BRITISH SCIENCE ASSOCIATION

science made simple

NATIONAL SCIENCE & ENGINEERING WEEK

11–20 MARCH 2011

CAMPUS SCIENCE

The Science Busking Pack for National Science & Engineering Week

WWW.NSEW.ORG.UK

In partnership with: EngineeringUK

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Introduction

Thank you for downloading this Science Busking Demo Pack from the **British Science Association**. This resource has been put together by **science made simple** and is intended for use by 16+ year olds, though if deemed suitable they can be adapted for use by under 16's with appropriate adult supervision.

It is intended that these demonstrations are carried out as part of National Science & Engineering Week (NSEW: 11–20 March 2011) www.nsew.org.uk. You can also request National Science & Engineering Week freebies (posters, stickers and bookmarks) from the British Science Association website to hand out at your event.

If you do a busking event as part of National Science & Engineering Week, please register your event as part of the **NSEW Events Programme** at www.nsew.org.uk.

About us

National Science & Engineering Week

is the UK's national celebration of the sciences, engineering and technology, taking place on 11–20 March 2011 all over the country and led by the British Science Association. This busking pack can be used as part of your own NSEW celebrations, either at home, university or in school!

www.nsew.org.uk

science made simple

is a social enterprise with a passion for science and all things associated with it! We aim to share our enthusiasm by offering a selection of inspirational and educational experiences that are tailor-made for schools, festivals, adult audiences and the public.

www.sciencemadesimple.co.uk

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Appropriate attention should be given to health and safety and all demonstrations should be fully risk-assessed *in-situ*. Neither **science made simple** nor the **British Science Association** take any responsibility for any injury or harm caused as a result of performing these demonstrations.

Hole in the Hand

Description: Bet your audience that you can make a hole in their hand (without causing any pain.) They may be dubious, so offer to let them do it to themselves. Get everyone to roll a piece of paper into a tube. Hold the tube up to their right eye and place their left hand against the side of the tube, palm facing towards them. With both eyes open, they should see a hole right in the middle of their hand. Get someone else to wiggle their finger into the tube at the same time.

Explanation: When you look at something, both your eyes see the same thing, just from slightly different angles. Your brain combines these two pictures together so that you end up with a 3D image. Using the tube, your brain is getting two different pictures. One eye is seeing the palm of your left hand. The other eye is seeing the other side of the room, viewed through the tube. Your brain has to decide which bits are the most important to combine together. So the dark sides of the tube are ignored and the bright circle at the end of the tube is seen mixed with the image of your left hand. Your brain will also tend to focus on moving objects.

Useful notes: You may need to get people to move their left hand back or forth to find the best position.

Equipment needed: one piece of paper per person

Topic links: Senses, Stereo vision, Brain processing

Touch your Toes

Description: Get two volunteers to bend over and touch their toes. Get them stand back-to-back, heels touching and again ask them to bend down and touch their toes. One or both volunteers will fall over.

Explanation: As you bend over, it is necessary for your bottom to move backwards to balance out the weight of your upper torso moving forward. Standing back-to-back (or against a wall) means your bottom can't move backwards and you are unbalanced, therefore you topple forward.

Useful notes: Select volunteers of similar height. This demo works well on the pretext of getting them to take a bow (for some reason). Firstly, train them to bow facing forward and make sure they have good technique (bending to 90˚), then get them to repeat back to back.

Equipment needed: Two volunteers of similar height

Topic links: Balance

Straw Oboes

Description: Take a normal drinking straw and cut off the bendy part. Flatten one end of the straw and cut the corners off to make a point like an arrow. Put the pointy end between your lips and blow. Move your lips around until you get a noise. If you cut pieces off the bottom of the straw then the pitch will get higher.

