SPACEBASE X4K

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.

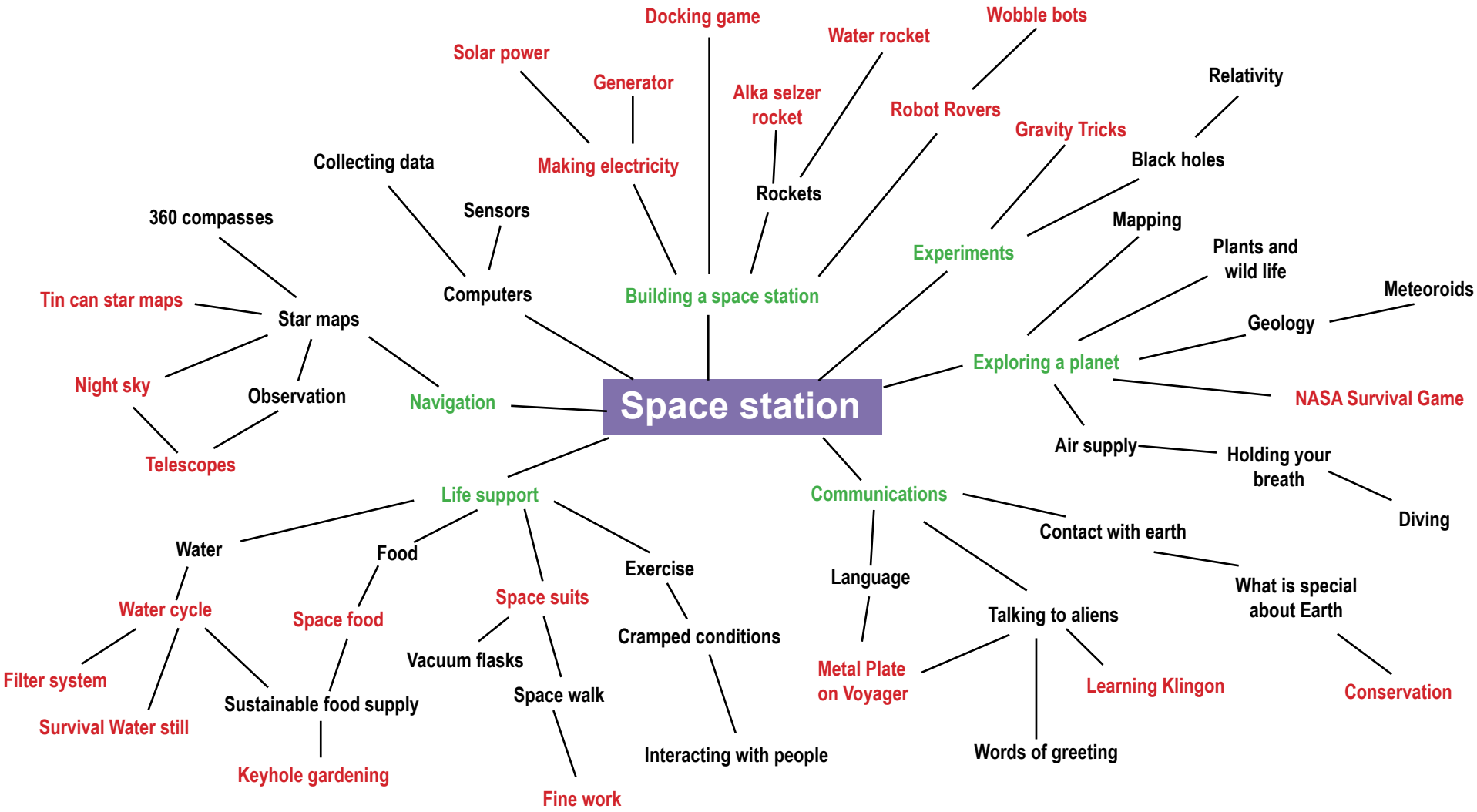
Each idea therefore has a 'science idea' that Scouts need to discover as they undertake each activity. In the review process it is hoped that Scouts express in their own way the things they have learned and the knowledge and new understandings they have gained.

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.



This resource has information on items coloured orange

Space Station theme chart

HOWTOONS.COM

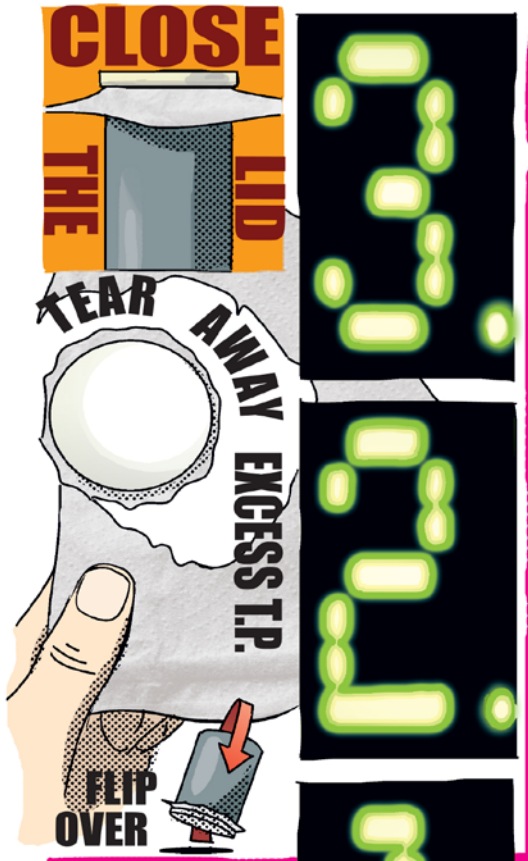
SMALL STEP FOR MAN

Toilet Paper

Alka-Seltzer

Cap

Film Canister
fill 1/4 with water

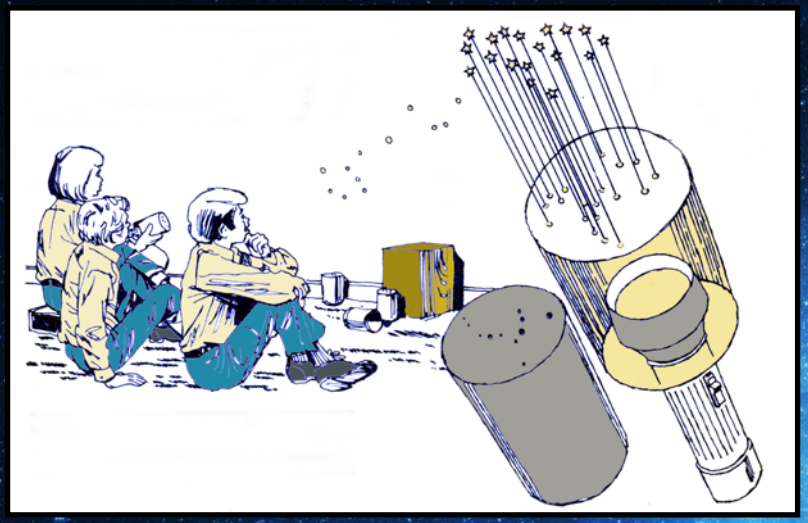


Alka-Seltzer tablets contain citric acid and sodium bicarbonate. When dropped in water the two ingredients mix, causing a chemical reaction that produces the CO_2 gas. The gas builds until the bottle can't contain it anymore, thus Newton's 3rd law.

