Earth Explorer

STEM resources

STEM – Science, Technology, Engineering and Maths – this subject matter form the basis of a wide array of knowledge that is inter-connected to work based careers. Many schools cover these areas through the school curriculum in an academic way but STEM based subjects don't have to be boring.

In Scouting we offer young people a unique learning space where everything can be explored. Learning by doing, working in teams, sharing ideas and being creative, solving problems – these are some of the ways that Scouting uses to gain and impart knowledge.

Throughout our programme we already introduce many STEM type activities to young people – of course we do not 'tag' them in this fashion and they are presented to young people as challenges, games and explorations in the fun learning spaces of our meetings and activities.

This collection of resources highlights the many activities and ideas that can be incorporated into our programmes, so that young people can see STEM as fun and awaken their interest in these subject areas.

In today's world, many employers seek a wide knowledge of the STEM related areas. With the increased focus on science, technology and information transfer and interaction those new to a work environment are expected to have a solid base of knowledge of these areas. Another requirement of the work place and an increasing request from employers are young people who have addition life skills. These skills include what are called 21st century skills – ability to work in teams, take leadership and responsibility, be creative and innovative, be able to solve problems all key skills provided by Scouting.

By combining STEM related areas with what we do best in Scouting – develop young people - we have a package of activities and ideas that can provide young people with a solid base from which to develop their life long career path.

This resource has been funded by the Science Foundation of Ireland because they recognise the value of the Scout programme and how it provides learning spaces for young people that are unique and based on play and fun. Science can be perceived as 'boring' by many young people but we hope in this resource to provide a series of novel activities that will show science in a new fun way.

The resources have been created around a series of themes. By using themes it allows us to explore the wide area of STEM through many different scenarios. The resource only provides the ideas, it does not present a programme structure or how it might be developed as a programme cycle. This we will leave to the young people in your Section as they develop programme cycles and adventures in your programme. So, many possibilities are possible from simple insertions in meetings, to themed camps and activities, wide games or incident trails.

The ideas presented are only a sample of the millions of possibilities that can be used. The internet is widely distributed with many ideas related to STEM. This resource presents and links to the best ones that can be undertaken by Scouts in all Sections.

Using the resource

The resource is driven by the poster (cover of this handbook) – a full size series of posters will be provided to each Group for display. On the poster is a series of QR codes that when scanned by a QR code app on a mobile phone that will bring the user to an online

interface. That interface will lead to this PDF resource, Video links, Pinterest pins and other websites. Each of the links is related to the theme that is been presented. There are a number of different resources and they can be found collectively via the resource area www.scouting360.ie

The mobile phone – in a young person's pocket- is a powerful interaction tool and computer and can quickly present the ideas to young people to explore. Ideas are presented in an easy to understand way and then it is time for some hands-on experience and learning by doing as each idea is tried out at meetings and activities.

It is suggested that Scouts (in all Sections) are exposed to the resources so that they can discover the ideas and then create programme cycles and adventures at which they can be included. The themes can be used as presented or mixed and matched to create new themes/adventures/trails etc.

Included in the resources is an innovation and creativity exercise. The idea of this exercise is to allow young people to create and invent. All inventions are created by a process of knowledge (science), inventing the new item or process (engineering), refining and developing (maths can be used) and finally producing a new invention (a tool – a piece of technology). The creation process is STEM applied and how it is done is in teams (small team system in sections), gathering knowledge, working creatively as a team, engineering their idea and solving problems and creating new solutions. We do this every time we challenge young people at meetings and on activities and incident trails. So again, Scouting is good at this.

It is therefore suggested that each programme cycle will include one 'invention' session where Scouts can take the knowledge they have explored in the themed meeting or programme cycle and use this knowledge to invent something new and exciting. Ideally this session would be undertaken in week three or four of a programme cycle when some knowledge has been gained in a themed area.

Plan, do, review, is of course a cornerstone of our programme method and the review process should include a reflection on what has been learned or changing attitudes to STEM type activities.

Storylining

As Baden Powell once said – 'Scouting is a game for young people and a job for adults' and within this context story- lining is extremely important in holding together the programmes and activities we run. A series of incidents can be held together with an inventive storyline, for example, related to escaping from a prison camp or tasks to be completed in a treasure hunt. Likewise at our meetings we will run games and challenges and these should also be story-lined (or within a symbolic framework – Lands of Adventure in the Cub Scout Section).

By using story-lining and scenarios we allow young people to use their imagination and develop creative solutions to a challenge in context. Artificial time pressure is introduced – build this tower before the flood raises, or do this challenge before the door time lock engages. Time pressure enables leadership and organisation skills to be developed.

Real life scenarios such as accident setups are also useful for some situations and again relate to the subject matter under exploration.

In the context of the STEM resources they have been related to themes which in themselves suggest possible storylines and scenarios. Action hero's for example focuses on action hero films and situations, James Bond, Bourne, Indiana Jones, MacGyver and many such films and TV series provide the backdrop and the situations that an action hero must escape from, find clues, improvise or be inventive.

Therefore cracking a code or survival situations can be cloaked in mystery, suspense and excitement with the introduction of a creative storyline – 'defuse the bomb in 30 seconds or the world blows up' can make exciting the creation of an electrical circuit. Cracking a code is just a simple way of telling the team what is the next location they need to travel to.

In some incidences a storyline can run over a whole weekend or period of time. This involves a bit more work in organising the elements of the programme but often it adds to and enhances the overall experience – a Viking theme, Space camp or Desert island survival.

Wide games are another feature of story-lining to be considered. In general terms they are quest driven scenarios – a mission must be completed. So in the context of a wide game Patrols (small team system) are each competing to reach an objective – a treasure hunt for example – and must complete various challenges and situations to progress towards their objective.

In all sections within a Group the programme is presented through a 'Programme Cycle'. This programme cycle can have any timeline but it contains three crucial features – Plan, Do, Review.

Each programme cycle is built around an adventure or series of adventures leading to a key highlight. Normally, a programme cycle will last around 4 weeks (but can be shorter or longer)

The 'adventure' is the main highlight of the Programme cycle – the weekend camp, for example, and the meetings or associated activities are the 'learning spaces' to enable the successful completion of the adventure. So, for example, the Scouts will need to be able to build an oven on the camp - so that they can bake a cake. The weekly meeting or a special day activity might be created for the Scouts to learn how to do this so it can be completed with success on the weekend camp.

Within this process all of the Scouts will be involved in the creation of the adventure, the weekly meetings and activities. The team system will be used at all times and all the interactions associated with this process will be focused on the programme cycle and the planned adventure.

The Plan, Do, Review method is used….so the adventure is planned, it takes place and finally the programme cycle is reviewed and learning is determined.

The process

The first step in the creation of a Programme Cycle This is where the ideas for adventures are created and selected. This resource will highlight some ideas based around the theme but additional ideas can be added and created as young people wish in the programme creation stage.

Doing and discovering

This STEM based resource is designed to enable young people to discover science, technology, engineering and maths all around them and as part of their daily lives.

They are not subjects primarily associated with school, and that as Scouts we can have a lot of fun using, exploring and discovering knowledge based on fun, play and group interactions.