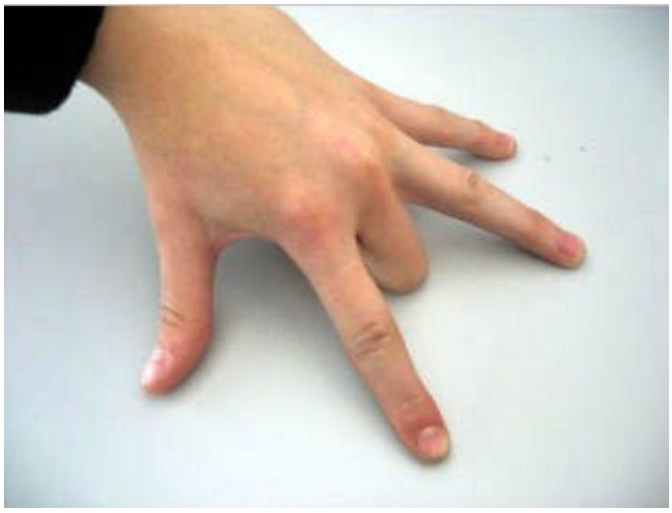
Explanation: When you blow through the straw the two points vibrate against each other, like the double reed in an oboe. This makes the air in the straw move back and forth, creating a buzzing noise. Sound travels as a wave. The shorter the wave, the higher the sound. Cutting the straw shorter means a shorter wave fits in the pipe, which gives a higher note.

Useful notes: This is a brilliant way to draw a crowd. Practice before taking this to an audience as it can be very tricky for some people to do.

Extras: Try cutting little holes in the straw and making some beautiful music.

Equipment needed: Straws and scissors

Topic links: Sound



Paralysed Finger

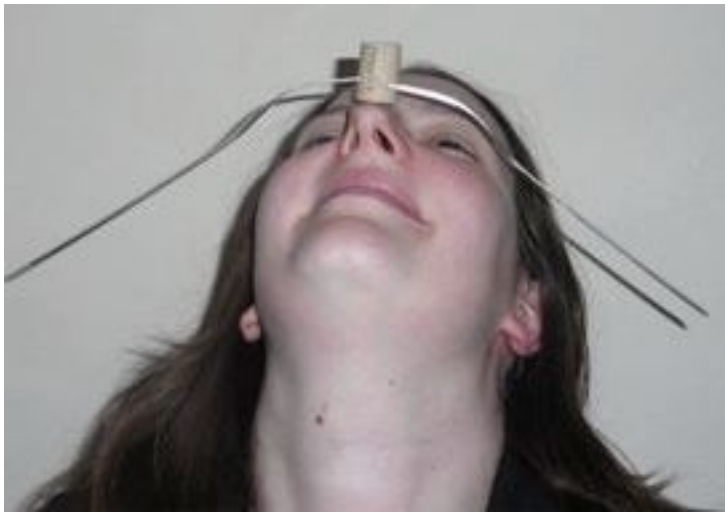
Description: Get everyone to place their hand, palm down on the table and raise and lower each finger one by one.

Now, get them to bend their middle finger over and place the centre section on the table or hard surface. Challenge them to raise and lower each finger again (minus the middle finger of course). It is possible for them to lift their thumb, index, and little finger without moving their middle finger, but it should be impossible to lift their ring finger.

Explanation: The tendons in your fingers are independent from one another apart from the ones in your middle and ring finger. These tendons are connected, so that when your middle finger is folded down you cannot move your ring finger. It feels like your ring finger is stuck!

Equipment needed: Table/hard surface

Topic links: Tendons, flexibility



Forky Cork Balance

Description: Get a volunteer to try balancing a cork upright on their nose. This should be almost impossible. Now hold the cork upright and push two forks into it. They need to be on opposite sides of the cylinder, like "arms". It will be much easier to balance the cork now. Use a volunteer's nose or finger to demonstrate.

Explanation: The cork is very light, so moves quicker than we can, making it very hard for us to get it to balance. The forks are much heavier. Adding the forks actually lowers the centre of mass of the object so it is now below the thing you are trying to balance it on, making it more stable.

Useful notes: Be careful pushing the forks in so the cork doesn't break.

Extras: Try balancing the cork on a pencil and spinning it around. It should still balance.

Equipment needed: A cork and two forks

Topic links: Balance, forces and motion

People vs. Paper

Description: Place a ruler on a table so a third of it hangs over the edge. Put a scrunched up ball of newspaper on the end resting on the table. Hit the end that hangs over the table and the ball will be lifted up into the air. Put the ruler back on the table in the same way and then cover the part on the table with a flat sheet of newspaper. This time it will be much harder to move the paper.

Explanation: To move the newspaper you have to push the air above it out of the way. There is more air over the flat sheet of paper so it is much harder to move, it has greater air resistance.

Useful notes: Make sure there is a space around this set up so the ruler doesn't hit anyone.