"For every action there is an equal and opposite reaction."
Sir Isaac Newton

Howtoon collection

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



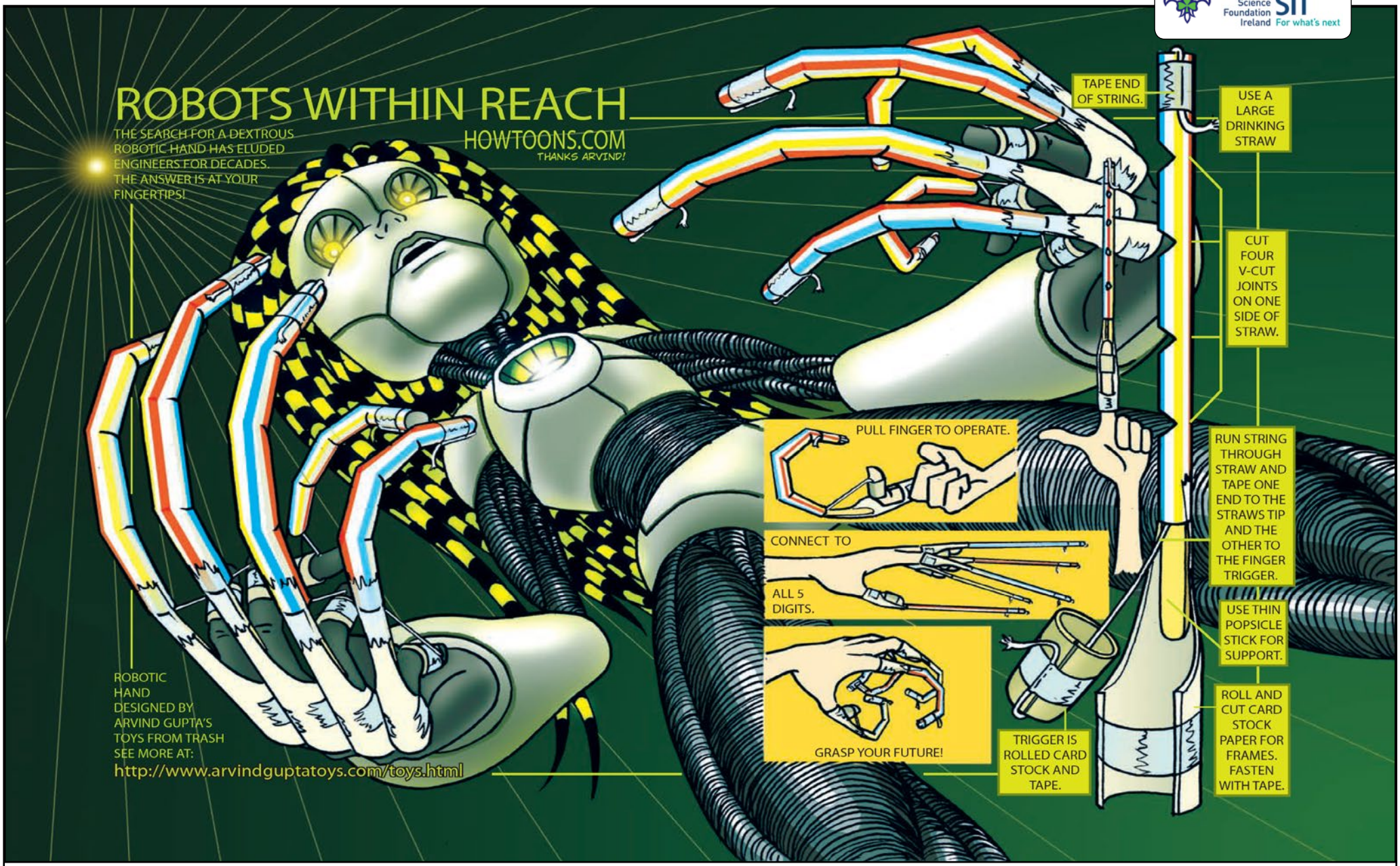
Science Bit

Mankind has long gazed toward the heavens, searching to put meaning and order to the universe and our planet earth.

Astronomy continues this quest through the scientific study of the stars, planets and space so as enable mankind to understand and widen our knowledge of the physical and chemical properties of objects in space. These studies provide insights and knowledge of the general universal laws of existence that govern the universe, our planet and daily life.

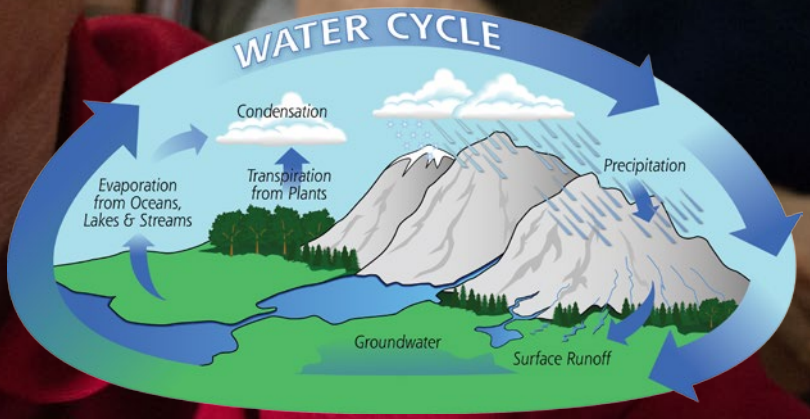
Astronomy


These amazing bots are easy to make with some simple part.
You need a small battery, the head of a tooth brush, a wobble motor and some sticky pads
Click on the Video and Web Icon for inspiration and instructions.
Wobble bots



Science Bit

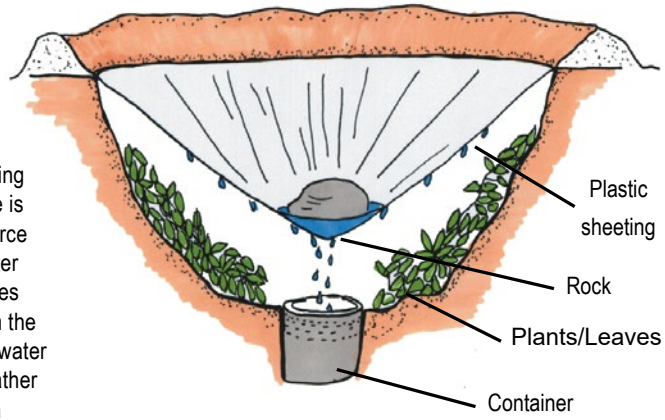
Water covers 71% of the Earth's surface and it is vital for all known forms of life. Safe drinking water is essential to humans and other lifeforms even though it provides no calories or organic nutrients. Less than 0.3% of all freshwater is in rivers, lakes, and the atmosphere. Approximately 70% of the freshwater used by humans goes to agriculture. Water is therefore precious. There is an finite supply and through the water cycle it continues its continuous cycle. Water is a combination of gases - hydrogen and oxegen .



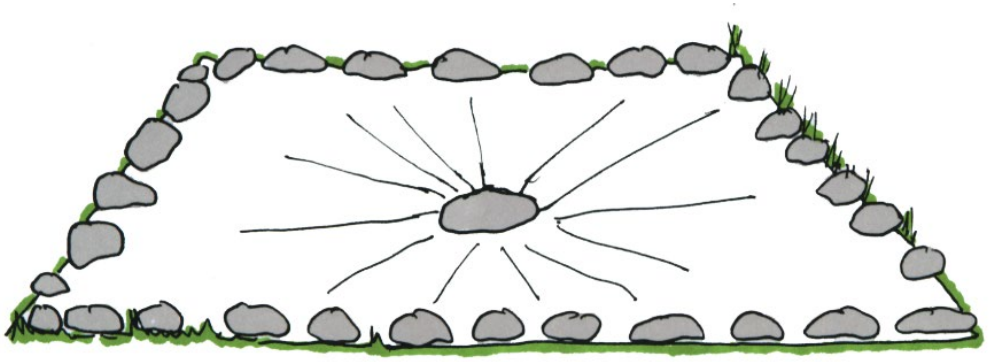
Water in space

Water still

A water still is a method of collecting water when no other water source is readily available, or when the source of water is suspect. Using the water still, you can collect small quantities of water through evaporation from the ground and from vegetation. The water still is essentially a survival tool rather than a water collecting method. In normal backwoods conditions, a stream is more likely to be the source of water or bring a supply of water with you.



The water still has two functions, to collect water by evaporation and to collect water by precipitation - rain and dew.