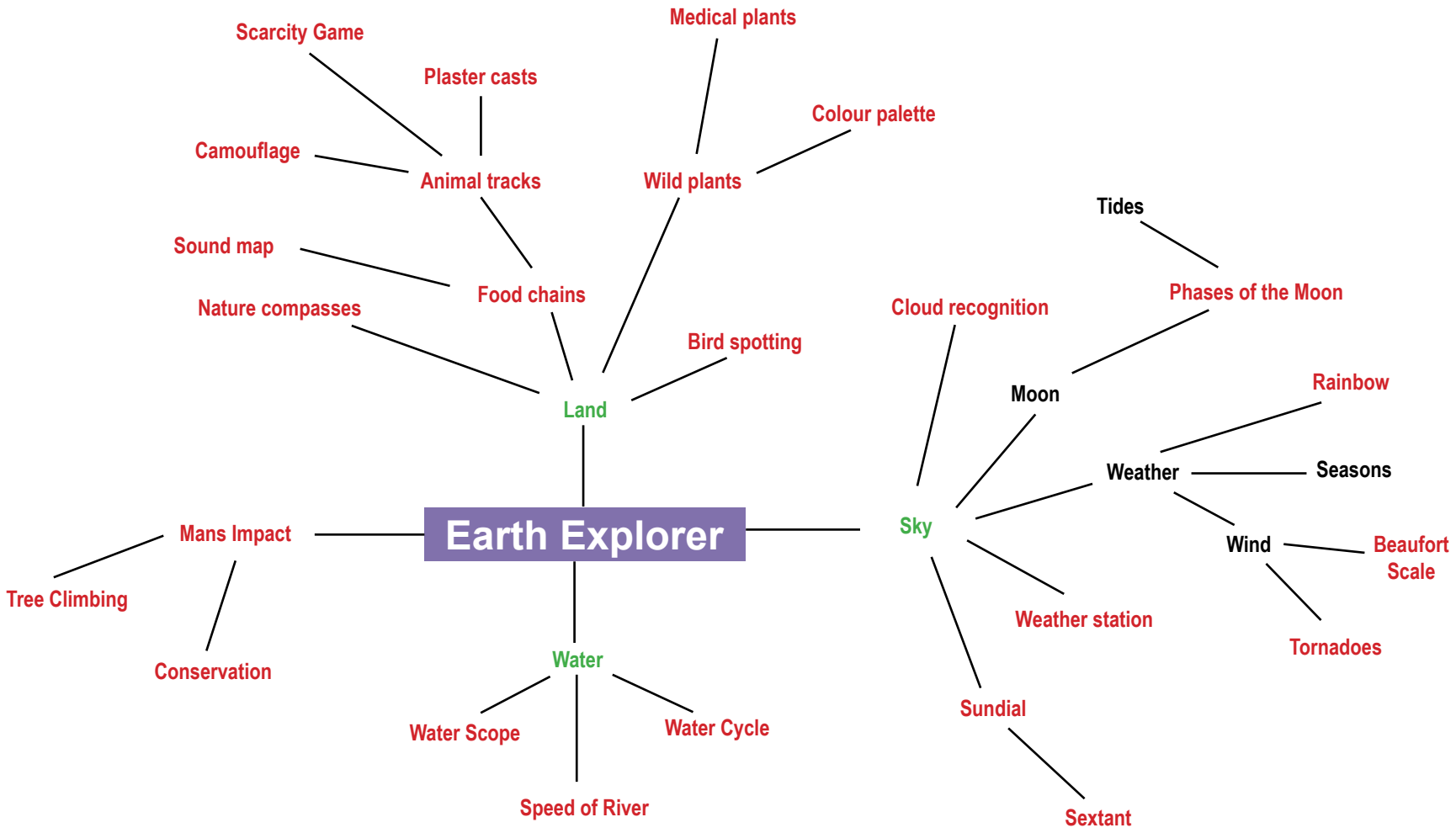
Each idea therefore has a 'science idea' that Scouts need to discover as they undertake each activity. In the review process it is hoped that Scouts express in their own way the things they have learned and the knowledge and new understandings they have gained.

Reviewing

The object of the review session is to understand what has happened, what we learned along the way and to 'mark up' and acknowledge how every Scout has progressed.

Reviewing is critical to the learning process. Until a Scout takes time to internalise and access what they have learned through an experience it serves no real value - bar entertainment.

As Scouting is in the business of assisting young people in their development the review process is a vital component of the Scout programme. There are many ways of conducting the review – it can be done as the activity progresses or at the end of each day or in a sit down discussion at the end of the programme cycle.



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Earth Explorer theme chart


0:18 / 7:03 HD
The Mission
You and your team are to produce a series of nature movies - like a BBC David Attenborough documentary - exploring and showing the diversity of nature in your community or campsite
Earth Explorer


Science Bit
Nature is the Earth and our home. To fully understand the complexity of life on our planet you need to understand the food chains and nature cycles that exist on Earth. Cycles are intertwined and if one element is taken out or increased it upsets the balance of life as we know it. The impact of the change can be small or dramatic. Increases in population for example increase the need for food production but also the potential for pollution.
Science Foundation Ireland
sfi
For what's next
Food Chains

Science Bit

Human health relies on a healthy environment. Healthy ecosystems produce fresh water, food, timber, fibre and medicines. They purify our water, clean our air, moderate the climate, and regulate floods. Protecting nature keeps the Eco-systems in balance. When we cut down the rain forest, less rain falls and the once very green area turns into a desert. If we remove nature - life is destroyed -animal and human.

Conservation

Science Bit

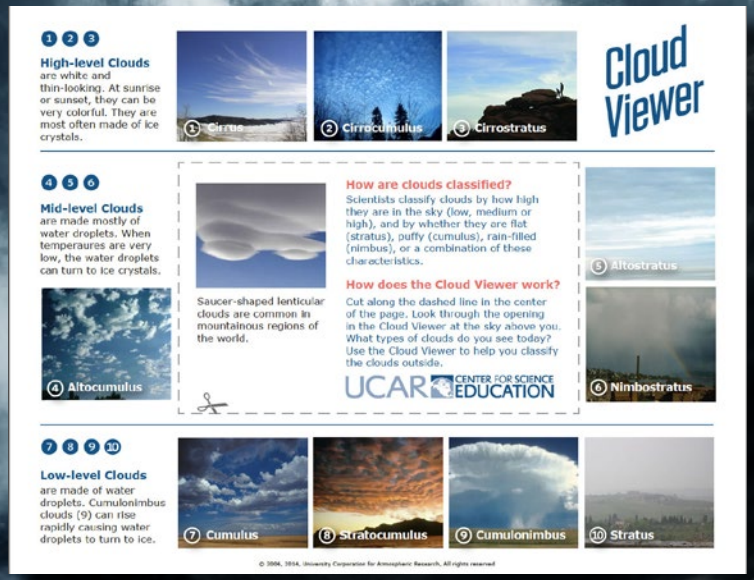
The sun heats the earth unevenly and causes warm and cold spots on the earth. This causes the temperature of the air to rise or fall and creates differences in air pressure.
Air moves from a region of higher pressure to one of lower pressure and this movement is wind, the greater the difference the stronger the wind.
The direction that wind takes is influenced by the rotation of the earth and the movement of warm and cold air.

Science Bit

Clouds are made up of tiny droplets or frozen crystals of water. Most clouds form as warm air rises in the atmosphere and cools down. All air contains some water vapor and warm air can hold more water vapor than cold air. As warm air cools the water vapor turns into tiny droplets of water or ice.

Clouds move with the wind. High cirrus clouds are pushed along by the jet stream, sometimes traveling at more than 150kph. When clouds are part of a thunderstorm they usually travel at 50 to 60 kph.

Understanding different cloud types and formation help us to understand wind speeds and allow us to predict the weather.