Equipment needed: Ruler, table, and sheets of newspaper (the broader the better)

Topic links: Forces and motion

Sumo Wrestler

Description: Challenge a (small) volunteer to push you over. Ask them to stand to your side and place both hands on your arm and push you over. Stand with your feet together but be ready to stop yourself as you start to topple. They should find this fairly easy.

Now, tell them to try again but this time stand with a wide stance. As they struggle, you can encourage other volunteers to help.

Explanation: In order to push the presenter over you must 'unbalance' them. When standing still, their centre of mass is directly inbetween their feet. If they are pushed to the side, their centre of mass is outside of their feet and they topple over. By adopting a sumo stance they effectively create a wide base and it is much harder to get their centre of mass outside of this area. They are much more stable.

Useful notes: Select volunteers carefully. They need to be able to follow instructions safely.

Equipment needed: None (Sumo suit optional)

Topic links: Forces, Balance

Human Origami

Description: Arrange four chairs together in a square so that the back of a chair is on each side of the square. Find 4 volunteers and get them to each sit sideways on a chair. The volunteers should all lean backwards until they are lying on top of the knees of the volunteer behind. At this point you can remove the chairs one by one. With luck, the volunteers will remain in the same state.

To safely get out of the position the volunteers must link their inside arms together and pull themselves up. This must be done simultaneously.

Explanation: This is an example of a structure which relies on all its individual parts to provide it's stability. If one part is removed it will become unstable and collapse.

Useful notes: Make sure the chairs are upright with flat seats. The idea of a box with four flaps can be used. If the flaps are simply folded over, an object will fall out of the bottom of the box. If each flap is carefully tucked under a neighbouring flap and over the flap on the other side it provides a solid platform and the object will not fall out of the bottom.

Equipment needed: 4 chairs, 4 volunteers of similar build

Topic links: Forces, Structures (such as skeletons)

The 5p challenge

Description: Set a challenge for the audience to bend over and touch a small 5p coin (or marker) with their nose and sit back up again.

To set up the challenge, people must kneel down and place their elbows on their knees, palms together, fingers pointing forward. The marker should be placed at the tip of their fingers. They should then sit back up in the starting position and place their hands behind their back.

They are now ready to bend down, touch the coin with their nose and sit back up without touching the floor.

In general, women will be able to do this without too much difficultly. Men will tend to topple forwards.

Ask the audience why they think this is so.

Explanation: This demonstration is about centre of mass and the way mass is distributed around the body. Men tend to carry their weight higher up - they have broad shoulders and narrower hips. Whereas women have more of an hour-glass figure and therefore a lower centre of mass. So they don't topple over when they lean forward.

Useful notes: This only really works with older teens and adults as there is less physiological difference between younger girls and boys. To ensure success (or rather failure!) pick a broad-shouldered man.

Equipment needed: Small coin or marker

Topic links: Balance, Gender differences, Muscle/fat density

Master eye

Description: Get everyone to make a circle with their thumb and first finger. Then with both eyes open look at an object on the wall or in the distance, and centre it inside the circle. Get them to close one eye, and then the other. What happens?

They should have found that the object jumps outside the circle when they closed one of their eyes. If the object seemed to move when they closed their left eye – then they have left eye dominance. If the object moved more when their right eye was closed, then their right eye is the dominant one.

Explanation: Your brain builds up an image of the world around you using slightly different views from your right or left eye. Most people tend to have a dominant eye so that even when both eyes are open, one is giving priority information.

The object you chose was lined up to be in the circle using information from your dominant eye. When you close this one you can see that the object was not lined up for your other eye.

About 80% of the population are right-eyed, and a very small percentage seem to have no eye-dominance at all.

Equipment needed: None

Topic links: Senses, Vision

Finger Finding

Description: Get everyone to stretch their arms out, one behind and one in front, and point their index fingers upwards. Ask people to shut one eye and quickly bring their back arm over so that the index fingers touch.

Then get them to use their other eye. Most people will find it easier with their dominant eye (see Master Eye demo). Then suggest using both eyes which is much easier again.

Finally suggest closing both eyes. After a few attempts many people will be able to get their fingertips to meet.

Explanation: Obviously the task is easiest with both eyes open, as we are better at judging distances using binocular vision. However, it is not necessary and it is possible to cope without it.

In this situation, we can completely remove our sense of sight and still succeed. This is because we still have a sense of the relative position of the parts of our body. This is known as proprioception. It helps us in many ways for example learning to walk in complete darkness without losing balance.

