South Molton Community Primary School

Totally Unplugged - **KS1 & 2 Science**

Ideas and Resources

KS1 Coverage- Although electricity is not part of the curriculum until Year 4 an unplugged day can cover a lot of the KS1 Working Scientifically statements through enquiry, discussions and some of the practical activities outlined in this pack. There are also opportunities through outdoor learning to incorporate learning about Plants, Everyday materials and Light.

KS2 Coverage-

Unplugged days at school can provide excellent opportunities for the Year 4 and 6 electricity units through highlighting common appliances that use electricity to exploring batteries as a way of storing electricity. Work on forces and magnets also ties in to some of the ways that renewable energy is created. Working scientifically statements can be covered through enquiry, discussions and some of the practical activities outlined in this pack.

Electricity and electrical appliances are part of everyone's life and there are practical skills that we can demonstrate to children whilst highlighting safety and the dangers of electricity.

- Check the fuse box
- Change a light bulb
- Change a fuse in a plug

Totally unplugged no-electricity days are supposed to be engaging, fun and memorable, we have included some science experiments to help make your day memorable through practical science work.

Science resources included in this pack:

Static Electricity Experiment

They say opposites attract and that couldn't be truer with these fun static electricity experiments. Find out about positively and negatively charged particles using a few basic items, can you control if they will be attracted or unattached to each other?

Experiments

What you'll need:

- 2 inflated balloons with string attached
- Your hair
- Aluminium can
- Woollen fabric

Instructions:

1. Rub the 2 balloons one by one against the woollen fabric, then try moving the balloons together, do they want to or are they unattracted to each other?
2. Rub 1 of the balloons back and forth on your hair then slowly it pull it away, ask someone nearby what they can see or if there's nobody else around try looking in a mirror.
3. Put the aluminium can on its side on a table, after rubbing the balloon on your hair again hold the balloon close to the can and watch as it rolls towards it, slowly move the balloon away from the can and it will follow.

What's happening?

Rubbing the balloons against the woolen fabric or your hair creates static electricity. This involves negatively charged particles (electrons) jumping to positively charged objects. When you rub the balloons against your hair or the fabric they become negatively charged, they have taken some of the electrons from the hair/fabric and left them positively charged.

They say opposites attract and that is certainly the case in these experiments, your positively charged hair is attracted to the negatively charged balloon and starts to rise up to meet it. This is similar to the aluminium can which is drawn to the negatively charged balloon as the area near it becomes positively charged, once again opposites attract.

In the first experiment both the balloons were negatively charged after rubbing them against the woolen fabric, because of this they were unattracted to each other.

Catching some rays

Build a solar oven

By providing heat, the sun can help us save fuel. Solar ovens have been around since the 1830s, when astronomer John Herschel used one to cook food during an African expedition. You can make one out of a pizza box.

SUPPLIESANDTOOLS:

- 1 pizza box
- newspapers
- scissors
- tape
- black construction paper
- cling film
- aluminium foil
- ruler

DIRECTIONS:

1. Draw an 8 1/2 inch x 11 inch square in the lid of the assembled box.
2. Cut out three sides of the square, and fold the flap back along the uncut edge.
3. Cover the inside of this flap with aluminium foil, using tape to hold the edges securely.
4. Line the inside bottom of the box with black construction paper. Use tape to hold the edges down.
5. Create insulation by rolling up some newspaper (about 1 1/2 inch thick) and fitting it around the inside edges of the box.
6. Tape one piece of plastic wrap (stretched tightly) to the underside of the lid opening, to cover. Tape another piece on the top of the lid opening, to create a layer of insulation that will help hold the heat in the box.
7. Prop the box at an angle facing the sun. Use a ruler to prop the flap open.

On a hot, sunny day the temperature can reach 200°F in your oven!

Other options: Use different containers—like bowls or cans. Paint the cans different colours and see if it makes a difference. Test the temperature (with a thermometer) inside the container with and without a plastic covering.

Turbines

Turbines are often used to produce electricity. Find out how they work!

