Air

Insight

Science Foundation Ireland sfi For what's next

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.

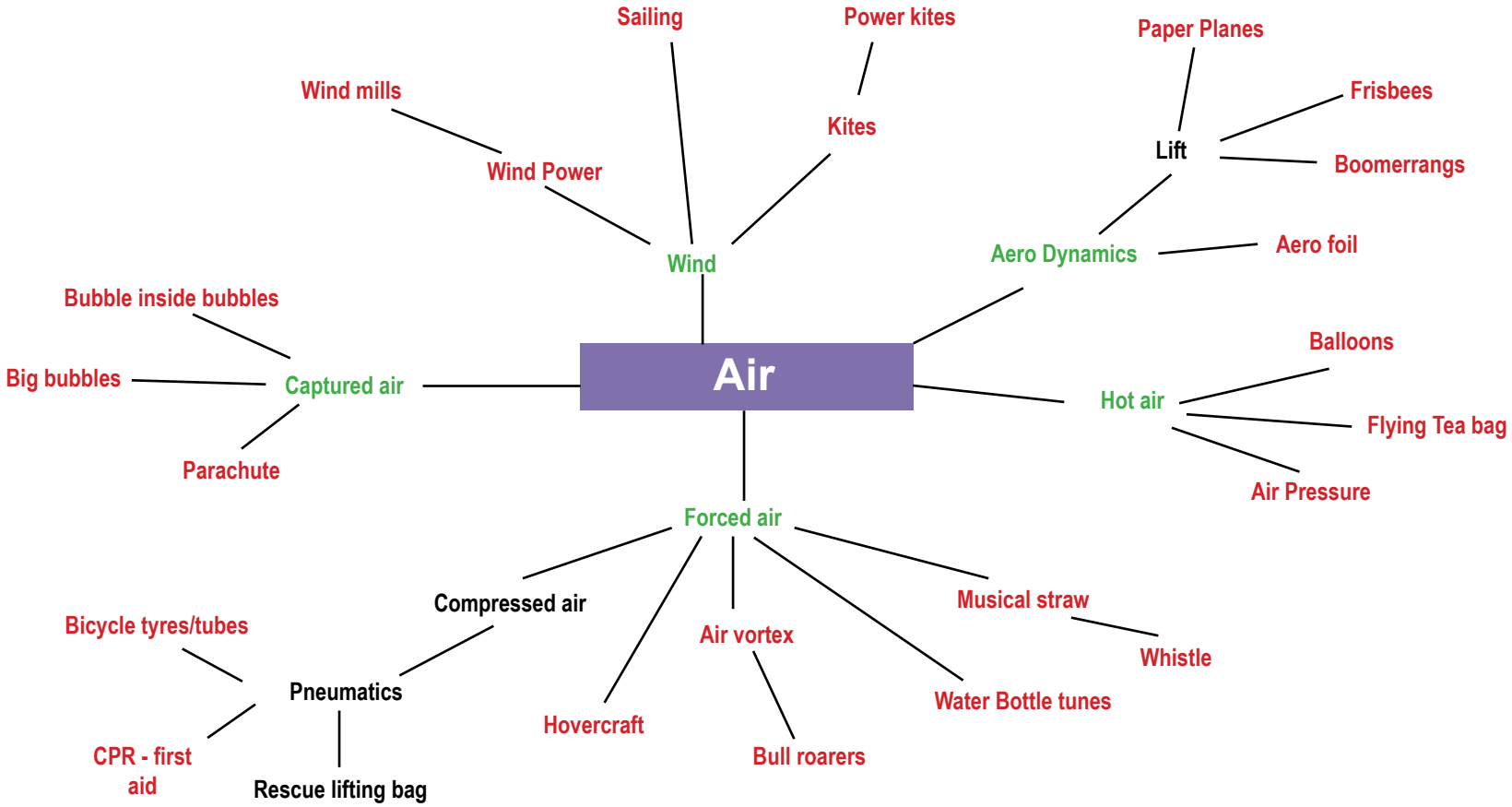
Each idea therefore has a 'science idea' that Scouts need to discover as they undertake each activity. In the review process it is hoped that Scouts express in their own way the things they have learned and the knowledge and new understandings they have gained.

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.

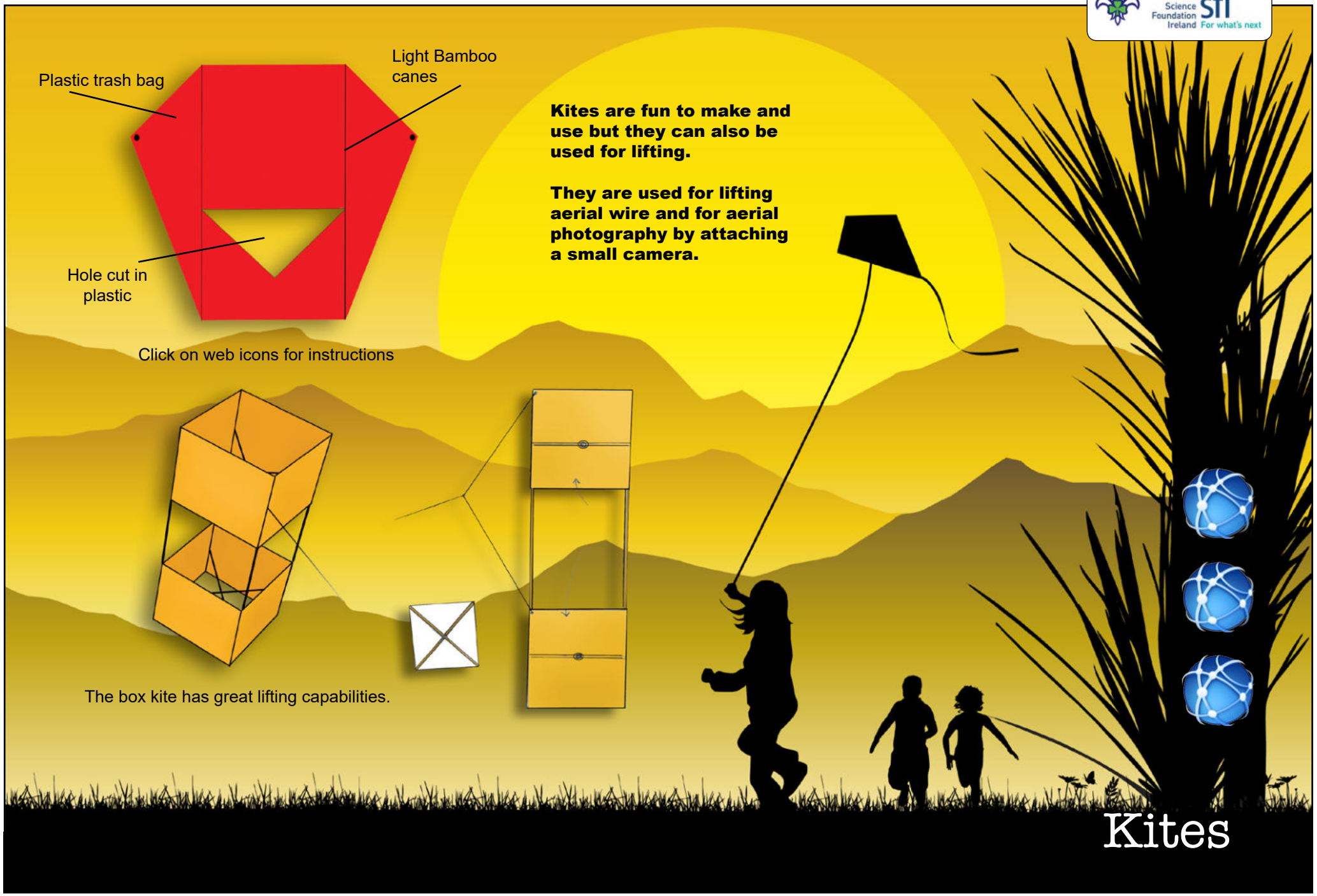
Reviewing is critical to the learning process. Until a Scout takes time to internalise and access what they have learned through an experience it serves no real value - bar entertainment.