Equipment needed: None

Topic links: Senses

Aristotle Illusion

Description: Get everyone to cross their fingers and run them both along the edge of their bottom row of teeth. It feels as if you have two rows of teeth. This is known as the Aristotle illusion.

A similar effect can be used to play a game. Get a volunteer to hold two wooden spoons out in front of them, one in each hand, with arms uncrossed. Tap the ends of the spoons in very quick succession and get the volunteer to raise the spoon that was tapped first. They should be able to do this. Now, get the volunteers to cross the spoons (not their arms) over and they're more likely to get it wrong. If they cross their arms and also the spoons, the two crossings-over cancel each other out and it again becomes easy to say which one was tapped first.

Explanation: This is one of the oldest tactile illusions and is an example of "perceptual disjunction". It arises because your brain has failed to take into account that you have crossed your fingers. If your row of teeth touch the outside of both fingers at the same time - something that rarely happens - your brain interprets it as two separate objects.

The spoon game also is to do with a failure to "remap" your body schema to take the crossed spoons into account. However, since it is possible to get single taps right, neuroscientists think that the confusion happens because your brain is trying to do too many things at once: remap your body schema and also work out the order of the taps.

Useful notes: The taps need to be in very rapid succession for this to work.

Equipment needed: Two spoons (optional - a variation is to tap the back of the hand)

Topic links: Touch, Reactions, Brain Processing

The Stroop Effect

Description: Challenge people to read the following list out loud as fast as they can.

(English)

RED GREEN BLUE YELLOW GREEN PURPLE RED BLUE RED GREEN YELLOW GREEN YELLOW RED BLUE BLUE YELLOW PURPLE GREEN

(Cymraeg)

COCH GWYRDD GLAS MELYN GWYRDD PORFFOR COCH GLAS COCH GWYRDD MELYN GWYRDD MELYN COCH GLAS GLAS MELYN PORFFOR GWYRDD

Try again, but this time they shouldn't read the word, but name the colour of the ink.

Explanation: People find it much harder the second time. This is because of the way the brain processes information. When the meaning of the word is not the same as its colour more thinking is needed. This slows down your reaction time.

Useful notes: Time participants and start a leader board to create more competitiveness.

Equipment needed: Coloured list, (Timer (optional)

Topic links: Reaction times, Brain processing

Drop it like it's hot mug

Description: Show the audience the mug and key tied together by string. Ask them to compare the weight of the mug and the keys. Place the string over the handle of the fork keeping hold of the keys. Pull the keys till the mug is close to the fork and the string is almost horizontal. The fork and mug should be held at shoulder height and the keys should be held slightly lower. Get the audience to guess what will happen when you let go of the keys. Ask them to count down with you from 5 and then let go! The keys will spin around the fork, wrapping the string tightly around it. This stops the mug from falling. As the string gets shorter with each spin you might notice the keys spin faster and faster around the fork, till all the string is coiled around the fork.

Explanation: The mug and keys are pulled downwards by gravity. The keys begin to swing around the fork like a pendulum and the friction between the coils of string is strong enough to keep the mug from falling. The keys gain momentum, spinning faster and faster as the string gets shorter. This is because the distance the keys travel each turn is getting smaller, taking less time, and increasing their speed.

Useful notes: If the string is too long the mug will hit the floor anyway. Cut the string so the length is the distance between the centre of your chest and the end of your fingers. Practice over a carpet or soft surface.

Extras: Compare the motion of the keys to ice skaters spinning. They start with their arms spread wide and pull them in to increase the speed of their spin. If you have an office chair that spins, get someone to spin you while you hold two full tin cans at arm's length then pull them in to your chest and out again.

Equipment needed: Mug, string, keys or a metal nut, and a fork

Topic links: Forces and Motion, Sport

Expand your mind

Description: Tell your volunteer that you are going to expand their mind. Get them to hold a handheld electric screwdriver with a spiral pattern in front of their face and keep it spinning.

Get everyone else to stare at the centre of the spinning disc as you slowly count to 20. On 20 get the volunteer to stop spinning the disc and move it away from their face.

If people continue to stare at the volunteers head they will see it appear to expand.

Explanation: This is a classic visual illusion, which relies on a phenomenon called motion after-effect. After staring at a waterfall - or a similar moving-yet-static object such as a rotating spiral - anything you look at afterwards will appear to be in motion in the opposite direction.

It works because the visual neurons that fire in response to the motion get fatigued. When you look at something else, these neurons fail to fire - and your brain interprets that as movement in the opposite direction.