Clouds

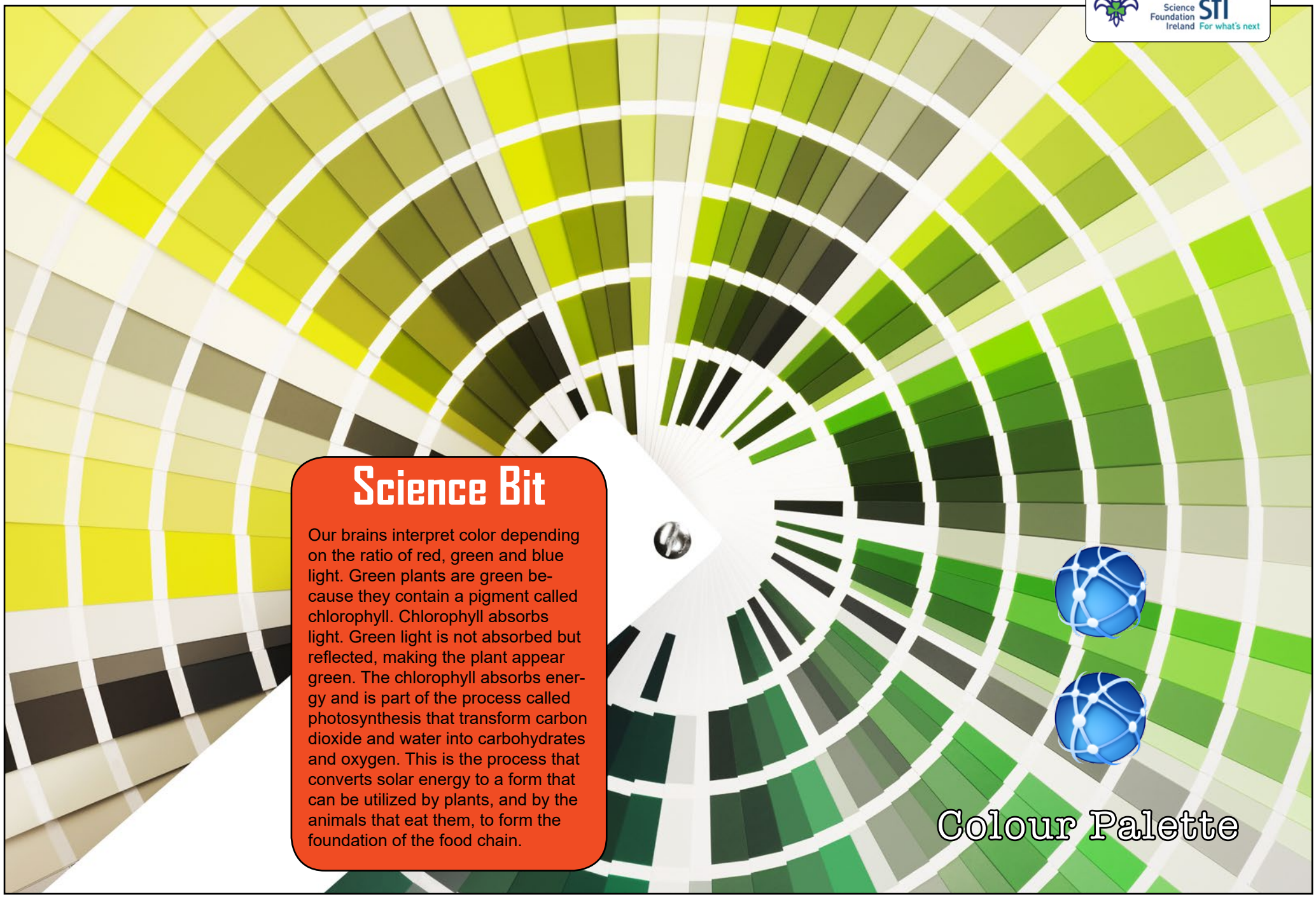

Science Bit
Most tornadoes form from thunderstorms. Tornadoes happen when cold winds high up meets warmer air and winds lower down. When these two air masses meet, they create instability in the atmosphere and this causes the winds to swirl and the warmer air from below rushes upwards at terrific speed. Rising air within the updraft tilts the rotating air from horizontal to vertical and the tornado moves forward. The warm wind rushing upwards can cause the tornado to move very fast -picking up and destroying everything in their path.
A hurricane is different to a tornado and can be as much as 400 miles from side to side.
A tornado is much smaller, with a diameter of no more than 50 yards.
A storm like a tornado but which forms at sea is called a waterspout.
Tornedoes

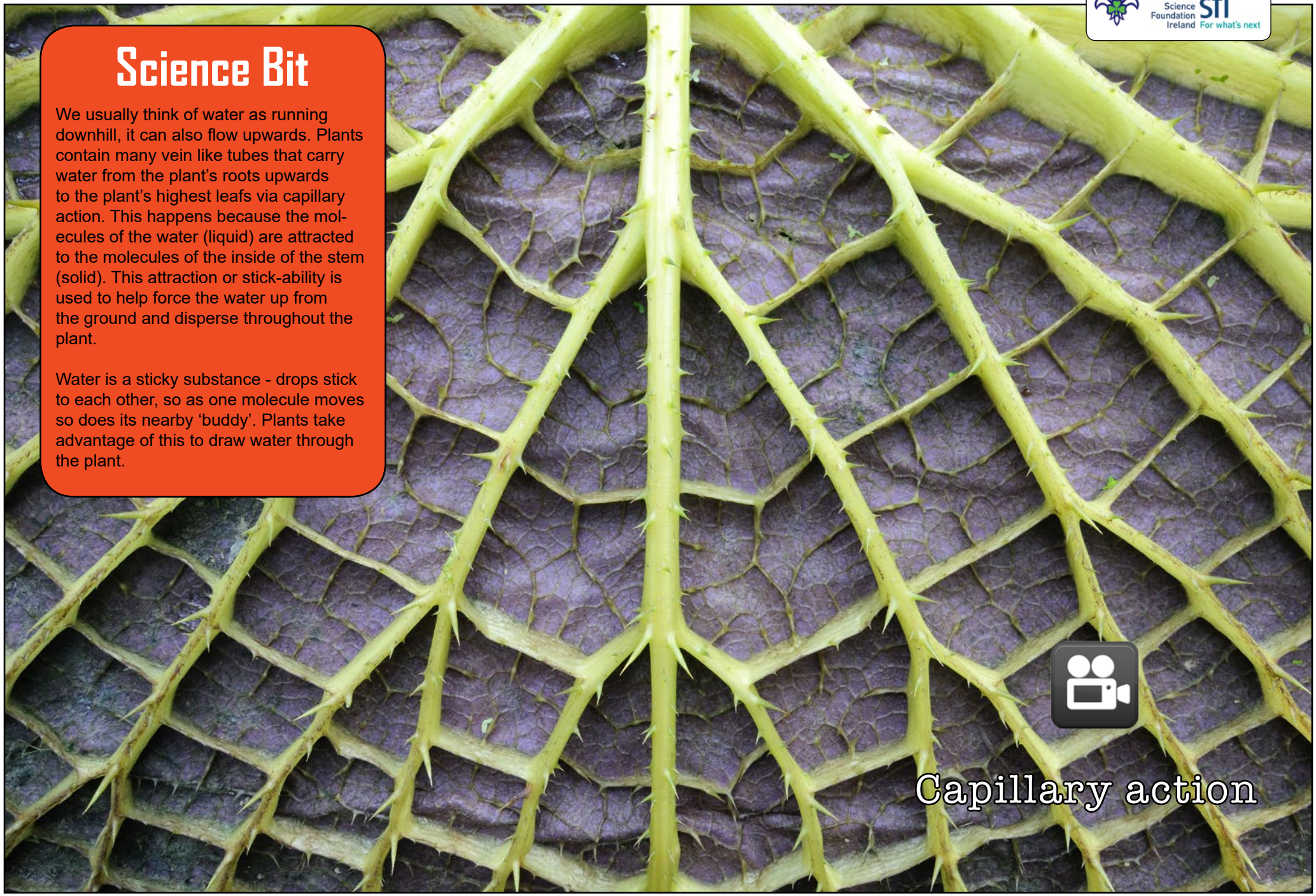
Science Bit

One of the most beautiful displays of nature is the rainbow. A rainbow is caused by the refraction of light through water droplets. As the light passes through the water droplets it causes the light to bend and separates into it component colours. This happens because light travels at different speeds as it moves through the water droplet/glass or reflective surface. A rainbow is an excellent demonstration that visible light is made up of a spectrum of wavelengths, each associated with a distinct colour.

