Better Planet Education

Family Home Learning Pack

ENERGY & POWER

Notes for parents and carers:

These home learning packs have been compiled by Better Planet Education to support you whilst your children are at home during the Covid-19 lockdown.

Each week, we will include suggestions for activities you can do alongside your children, as well as those that they can do independently, whilst you are working from home.

We will attempt to suggest activities which require no special materials other than those you may find around the house. It may be possible to pick up some resources during your occasional shop for essentials but please do not aim to shop specifically for listed supplies! We will also attempt to minimise the need to print out any materials.

In your pack each week:

- Open ended project ideas and research topics
- Activities to explore independently or together
- Games to play
- Ideas for science experiment
- Art and craft idea Links to other learning resources
- A use each week for toilet roll tubes...

ACTIVITY IDEAS

How do we power the machines that we keep in our homes to help us lead more efficient lives? Where does our electricity come from before it arrives at our houses and how is it made? It's easy to take for granted the power that we use every day. Begin to explore some alternative power sources with the activities in this pack.

How do we power our homes?:

Which items in your home need some kind of power source to make them work? Children may be familiar with toys that need batteries and will know that some appliances need to be plugged in before they will work. Before you carry out the activities in this pack, it might be useful to watch this introductory video which shows lots of items around the home that work via electricity: **https://www.stem.org.uk/resources/elibrary/resource/30647/things-use-electricity**

Power search:
Using a list or pictures, investigate how many toys and appliances you have in your home that are powered by electricity, either via the mains or batteries. What sorts of actions does the item do when the electricity is switched on? Power is often converted into light, heat or movement.

Where does our electricity come from?:

Mains or battery?:
Sort the items that you have found into those that run on batteries and those that are plugged in to the mains electricity. Can some work in both ways? Do some of the batteries need to be plugged back into the mains to charge up?

CAUTION: *Remind children that the amount of electricity stored in a toy's battery is quite small and those toys are safe to play with. The amount of power supplied to a plug socket is much greater and can be dangerous.*
How does the power travel in a circuit?

If you don't have a kit for building simple circuits using batteries, this site provides a simple explanation of how a circuit works plus the opportunity to 'build' some circuits online. It's no replacement for the real thing, but, in the absence of a kit at home, this can help explain the basics.
http://www.learningcircuits.co.uk

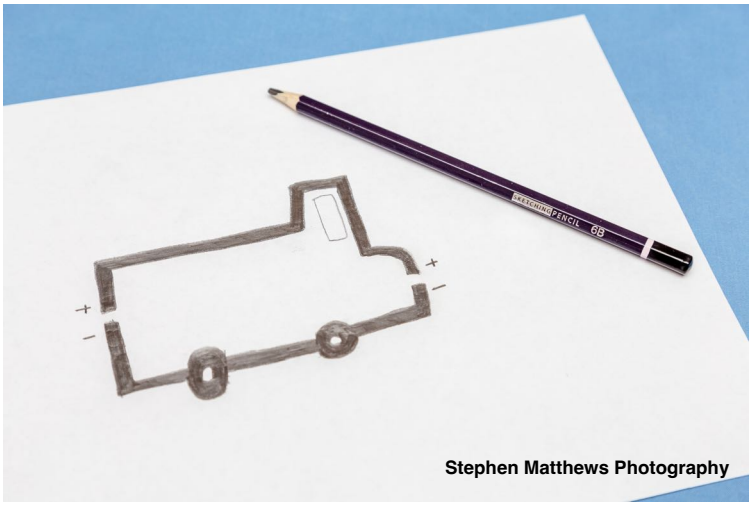
Pencil and paper circuit:

If you do have a kit, or some simple components at home, it can be interesting to explore which materials will and which won't conduct electricity. Did you know that you can DRAW yourself a working circuit? Graphite is a conductive material so it will carry an electrical current. You can prove this with the following activity.

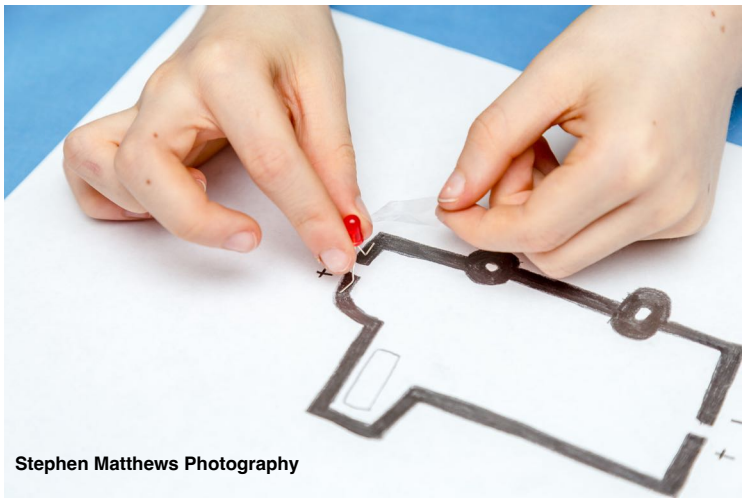
You will need:

A piece of paper
A GRAPHITE pencil (soft art pencils work best - we used a 6B sketching pencil)
An LED
some tape
A 9v battery

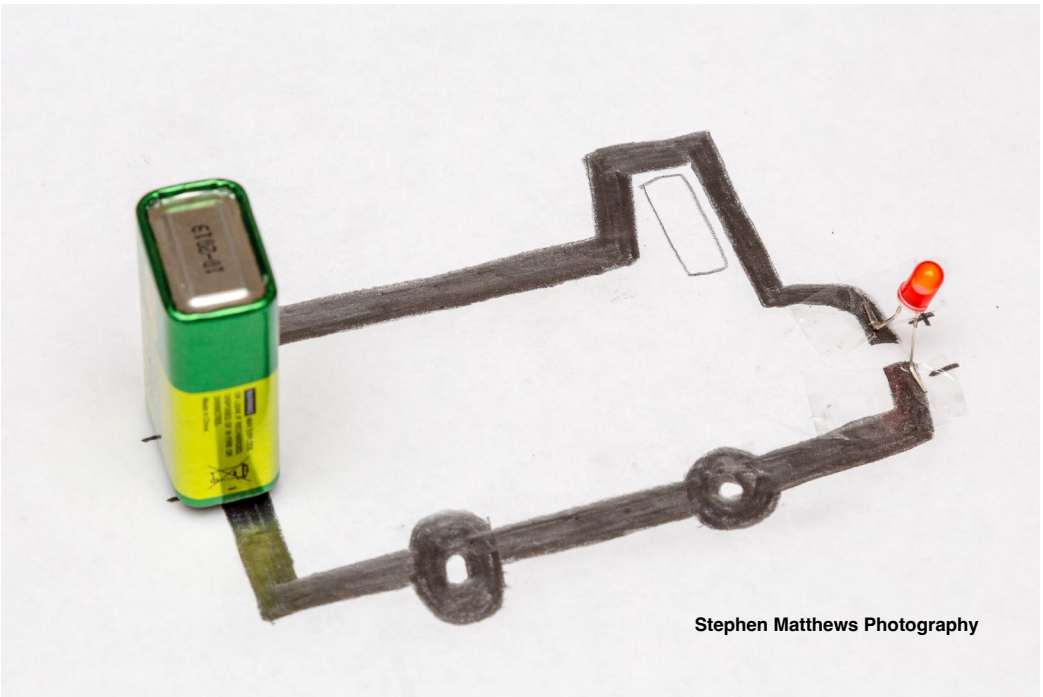
First, you will need to draw a design.
Make sure that your lines are shaded in heavily with a good layer of the graphite.
Leave a break of around 1cm between your lines and label one side positive and one negative.



Take your LED and bend the bottoms of the wires. The longest wire will be the positive side. Tape the wire down so that the sides make contact with the graphite lines.


Stephen Matthews Photography


Stephen Matthews Photography


Stephen Matthews Photography

Place your battery at the other end of your circuit, making sure you align the positive and negative sides. What happens to the LED?

Try experimenting with drawing lines of different lengths and thickness. Graphite is quite low in conductivity, so if your lines are too long, the LED will be dimmer. Experiment to see what kind of line gives you the best results.

Thank you to Alex in Durham for testing this activity for us!

How do batteries work?

This video can help explain how a battery works (youtube clip, supervision recommended) **https://www.youtube.com/watch?v=RWWLfUIiMAw**

Power Station Explanation:

But where does the power that comes out of our plug sockets come from?

This BBC clip helps explain the workings of a power station and some of the fuels that can be used to create the electricity that is carried to our homes.

https://www.bbc.co.uk/teach/class-clips-video/primary-science-how-is-electricity-made/zfhfgwx

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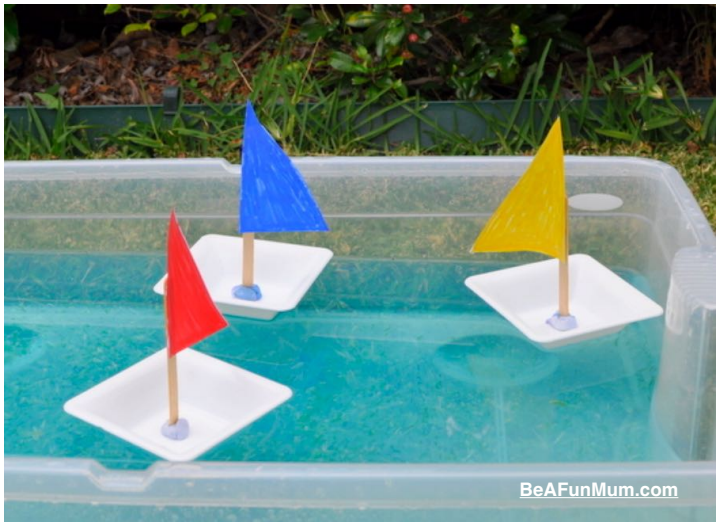
Wind Power:

The wind has been used as a source of power for centuries. Ships once sailed the seas powered only by the wind in their sails, and windmills were used to grind wheat into flour for bread. Wind turbines can also be used to generate electricity for use in our homes.

