonate of soda is added to the hot mixture, it quickly releases a lot of carbon dioxide gas.

This is what gives honeycomb all those bubbles!

The Moon

Gravity, the Moon and our Neighbouring Planets



What's gravity like on the Moon and other planets in the Solar System?



- 1 The force of gravity on the Moon is one-sixth that of Earth.
- 2 That means that if your cat or dog weighed 6kg on Earth, it would weigh 1kg on the Moon.
- 2 Do you think that you would feel lighter or heavier on the Moon compared to Earth?
- 3 The force of gravity on celestial objects like Earth, our Moon and the other planets in our Solar System is different and related to the size of the planet and how heavy they are.

Feeling gravity across the Solar System:

The Moon

The Moon is one-sixth smaller than Earth and its gravity is one-sixth that of Earth.

Jupiter

Jupiter is the biggest planet in our Solar System, 318 times bigger than Earth! You might think that means that the gravity on Jupiter should be 318 times bigger than Earth too. However, since a lot of Jupiter is made up of gas, the gravity on Jupiter is almost 2.5 times heavier than Earth.

Mars

Mars is smaller than Earth, it's one-third the size of Earth with a thin atmosphere and has a gravity force one-third that of Earth.

Now it's Your Turn:

Find out what is the gravitational force of the Sun, and then do the same for other planets in our solar system.

The Sun

SIZE _____ FORCE _____

Mercury

SIZE _____ FORCE _____

Venus

SIZE _____ FORCE _____

Earth

SIZE _____ FORCE _____

Mars

SIZE _____ FORCE _____

Jupiter

SIZE _____ FORCE _____

Saturn

SIZE _____ FORCE _____

Uranus

SIZE _____ FORCE _____

Neptune

SIZE _____ FORCE _____

Pluto

SIZE _____ FORCE _____

Living on Different Planets



DRAMA ACTIVITY

Here's a fun drama-based experiment to think about how gravity affects the way we move.

Living on Earth

- Walk around the room, at the pace you normally walk around.
- Now pick up your schoolbag - what muscles do you use to pick up your schoolbag?

Living on the Moon

- Now imagine you are on the Moon.
- The Moon has a gravitational force one-sixth that of Earth.
- That means that you would be one-sixth lighter.
- So, how would that affect the way you walk? Would you be bouncier in your walk?
- Walk around the room as if you are on the Moon.
- Now pick up the schoolbag as if you are on the Moon. What's different?
- What would happen to your muscles over time if you lived on the Moon? Would they get weaker or stronger?

Living on Jupiter

- Now imagine you are on Jupiter.
- Would you feel heavier or lighter on Jupiter?
- How would you walk on Jupiter?
- Is it easier or more difficult to walk?
- Would it be easier or more difficult to pick up your schoolbag?
- And what would happen to the muscles in your body if you lived on Jupiter? Would they get weaker or stronger?

Living on the International Space Station

- For the astronauts orbiting the Earth on board the International Space Station who are not experiencing any gravity, what do you think happens to their muscles over time?
- How do you think they would feel when they returned to Earth?
- Would they feel weaker or stronger than citizens on Earth when they first return?

Design a special spacesuit to wear on Venus



Name:

Age:

Title of my drawing:

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BAKING EXPERIMENT

REGOLITH MOON BASE



Your Regolith Moon Base could look something like this.

Ingredients:

200g mini marshmallows, or large marshmallows cut into small pieces
50g unsalted butter
150g Rice Krispies or puffed rice cereal
A little icing sugar to stop things sticking!

You'll also need:

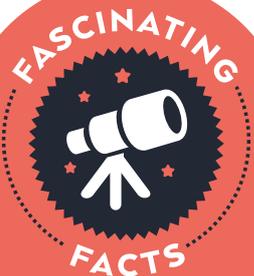
A large microwave-safe bowl
A smaller bowl to mould your Moon Base around
Silicone spatula
Cling film / greaseproof baking paper
Disposable gloves (make handling things easier!)
A sharp knife

Method:

- 1 Turn your smaller bowl upside down onto a sheet of baking parchment and place a piece of cling film tightly over it, tucking it in underneath the bowl. This will make it easier to remove the moon base later.
- 2 Melt the marshmallows and butter in the large bowl in the microwave in 20 second bursts, stirring in between. Once it's fully melted, stir in the Rice Krispies.
- 3 If you've got gloves, put them on now, otherwise dust your hands with a bit of icing sugar as this will make things easier to handle!
- 4 Tip the marshmallow mix over the small bowl and use your hands to sculpt it roughly over the bowl into a dome. If you've got extra left over, you could even make a tunnel as an entrance (using a cling film covered rolling pin) or you could put it into bun cases to eat afterwards. As the mix is extremely sticky to work with, the easiest way to mould it into an even shape is to lay another sheet of greaseproof baking paper on top and use this to smooth out the surface, this will keep your hands from sticking!
- 5 Once you're happy with the shape of your Moon Base, put it in the fridge for at least 30 minutes until it's firmed up. Once firm, gently turn it over and remove the bowl and cling film from the inside. You can use a knife (be careful!) to cut out an entrance for your moon base and can go wild with your imagination to decorate it!

“Regolith” is what we call the broken up bits of rock and dust on the surface of the Moon. By using it to make future habitats, it saves us having to carry all that material from Earth. In this recipe, you can make your own Moon Base, using Rice Krispies (or puffed rice cereal) as the “moon rocks” and a delicious marshmallow cement to join them together.

3



In this example, the Rice Krispies are our moon rock or regolith.

If we had to carry all our material to space, that would be 400g.

But if we can get the Rice Krispies (or moon rock) when there, we only need to bring 250g with us. This saves us almost 40% of the total weight!

Flourishing Earth



Our planet provides everything we need to survive:

- LIGHT to keep us warm and to be able to move around
- AIR to breathe
- WATER to drink
- FOOD to eat

The planet is completely self-sufficient.



Think about your home. Is it self-sufficient like the planet? Do you have everything you need in your home?

- You have water available when you turn the tap.
- You have light when you switch on the light.
- You have warmth when you switch on the heating.
- You have a kitchen to cook all the food you need.

What about waste?

- You have water to flush the toilet.
- You have a sink to wash the dishes.
- You have a washing machine to clean your clothes.
- You have a bin to dispose of all your rubbish.

But our homes aren't really self-sufficient:

- The water comes from a system of pipes that come in from outside.
- The light and heat comes from a supplier of electricity or gas which also comes in from outside.
- Your parents or guardians have to go to the shops to pick up food.
- You put your bins out every week for the council or bin company to take away for you.
- And your waste water gets pumped to a treatment plant to clean the water.

So, our houses are part of a network of systems that give us what we need.

But how would we live on another planet or on the Moon?

- There are no electricity suppliers.
- Or food shops.
- Or people to come and take our waste away.



FASCINATING



FACTS

In space, scientists and engineers have come up with solutions for the astronauts to live almost self-sufficiently, like mini-planets.

- 1 They design systems that re-use everything. These systems are called closed-loop systems.
- 2 The International Space Station is almost a completely closed-loop system.
- 3 They get their electricity from the huge solar panels hanging outside, capturing the rays of the Sun and converting them into electrical energy.
- 4 They get their oxygen from a special machine that takes the air and purifies it for the astronauts.
- 5 They extract the moisture in the air and collect it for drinking water.
- 6 They re-use their water too - their urine is purified and becomes drinking water!
- 7 Every cup of water is kept and re-used as much as possible.
- 8 This is because water is extremely valuable in space - you cannot source it anywhere except on Earth. And humans need water to live.
- 9 That's why astronauts don't take showers in space or flush their toilets with water.

LIVING OFF EARTH

Imagine that you had to move to Mars and your home had to be completely self-sufficient.

- What changes could you make to your house or the way you live?
- What if water was as rare on Earth as it is in space or on another planet? How would you change the way you use the water in your house? What would you do differently?
- Would you still wash your dishes? Would you still wash your clothes?
- What if fresh food was extremely difficult to source or there were no shops to buy food? What would you eat and how would you use your food more wisely?

The system is not entirely closed-loop:

- 1 They do purify their poop but don't use all of it. Most of the poop goes into the rubbish.
- 2 And they do need regular supplies of food from Earth.

But if we were to live on a new planet, we would need to find new ways of living where we would re-use everything.