Rainbow


Science Bit
The Earth is a living planet and below its surface is a grid of 17 rock plates that move/float on a hot softer inner core. Volcanoes occur on the joints between these plates as they pull apart and allow the soften inner core to escape. Earthquakes are the opposite and occur when plates crash together. It is through this action that the earth masses as we see them today have been formed.
As the lava from the centre of the earth pushes out of the volcano it slides down the mountain and cools down to form into new rock formations. Large blooms of smoke and ash are also sent into the atmosphere and can block sunlight and disrupt weather cycles.
Science Foundation Ireland sfi For what's next
Volcano


Science Bit
Our brains interpret color depending on the ratio of red, green and blue light. Green plants are green because they contain a pigment called chlorophyll. Chlorophyll absorbs light. Green light is not absorbed but reflected, making the plant appear green. The chlorophyll absorbs energy and is part of the process called photosynthesis that transform carbon dioxide and water into carbohydrates and oxygen. This is the process that converts solar energy to a form that can be utilized by plants, and by the animals that eat them, to form the foundation of the food chain.
Colour Palette


Science Bit
We usually think of water as running downhill, it can also flow upwards. Plants contain many vein like tubes that carry water from the plant's roots upwards to the plant's highest leafs via capillary action. This happens because the molecules of the water (liquid) are attracted to the molecules of the inside of the stem (solid). This attraction or stick-ability is used to help force the water up from the ground and disperse throughout the plant.
Water is a sticky substance - drops stick to each other, so as one molecule moves so does its nearby 'buddy'. Plants take advantage of this to draw water through the plant.
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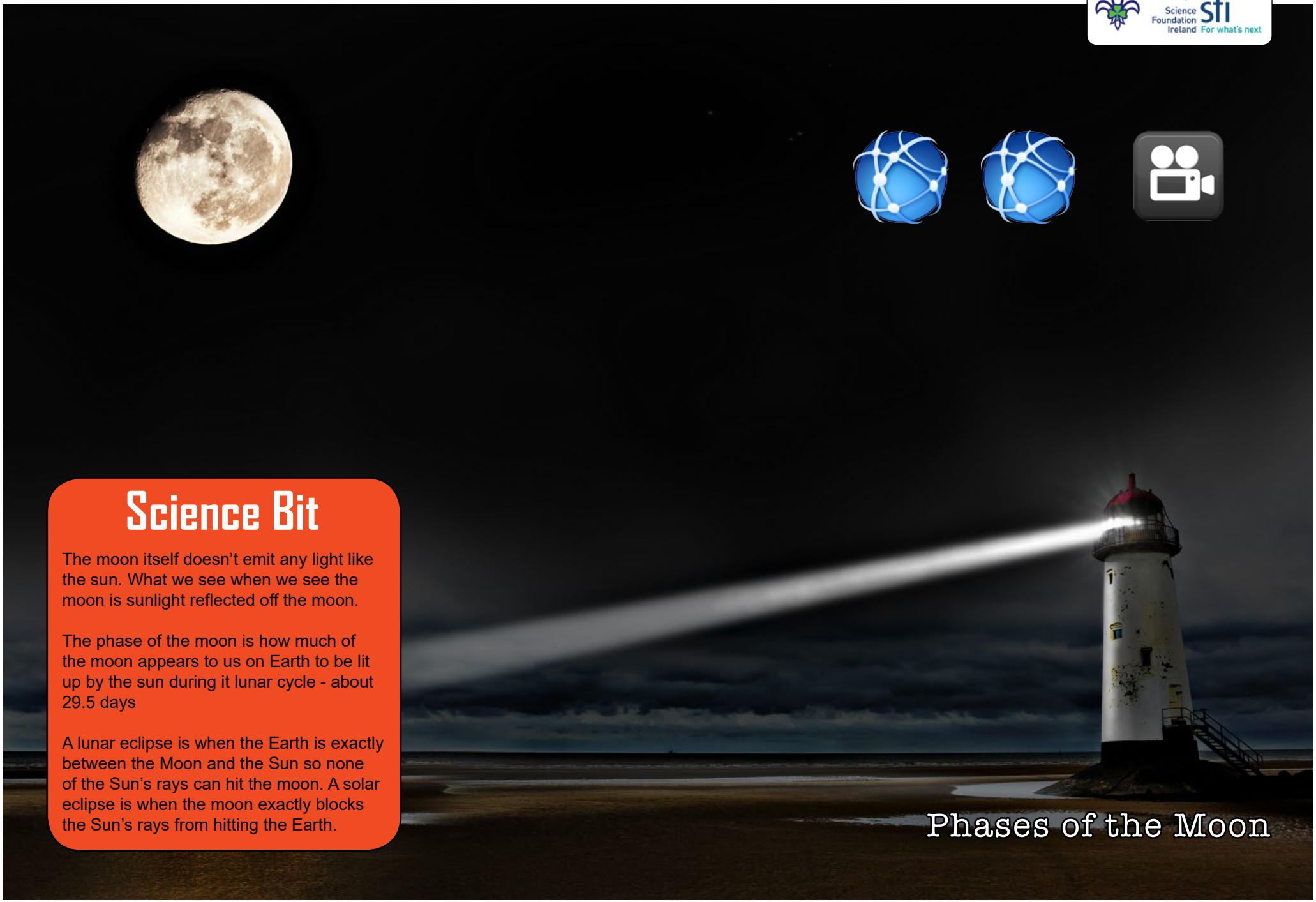
For what's next
Capillary action