SUPPLIES AND TOOLS:

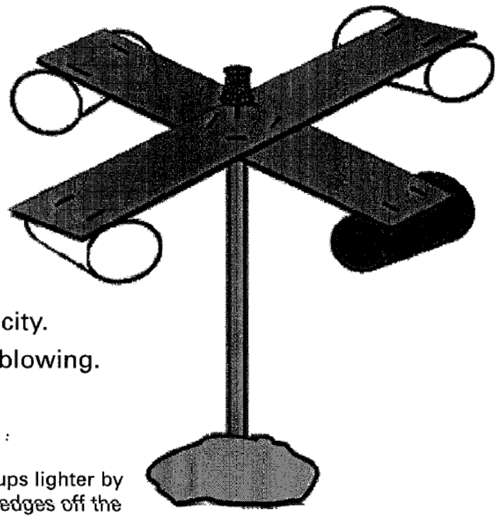
- an empty half-gallon milk carton
- a hammer and a nail
- masking tape
- a pitcher of water
- string

DIRECTIONS:

1. With the hammer and nail, punch a hole in the bottom right corner on each side of the milk carton. Also punch a hole in the center of the top ridge of the carton, for hanging.
2. Tape each of the bottom holes with masking tape, and put the string through the top hole.
3. Hang the carton outside, where the ground underneath can get wet (from a tree branch, for example).
4. Open the carton flap and fill the carton with water.
5. Pull the tape off one of the corner holes. What happens?
6. Pull the tape off two opposite corners. What happens?
7. Pull the tape off all corners. What happens?

You've rediscovered Sir Isaac Newton's principle—For every action there is an equal and opposite reaction. When water pours out of the small hole, its force pushes the carton in the opposite direction, causing it to turn. The more holes, the faster the turn.

How windy is it? Make an anemometer and find out!



Wind is used to generate electricity. Wind turbines, which change the wind into electricity, need an average wind speed of about 14 miles per hour to generate electricity. An anemometer tells how fast the wind is blowing.

SUPPLIES AND TOOLS:

- 4 small paper drinking cups
- scissors
- a marker
- 2 strips of stiff, corrugated cardboard, about 18" x 3" each
- stapler
- push pin
- sharpened pencil with an eraser on the end
- modeling clay

DIRECTIONS:

1. Make the paper cups lighter by cutting the rolled edges off the tops.
2. Color the outside of one cup with the marker.
3. Cross the cardboard strips so they make a plus sign. Staple them together.
4. Find and mark the exact center of the cardboard strips.
5. Staple the cups to the ends of the cardboard strips, making sure the cups all face the same direction.
6. Push the pin through the center of the cardboard and attach the cardboard cross with the cups on it to the eraser point of the pencil. Blow on the cups to make sure the cardboard spins around freely on the pin.
7. Place the modeling clay on a surface outdoors. Stick the sharpened end of the pencil into the clay so it stands up straight.

HOW TO USE YOUR ANEMOMETER:

Using a watch with a second hand, count the number of times the marked cup spins around in one minute. You are measuring the wind speed in revolutions (turns) per minute. Weather forecasters' anemometers convert the revolutions per minute into miles (or kilometers) per hour. Measure your wind speed at different times of the day over the course of several days. Move your anemometer to a more open area, and an area that is more protected. How does this affect your recordings?

Lemon and Potato Battery Experiment

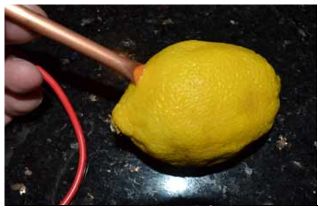
Learn how to generate electricity from common fruit or vegetables

Is it possible to produce electricity from common fruit or vegetables? Fruits and vegetables require energy from the sun to grow and produce a harvest. Is it possible that some of the sun's energy is stored in the produce for our use? We know that by eating fruits and vegetables our body can convert this food to energy. Is it possible to directly generate electricity from a piece of fruit or a vegetable. This lemon battery and potato battery science experiment tests this theory.

