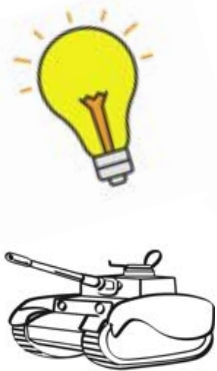


STEM

Activities you can do at home!

Science, Technology, Engineering and Maths





S

T

E

M



We are Education Officers at ALIenergy, and we work to support learning around four important subjects. Normally, we do this with workshops in schools, taking part in summer shows and careers events. This year everything is different, so we are doing things a bit differently. This workbook is for you to learn about STEM and have some fun at home. Enjoy the activities and be creative with your workbook, there are lots of doodles for you to colour in and a fun competition to get involved in too for a chance to win a kit to BUILD YOUR OWN ROBOT ARM!!



What is STEM?

Science, Technology, Engineering and Maths are not just subjects at school, college or university. They are in almost everything we experience and explore: the buildings, plants and animals around us, the food we eat, the gadgets we use, how we get around - not to mention the energy we need for life and learning in our technological world.

Why is STEM so important?

Life in the 21st century, and especially the early 2020's, is full of challenges for humans to face and overcome. The demands for food, clean drinking water, energy sources and so on are harder to meet than ever, given how our planet's climate is changing while its population is rising. Finding new ways to adapt and survive in this ever-changing world relies heavily on people who have STEM skills, so choosing STEM makes sense.



WHY CHOOSE STEM?

1 PLANET

Studying and working in STEM helps us understand, protect and improve the world we live in.

EARTH



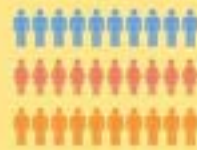
GROWING SECTOR 3 TIMES



In the past 10 years STEM jobs have grown THREE times faster than in other sectors.

500,000 JOBS

There will be over 500,000 new STEM jobs in the UK in the next 5 years.

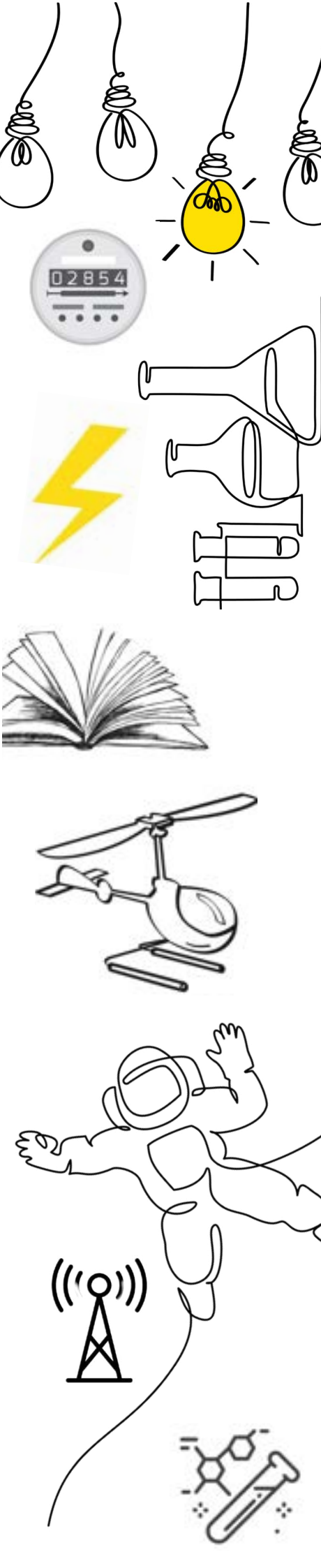


EXCITING CHOICES 1,000's



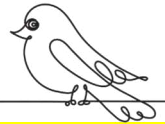
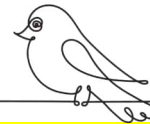
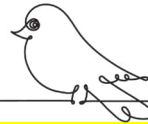
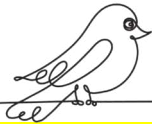
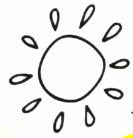
There are thousands of different jobs in STEM, from designers to pilots, vets to software engineers.

WHERE COULD YOUR STEM JOURNEY TAKE YOU?