Useful notes: Always select volunteers carefully and observe safety guidelines. The pattern can be reversed so that objects appear to shrink. (This can be a good follow up to the 'Poke your head through a hole' trick.)

Equipment needed: Spinning spiral pattern - Handheld electric screwdriver and board or ready made kit - *THE INCREDIBLE EXPANDING BUNNY, £3.99, Hawkins Bazaar, Item no. 09699*

Topic links: Visual illusion, Brain

Rope puzzle

Description: Get a volunteer (A) to put their hands through the looped ends of a piece of rope. Then get a second volunteer (B) to do the same with a second piece of rope which is looped around the first rope. Challenge them to free themselves without taking their hands out of the ends of the rope.

Explanation: People will tie themselves up into all kinds of knots to the amusement of those watching.

The solution is to position Rope A so that it dangles under one of the hands of Person B. Person A should take hold of the middle of their rope and pull it through the loop below person B's wrist, up over their hand and under the loop going over their wrist.

Equipment needed: Two pieces of rope looped at ends.

Topic links: Flexibility, lateral thinking

Mini Music Box

Description: Get a volunteer to hold the music box and turn the handle. The music will be very quiet. Ask what is vibrating and how we can make it louder? Encourage the audience to find different surfaces to place the music box on and the volume of the music should change.

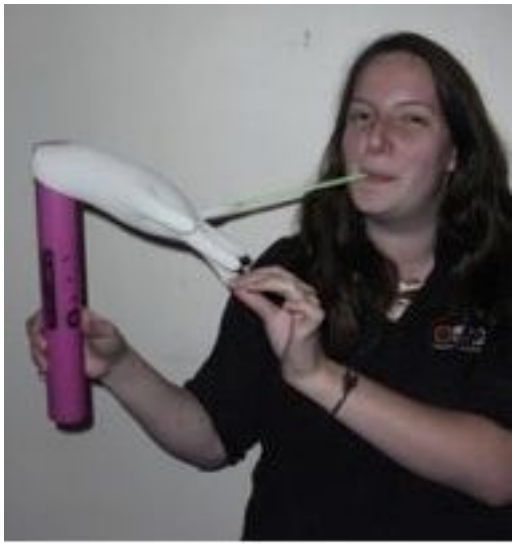
Explanation: Sound is caused by vibrations. In the first attempt the music box vibrates only a very small amount of air around the metal springs. Placing the box on a solid surface means that the vibrations will travel through the material and move more air, making a louder sound.

Useful notes: Glass is one of the best surfaces to use.

Extras: Try placing the music box on the flat end of a polystyrene cup.

Equipment needed: Music box

Topic links: Sound



Glove-a-phone

Description: Push a cardboard tube into the hole at the bottom of a latex glove. The tube should go into the glove to a depth of about 4cm. Neatly wrap the glove around the tube, making sure there are as few wrinkles in the glove as possible. Now use some sticky tape to wrap around the bottom of the glove so it is completely stuck to the cardboard tube. You can test this by blowing into the other end of the tube and checking that the glove inflates and that no air leaks out. Use the scissors to snip off the very end of the little finger of the glove. Push one end of the drinking straw into the hole in the little finger. The straw should go in about 3cm. Now use some sticky tape to wrap around where the straw goes into the glove so that they are stuck together. Stretch the glove over the top of the cardboard tube. Try to get a single thickness of the glove stretched over the tube with as few wrinkles as possible. Stretch the glove by holding a finger of the glove and pulling it down the side of the tube. Now blow into the straw and start to inflate the glove. This should make the glove that is stretched over the tube start vibrating. You should start to hear a funny sound! If you get a volunteer to place one finger very gently on the glove stretched over the tube, they should be able to feel the vibrations that are making the funny sound.

Explanation: Blowing into the straw inflates the glove and causes the stretched part to vibrate. This vibrates the air in the tube, making a sound.

Extras: Make glove-a-phones using lots of different lengths of tube.

Equipment needed: Cardboard tube, latex glove, straw, sticky tape, and scissors

Topic links: Sound

Tornado in a Bottle

Description: Fill a 2 litre pop bottle with water, tip it over and watch the water flow out. This should happen slowly. Now do the same again, but this time swirl the bottle around and look at the difference. A whirlpool is created in the bottle and it empties much quicker.