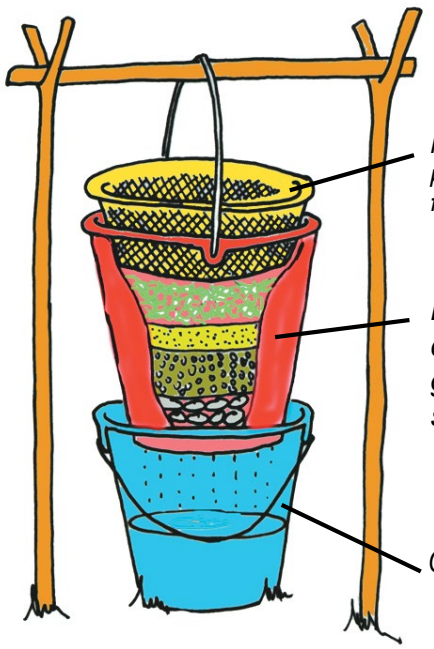


Waste Disposal

Waste water filter system

On camp we filter waste water before it is returned to the earth, to remove food debris, soap and grease. This filter system is constructed above ground and the filter water collected before spreading it over waste ground away from the site. The filter system will contain grass or straw to trap the particles and this must be replaced daily.

Detail waste water filter system



Plastic colander to collect food particles etc., Rests on top of grass filter

Filter bucket, with holes drilled in bottom, containing grass, sand, pebble,clay and stones

Cleaned water collection bucket

Water

Space Food

Team Challenge

You and your team have to create a metal plate (A4 page) on which you will put details/ information that an alien life form could decipher to tell them about life on earth.

Science Bit

Some of NASA's top minds believe we're not alone in the universe.

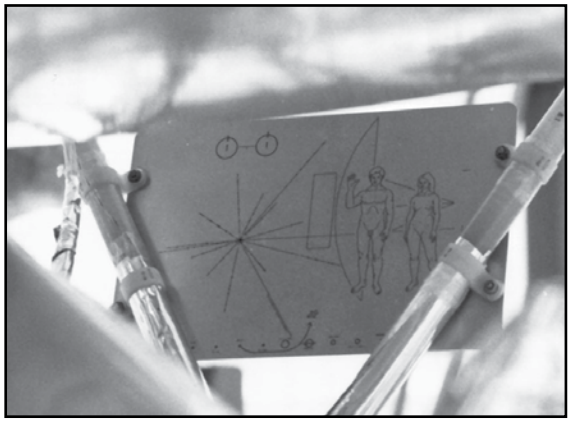
"I believe we are going to have strong indications of life beyond Earth in the next decade, and definitive evidence in the next 10 to 20 years," NASA chief scientist Ellen Stofan

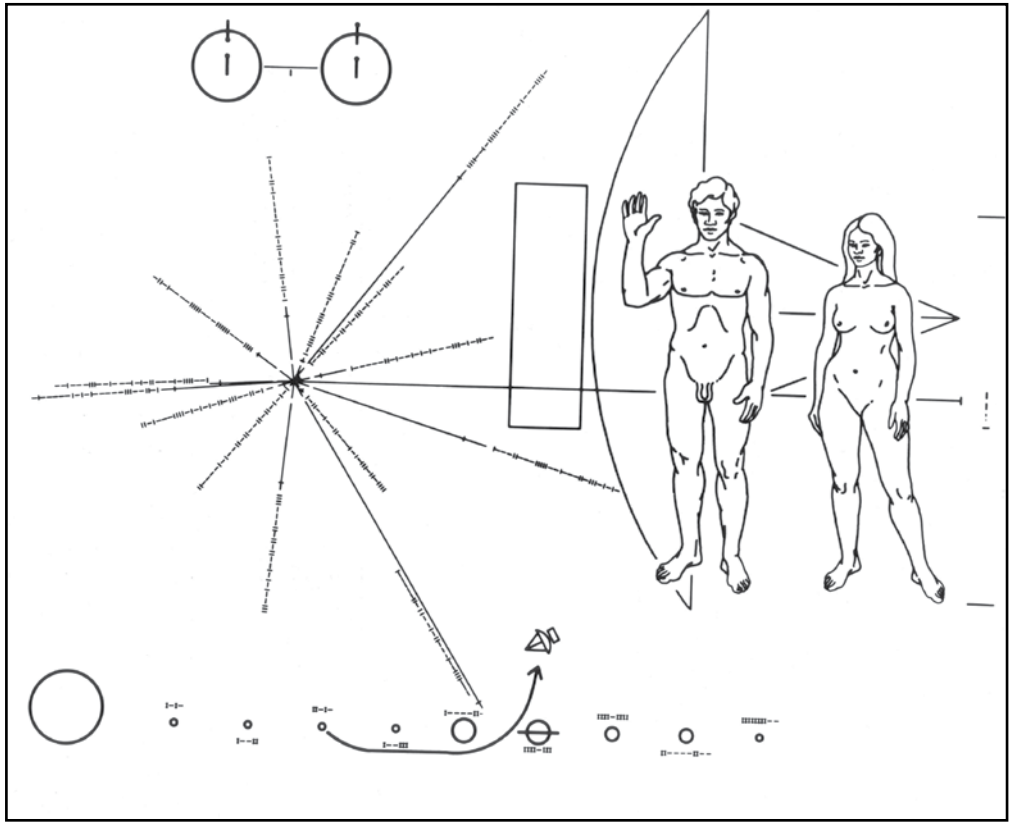
Stofan clarified that the life she expects to encounter is tiny—on the scale of bacteria. "We are not talking about little green men," she said.

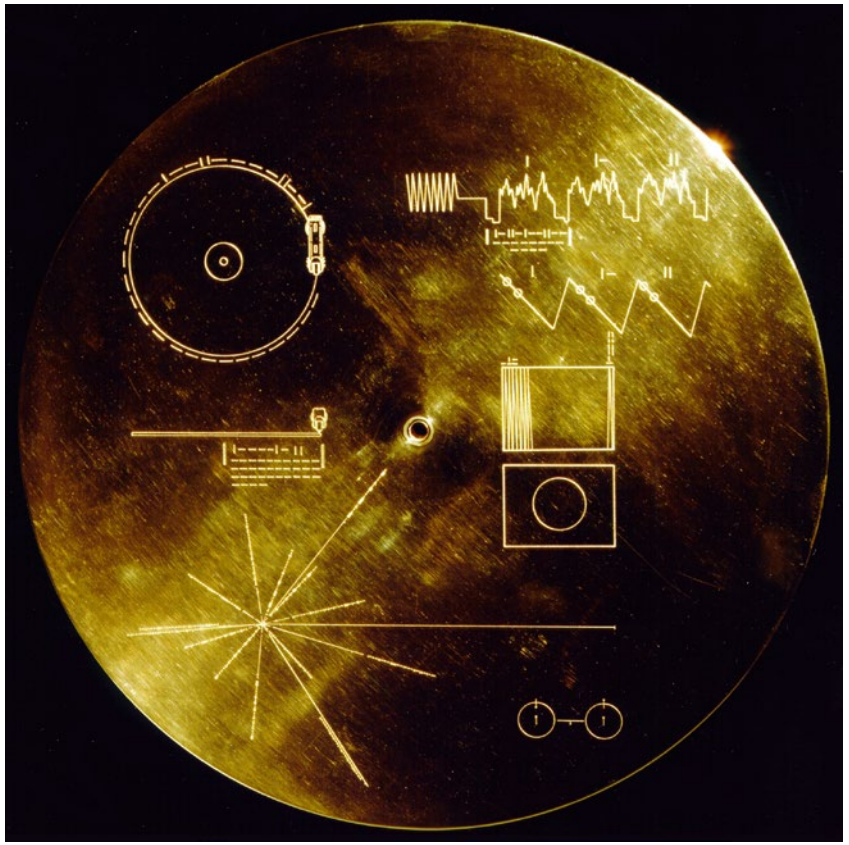
There are a number of reasons to be somewhat expectant about the possibility of extraterrestrial life. One is that we keep finding new evidence that water is replete in our own solar system: subterranean oceans on the moons of Saturn and Jupiter, crater pools on Mercury, signs of a Martian ocean that may have once been over a mile deep. Another reason is that we keep finding planets outside our solar system that look like Earth—so far scientists have pinpointed over 4,000 that are rocky and mild in climate. So the trouble isn't with identifying places where life might exist—there are plenty of those. Rather, it's a needle-in-the-haystack problem: finding microscopic lifeforms in the great expanse of space.