Science Bit

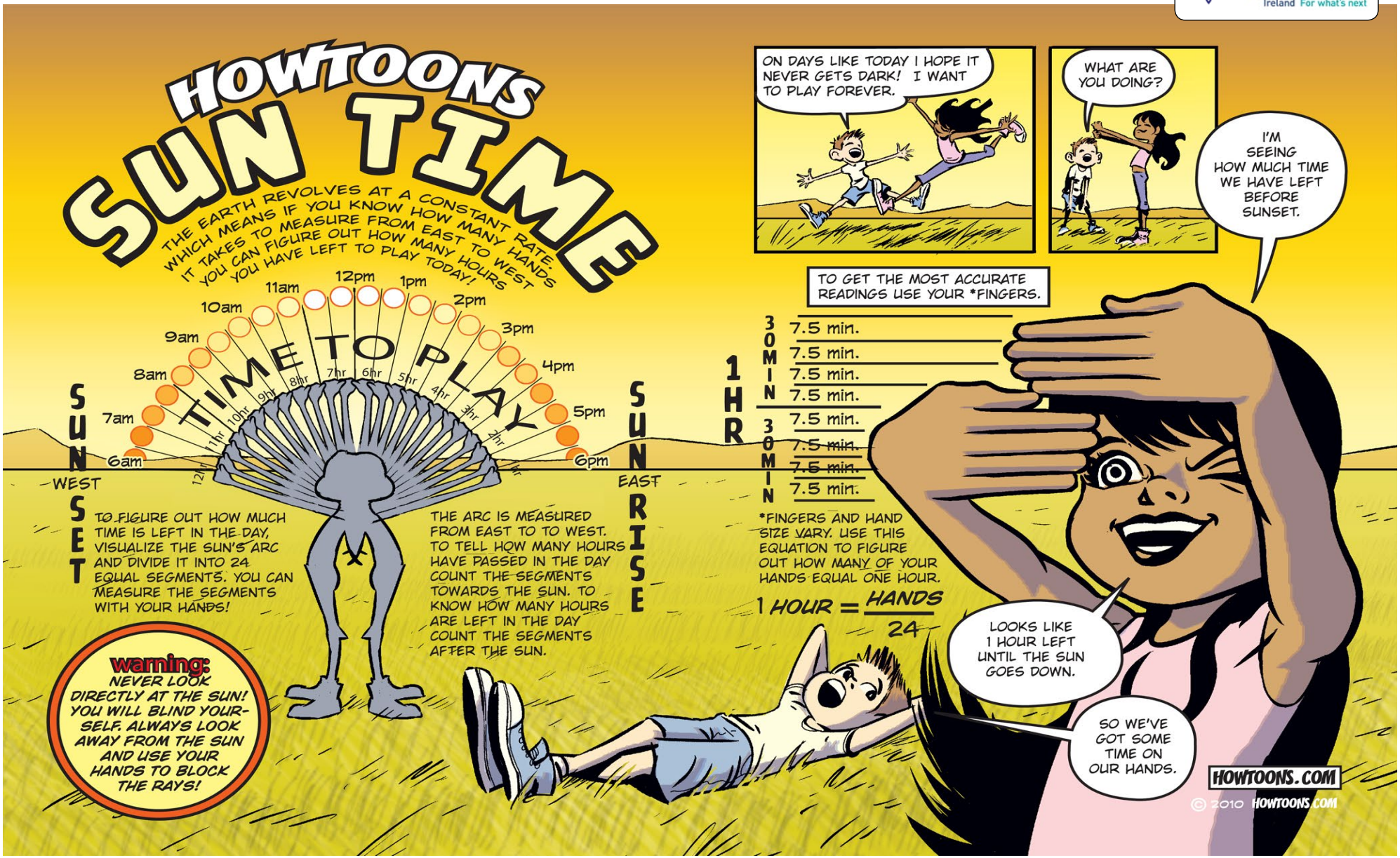
Plants need to disperse seed away from the parent plant who is also competing for light, nutrients and water. Nearly all seed is produced with fruits. The fruit enable the seeds to be spread in a number of ways - wind,water, bursting and exploding, animals eating the fruit or carrying the fruit, dropping and rolling.

Seed


Science Bit
An ecosystem includes all of the living things (plants, animals and organisms) in a given area, interacting with each other, and also with their non-living environments (weather, earth, sun, soil, climate, atmosphere).
In an ecosystem, each organism has its' own niche, or role to play.
The Oak is one of the larger trees and is a miniature ecosystem.Hedgerows, for example, are another offering-great storehouses of wildlife activity from insects to wild flowers.
The Oak


Science Bit
The moon itself doesn't emit any light like the sun. What we see when we see the moon is sunlight reflected off the moon.
The phase of the moon is how much of the moon appears to us on Earth to be lit up by the sun during it lunar cycle - about 29.5 days
A lunar eclipse is when the Earth is exactly between the Moon and the Sun so none of the Sun's rays can hit the moon. A solar eclipse is when the moon exactly blocks the Sun's rays from hitting the Earth.
Phases of the Moon


Science Bit
The weather is the state of the atmosphere at any time, including things such as temperature, precipitation, air pressure and cloud cover. Daily changes in the weather are due to winds and storms. Seasonal changes are due to the Earth revolving around the sun.
The Sun's rays don't fall evenly on the land and oceans. The Sun shines more directly near the equator bringing these areas more warmth. However, the polar regions are at such an angle to the Sun that they get little or no sunlight during the winter, causing colder temperatures. These differences in temperature create a restless movement of air and water in great swirling currents to distribute heat energy from the Sun across the planet.
The Earth has a limited amount of water and all living things need water to survive. So, that water keeps going around. We call it the water cycle.Water is evaporated by the sun to form clouds and later to fall as rain - following back to the sea to continue the cycle.
Weather Station



Howtoon collection

Visit howtoons.com for a full library of interesting activities you can try and explore.


Science Bit
Before the invention of the clock the sundial was the only source of time. A sundial is a device that measures time by using a light spot or shadow cast by the position of the Sun on a reference scale. As the earth turns on its polar axis, the sun crosses the sky from east to west which differs by varying amounts during the year from standard time, the time kept by most clocks. The position of a sundial is relative to its position on the earth - a sundial therefore measures local solar time. The angle of the gnome, shadow caster, is determined by the latitude position of the sundial.
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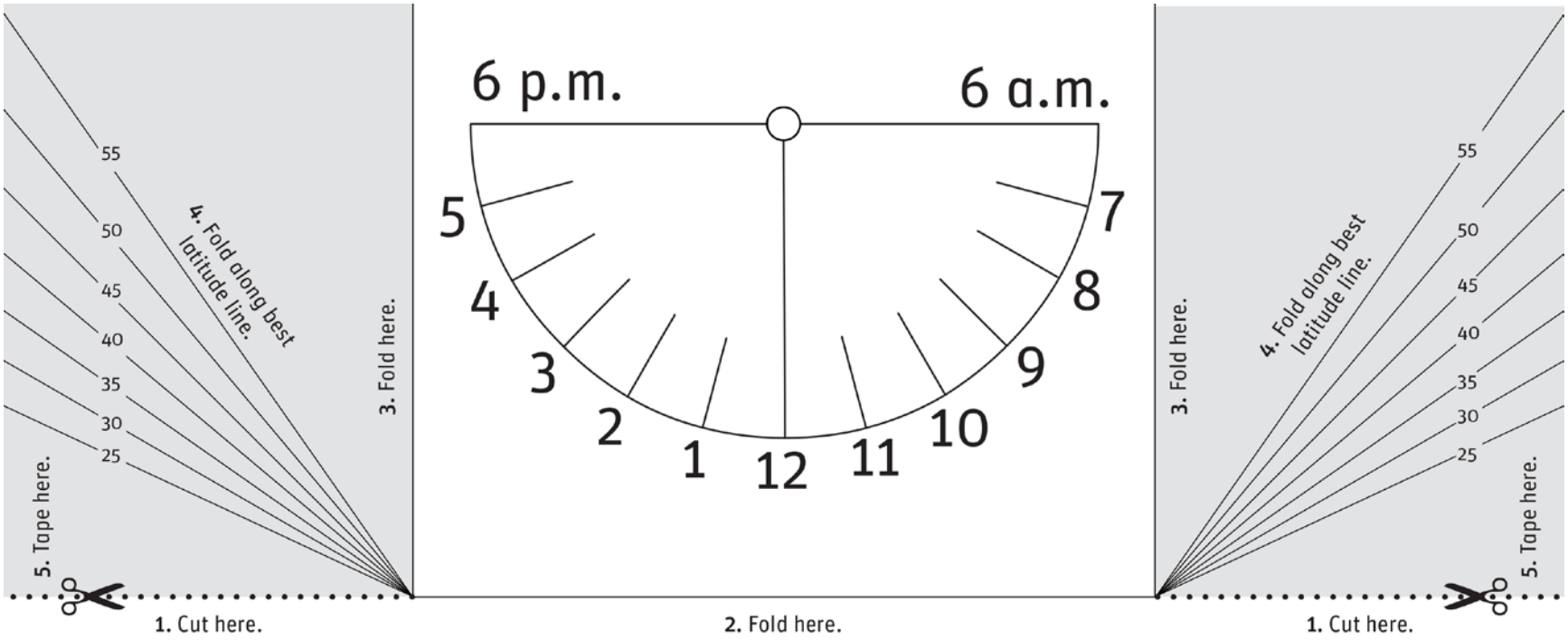
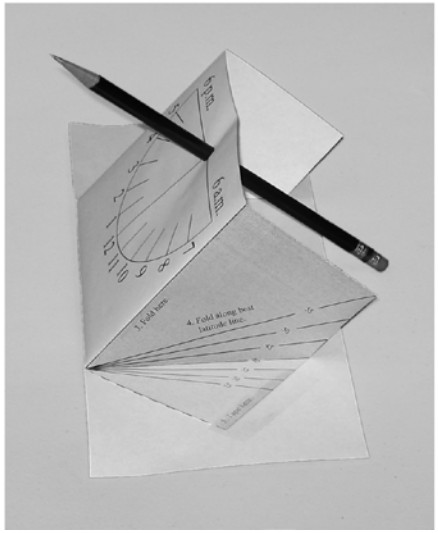
For what's next
Sundial

