The following experiments are a selection of those demonstrated by Paul Nugent at "Playful Science" Brussels, Belgium 2023
More ideas at www.scienceonstage.ie/resources/
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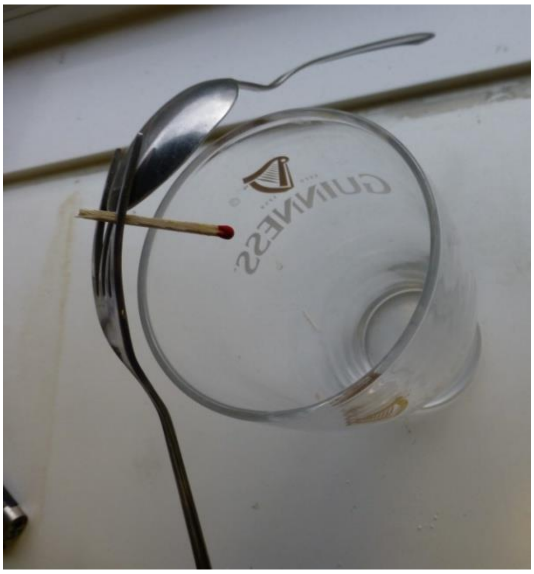
Spoon, Fork and Match Trick

Background:
How do you balance a spoon, fork and match on the rim on a glass?
What happens when the match is burnt?.

You will need:
A glass
A spoon, fork and match
A lighter

Follow these steps:
1. Balance the spoon, fork and match on the rim of the glass as shown in the photograph
2. Light the part of match over the inside of the glass

So what happened?
. When the match is burnt the flame extinguishes when it reaches the glass. This is because the glass conducts the heat way and this is needed for fire.
The spoon, fork and match don't fall as the combined centre of mass is under the point of support on the rim

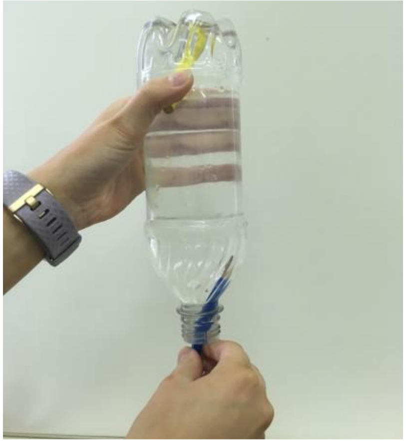


A Strange Bottle of Water

Background:

Surface tension is the tendency of a still liquids surface to shrink into the minimum surface area possible. This invisible skin is what allows objects with a higher density than water such as paperclips and insects to float on a water without becoming even partly submerged.
Because of the relatively high attraction of water molecules to each other through hydrogen bonds, water has a higher surface tension (72.8 millinewtons (mN) per meter at 20 °C) than most other liquids.
This a very visual demonstration of water's surface tension.

You will need:

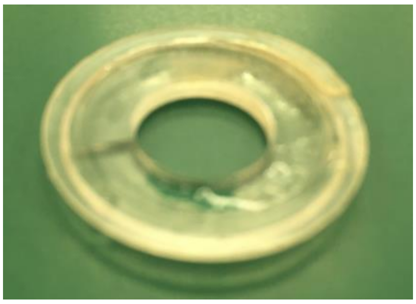


- A PET (polyethylene terephthalate) plastic transparent bottle
- A clear top with hole in it
- Some pencils, toothpicks, matches etc

Follow these steps:

1. Show the bottle of water which looks perfectly ordinary.
2. Invert the bottle a small amount of water falls out and then no more.
3. Careful place matchsticks and pencils through the hole into the bottle

So what happened?



When the bottle is inverted the water's surface tension is sufficient to support the water in the bottle. When the pencil is inserted the surface tension is momentary broken and the pencil floats upwards.

What next?

The cap can be 3D printed or purchased from some magic shops.
A version can be made from a vinegar bottle that has a hole in the lid. Matchsticks or tooth picks can be inserted into the smaller hole. When inserted the pencil rapidly raises to the top. Ask students to devise a method for measuring this upthrust or buoyancy force.

Make your own Metal-Cutter

Background:
Using a couple of 9 volt batteries you can make a precision metal foil cutter. Concepts such as current flow, conductivity etc. can easily be demonstrated.

You will need:
At least 4 9V batteries
A container
Some leads with crocodile clips
Pencil graphite
Aluminium kitchen foil
An elastic band

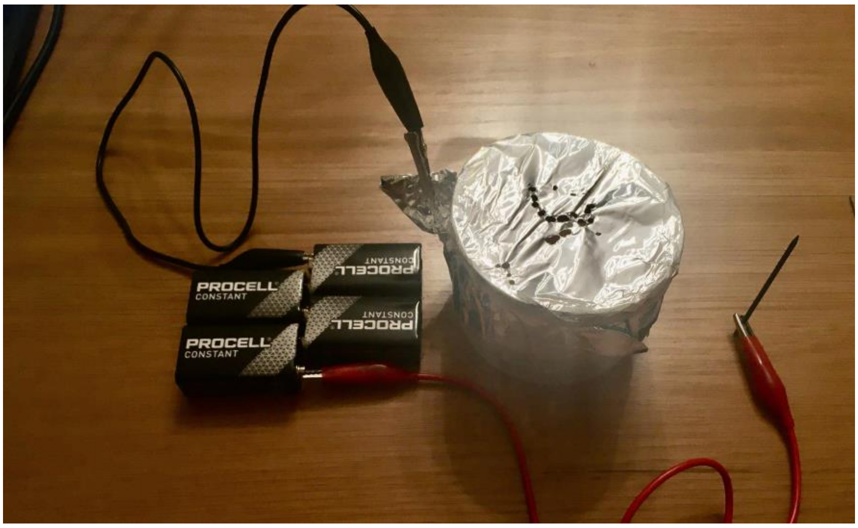
Follow these steps:
1. Connect then batteries in series
2. Connect the positive terminal to the pencil's graphite

Spread the foil on the top of the container and fix with an elastic band as shown

3. Connect the negative terminal to the foil.

So what happened?
When the graphite touches the foil, the electric circuit is completed. A large current flows vaporising the carbon and melting the metal and producing a fine cut or hole.