Materials Needed

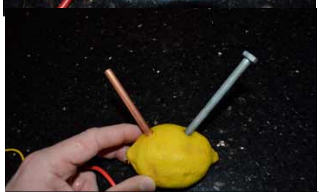
- ☐ *Lemon*
- ☐ *Potato*
- ☐ *Copper strip or rod*
- ☐ *Zinc strip or zinc-coated bolt*
- ☐ *Circuit wire or alligator clips with wire*

EXPERIMENT STEPS



Step 1: Cut 2 small slits in the skin of both the lemon and the potato.

Make the slits are a few inches apart.

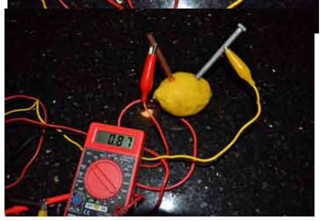


Step 2: Push the copper and zinc strips into the slits in

each piece of produce. Make sure the rods do not touch each other.

Step 3: Connect an electrical wire to the end of each metal strip.

Alligator clips make this step easy.



Step 4: Measure the voltage drop between the two wires attached to the metal strips on the lemon and the potato. This is the amount of voltage being produced by each piece of produce. Compare the difference in the amount of voltage produced by a lemon and a potato. What do you notice? How long will the fruit and vegetable generate voltage?

Science Learned

The lemon and the potato act like a low-power battery. This experiment shows how a wet cell battery works. Chemicals in the fruit or vegetable create a negative charge in the zinc strip. Electrons move into the zinc strip and travel up the wire attached. The electrons then travel through the voltmeter which measures the voltage drop and end up in the copper strip which becomes the positive end of the circuit. Pardon the pun, but from this experiment we can say that it is possible to "produce electricity".

Candle experiments

Place your bets

An experiment to see how long a candle would burn for while floating in fluid and covered by a glass jar. Thomas said: “I've really enjoyed the experiment because we had to make a guess and then find out how long the candle would burn for before it went out. On our first guess we said it would burn for 30 seconds and it went out in 17.”

Drinking candle

Sometimes candles need a drink too
Try this and find out why!
What you need:

- Water
- Saucer or shallow bowl
- Tea light or small candle
- Lighter or match
- Glass
- Food colouring (optional)

How to:
Ask an adult for help using the lighter or matches. Make sure you carry out the experiment away from flammable materials.

1. Pour water into the saucer or bowl to around 1cm deep. Adding a couple of drops of food colouring will make the water easier to see.
2. Place the tea light or small candle in the centre of the bowl, making sure that the wick doesn't get wet.
3. Use the lighter or match to light the candle.
4. Turn the glass upside down and place it over the candle.

What happens to the water? What happens if you use more than one candle?

Does the color of a candle affect its burn rate 

This is probably the most popular candle science project with younger students. Dinner candles (tapers) are probably the easiest to use for this experiment. Be sure to purchase the same size, unscented candles made by one manufacturer, and varying only by color. Mark each taper with a horizontal line 1/2 inch below the lip of the candle, and again at a point 2 inches below that. Once the candle has burned to the first mark, begin recording the time it takes until the candle burns to the second mark. Compare the times for each different colored candle.

Does temperature affect a candle’s burn rate?
Use the same experiment set-up as above. You can compare candles that have been placed in the refrigerator to candles at room temperature, or you can compare candles

burned in a heated room versus an air-conditioned room. Be sure the temperature difference is at least 20 degrees. Caution: If you put the candles in the refrigerator, be sure they are tightly wrapped so that moisture does not get into the wick. A damp wick will alter its burn characteristics, adding an unintended variable. Do not freeze candles. Handling candles this cold may cause them to crack and lose their integrity, making them unsafe to burn.

Thinking about our usage

Find out your school's footprint

Encourage pupils, teachers and parents to calculate their carbon footprint. The carbon detectives' kit is an online carbon footprint calculator for schools in England and can be found at www.carbondetectives.org.uk Pupils can work out their own footprint at www.carboncontrol.org.uk or www.footprint.wwf.org.uk They should collect data in advance for this activity.