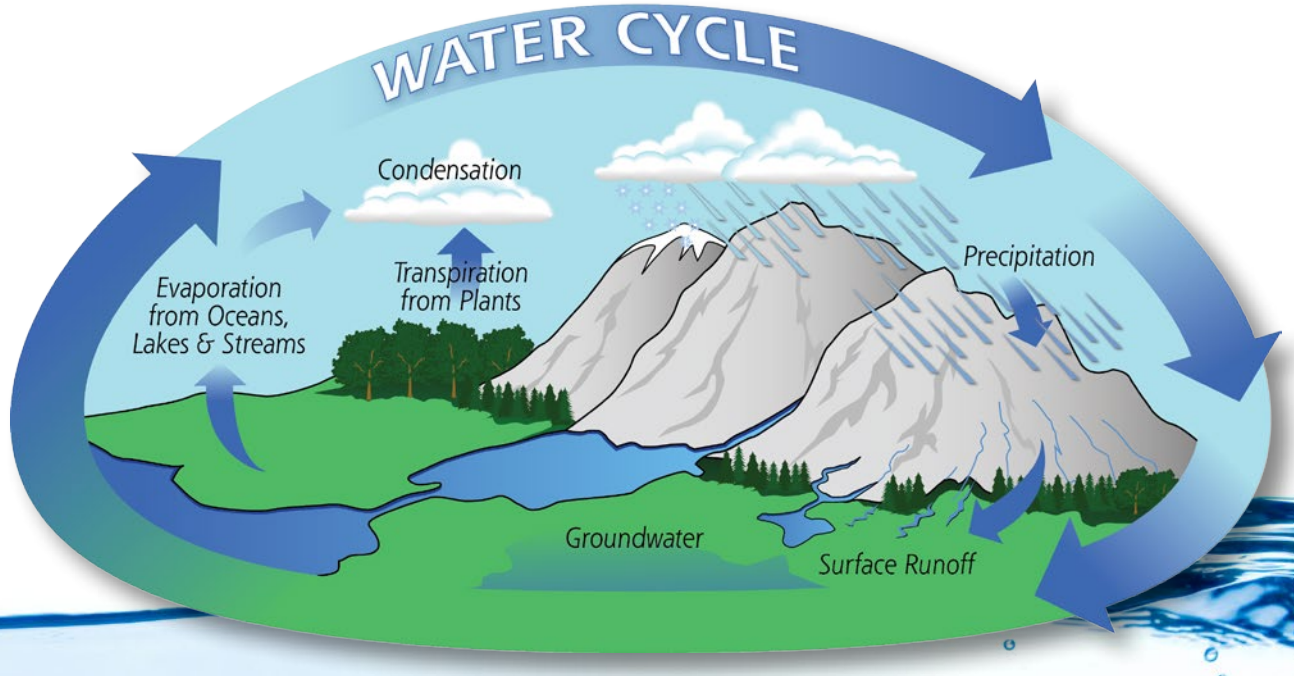


Northern Hemisphere Sundial

1. Cut in from edge of paper along dotted lines. Stop at solid lines.
2. Fold along solid horizontal line with line on outside. Crease, then open flat again.
3. Fold along solid vertical lines with lines on outside. Crease, then open flat again.
4. Select the latitude line closest to your latitude. Fold with line outside, crease, and fold again with line on *inside*.
5. Tape the paper together as shown at right.
6. Insert a sharp pencil point-first through the small circle at top center. Remove pencil and reinsert it with the eraser first.
7. If needed for stability or durability, tape the whole thing to a sheet of cardboard.
8. Turn the sundial so the pencil points due north, as determined by a map or a compass.
9. If you can't find north, orient the sundial so that it agrees with your clock. (Subtract one hour from the clock time if you're on daylight-saving time.)