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

Air theme chart

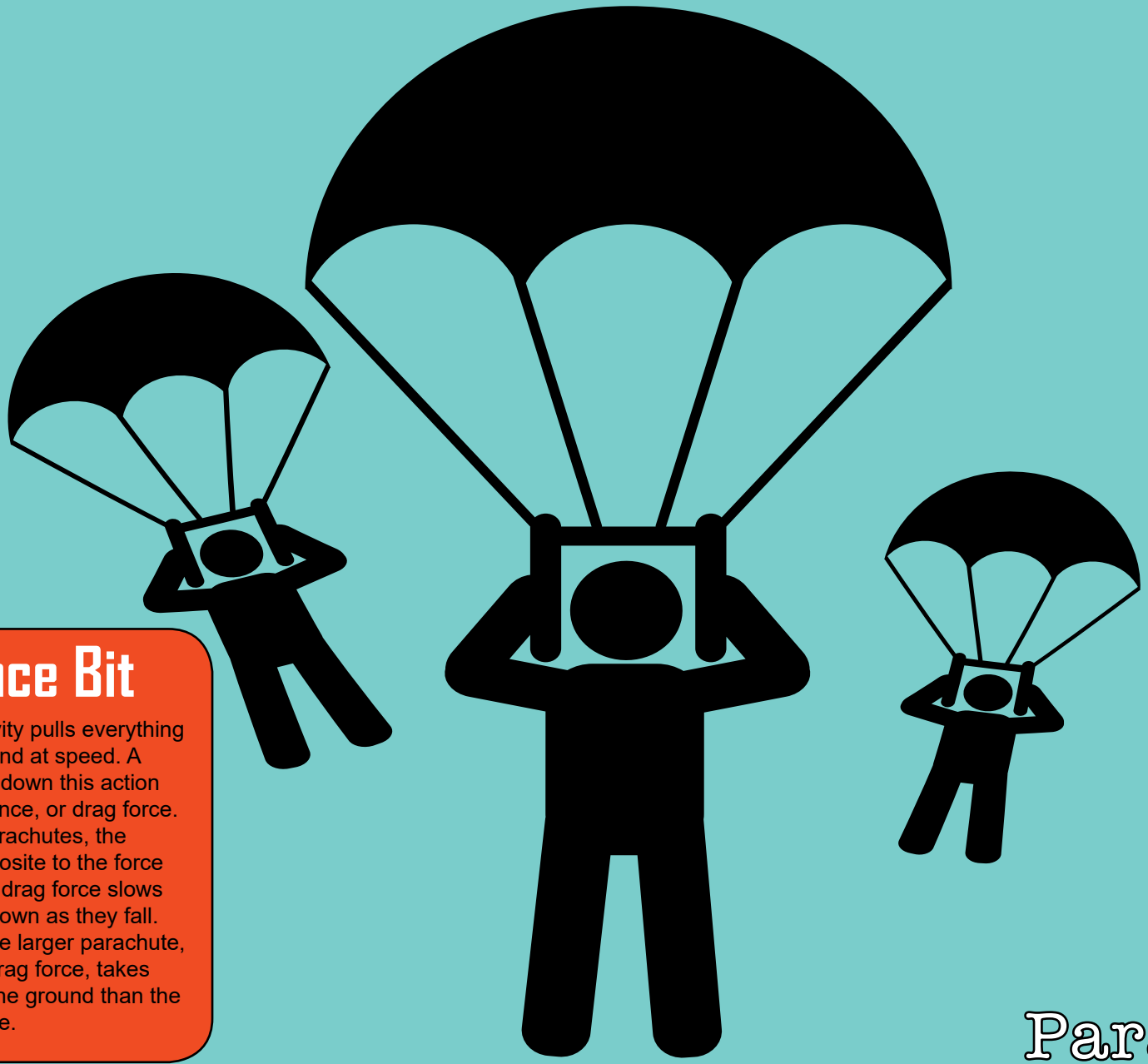

Plastic trash bag
Light Bamboo canes
Hole cut in plastic
Click on web icons for instructions
Kites are fun to make and use but they can also be used for lifting.
They are used for lifting aerial wire and for aerial photography by attaching a small camera.
The box kite has great lifting capabilities.
Kites

Mankind has been obsessed with the idea of flying for thousands of years. The kite represented one way he could physically attach himself to the concept of flying. It was inevitable that one day kites would drag themselves into the modern age and that's what has happened to stunt/sport kites particularly.