Make your own BIRD FEEDER



You will need:

- Plastic bottle
- String
- Scissors
- Bird seed
- A tree or place to hang it outside
- A twig or wooden spoon

One of the biggest challenges facing the marine world is plastic! Over 40% of the world's oceans are polluted by man-made products such as plastic bottles and so it's really important that we all do our bit to recycle and reuse products wherever possible. Hold on to a couple of plastic bottles and give them a new use in life by making bird feeders!! You are doing your bit to keep plastic out of our oceans and keep your garden birds happy at the same time.

FEEDING NATURE

1. With help from an adult, cut 2 holes directly opposite each other in the plastic bottle.
2. Push through either a small stick or wooden spoon to act as a little perch for birds to sit on either side while they are eating.
3. Fill the bottle with bird seed and screw the top back on to keep out the rain.
4. Tie string around the bottle neck and find a place to hang it outside.



SKILLS YOU NEED

Other than carefully following the instructions, you don't need to have any particular skills to carry out this activity. If you look at the world of work where people help conserve nature and protect vulnerable species, skills such as bird identification and concentration skills are sought after!

DID YOU KNOW?

Woodpeckers peck on a tree at the rate of almost 21 times in a second - that's fast!
Crows can imitate the voices of various animals!



LINKS TO STEM JOBS...

A Bird Specialist who has studied Ornithology can expect to earn an average salary of £35,000 per year! An individual does not necessarily need to do a degree course and can often work their way up with lots of experience in bird-watching and ringing!










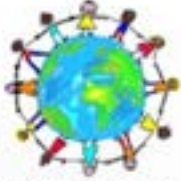















WHY NOT TRY

Next time you are on a walk out in nature, start collecting twigs, sticks, leaves and other natural bits and pieces. You could stuff these into an old plant pot, gallet or even just tie together with string. Put this in a dark and damp corner of your garden, providing it home for all the bugs and insects that we rely on to keep the natural cycles of our garden going!



STEM Words BINGO

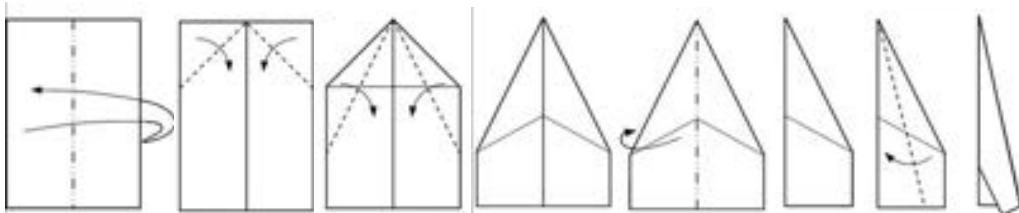
Look around for examples of these. You can play with other people, first person to find five in a row wins, or play on your own and see if you can find all of them. Good luck!

 <p>Something powered by electricity</p>	 <p>Something with gears</p>	 <p>Something which reflects</p>	 <p>Something designed by an engineer</p>	 <p>Something living</p>
 <p>Something used to measure</p>	 <p>Something hollow</p>	 <p>Something that has wings</p>	 <p>A source of water</p>	 <p>Something that rotates</p>
 <p>Something that floats</p>	 <p>An example of technology</p>	 <p>Something used to magnify</p>	 <p>An example of insulation</p>	 <p>Something with a wheel</p>
 <p>Something that melts</p>	 <p>Something that uses battery power</p>	 <p>Something that relies on wind power</p>	 <p>Something really really tiny</p>	 <p>Something we can recycle</p>
 <p>Something that cannot be recycled</p>	 <p>Something transparent</p>	 <p>Something which creates sound energy</p>	 <p>Something that dissolves in water</p>	 <p>Something that gets hot</p>

FLIGHTING FUN



What do you think are the design characteristics of a successful paper plane? Using a similar design to the picture below, or by making your own template, investigate how different shapes, angles and materials affect your plane's ability to fly short and long distances.



You will need:

- Paper
- Pen/pencil
- Scissors
- Measuring tape
- A target-made from card?

FLIGHTING FUN



WHAT ARE WE LEARNING?