What next?
Experiment with different thicknesses of pencil graphite.
Get students to research commercial Plasma Cutters and Electrical Discharge Machines (EDM). Discuss any similarities and differences.



Nutty Nuts and Bolts

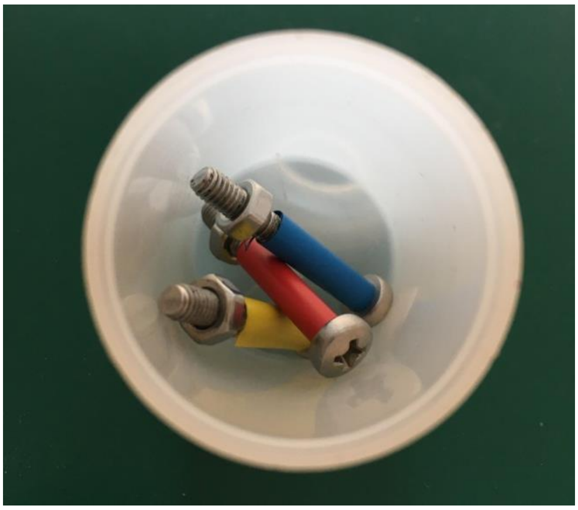
Background:
A simple demonstration of friction that can be used to stress the importance of observation.

You will need:
A film cannister or other suitable container
3 nuts and bolts
3 different coloured tapes
One willing volunteer

Follow these steps:
1. Place a piece of different coloured tape on each of the bolts
2. Ask the volunteer to choose one of the bolts and to place the nut in the middle of the tread
3. The scientist places all 3nuts and bolts into the cannister
4. The scientist rotates the cannister
5. The contents are emptied out into the volunteer's hand

So what happened?
. While the volunteer is distracted, two nuts and bolts are placed downwards in the canister. The chosen on is placed nut upwards. Friction causes the nut to loosen off.

What next?
Experiment by changing the direction of rotation and orientation of the nuts and bolts



Paperclip and Paper Catalyst Model

Background:
Students often have to be familiar with the action of a catalyst. This simple magic trick can be used by students to reinforce their understanding.

You will need:
Two paperclips
a strip of paper a bank note will do nicely

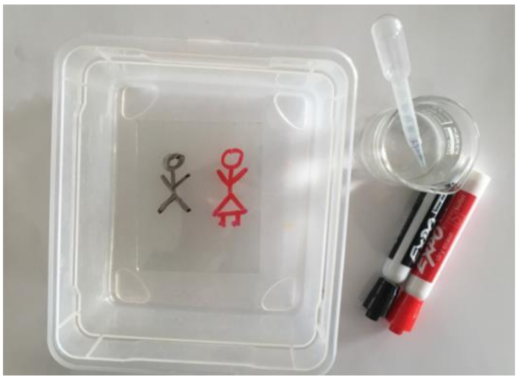
Follow these steps:
1. Pose the question: How many times would you need to throw two paperclips into the air for them to land interlink? Obviously a very large number.
2. Place the two paperclips on the strip of paper as shown
3. Pull the two ends of the paper fly up into the air and magically land interlinked.

So what happened?
When the strip of paper is pulled, the paperclips move together linking to each other.

What next?
Discuss with your students how the paper acts like a catalyst, lowering the activation energy while not being used up in the reaction. Discuss any shortcomings this model may have.
Experiment with putting some elastic bands in between the paperclips. They will also be linked leading to a discussion about polymers and chains of molecules.

The Dry –Erase Dancers

Background:
Make figures appear to move and dance.
This a very visual demonstration of insolvent compounds and floatation.



You will need:
some dry-erase white board markers
a clean white bowl or plate or a piece of flat glass in a container
a dropper
some water

Follow these steps:
1. Draw your figures on the clean dry surface
2. Add drops of water to the figures. They will appear to float.
3. Rock the container to create movement.

So what happened?
The surface is very smooth, and the marker ink loosens from the surface. Whiteboard markers usually contain a silicone polymer, an “oily” and hydrophobic molecule. Hydrophobic means “water-fearing,” which means that the marker pigments can’t mix with water. The marker pigments are also lighter than water. Therefore, the marker ink is buoyant and floats on top of the water.

What next?
Experiment with:
-Different marker brands and colours
-Different amounts of applied ink
-Different surfaces drawn on
-Different temperatures of water used

The Elastic Elevator

Background:
On first viewing a paperclip appears to be moving up a piece of an elastic band. Is it ‘telekinesis or magic?.

You will need:
An elastic band
A ring or paperclip

Follow these steps:
1. Break the elastic band.
2. Pass the band through the ring
3. Slope the band so that it is inclined
4. Magically the paperclip appears to move up the band.

So what happened?
Secretly let the band slip through the finger and thumb at the lower end. It is the elastic that is moving rather than the paperclip.
This trick can be used to explain the scientific concepts of: elasticity, friction, forces and the conservation of energy.

What next?
Pose these questions to your students:
Will the paperclip climb to the top of the band? If not how far?
Is there a maximum angle for the trick work?
Ask students to draw a free body diagram indicating all the forces acting