Power kiting uses a large kite or high winds to produce a load big enough to move the flyer. Most of the variants of power kiting— especially the popular ones— are some type of sailing. All of the sailing forms use a large kite or a stack of kites as the power source for some vehicle however large or small. The kite is always steerable so that the flier can position it in the sky similar to the way a sailor trims a sail. The pilot can sail the craft upwind downwind or across the wind just like a conventional sail boat. However the kite allows techniques and speed not possible in any conventional sail boat.

Kite dragging and sand skiing use the kite to move the flyer downwind. Kite jumping uses the kite to lift the flyer off the ground and cushion the return to the ground. Man lifting suspends the flyer off the ground.

Power Kites



Science Bit

The force of gravity pulls everything towards the ground at speed. A parachute slows down this action due to air resistance, or drag force. In the case of parachutes, the drag force is opposite to the force of gravity, so the drag force slows the parachutes down as they fall. Consequently, the larger parachute, with its greater drag force, takes longer to reach the ground than the smaller parachute.

Parachutes

Science Bit

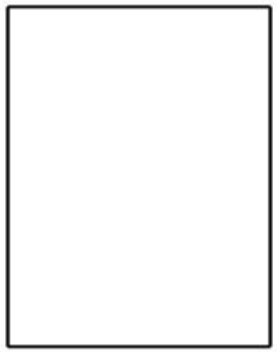
What makes a paper airplane fly? Air — the stuff that's all around you.

Anything that flies, such as air-planes, helicopters, and birds, utilize the principles of aerodynamics to move through the air.
The first effect is the "push" given by the airplane engines which propel the airplane through the air. The second effect is the movement of air over the airplane's wings which creates the lifting force required to keep the airplane up in the air.
In simple terms, the wings of an airplane generate lift force and the engine creates the thrust to propel the airplane through the air.

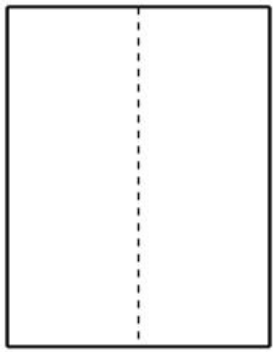
The Four Forces in Balance
A long flight occurs when four forces — drag, gravity, thrust, and lift — are balanced. These planes fly a slow and gentle flight.

Paper Planes

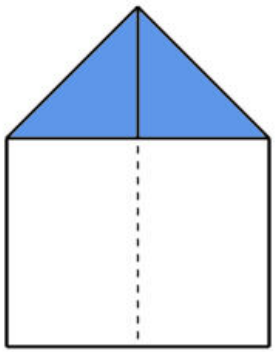
start with paper in portrait orientation



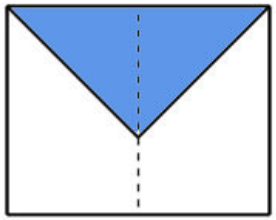
fold in half lengthwise



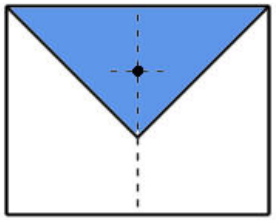
fold the upper edges to the centerline



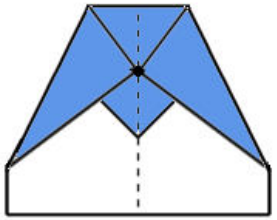
fold the triangle downwards along its lower edge



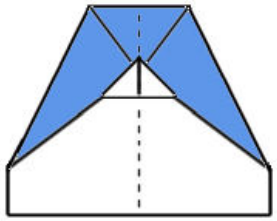
fold the tip of the triangle up to the top to locate the halfway point, then unfold



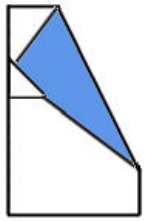
while firmly holding the center in place, fold both upper corners to the halfway point



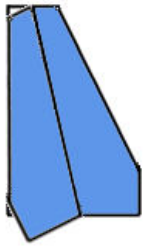
fold the remaining tab up as far as it will go. it should slightly overlap the previous fold



fold in half along the centerline, with the tab on the outside

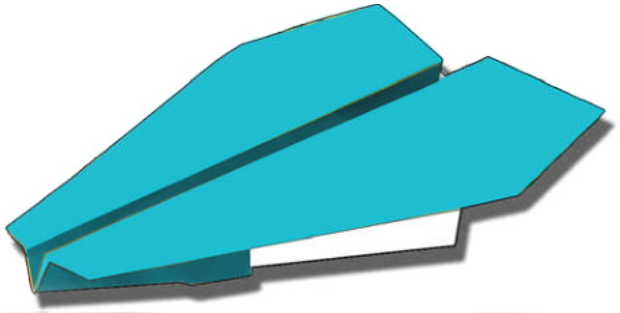


fold one wing such that the outer edge is brought colinear with the plane's centerline



fold the other wing in a symmetrical fashion

unfold and fly!



tips for flying:

neutral roll stability

high roll stability

unstable in roll

throw the plane, holding it by the tab. throw it directly forward, but give the wings a small upward angle of attack. 5 degrees should be plenty.

if the plane climbs, stalls, and crashes, curl the rear wingtips **downward** slightly.

if the plane nosedives rapidly, curl the rear wingtips **upward** slightly.