By throwing your paper plane you are creating a force called Thrust, its the force that propels it forward when you throw it. The air acts like a wall and pushes against it, this is a force called Drag. The plane will only keep going forward if the thrust is stronger than the drag. Gravity pushes down on top of the plane trying to force it to the ground but the wings of the plane create a balance, and a force called Lift. It is a combination of all 4 of these forces - Thrust, Drag, Gravity and Lift that affects how far your plane will travel.



LINKS TO STEM JOBS...

A Pilot and an Aerospace engineer must be specialists in the forces we have just learned about. They must take all of these factors into account in the jobs that they do.



WHAT SKILLS ARE REQUIRED IN AVIATION?

Becoming a pilot requires a very particular and specialist set of skills:

- = spatial awareness
- = confidence
- = problem solving
- = a passion for aviation
- = first class communication skills
- = quick thinking
- = technical ability



1. Carefully create, cut and shape your template to build your plane.
2. Create a Bullseye target on the wall - you could draw a target on a large sheet of paper and stand different distances away from it or you could use cones spread apart, one 5 metres away from you, and another 10 metres.
3. Start testing your plane, first using the short distance, and build up to the long distance.
4. To make things more tricky you could change your plane to a more advanced design and number your target to compete against another person for the highest number.

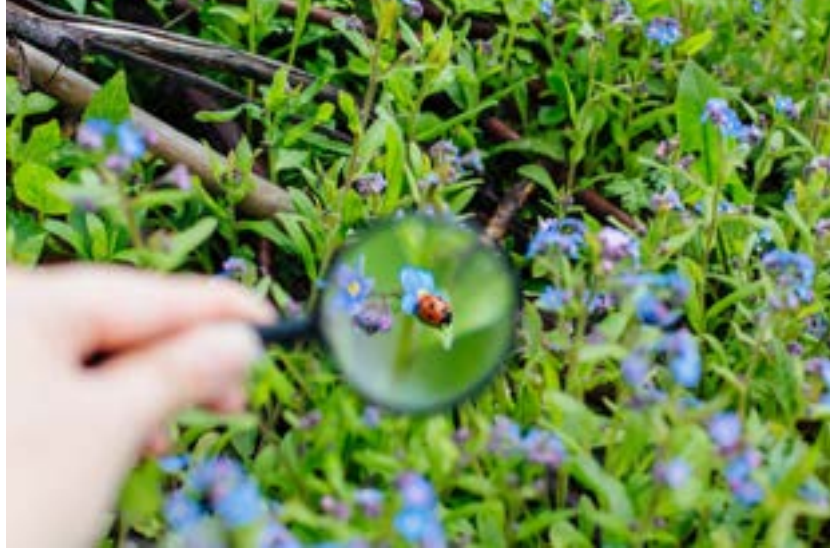


COLOUR ME IN



Photo

SCAVENGER HUNT



You will need:

- A camera or phone with a camera
- A scavenger hunt list
- A magnifying glass
- A timer

Textures	Plants	Shapes	Object
Rocky	Leaves	Oval	Bird
Wet	Roots	Circle	Moon
Soft	Soil	Rectangle	Frog
Spongy	Petal	Square	Tree
Sticky	Fruit	Star	Insect
Rough	Veg		Grass
Jaggy	Seed		Stone



PHOTO SCAVENGER HUNT

1. Decide on the theme of your hunt using some of the examples in the table above and your own ideas.
2. You have 15 minutes to find and photograph an example of each item on the list. They must be found in the natural environment rather than man made.
3. Use a magnifying glass or the zoom on your camera to inspect its elements closely.



WHAT ARE WE LEARNING

When you are closer to the natural world, you discover that it is made up of so many different colours, shapes and textures. Morphology is the biological study of the shape of living things.

LINKS TO STEM JOBS...

People who work in STEM roles such as Engineers and Scientists look at nature for inspiration when trying to solve problems and designing new things. The term used to describe this is biomimicry. A very surprising example of this is seen in the design of the nose section of Japanese Bullet train which is based on the beak of a Kingfisher bird - wow!



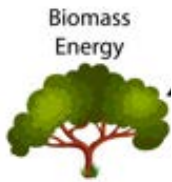
WHY NOT TRY

Why not make this into a more competitive team challenge and see who can find the most items in the time?

Why don't you research some of the other ways that nature has inspired designs?