- What about power? If you had to generate the power in your house yourself, how would you generate the electricity and how would you ensure that you had enough power to keep the lights and the TV on?
- And if there was no collection of your bins, what would you do with your waste?
- How would your toilet work if you couldn't flush your poop away? What kind of toilet would you need to use instead?

There's a lot to figure out to live in a closed-loop way!

If you like, ask your family and friends for their ideas and see what you can come up with together.



4

IMAGINING NEWWAYS TO LIVE:

Imagine you are a journalist for a newspaper who has travelled to the future. You are interviewing different people who live in a closed-loop town. What would you like to know about what life is like there?

Think of some questions you could ask them, such as:

- What is the best part about living in a closed-loop town?
- What's their favourite closed-loop invention?
- How did their town become a closed-loop town?
- How has it made life better for them?

Think of a few different people you are going to interview. Maybe the town mayor, the school teacher, the shopkeeper, the farmer, the children or even the pets? If you like, you can ask people in your family or friends to pretend to be the different people in the town and you can ask them your questions. Or else you can simply imagine the answers yourself.

Now, come up with a catchy headline and write your newspaper article explaining to people in the present what you found out.

Write your article on the next page!



THE FUTURE NEWS



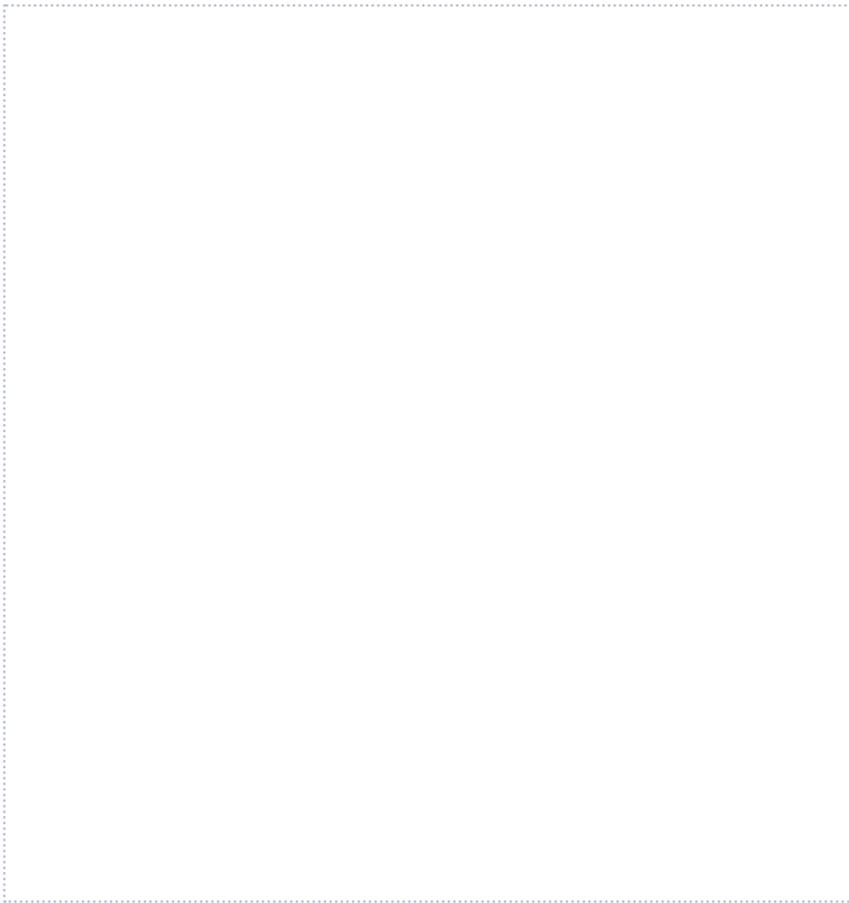
Write your headline here

A large rectangular area enclosed by a dotted line, intended for a drawing.