Paper Planes

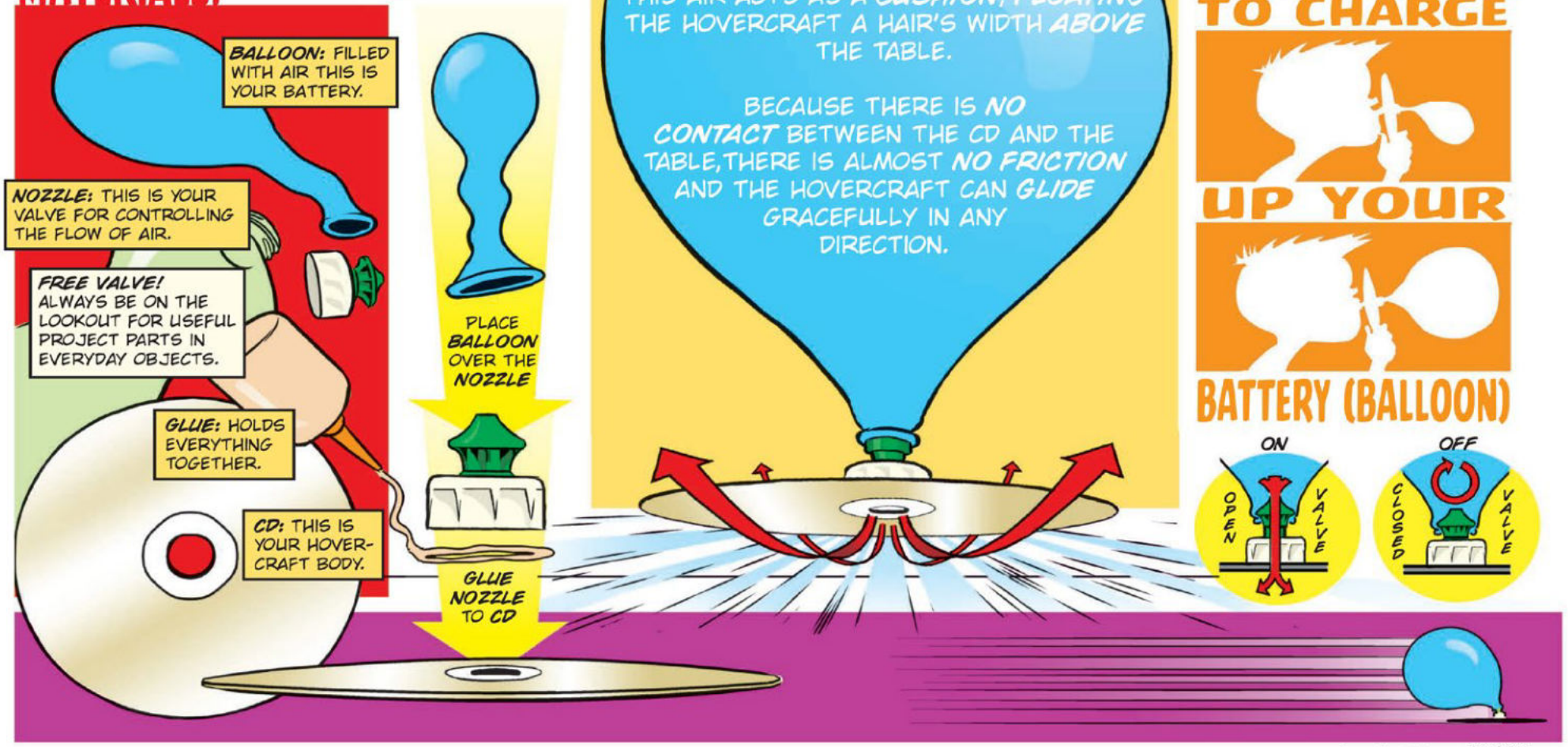

Flying


Helicopter


Hovercraft

HOWTOONS

MATERIALS: CD HOVERCRAFT



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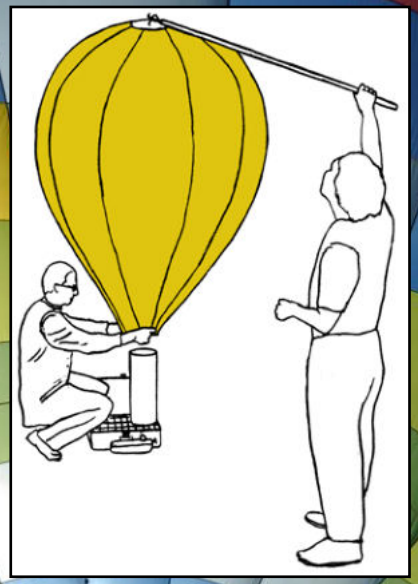
Hot Air Balloons

Science Bit

Hot air balloons are based on a very basic scientific principle: warmer air rises in cooler air. Essentially, hot air is lighter than cool air, because it has less mass per unit of volume. A cubic foot of air weighs roughly 28 grams (about an ounce). If you heat that air by 100 degrees F, it weighs about 7 grams less. Therefore, each cubic foot of air contained in a hot air balloon can lift about 7 grams. That's not much, and this is why hot air balloons are so huge -- to lift 1,000 pounds, you need about 65,000 cubic feet of hot air.

To keep the balloon rising, you need a way to reheat the air. Hot air balloons do this with a burner positioned under an open balloon envelope. As the air in the balloon cools, the pilot can reheat it by firing the burner.