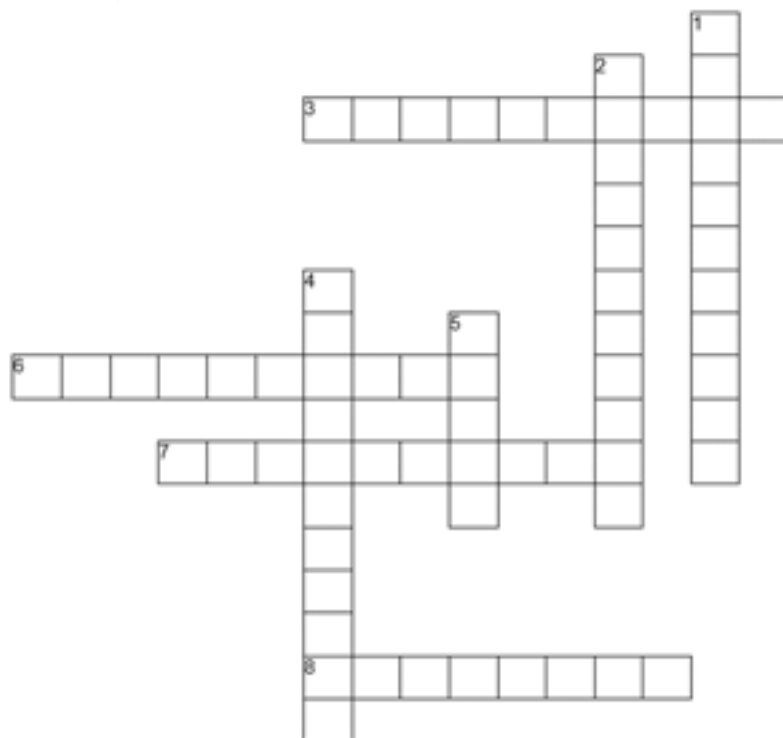
Test your ENERGY KNOWLEDGE



Renewable Energy Sources

Non-Renewable Sources

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Down

1. Nonrenewable forms of energy are called _____.
2. _____ are found on top of roofs and generate electricity from the sun.
4. Most of the energy we use generates _____, which is needed to power things like our lights, PlayStation etc.
5. Energy which comes from the movement of water in places like rivers, is called _____ energy.

Across

3. Gases in the atmosphere which trap heat are called _____ gases.
6. Reducing the amount of energy we need to perform a task and doing more with less, is called energy _____.
7. _____ energy comes from the heat found deep within the earth.
8. Wind energy is captured using machines called wind _____ which can often be seen on hills in windy places.

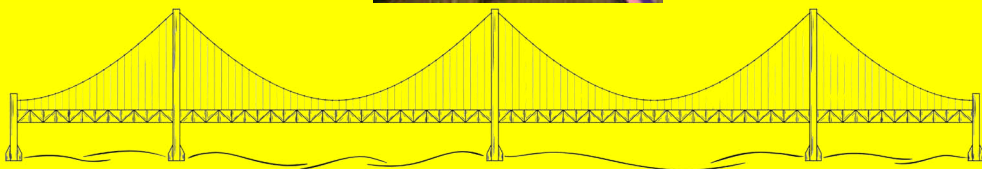
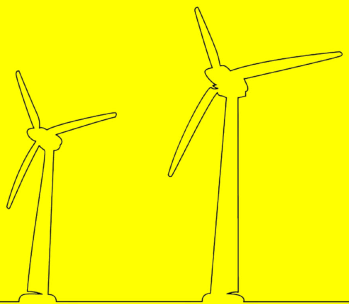


TOWER BUILDING Challenge

You can use a huge variety of items for this activity. Why not try more than one design to see what works best.

- Marshmallows or play dough and spaghetti
- Paper cups and lollipop sticks
- Card
- Newspaper
- Weights such as books/ coins

There are lots of ways you can build a tower using materials often found lying around the house. Try to find out which materials, shapes and angles allow you to build both the tallest tower but also the strongest. Have a think about designs most commonly found in famous buildings like the Eiffel Tower and investigate why.



Challenge 1 - Build a structure that can support the most possible weight. You could use books to create a sturdy base.

Challenge 2 - Build the tallest structure possible without it collapsing.

Challenge 3 - Build a bridge between 2 tables or stacks of books that can hold a weight on top.