Calculate your energy use

Use a plug-in electricity monitor to find out which machines are using the most energy. Pupils can measure items around the school (TV, fridge, computers, phone chargers). Then do calculations for how much energy each uses in a day, week, month and year. How much do the pupils personally contribute? How much will they contribute over their lifetime in the school? Try to relate energy use to carbon: which appliances produce the most carbon? You can buy plugs to measure the energy output of appliances from www.alertme.com/energy-saving.

Where does our electricity come from?

Ask pupils to think in pairs about where electricity comes from (beyond the socket!). Give them a set of cards to put into a sequence (these might include a power station, a TV, coal, an electric socket and electricity cables). Show an animation of how a power station works www.cabeurl.com/4s and ask them to draw a flow diagram to show the processes. What are the problems with burning coal? At what stages are energy or heat wasted? How can these problems be overcome? www.cabeurl.com/4b
KS1 and 2 – introduce pupils to the concept of energy generation.

Solar powered future

Show pupils the video on www.greatcell.com about new developments in the design of solar panels, mimicking the processes of photosynthesis. These new solar cells are thin, coloured, translucent and even flexible. How could these new cells change how solar panels are used? Ask pupils to design a product which incorporates these new solar energy cells. For some ideas, see what design students around the world came up with as part of the 'Sunny Memories' project www.cabeurl.com/9q.

History of Electricity

Why not look at inventions for using and generating energy? You could cover

Windmills First invented in Persia (now Iran) in the 7th Century AD. The first person to think of using wind-powered mills to generate electricity was Macellus Jacobs (USA) in 1930.

Steam Engines James Watt (UK) 1763. It was his steam engine that paved the way for the Industrial Revolution.

Batteries The first to succeed in producing energy this way was Alessandro Volta in 1799.
The Lightbulb Joseph Swann (UK) and Thomas Edison both produced a glowing lightbulb within months of each other. In 1883 they went into partnership to manufacture their invention.
Further Ideas Why not add other electricity using inventions (such as TV, refrigerators, vacuum cleaners etc) to your timeline or Book of Centuries.

Other available Resources

Plan-Ed
www.plan-ed.org
A range of educational resources from Plan UK on the theme of development education.

Renewable world
www.renewableworld.org.uk
Interactive site facilitating exploration of the diversity of renewable materials and their role in building a sustainable future.

Shout about climate solutions KS3 activity pack from Friends of the Earth
www.cabeurl.com/51
Information and activities produced to support teaching.

Think energy
www.think-energy.co.uk
On-line activities for KS2 and up.

Carbon detectives
www.carbondetectives.org.uk
An interactive website that allows pupils/schools to monitor their use of energy and resources.

Cities of today, cities of tomorrow
www.cabeurl.com/55
A United Nations project about urban development including teaching resources.

Climate chaos
www.cabeurl.com/54
A week of activities about climate change for KS2 from Oxfam.

Climate choices – ch
www.climatechoices.org.uk
A range of materials, information and links aimed at KS2.

Development Education Proje
www.teachclimatechange.org/
Comprehensive list of recommended resources.

Energy matters
www.cabeurl.com/4d
Free resources from the Centre for Sustainable Energy.

Engaging Places
www.engagingplaces.org.uk
An online guide to using buildings and places in teaching and learning, including support for schools running a Green Day event.

Global energy consumption
www.cabeurl.com/53
Table showing 1990, 2000 and 2005 per capita figures for individual countries.

Google UK school resources
www.google.co.uk/schools
How to use Google searches, maps, earth, images and news to support the curriculum.

Grasping of climate: an inspirational guidebook for teachers
www.cabeurl.com/50
An EU-funded project exploring how to engage pupils in climate change activities in England, France and Sweden.

Greener futures
www.greenerfutures.com
A range of resources and games for KS1-3.

Game
www.cabeurl.com/6y
A downloadable game which explores the design and construction process by facilitating the creation of the best school in the world.