Explorer Plate

The Pioneer F spacecraft, destined to be the first man made object to escape from the solar system into interstellar space, carries this pictorial plaque. It is designed to show scientifically educated inhabitants of some other star system, who might intercept it millions of years from now, when Pioneer was launched, from where, and by what kind of beings. The design is etched into a 6 inch by 9 inch gold-anodized aluminum plate.







Voyager Spacecraft Golden Record

Explorer Plate


Communications - SETI


Communications - Learn Klingon

Talking Together

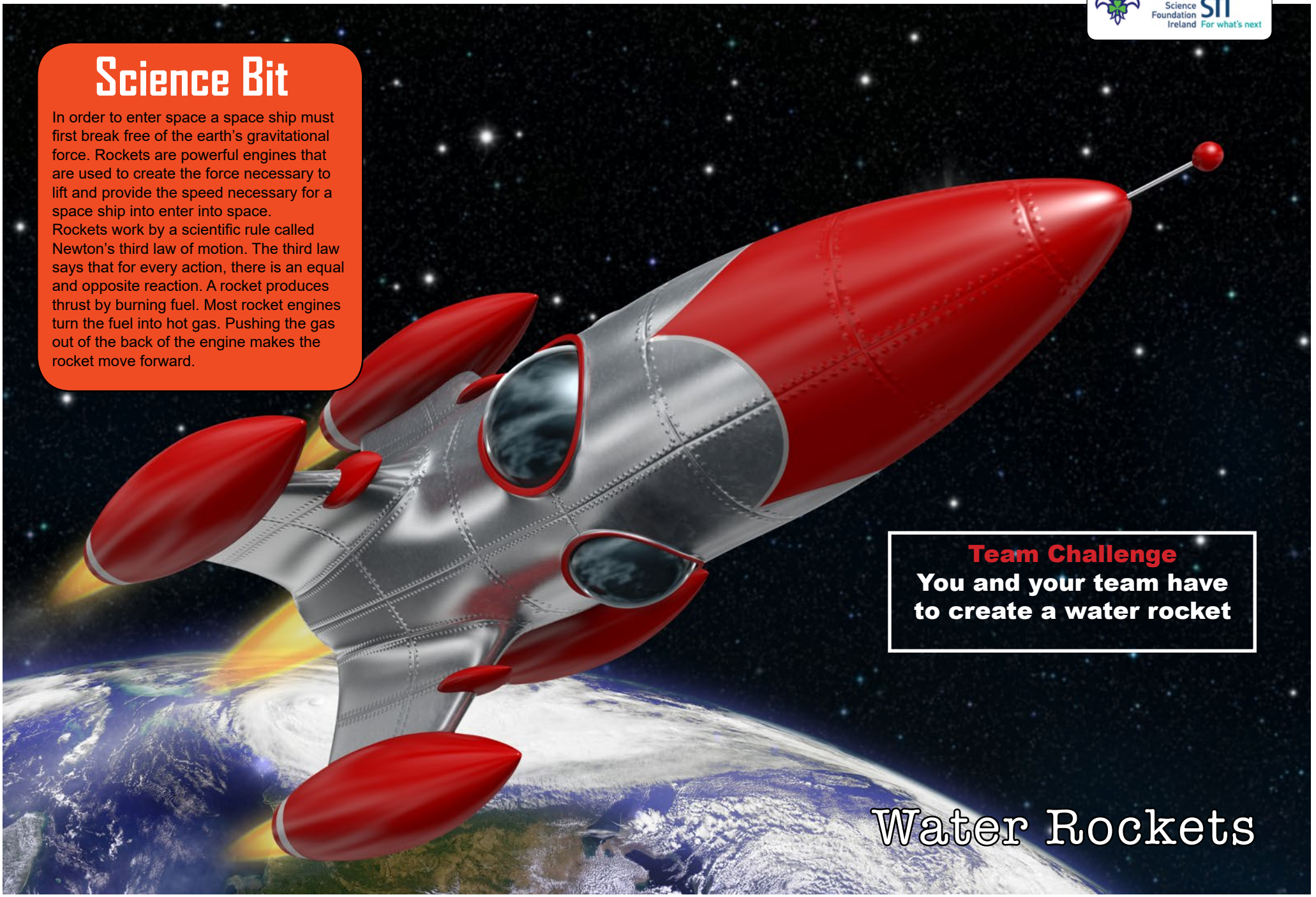
Your spaceship has just crash-landed on the moon. You are 200 miles (320 km) away from Moon Base 3.

It is midday (remember the lunar day lasts 14 Earth days). Your crew's survival depends on reaching the base.

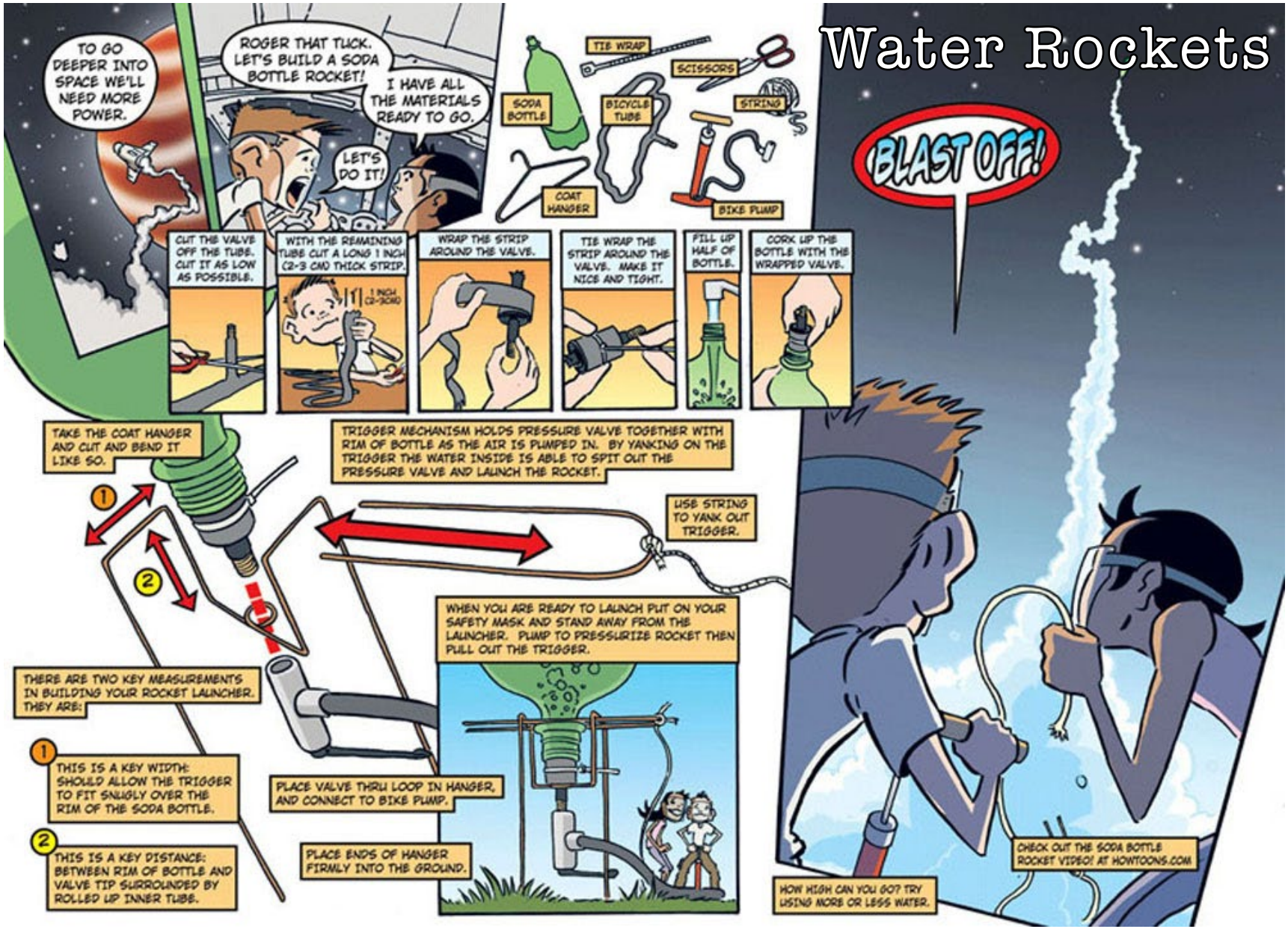
15 items have been salvaged from the wrecked ship You, in private, must firstly rank the items 1-15 in order of importance. When you are finished you should now join up with your Patrol/Team and agree a group listing.