Science Bit

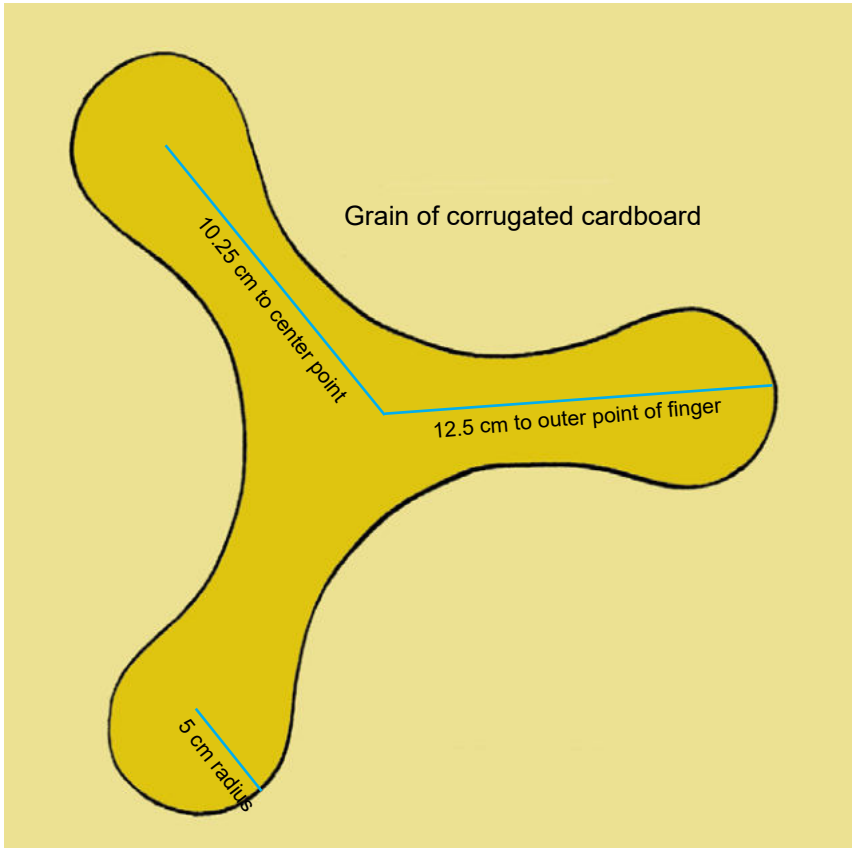
Two key forces that act on a Frisbee during flight are lift and drag. Lift is the force that allows the Frisbee to stay airborne. The Frisbee itself creates this lift force as it flies through the air. Because of the Frisbee's curved shape, the airflow above it must travel at a higher velocity than that underneath, thereby creating low pressure above and high pressure below the disk. The angle at which the Frisbee is thrown, which we'll call the "launch angle" (the angle of attack), affects both lift and drag.

Frisbees

Science Bit

The returning boomerang has specialized components that make it behave a little differently than an ordinary bent stick.
A classic banana-shaped boomerang is simply two wings joined together in a single unit. This is the key to its odd flight path.
The wings are set at a slight tilt and they have an airfoil design -- they are rounded on one side and flat on the other, just like an airplane wing. The air particles move more quickly over the top of the wing than they do along the bottom of the wing, which creates a difference in air pressure. The wing has lift when it moves because there is greater pressure below it than above it.
The difference in lift force between the two sides of the boomerang produces a consistent torque that makes the boomerang turn. It soars through the air and gradually loops back around in a circle.

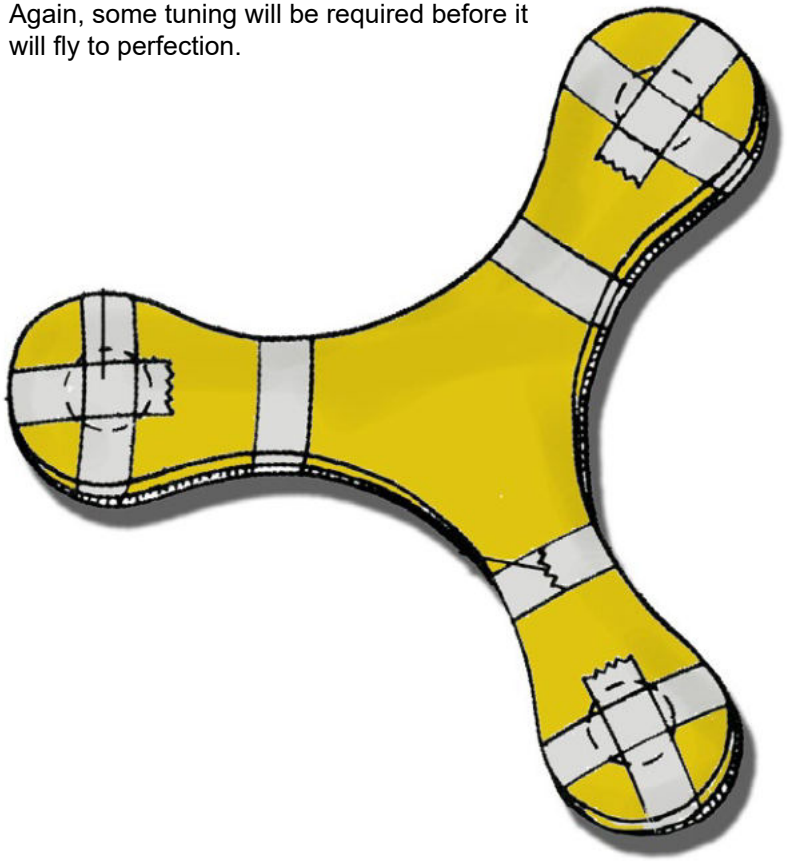
Boomerangs



For indoor version (also can be used in light wind or calm conditions) the cardboard version is just one sheet thick.

Once the shape is cut out fold in the top of each finger. Throw it a couple of times and modify - by folding in and out and twisting the edges of each finger.

To use the same design as an outside boomerang it needs to be thicker and have some ‘weight’. To do this you need to have two ‘indoor’ type boomerangs and a few small coins, and some tape.
Again, some tuning will be required before it will fly to perfection.