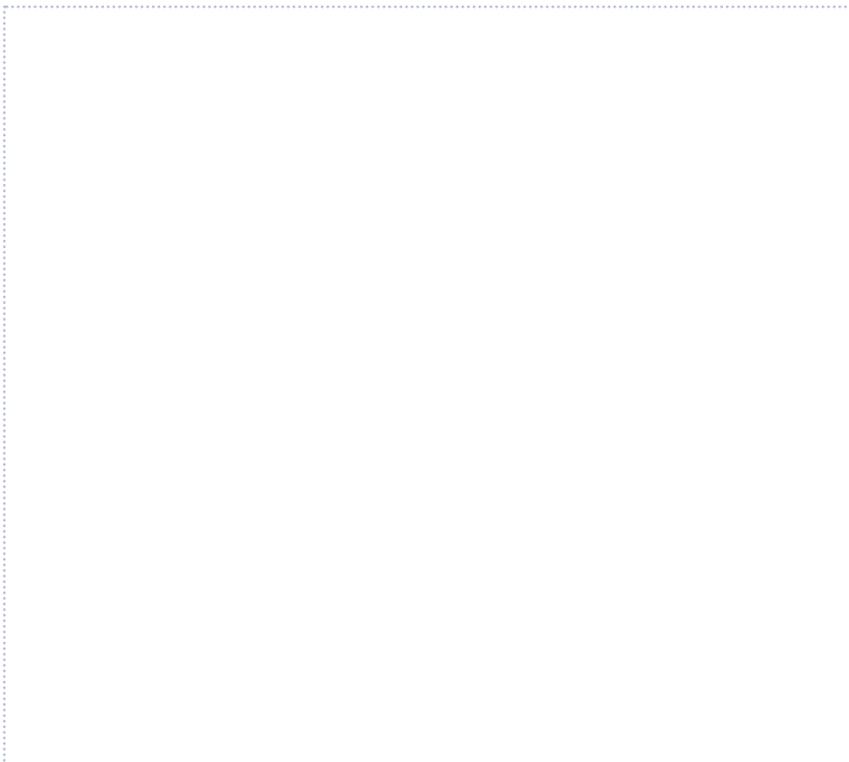
Add a drawing here

A series of horizontal blue lines for writing the news article.

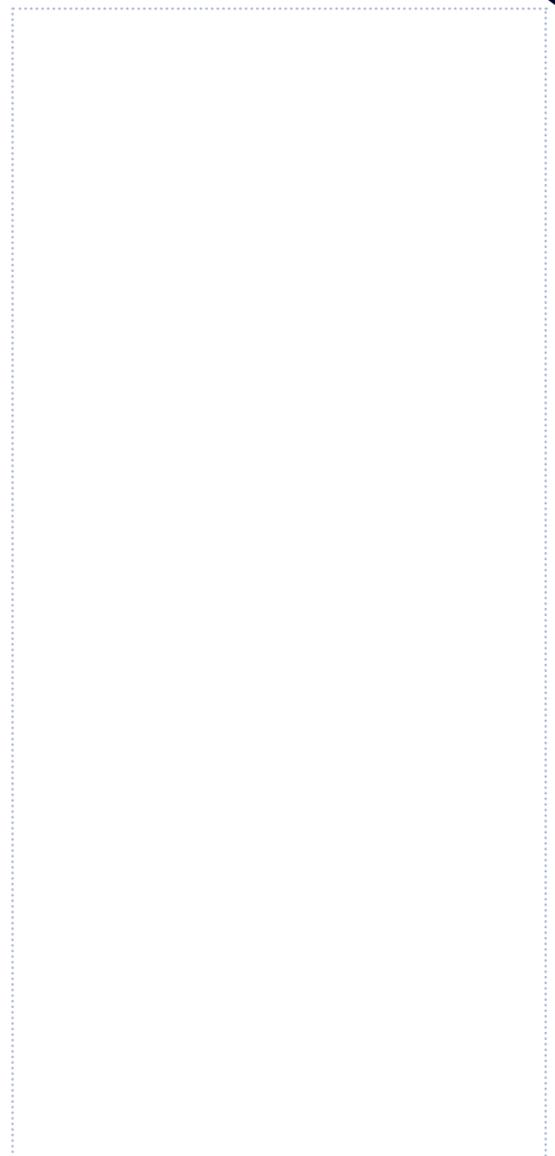
Draw pictures to share your vision of a future Earth where we have figured out a way to live where we re-use everything.



What are the inventions that make it possible?



What do houses look like now?



What about the people – do they look happier or healthier?





Grown-ups can find us on social media at:

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British Council Ireland @ieBritish

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