Box of matches
Food concentrate
15m of nylon rope
Parachute silk
Solar powered portable heating unit
Two .45 calibre pistols
One case of powered milk
Two 45 kg tanks of oxygen
Self-inflating life raft
Magnetic compass
15 litres of water
Signal flares
First Aid kit (containing spacesuit injection needles)
Solar powered FM receiver-transmitter
Stellar map (to aid navigation)

This exercise is all about talking dialogue - listening, discussing, solving conflict and reaching a democratic solution.


Science Bit
In order to enter space a space ship must first break free of the earth's gravitational force. Rockets are powerful engines that are used to create the force necessary to lift and provide the speed necessary for a space ship into enter into space.
Rockets work by a scientific rule called Newton's third law of motion. The third law says that for every action, there is an equal and opposite reaction. A rocket produces thrust by burning fuel. Most rocket engines turn the fuel into hot gas. Pushing the gas out of the back of the engine makes the rocket move forward.
Team Challenge
You and your team have to create a water rocket
Water Rockets

Water Rockets



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

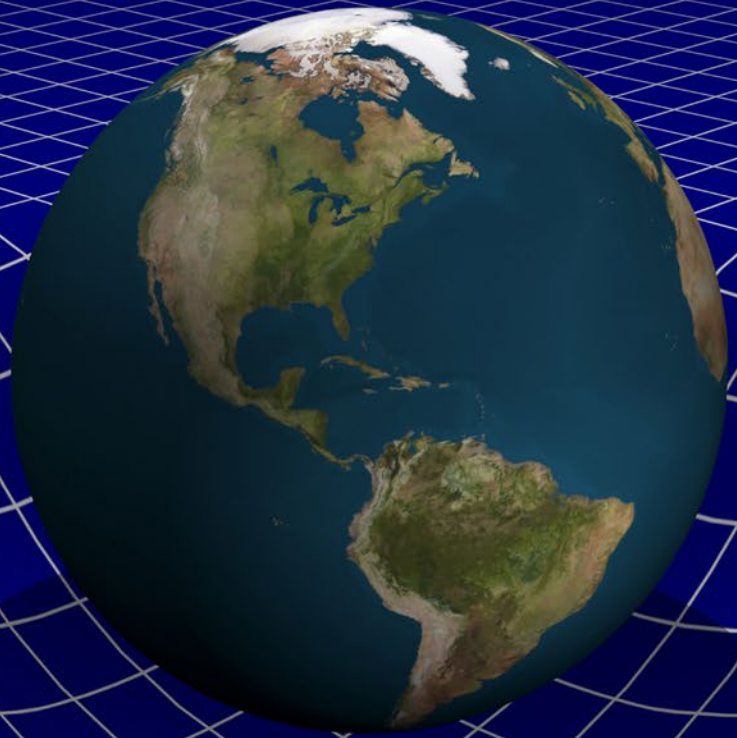
Science Bit

Gravity is the force that attracts two bodies toward each other, the force that causes apples to fall toward the ground and the planets to orbit the sun. The more massive an object is, the stronger its gravitational pull.

It is what causes objects to have weight.

The gravity on the moon is about 16 percent of that on Earth, Mars has about 38 percent of Earth's pull, while the biggest planet in the solar system, Jupiter, has 2.5 times the gravity of Earth.

Black holes are massive collapsed stars with such strong gravity that even light cannot escape from it.



Team Challenge

You and your team have to try out and master some gravity defying tricks

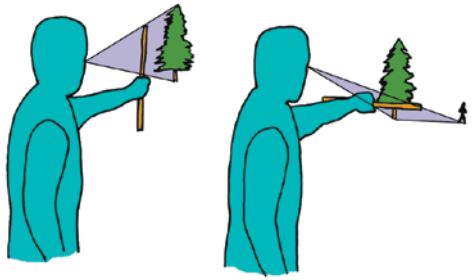
Gravity

Plane Table mapping

Estimation techniques

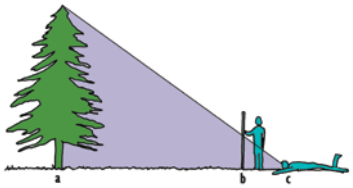
Lumberman method

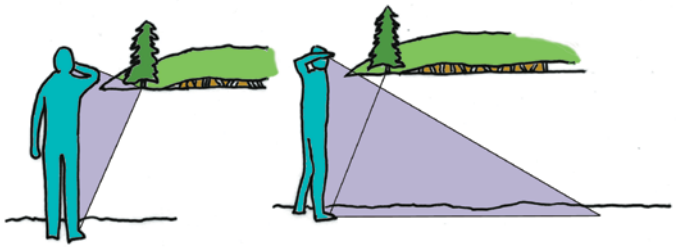
Hold a stick out in front of you and place the tip in line with the top of the tree. Move your thumb until it is in line with the bottom. Turn the stick 90 degrees and have a friend walk from the base to the tip of the stick counting as they go. The distance travelled is the approximate height of the tree.



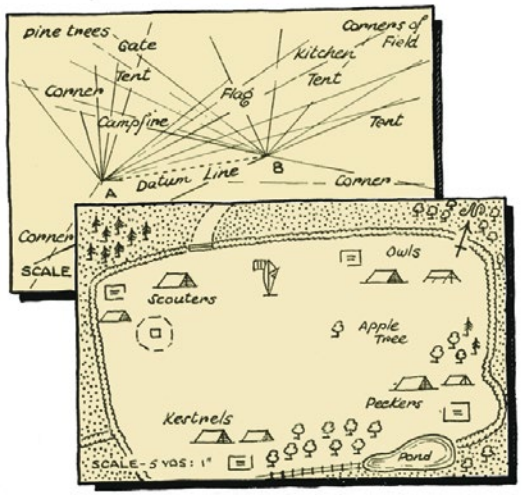
Napoleonic method

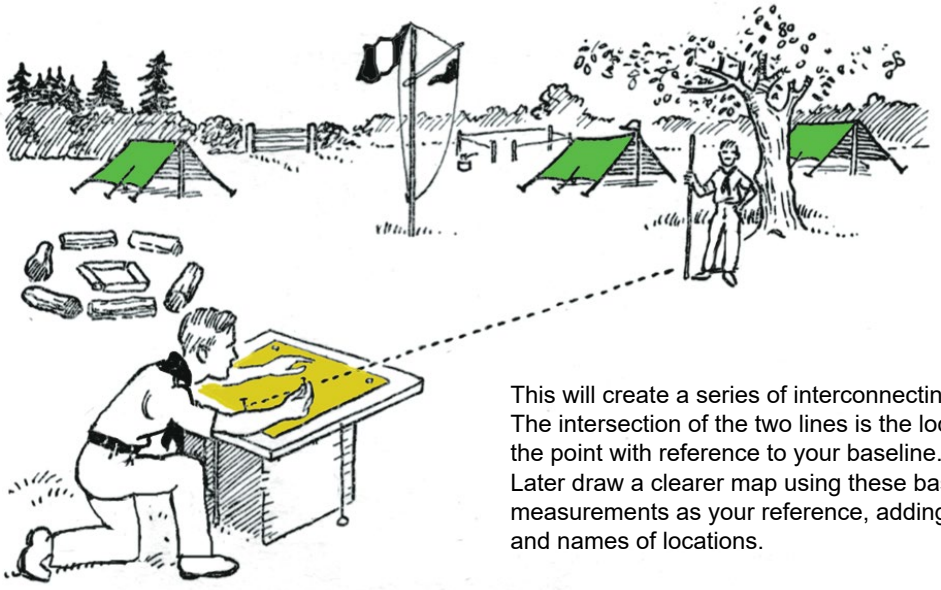
Stand on one bank and hold your hand against your eyebrows, with the palm facing downwards. Slant your hand until it appears to touch the opposite bank. Turn 90 degrees and note the point where the edge of your palm appears to touch the ground. The distance from where you stand to this point is the width of the river.