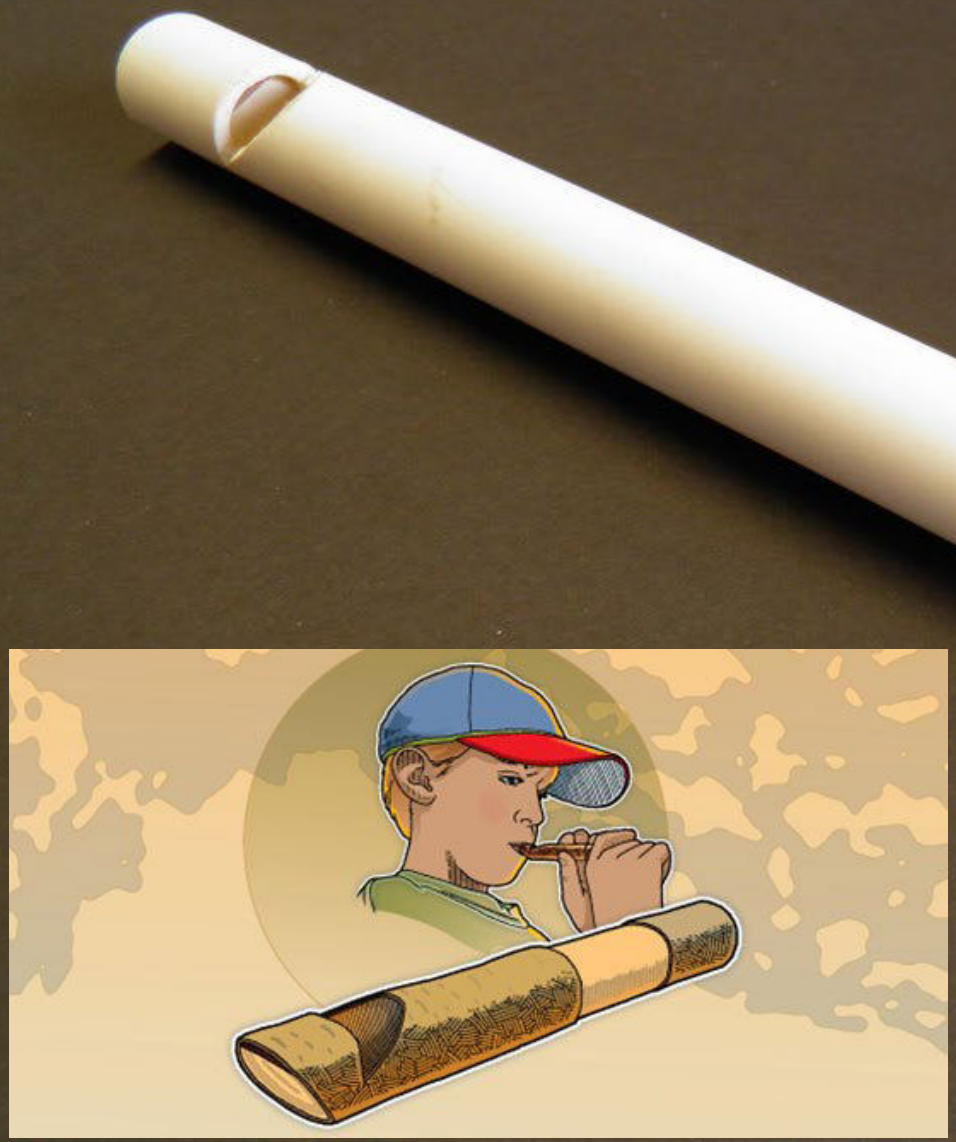


Simple Boomerang

Science Bit

Air enters the whistle at one end. As the air reaches the other, closed end, all the air molecules “pile up” on top of each other and cause a high-pressure region. The air escapes out the little hole in the end, making the noise you hear. The sound is dependent on the length of the whistle. The longer the whistle, the lower the pitch will be. The ball inside the whistle is not necessary for the whistle to work but serves a purpose. A whistle without a ball has a flat tone. The ball disturbs the air flow and increased the sound. Blowing across a pipe or vent produces a sound by vibrating a column of air inside of a tube. Pipes of different lengths produce different sounds.

Whistles



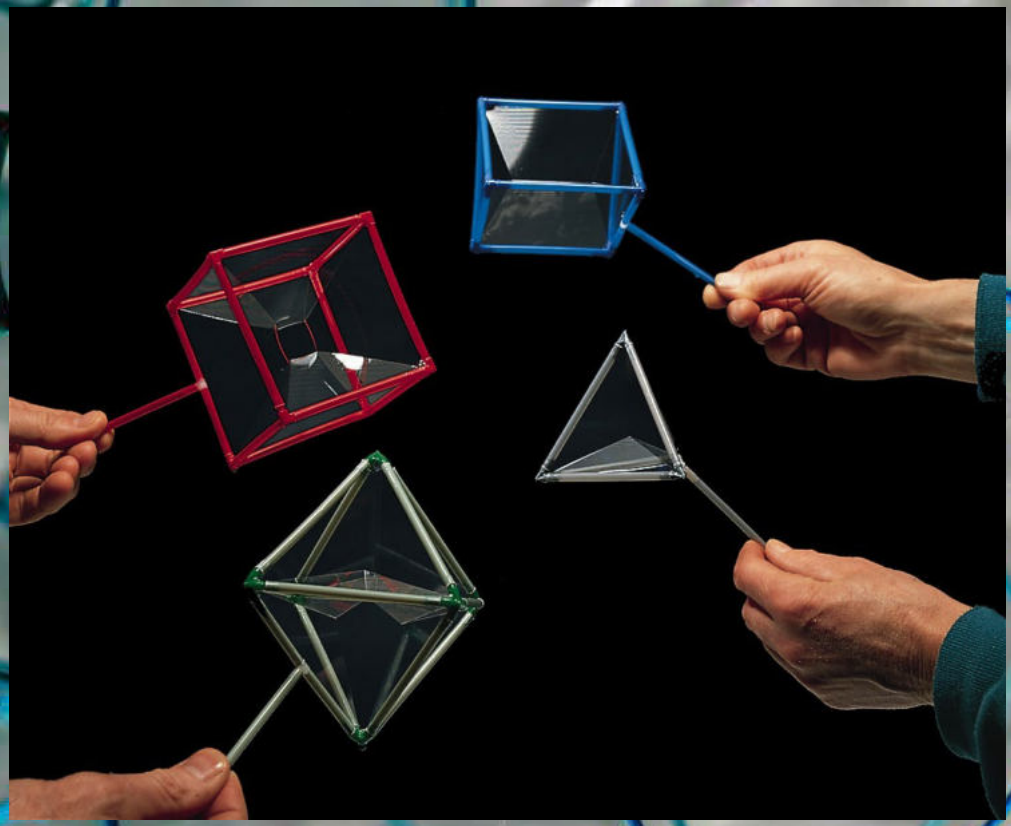
Sliding Whistle

Water Bottle Tunes

Big Bubbles

Science Bit

Bubbles are pockets of soap and water that are filled with air. The special thing about soap bubbles is that they can float freely in the air. Bubbles provide the opportunity to study science concepts such as elasticity, surface tension, chemistry, light, and even geometry. A bubble is just air wrapped in soap film. No matter what shape a bubble has initially, it will try to become a sphere. The sphere is the shape that minimizes the surface area of the structure, which makes it the shape that requires the least energy to achieve.