Explanation: For the water to leave the bottle air needs to replace it. With the first attempt you will see lots of bubbles as the air slowly enters. In the second attempt the water swirls around the sides of the bottle, forming a vortex and the air rushes in through the empty column. Now the water can flow continuously out.

Useful notes: A connector can be bought to join two pop bottles together so you can keep repeating the demo easily. Keep the bottom bottle resting on a table or the floor and swirl the top bottle around.

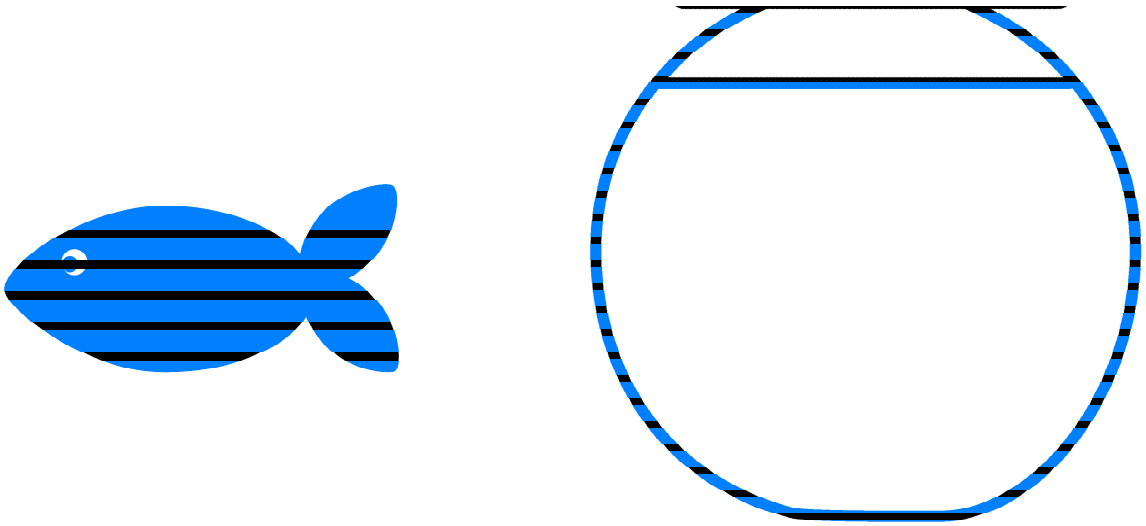
Extras: Have a bottle emptying competition. Get one person to squeeze a bottle to get the water out. The other competitor needs to put a flexible length of plastic tube into their bottle, stretching from the bottom of the bottle to the neck. When they turn their bottle over they should blow into the tube, which forces the water quickly out.

Equipment needed: Water, two 2 litre pop bottles and connector or a bucket and funnel

Topic links: Forces and motion

Afterimage

Description:



Get everyone to stare at the fish whilst you slowly count to twenty. Then tell them to stare at the centre of the fishbowl.

They should see a ghostly orange afterimage of the fish.

Explanation: White light is made up of all colours. Your eyes get tired as you look at the blue fish. Our eyes detect red, blue and green light. Staring at the blue shape tires out the blue receptors in the retina. When you look at a white background the blue receptors are fatigued leaving you detecting red and green only. Red and green light combine to make yellow.

Equipment needed: Picture with strong blocks of colour

Topic links: Vision, fatigue

Lift your leg

Description: Challenge your audience to stand with their side against a nearby wall. They should have one shoulder and one leg firmly pushed against the wall. Now get them to try and lift their outside leg.

Explanation: Human beings have a centre of balance around the belly button. You can usually stay balanced as long as the imaginary vertical line down from your belly button falls between the area that you are balancing on – usually your feet!

When you lift your leg, the top half of your body needs to lean slightly the other way so that this line falls onto the one foot that is balancing you.

Because the wall is in the way you can't move your upper body to counterbalance your leg. Your body knows it will fall over if you do lift the leg so it is very hard to convince yourself to do it. It feels a bit like your leg is stuck or frozen! The same thing happens if you try and touch your toes with your heels against the wall.

High jumpers need to move their centre of balance over a pole to win medals. The Fosbury flop is a style of high jumping where your centre of balance actually travels under the pole. This requires less energy than getting your whole body up to the height of the pole. The year that athletes began using this technique there was a big increase in the world record. The ultimate example of the appliance of a bit of science!

Useful notes: Avoid walls with skirting boards. Don't allow people to hold onto the wall or other objects to balance.