Plane table surveying is a method of making a simple map. You will require graph paper, pencil, ruler and a drawing board or base.
Before you start you need to determine the basic size of the area so that a scale can be struck for the survey. Walk the field and work out the number of paces along each side and from this select a scale.
Next decide on location for the two sighting positions. Select a position that is roughly central and from which each corner can be seen.
Place a pin in your drawing board and draw a line. Sight along this in the direction of your second point and mark its location exactly according to the scale decided. Place a second pin in this spot.
Now working from the two pin points sight features and key points of your camping field on the map and measure distances. Use your ruler to scale their positions on the drawing board.





This will create a series of interconnecting lines. The intersection of the two lines is the location of the point with reference to your baseline.
Later draw a clearer map using these base measurements as your reference, adding colour and names of locations.

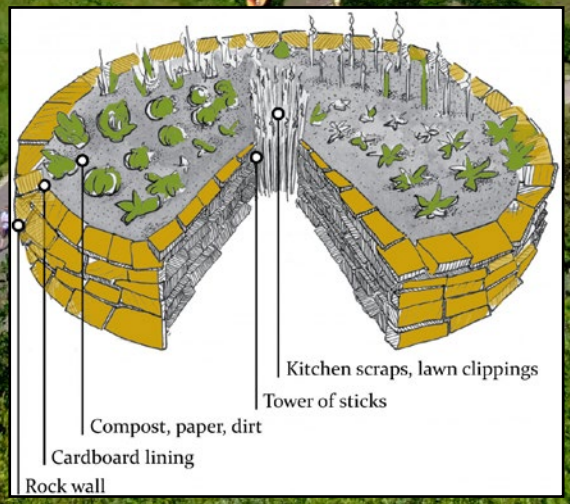
Plane table mapping

Science Bit

All living things need food to survive. Most of the food we eat has its origins in plants. We produce food by growing it, or eating animals which in turn also eat plants to create mass and meat.
Plants in space are plants grown in outer space. In the context of human spaceflight, they can be used for food and/or refreshing the atmosphere. Plants can also scrub carbon dioxide and return oxygen, as well as adjust humidity. Plants can be grown in a space garden and are at experimental stage at the moment on board the International space station. Growing plants in space may also provide a psychological benefit to human spaceflight crews.

Team Challenge
You and your team have to create a keyhole garden and produce some food.

Artist's impression of a plant growing module to be used on Mars



Food supply

If the Earth were only a metre in diameter.

If the earth were only a metre in diameter, floating a few metres above a field somewhere, people would come from everywhere to see it. People would walk around it, marvelling at its big pools, the bumps on it, and the holes in it. They would also be amazed at the very thin layer of gas surrounding it and the water suspended in the gas.

The people would marvel at all the creatures walking around the surface of the ball,and the creatures in the water.

The people would declare it sacred because it was the only one, and they would protect it, so that it would not be hurt. The ball would be the greatest wonder known, and the people would come and pray to it, to be healed, to gain knowledge, to know the beauty and to wonder how it could be. People would love it, and defend it with their lives because they would somehow know that their lives, their own roundness, could be nothing without it.

If the Earth were only a metre in diameter.

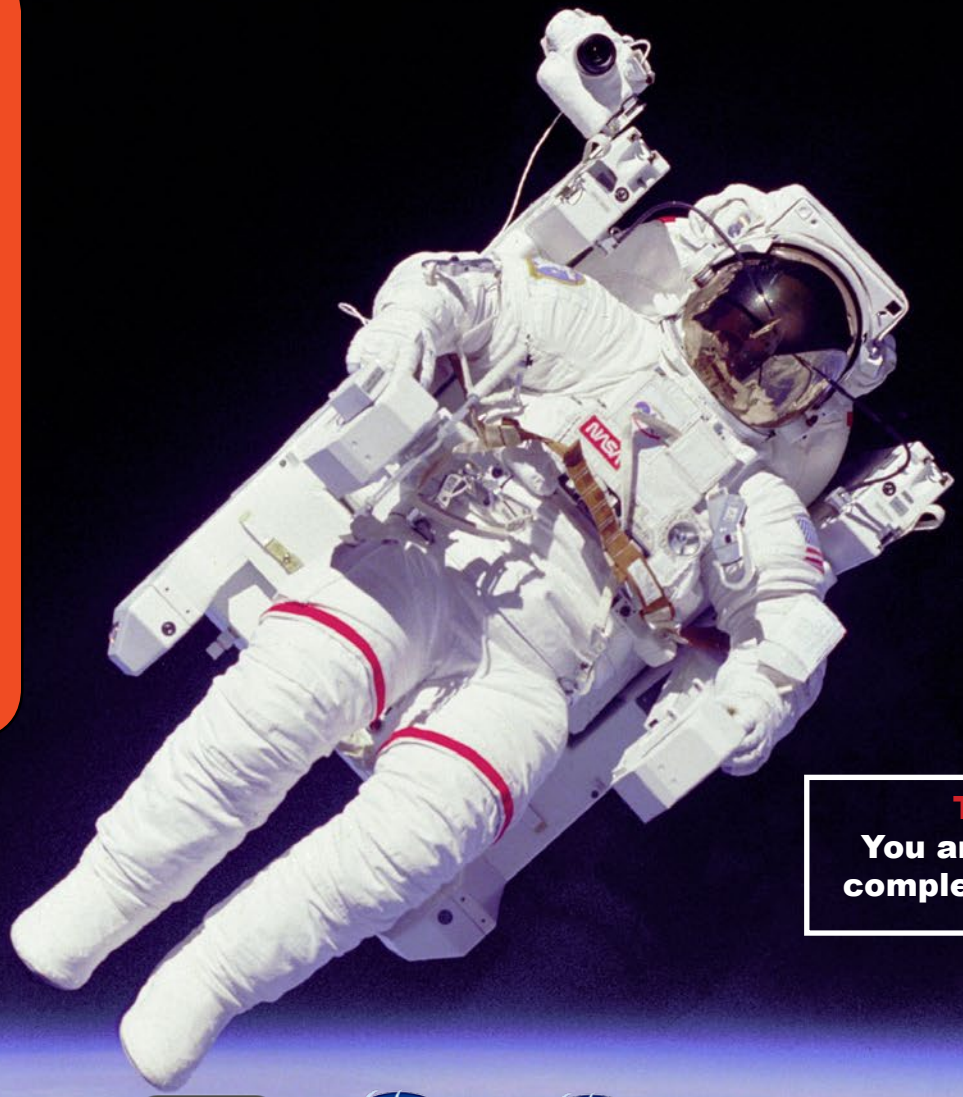
Conservation

Science Bit

A spacesuit is more than clothes astronauts wear in space. The suit is really a small spacecraft. It protects the astronaut from the dangers of being outside in space.