BUILDING STEM SKILLS

WHAT ARE WE LEARNING



It is likely that a strong and successful tower will include triangles in its design. Triangles are rigid shapes and when placed under a heavy force, they hold their shape well unlike a square for example, which will be squashed into a parallelogram. Overlapping and crossing the sticks will help to make the shape stronger.

DID YOU KNOW?

The World's Largest Paper cup pyramid was built in 2016 in India and was made of 56,980 cups stretching 22 feet tall - how high can you make yours?



LINKS TO STEM JOBS...



Engineers and architects create tall structures and strong bridges, they must think very carefully about their shape and base. Like you have had to do in this activity, they also have the deal with time and material limitations when they are working.

WHY NOT TRY

Next time you are on a walk out in your local area, look at buildings, bridges and other structures which you think have been designed and built by engineers and architects. What similarities can you spot? What shapes can you see at work? Do you think engineering is all around us?





What ENERGY do you see AROUND YOU?

We tend to walk around the local area in which we live and not really look closer to the detail that's right in front of our eyes. When it comes to energy, it's incredible how much is going on here in Argyll. There is an abundance of energy choices in our local area, it's a real hub for renewable energy. Because of this, there are big energy developments, worldwide companies and energy specialists at work on our doorstep tapping into our area's rich resources. Next time you take a walk, why not make it an Energy Walk. Keep your eyes peeled for all the cool work going on and research it further if you are interested to know more about energy in Argyll! It may also help give you inspiration for the art competition later in the workbook, perhaps you could take some pictures as a reminder!

What natural resources do we have in Argyll which we could use to create electricity?



Can you see any renewable energy sites and if so, what kind?

Four horizontal lines for writing.



Four horizontal lines for writing.



Can you find out 3 companies who work in the energy industry in Argyll? Perhaps you know someone who works with them locally or can do

Within those 3 companies, can you name some roles relating to STEM? E.g. Engineer or Data Analyst

Three horizontal lines for writing.

Three horizontal lines for writing.



REDUCE, REUSE, RECYCLE.



Be an ECO GARDENER!



Science is all around us and one place you will see lots of science at home is in the kitchen.

What do you do with the stems of vegetables you eat like leeks, spring onions and lettuce? Like many of us, do you throw them in the bin?

Next time, why don't you keep them and try out our kitchen garden experiment using the steps below. There is science and life all around us!



- You will need:
- A small container
 - Some veg roots saved from the bin!
 - Water

1. With help from an adult, keep aside some veg roots. You could try spring onions, leeks, and lettuce.
2. Sit the veg in a small container of water root end down and just enough water to cover the food half way up.
3. Change the water in the container every few days.
4. Watch as your veg begins to grow again!



ECO GARDENER

FUN FACTS

Placing a banana or apple in a brown bag with an avocado will make the avocado ripen faster. Bananas and apples release ethylene gas, a naturally occurring plant hormone that speeds up the ripening process.

A lemon can act as a battery and has enough energy to power a light or small motor!



LINKS TO STEM JOBS...

Science is everywhere, even in the food we eat. Food science is the study of the physical, biological, and chemical makeup of food. Food Scientists can enter the profession through various routes such as starting in a food factory or studying a degree at university. You could work in a variety of environments such as science labs, factories and hospitals.