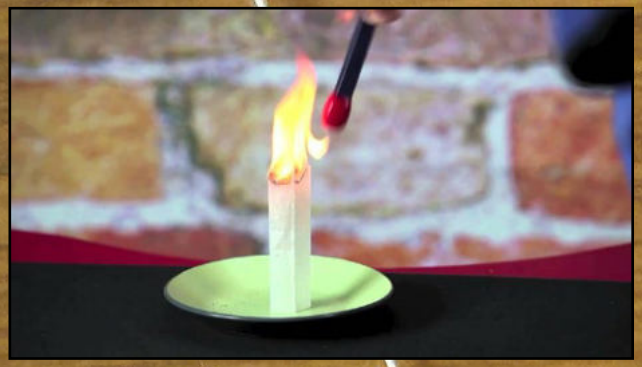
Science Bit

Bubbles are round because a sphere is the shape that is the most stable for them—a sphere is more stable than a square or a triangle or any other shape. But when a bubble is surrounded by other bubbles, these “side” bubbles push against the “center” bubble, squishing and squashing until it has corners and sides—like a cube!

Now that you’ve made a cube-shaped bubble, keep the science going by trying your hand at different shapes.

Bubbles inside bubbles

Flying Teabags



Science Bit

Lighting the top of the teabag cylinder heats the air inside the cylinder. The air molecules start to move more quickly and spread out to take up more space. As the air molecules spread out, the air inside the cylinder becomes less dense. As the warm, less dense air rises, it has enough force to lift the ash of the teabag.
Hot air balloons work by the same principle

Spin over your head
Connecting string should be 1200 long

The bull-roarer is an ancient method of signaling used by many people, often as part of a tribal ceremonials

It consists of a piece of wood that is carved into an aerodynamic wing shape at least 30cm long, attached to a string that is spun over the head to create a buzzing noise.

They are easy to make and can be decorated with your own interesting designs and colour schemes.

Bull Roarer

Science Bit

When the membrane thrusts a burst of air out of the hole, it displaces the surrounding air out side. The surrounding air swirls around in the shape of a twisting doughnut. The twisting doughnut will carry the original burst of air as far as 18 mts away.

The physics of moving air is called fluid dynamics. It may seem strange to call air a fluid but motion of gases and liquids are very similar. When a fluid twists or swirls, we call vortex. They twist in the shape of a doughnut and the mathematical name for this is called a toroid. Hence our cannon generates toroidal vortices.

Air Vortex

Science Bit

The air is pressing against you and every other object, with a pressure 14.7 pounds per square inch. This would normally be enough to crush a can by itself, or even a person! This doesn't happen because the air inside the soda can (or the material inside your body) is pushing outward with equal pressure, and because the air pressure "cancels itself out" by pushing at us from every direction equally.

Air Pressure

Science Bit

The space around us is not empty but is filled with air, which is pushing on everything around us. This is called air pressure.
When tyres or a container such as a ball are pumped up, air is squashed inside. This increases the pressure inside the tyre so that it becomes harder and can support more weight. Its flexibility allows for a smoother driving experience.

Air Pressure

Breathing

Breathing is necessary for life. Being without air for any longer than 4 minutes can result in brain damage. Being without air for more than 7 minutes will almost certainly result in death.
The fact that a patient is not breathing must be recognised at once. There must be no delay in relieving blocked airways or in giving C.P.R.

Your aim is to restore and maintain breathing quickly before attempting any other treatment

Patient is unconscious

Send for help

ABC - Airway, Breathing, Circulation

Yes

No

If the patient has fainted

Raise their feet

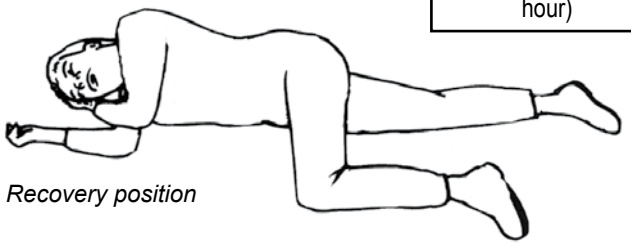
Open window and allow the patient have some fresh air

Offer the patient some water

Place in recovery position

Keep the patient warm

Monitor until help arrives



Recovery position

Clear airway

If breathing resumes

Still not breathing

Assist breathing.

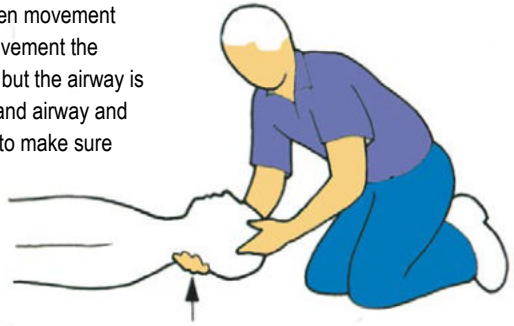
No response

Continue until help arrives(for at least 1 hour)

Assisted breathing

Look for movement of the chest and abdomen
Listen for the sound of air movement
Feel for air movement against the side of the cheek

If you see chest or abdomen movement without hearing any air movement the patient is trying to breathe but the airway is obstructed. Check mouth and airway and position the head and jaw to make sure airway is open.



If patient is not breathing give 4 quick breaths.

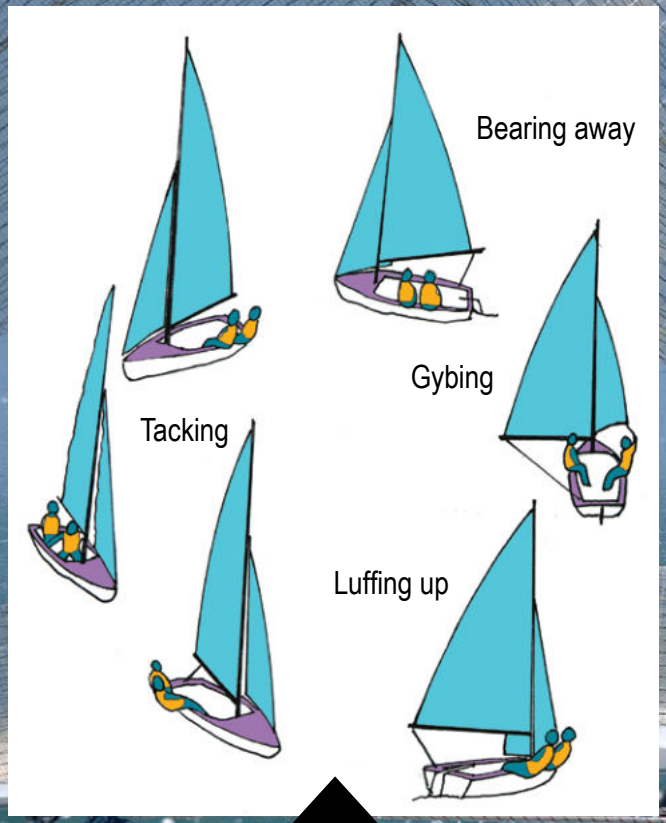
If at anytime you do not see the chest rise when you breathe in check for blockage of the airway.