Equipment needed: A wall

Topic links: Balance

Balloon Kebab

Description: Blow up a balloon to the size of a small melon and challenge the audience to pierce it all the way through with a wooden kebab stick without the balloon bursting. The trick is to pierce the balloon just beside the knot and through the darker part on the other side.

Explanation: The darker parts on the balloon are places where the rubber isn't stretched as tight and is stronger. As soon as you pierce these areas the rubber seals around the kebab stick tightly. The balloon will slowly deflate.

Useful notes: Get the audience to blow up their own balloons. Tell them to hold the kebab stick like a pen and point it away from themselves. Remove the kebab sticks before they walk away.

Equipment needed: Balloons and kebab sticks

Topic links: Forces and motion.

Burp in a Pot

Description: Ask people why they think Alka-Seltzer needs to be dissolved in water before taking.

Place a tablet in some water and watch it fizz. Suggest that if you were to eat the tablet without water it would create all that fizz inside your stomach. How could you expel this build up of gas? In a giant burp?

Using the film canister as a substitute stomach, fill it about a third full of water. Place a quarter of an Alka-Seltzer tablet in the canister and quickly fit the lid. Place on a level surface and stand back.

The lid will be fired off.

Explanation: When an Alka-Seltzer tablet is placed in water, the CO2 is produced as a result of a chemical reaction. In the canister the gas builds up so much pressure the lid is forcibly launched.

Burps, on the other hand, are usually caused by excess air that has been swallowed.

Useful notes: Always take care when dealing with projectiles and use appropriate eye protection.

Equipment needed: 35mm film canister, alka-seltzer, water

Topic links: Gas, Chemical reactions

Slinky Sounds

Description: Get a volunteer to shake a slinky and listen to the sound it makes. Now put a polystyrene cup in the top of the slinky and try again. The noise it makes now is surprising, especially when the slinky hits the floor.

Explanation: Sound is caused by vibrations. When the slinky is shaken it creates complex vibrations that make a sound. Adding the cup means the air inside the cup vibrates as well, amplifying the sound.

Useful notes: Slinkys are easily tangled. Watch out!

Extras: Try using two pieces of string tied to the slinky as an alternative to the polystyrene cup. Wrap the string around your forefingers and place your fingers in your ears. Now jump around!

Equipment needed: Metal slinky, polystyrene cup and string

Topic links: Sound

Reaction Ruler

Description: Hold the ruler at one end and let it dangle downwards. Get a volunteer to hold their thumb and index finger in a pincher position just either side of the zero mark at the bottom of the ruler.

Tell them that you are going to drop the ruler and that they must catch it between their thumb and finger. Try not to give any warning just before you drop it.

When they catch the ruler read off the measurement closest to their thumb.

Repeat several times to get an average score and set up a fastest reaction scoreboard.

Explanation: In this case, your reaction time is the time it takes your brain to translate the visual information into a movement of your fingers. Lots of factors affect your reaction time - age, tiredness, alcohol or drugs.

The average catch distance on the ruler can be used to estimate the reaction time (in milliseconds). The following table gives a rough guide

less than 1cm = 0-50ms Cheating
2-8cm = 50-130ms Impressive
8-15cm = 131-175ms Excellent
15-20cm = 176-200ms Good
20-27cm = 201-240ms Average
27-30cm = 241-250ms Fair
30cm+ = 251+ms Slow

Equipment needed: Ruler (see ruler at the end of this pack)

Topic links: Reaction Times

Coat-hanger Clang

Description: Attach two pieces of string to the corners of a coat-hanger (or metal grill.) Get a volunteer to wrap the free ends of the strings around their index fingers. They should then press their index fingers to their ears and lean forward so that the coat-hanger dangles freely.

Tell them you are going to strike the coat-hanger with a fork and ask them to stand up straight when the clanging noise finishes.

To those watching, the small audible noise lasts only a few seconds. However, the volunteer stays bent over as they hear a very loud bell like ringing for up to a minute.

Explanation: Sound travels through the air as a series of vibrations. We hear these vibrations when they hit our eardrums. Vibrations travel more efficiently through solid objects such as the string, and so the person directly connected to the coat-hanger hears a much louder and longer noise. This is why you sometimes see people in old movies placing their ear on a railway track to detect an oncoming train.