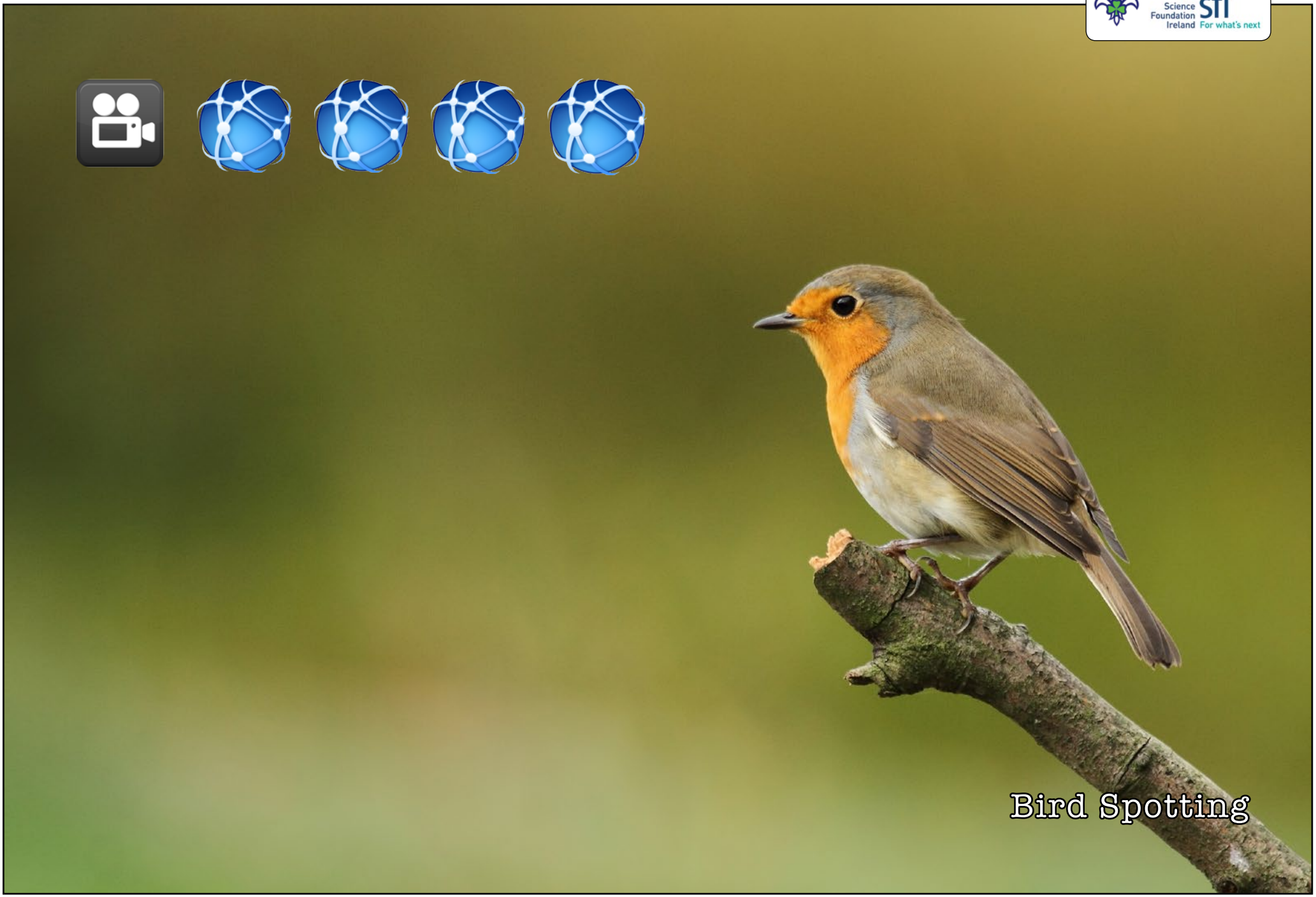
Sundial



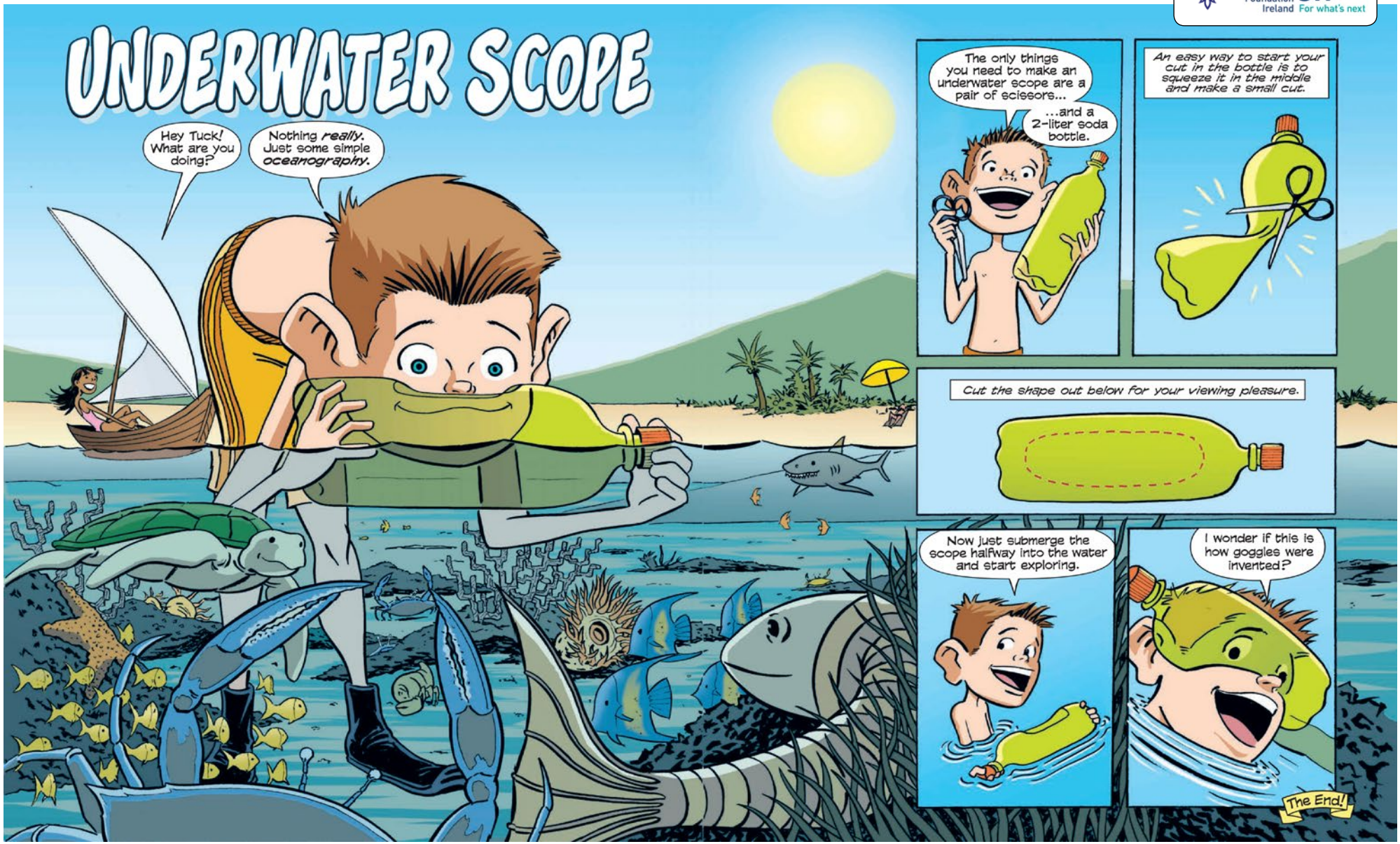
Science Bit

Water is a finite resource and all living things need water to survive. While the earth has a lot of water 70% of the earth's surface is covered in water only 3 % is drinkable. The water cycle is the process that drives the creation of water in lakes and streams, feeds plants, animals and humans. The sun drives the entire water cycle and is responsible for its two major components: condensation and evaporation. When the sun heats the surface of water, it evaporates and ends up in the atmosphere as water vapor. It cools and rises, becoming clouds, which eventually condense into water droplets.(rain)

Water Cycle


Bird Spotting


Science Bit
All living organisms depend on one another for food. A food chain is a simplified way to show the relationship of organisms that feed on each other. In water the bottom of the food chain are microscopic phytoplankton (plant plankton) that create food from the sun rays and minerals dissolved in the water. The small animals and fish who eat plankton then become food for larger fish.
The food chain on land is just as complex as the sea. Small animals eat plants or bugs. Larger animals then eat them. Each part of the chain is reliant on each other and a broken link caused by over fishing, hunting or pollution can impact on everything.
Food Chains



Science Bit

Survival is essential to all living things - it increased its chances of reproducing. In the food chain - there is always a predator and this simple fact has caused insect and animal species to evolve a number of adaptations that help them find food and keep them from becoming food. Some animals' colours and patterns resemble a particular natural background. This is an important component of camouflage in all environments. For instance, tree-dwelling animals are mainly brown/ green; birds of the forest floor are brown and speckled; in each case the animal's coloration matches the hues of its habitat. Similarly, desert animals are almost all desert coloured. This is taken by zoologists as evidence that camouflage is influenced by natural selection, as well as demonstrating that it changes where necessary to resemble the local background. Military uniforms, too, generally resemble their backgrounds; for example khaki uniforms are a muddy or dusty colour,