Pinch the patient's nose with your thumb and forefinger while maintaining the head tilt.

Take a deep breath, open your mouth wide and make a tight seal over the patient's mouth.

Breathe into the patients mouth twice. As you breathe into the mouth, watch for the patients chest to rise. Be sure to look up and take a deep breath, to completely refill your lungs between breaths. Each breath should last at least one to two seconds, to allow adequate time for good chest expansion.
It is a good idea to learn CPR from a recognised First Aid Organisation.

CPR

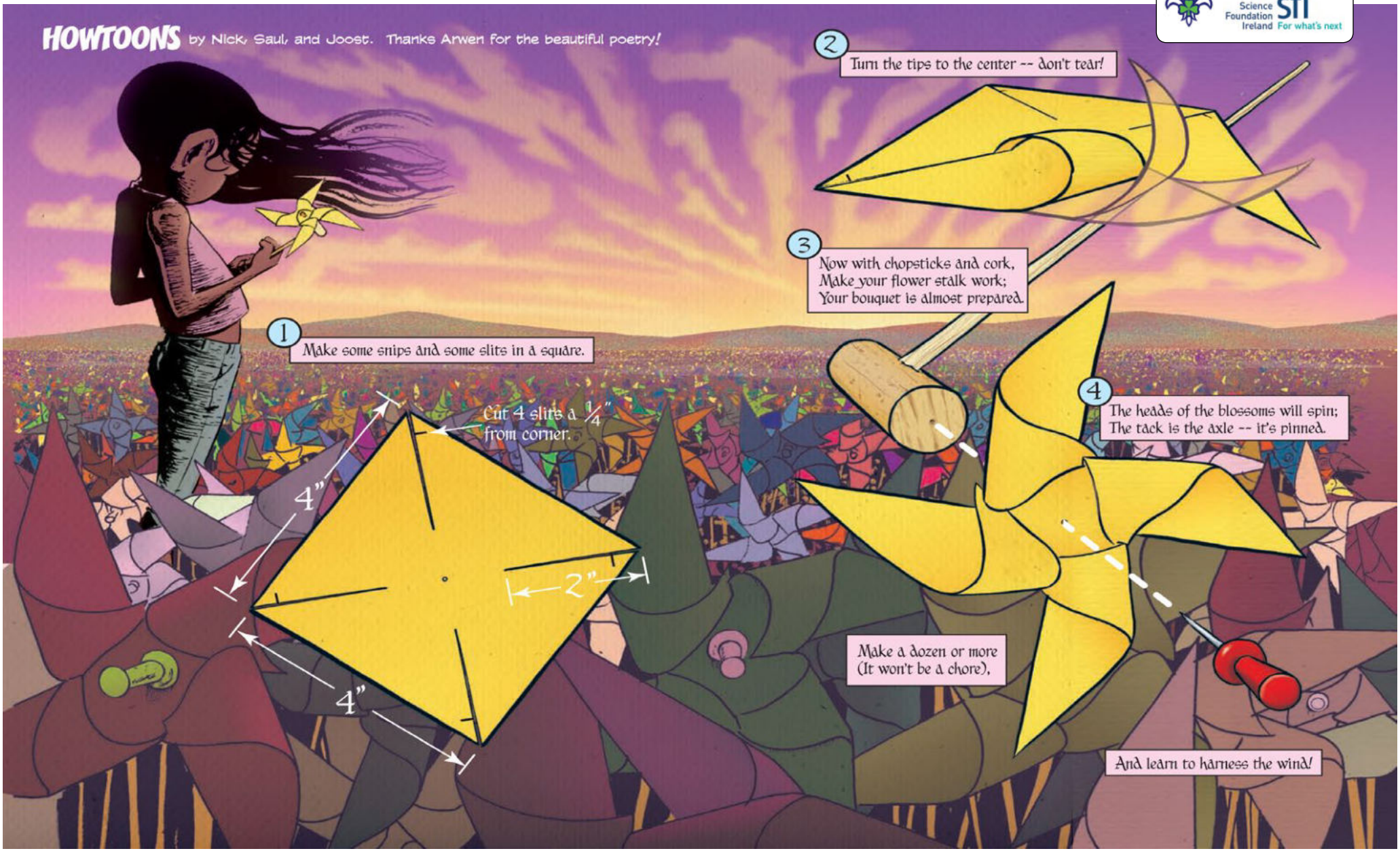


Science Bit

By positioning the sails it causes air to flow over the sails, it moves faster over the outer side of the sail, creating lower pressure on the inner side. This produces a force which is mostly to the side and a bit forwards. Pressure on the centerboard on the underside of the boat cancels the sideways force and as a result causes a forward component and forces the boat to move forward. The tighter the position of the sails to the air flow the faster a boat will travel.

Sailing


Science Bit
Air is a fluid like except that its particles are in gas form instead of liquid. And when air moves quickly, in the form of wind, those particles are also moving quickly. Motion means kinetic energy, which can be captured, just like the energy in moving water can be captured by the turbine in a hydroelectric dam. In the case of a wind-electric turbine, the turbine blades are designed to capture the kinetic energy in wind. When the turbine blades capture wind energy and start moving, they spin a shaft that leads from the hub of the rotor to a generator. The generator turns that rotational energy into electricity. At its essence, generating electricity from the wind is all about transferring energy from one medium to another.
Wind power



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