Useful notes: A guitar pickup can be used to amplify the sound that the volunteer is hearing so that everyone can hear. Running a fork across a metal grill creates a beautiful and mysterious chiming noise that is very unexpected.

Equipment needed: Two pieces of string, Metal coat-hanger/BBQ grill or similar, Fork/metal rod

Topic links: Vibration, hearing

Whirly Tubes

Description: Ask the audience how we can use the tubes to make a sound. Demonstrate blowing into the tube. Now get someone to spin the tube above their head. The faster you spin the tube the higher the pitch of the noise gets.

Explanation: Sound is caused by vibrations. Spinning the tube makes the air inside it vibrate because it is corrugated on the inside. This creates lots of little vortices as the air rises over one ridge to the next. The faster it is spun, the faster the air is vibrating and the higher the pitch.

Useful notes: See how many different notes you can make. Some people claim to be able to make seven. Make sure anyone using the whirly tube has at least a two metre space in all directions.

Extras: Try covering the hole closest to your hand while spinning. You will hear no sound as there is no air passing through the tube.

Equipment needed: Whirly tube

Topic links: Sound, forces and motion

Water Balloon

Description: Ask the group what they expect to happen if you put a balloon into a flame. Do this with an inflated balloon to demonstrate that it pops.

Now show them a balloon with water inside and ask if they would like you to repeat the experiment. Ask for a brave volunteer to sit under the balloon as you do it. You can raise the tension by getting the volunteer to wear a raincoat and/or protective gear.

However, this time the balloon will not burst.

Explanation: The rubber in an inflated balloon is stretched thinly so that heat is quickly transferred into the balloon. As a result, the balloon partially melts or burns, which causes it to burst. However, water has an amazing capacity to absorb heat. A small amount of water at the bottom of the balloon prevents the rubber reaching a temperature sufficient for it to melt or burn.

One of the ways our bodies stay cool is by sweating. Sweat is mostly water and when it evaporates from the surface of your skin, it removes excess heat and cools you. Not all heat energy produced by the body is lost through sweat though. Some is directly radiated from the skin to the air and some is lost through respiratory surfaces of the lungs.

Useful notes: Warn people about the potential noise and do not pop balloons near anyone's ear. Very clear guidance should to be given about the dangers of playing with fire and the importance of ensuring adult supervision when using matches. Always keep the flame underneath the balloon and move it around to avoid damaging the balloon membrane..

Equipment needed: One fully inflated balloon, another balloon filled with some water and inflated, match/lighter, raincoat (optional)

Topic links: Temperature, Heat capacity, Sweat

Money Smile

Description: Take a £5 note and fold it twice vertically through the centre of the eyes, so they are sticking out. Push the folds together so you crease the centre of the mouth in the opposite direction. Now tilt back and forward, watching the Queen smile and frown.

Explanation: This is an optical illusion. This is a good example of why we should question the world around us and not rely completely on the sense of sight.

Useful notes: This works for any British note. Try this technique with other images.

Equipment needed: £5 note

Topic links: Optical illusions

Magic Mallows

Description: Roll some marshmallows between your palms till they fit easily through the neck of a clear glass bottle. Ask the audience to guess what will happen to the marshmallows when you start taking air out of the bottle. Put a wine vacuum sealer into the top of the bottle and use the pump to take air out of the bottle. The marshmallows will get bigger. To prove this open the seal letting the air back in. The marshmallows will rapidly shrink back to their original size.

Explanation: Marshmallows are very light as they have lots of tiny bubbles inside them. When air is taken out of the bottle the air pressure in the bubbles is now higher than the bottle so they expand and the marshmallows grow. When the air is let back into the bottle the pressure in the bubbles is now lower so they contract back to their original size.

Useful notes: Long thin marshmallows work much better than smaller shorter ones.

Equipment needed: Clear glass bottle, marshmallows, wine sealer and pump

Topic links: Solids, liquids and gases

Thank you for using this pack!

We hope you enjoyed the activities within this pack. To help us to continue to provide new activity packs, we'd like to ask you to tell us a little about what you did for National Science & Engineering Week.

Please take a few minutes to fill in this form. If you used this activity pack for NSEW, send in this completed form and we will send you a National Science and Engineering Week Certificate.

Organisation: _____

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Which dates did you do National Science and Engineering Week activities on? _____
What did you do?

Please make any comments about this activity pack, National Science & Engineering Week and/or other possible topics for future packs (feel free to continue on a separate sheet of paper).

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cheat! impressive respectable