Camouflage


Science Bit
Natural navigation is the rare art of finding your way using nature, including the sun, moon, stars, weather, land, sea, plants and animals. The availability of light from the sun, brightness and shadow, prevailing wind and weather cause plants to grow in a particular way. Trees will bend to the wind, mosses and lichens tend to grow on the north side of rocks. The stars and moon at night are an ancient method of navigation. By careful awareness and observation you can detect these signs and find your way without the use of a compass.
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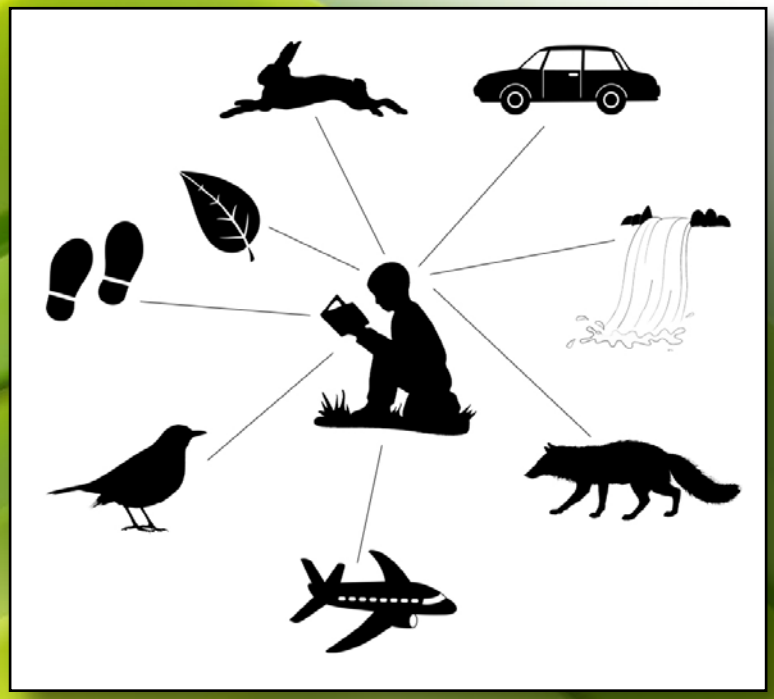
For what's next
Nature Compasses



Sound Map


owl
snake
mouse
grasshopper
grass
Scarcity Game


Science Foundation Ireland
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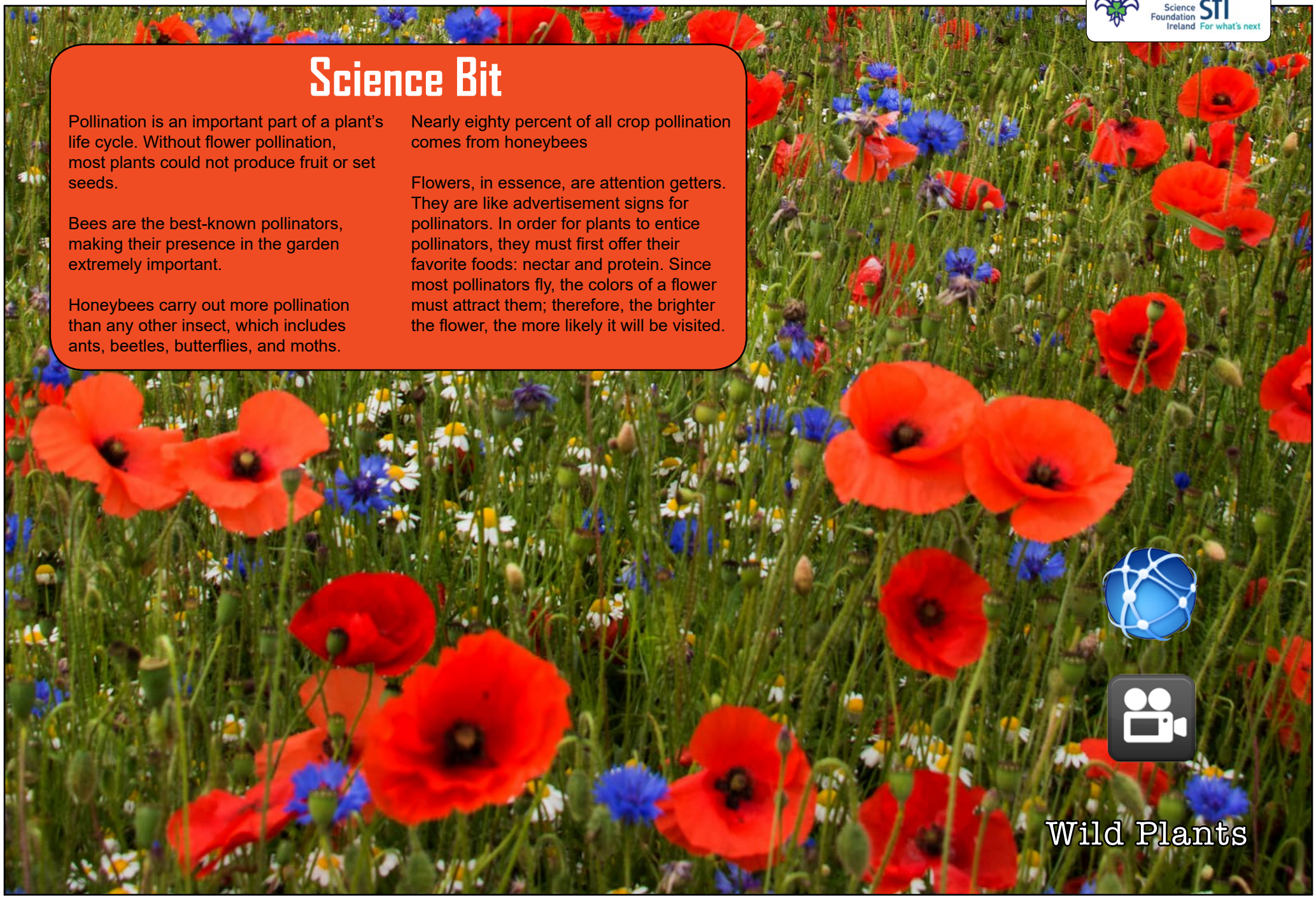
For what's next
Animal Tracks


Science Bit
Today there are at least 120 distinct chemical substances derived from plants that are considered as important drugs. Many of todays medicines and cures derive from ancient natural remedies. For many years the quinine chemical was extracted from the bark of this tree and processed into pills to treat malaria. The bark of the willow tree is nature's rival to Aspirin. Many wild flowers and herbs are used to cure minor ailments.
Plants produce chemicals to protect them from predators - insects and animals. It is these substances that, in some case, benefit humans.
Science Foundation Ireland sfi For what's next
Medical Plants


Science Bit
Pollination is an important part of a plant's life cycle. Without flower pollination, most plants could not produce fruit or set seeds.
Bees are the best-known pollinators, making their presence in the garden extremely important.
Honeybees carry out more pollination than any other insect, which includes ants, beetles, butterflies, and moths.
Nearly eighty percent of all crop pollination comes from honeybees
Flowers, in essence, are attention getters. They are like advertisement signs for pollinators. In order for plants to entice pollinators, they must first offer their favorite foods: nectar and protein. Since most pollinators fly, the colors of a flower must attract them; therefore, the brighter the flower, the more likely it will be visited.
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Wild Plants