WHY NOT TRY

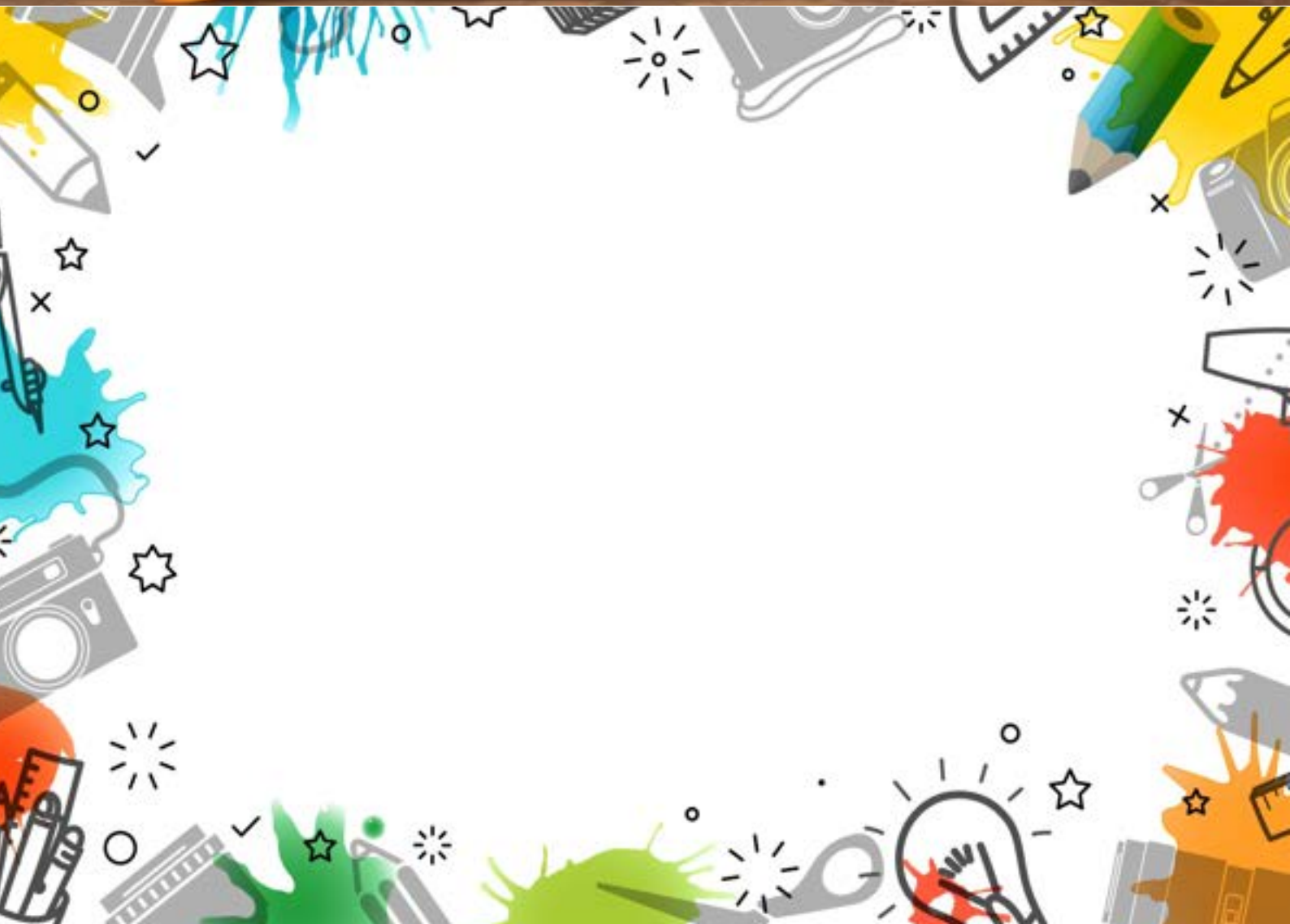
There are lots of cool ways you could jazz up this experiment. For a start, you could make a chart and record daily changes in your plants, identify what happens to roots, stems, colour, rate of growth and compare different plants to each other. You could take pictures of your plant every few days so you can see a visual timeline of the changes. Also experiment with re-growing other types of fruit and veg - can you regrow a pineapple?



We have learned from these activities that STEM is all around us, and not just something we study in school. We rely on it every day for simple tasks and will rely on it even more in future with the challenges we face in the world.

- Are you interested in studying STEM in the future?
- Are you interested in a STEM career?
- If yes, then what might that look like? Perhaps you want to be a scientist working to develop a cure for cancer, or maybe an IT engineer developing a new PlayStation model, or working on an Arctic exploration ship monitoring the impacts of climate change.

Use the space below or on another piece of paper to show us how you visualize you and your STEM future. You can send pictures to enquiries@dalienergy.org.uk for a chance to win a Build Your Own Robot Arm Kit!!