Spacesuits help astronauts in many ways. The suits protect astronauts from getting too hot or cold. Spacesuits also give astronauts oxygen to breathe while they are working in space. The suits hold water to drink. They also keep astronauts from getting hurt by space dust. Space dust may not sound very dangerous. But when it moves faster than a bullet, the dust can hurt someone. The suits even have special gold-lined visors to protect eyes from bright sunlight.

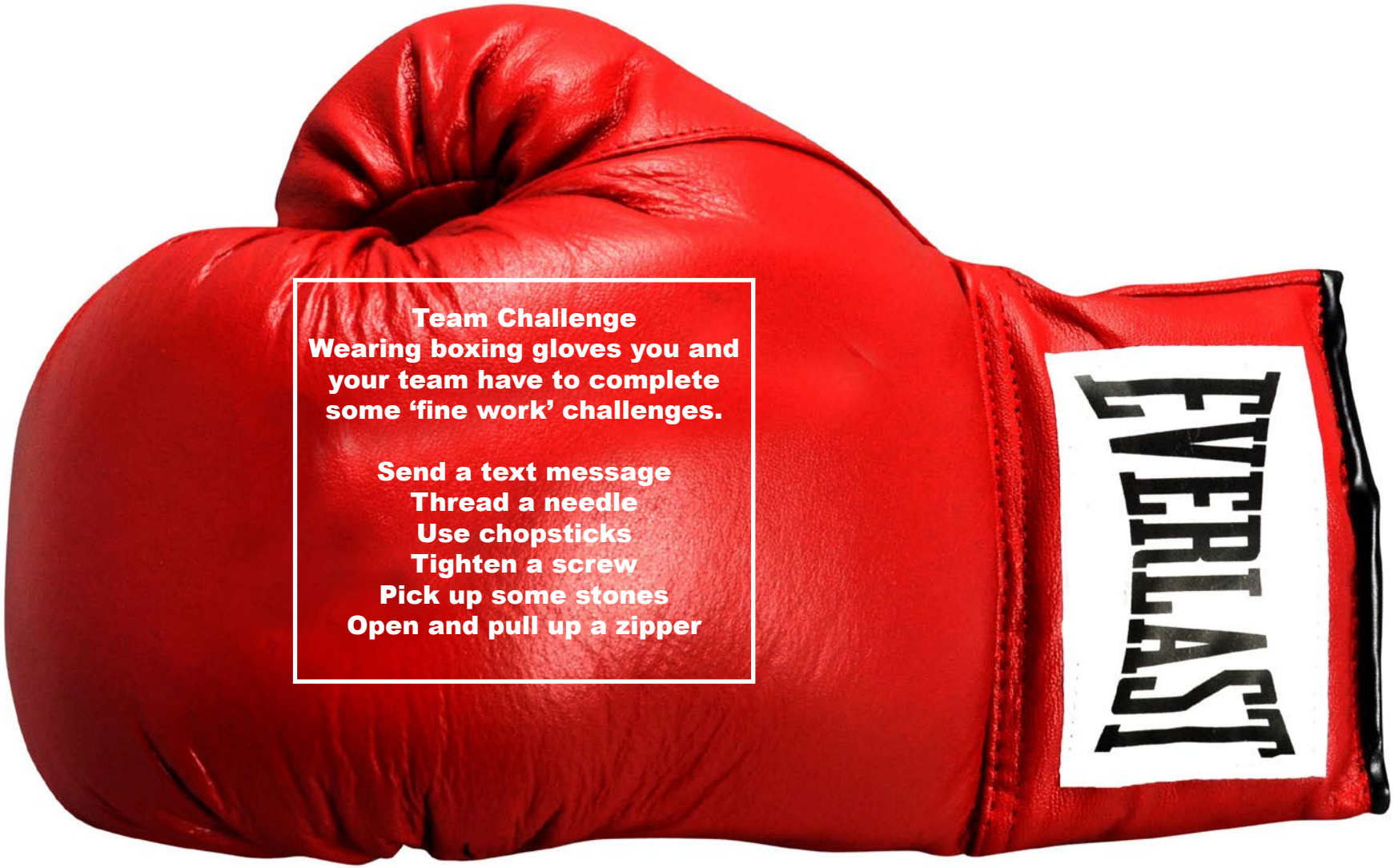
On the back of the spacesuit is a backpack. The backpack holds oxygen so astronauts can breathe. It also removes carbon dioxide that astronauts have breathed out. The backpack also supplies electricity for the suit.



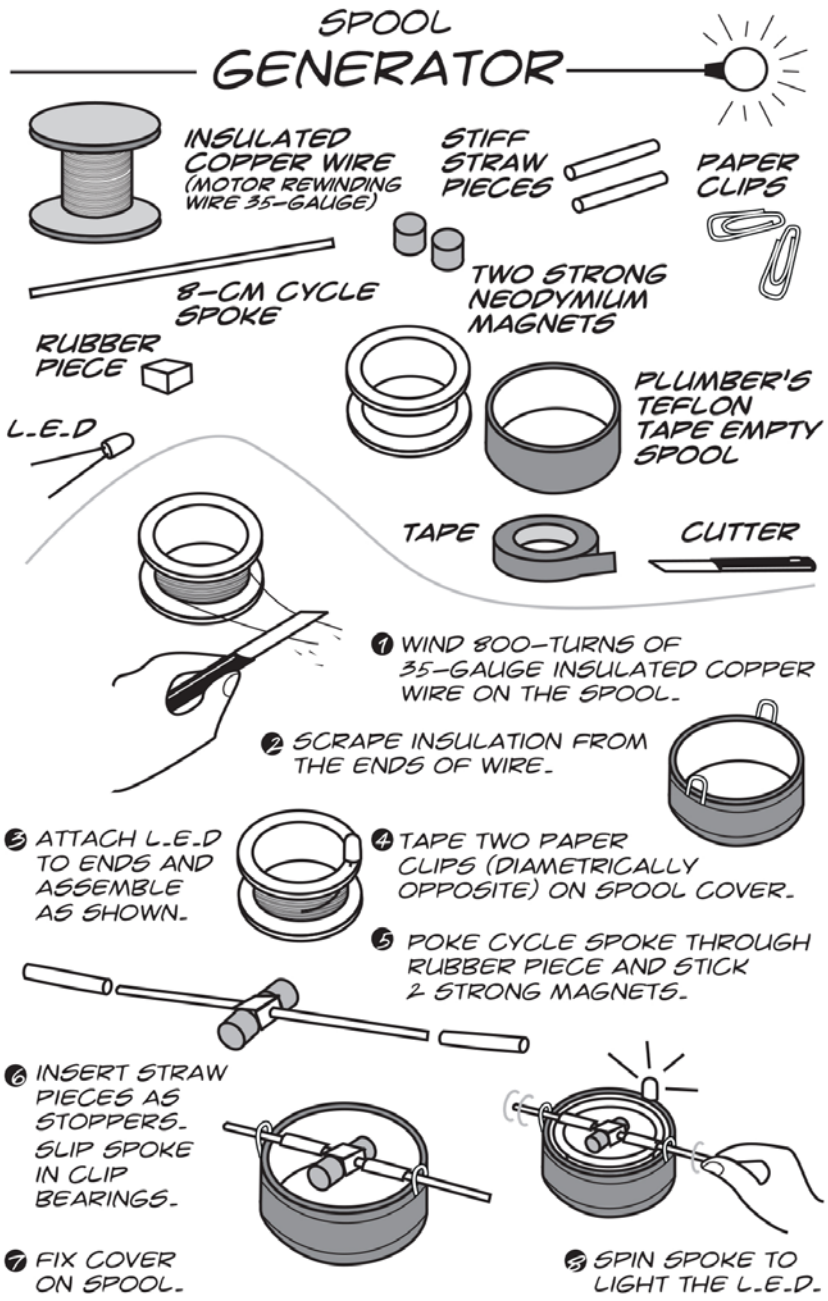
Team Challenge

You and your team have to complete astronaut training.

Space suits


Team Challenge
Wearing boxing gloves you and your team have to complete some 'fine work' challenges.
Send a text message
Thread a needle
Use chopsticks
Tighten a screw
Pick up some stones
Open and pull up a zipper
EVERLAST

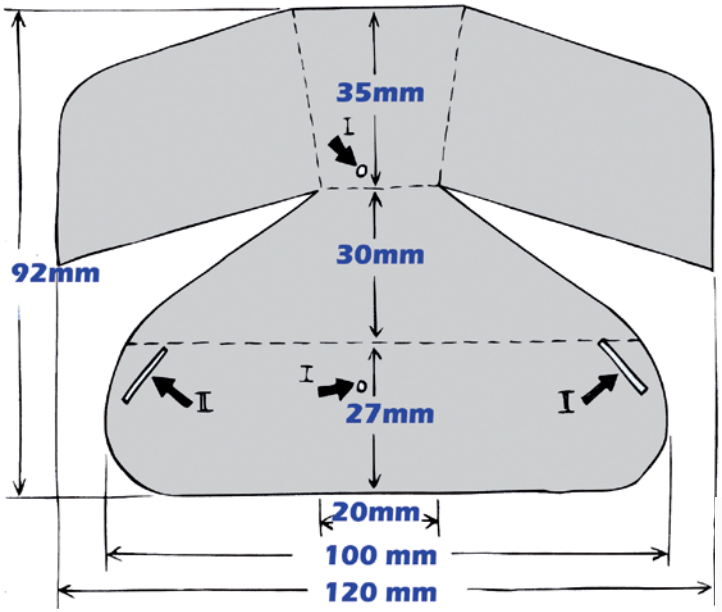
Space suits

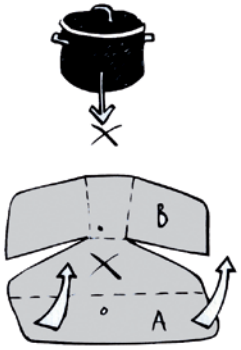


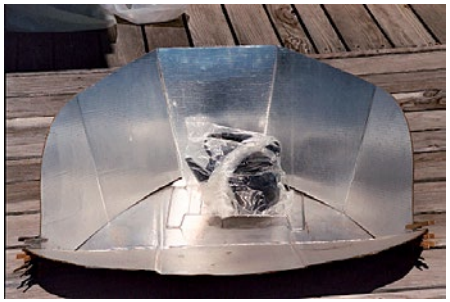
Spool Generator

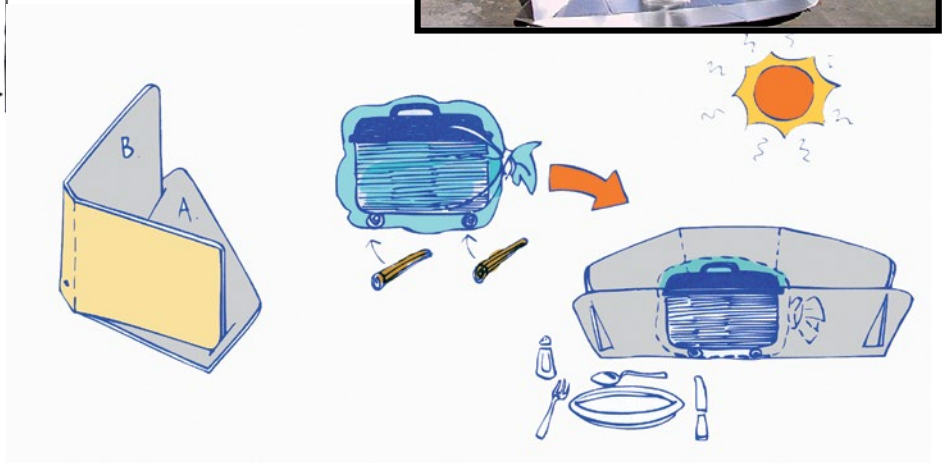
Solar Cooking

The solar cooker is a light weight, low budget and environmentally friendly alternative to the heavy cookers we find in our kitchens. All you need is a piece of heavy cardboard, some aluminum foil, a transparent plastic bag and a black pan.
This cheap solar cooker has been developed for use in developing countries where fuel is scarce. They are easy to make....make one and try it out!!!









In many villages there is a complete lack of fuel wood and the people have resorted to burning dried animal dung or crop residues. These practices deprive the soil of much of its potential fertility. (Journey To Forever)

Solar Cooking

Science Bit

A solar panel contains photovoltaic cells. Photovoltaic can convert light into electricity. The current produced is directly dependent on how much light strikes the module. Some materials exhibit a property known as the photoelectric effect that causes them to absorb photons of light and release electrons. When these free electrons are captured, an electric current results that can be used as electricity and for charging batteries and devices.

Solar powered Charger

Science Bit

To enter a spacecraft or space stations, it is necessary to maintain a habitable environment when persons are exiting or entering the craft. An airlock is a device which permits the passage of people and objects between a pressure vessel and its surroundings while minimizing the change of pressure in the vessel and the loss of air from it.

The lock consists of a small chamber with two airtight doors in series which do not open simultaneously.

Before opening either door, the air pressure of the airlock—the space between the doors—is equalized with that of the environment beyond the next door to open.

Docking is the maneuvering sequence that is performed to enable the space craft and station to join together.

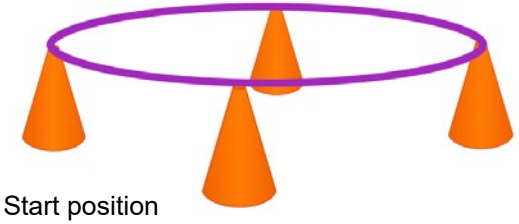
Docking

Transport Game

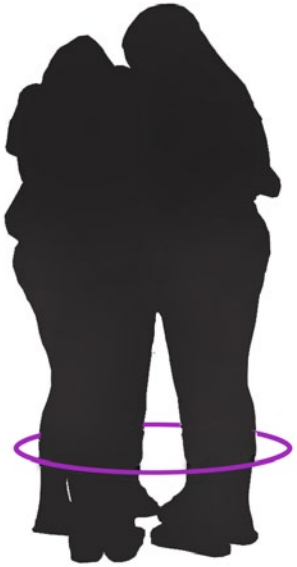
a number of rope loops, baskets and tennis balls are required.
Working in teams of two people.
Each team must deliver a tennis ball into each basket.

Docking

Setup
4 cones are placed on the ground and a hula hoop is placed on top of them.
At the opposite end of the play area 4 cones are placed - so that a hula hoop can rest on top of them.

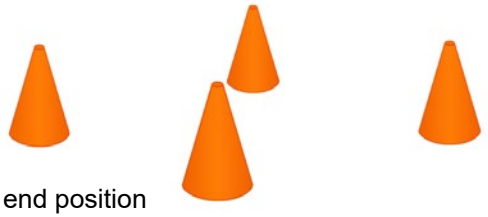


Start position



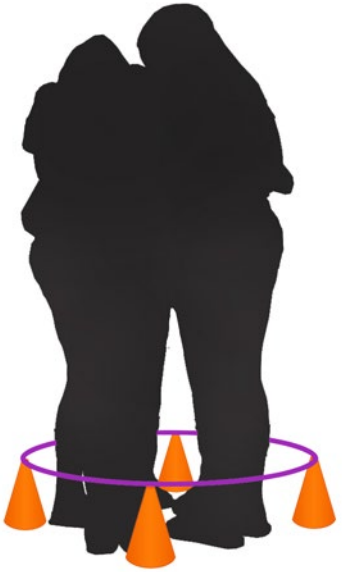
Teams are invited to step inside the hoop - getting as tight as possible. The team then move their legs outwards until the hoop is ‘trapped’ by the pressure of their legs.

The team now move, carefully together, to the end position which is some distance away. The team must make sure the hoop stays in position. If it falls the team have to return to start position



end position

When the team reach the end position they must rest the hoop back on the cones. move their legs inwards to release the pressure and step out of the hoop. The docking process is complete.



Docking Games