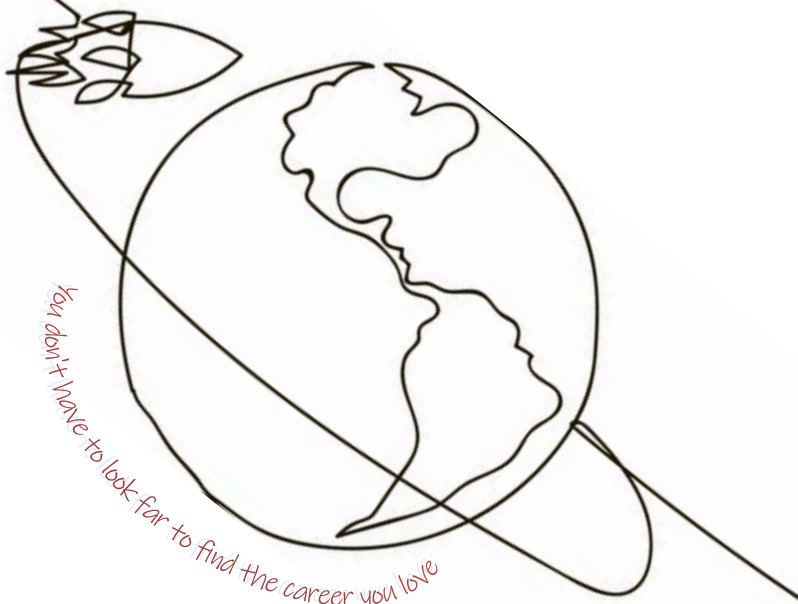
OPTIONS

- School careers advisor
- Teachers
- Family
- Online support
- STEM Ambassadors



When it comes to thinking about a career path and 'making choices', it can seem like a bit of a daunting prospect and make you feel like 'I've not long started high school, surely it's far too soon!'. The good news is, it is early and it's ok if you don't yet have a clue. There are plenty of sources of careers advice on offer when the time comes.

If you think you are interested in STEM subjects and this might be an area for you to explore in the future, then there are lots of ways you can develop your interests both inside and outside the classroom. You could join an after school club, teach yourself a new skill like chess or Lego, and learn more about STEM online.



You don't have to look far to find the career you love

FUTURE PATHS

5 YOU COULD TAKE

1 FURTHER EDUCATION

Any education after secondary school that is not a degree programme at university. There are local colleges with a range of different STEM courses.

2 HIGHER EDUCATION

Education after secondary school that most commonly takes place within a university and is studying at a degree level. Scotland has some of the most respected STEM departments in universities.

3 FOUNDATION APPRENTICESHIPS

These are for school students to gain work experience and an industry recognised qualification in their chosen field, including those in STEM. They happen alongside school studies, with apprentices spending a proportion of their school week developing skills in the workplace.

4 MODERN APPRENTICESHIPS

Anyone over the age of 16 who has left school can take a Modern Apprenticeship and start earning straight away. You learn skills on the job while working towards qualifications. It is a partnership between an employer, Skills Development Scotland and a local person.

5 GRADUATE APPRENTICESHIPS

These are for college or university students to put their learning straight into practice in paid positions with an employer. Designed by industry the apprentices are certain that the skills they gain in both the workplace and in their studies are entirely relevant and sought after.

SO MANY ROUTES FOR YOUR STEM JOURNEY



ALIenergy works for a world where everyone lives sustainably, where climate change has been tackled and in which the energy we use is cleaner and greener. As Education Officers, Katie and Michael support the vital role STEM plays in pursuing these goals and work to connect school pupils with local employers.

Check out our latest video **STEM Journeys in Argyll**. This is available on www.alienergy.org.uk and our YouTube channel and includes:

- a five-minute video featuring four very different STEM professionals working across Argyll,
- seeing how Dougie, Jack, Morgan and Sarah work and finding out about their career journey and views on STEM, and
- chances to read profiles from other people working in interesting STEM roles.



We hope that the video inspires you to think about STEM and understand more about what amazing careers are right on your doorstep. There is no one right way to get to the career you love. Sometimes it's about trial and error and finding the right path for you. If you would like some more information or have any questions about STEM Education or STEM in Argyll, then you or your parents/carers can contact us on katie@alienergy.org.uk or Michael@alienergy.org.uk. Don't forget to send your competition entries in enquiries@alienergy.org.uk. A winner will be announced and awarded with their prize before the end of May.



AliEnergy's Education and Skills Development Programme is funded by ScottishPower Renewables' Beinn an Tuirc 2 Windfarm Community Benefit Fund