Try these two activities to see if you can power a small vehicle using only air!

Blow along boat:

See if you can use recycled materials to build a simple boat. Even a small piece of card will float for a short time, but you can get inventive with upturned lids, take-away tubs and milk cartons cut in half. Sails could be made of paper or cloth and attached with a chop stick and some modelling clay or taped on to a rolled up paper mast. Once you've constructed a boat, see whether you can power it along in a shallow bowl (or bathtub!) of water using only your breath.



Make a hovercraft:

Use the air released from a blown up balloon to lift a home made hovercraft off the ground!

You will need:

·A CD or CD Rom
·Strong glue (a glue gun works best if you have one)
·The cap from a recycled drinks bottle (taller caps give more room to attach the balloon)
·A balloon
·pens to decorate your hovercraft

First, decorate your hovercraft and attach your drinks bottle cap over the hole in the

middle of the CD using strong glue.

Next, make sure that your balloon will fit over the bottle cap securely. It's worth having a few practise runs at attaching the balloon, before you blow it up.

When you inflate the balloon and attach it to the 'hovercraft', the escaping air will lift the CD and send it travelling across the ground!

With thanks to Felix and Dylan in Devon for testing this activity and making these excellent hovercraft.

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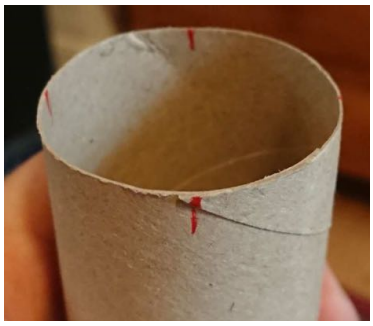


This week's use for a toilet roll tube:

Make a Wind Spinner:

Chris in London sent in this design for a spinner that shows how the wind can be used to turn a machine with sails. Wind turbines work in a similar way. This video explains how electricity can be generated by a wind farm! (Youtube clip, supervisions recommended): **https://www.youtube.com/watch?v=U5_cZ3IRUkU**

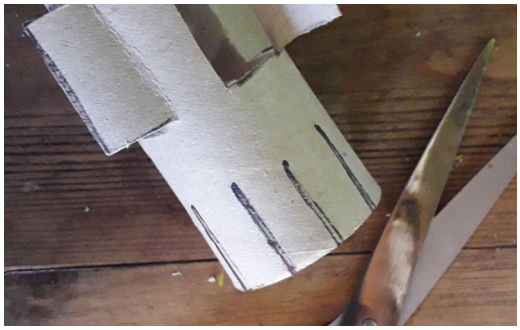
First, mark the tube into quarters. You can do this by eye, or measure and discuss quarters and degrees, if you fancy some extra maths.

Once you've divided the tube into quarters, draw on a flap to cut out. Leave a gap between each cut out section. You might want to make the gaps wider and the flaps smaller for added strength.

Leave around 5cm space at the top of the tube to cut more flaps later, to balance the tube.

Cut out the flaps along three of their sides and press them outwards, being careful not to tear the card in between. It's tricky to do this with scissors, you might want to use a craft knife, being very careful about where you are holding the tube!

Next, cut around 9 equally spaced slits into the end of the toilet roll tube and fold them in, one at a time, securing at the end with tape.



Finally, balance the spinner on a pen or pencil (a chunky pen, such as a marker can provide better balance) and blow to make it spin.

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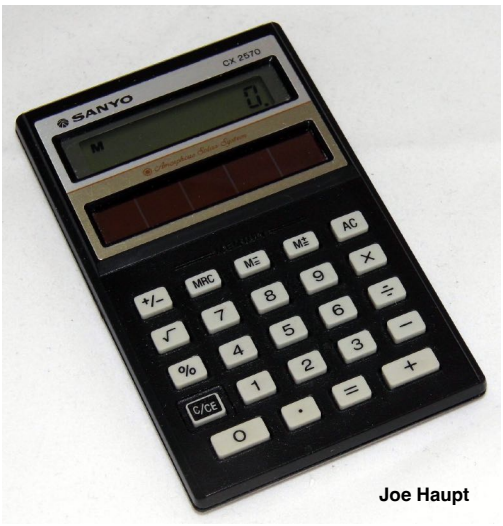
Solar Power:



Joe Haupt

Solar power search:

Do you have anything in your home that is powered by the sun? Maybe you have solar panels that heat your water or provide you with electricity? Or perhaps you have a solar powered calculator? What is solar energy? Watch this video to learn that all our energy comes first from the sun. What are some of the ways that we can convert the sun's energy into energy we can use in our homes? (Youtube clip, supervision recommended):
https://www.youtube.com/watch?v=inPtRWtvDaM

Make a solar powered oven:

For a simple demonstration of the way that concentrating the sun's rays can be useful for generating heat, try making this solar oven. On a sunny day, you should be able to use it to melt cheese, chocolate or marshmallows.

Thank you to Ryan and Alex in Durham for building a superb solar oven for us.

You will need:

- A pizza box
- Some aluminium foil
- Sticky tape
- Scissors
- A pen or pencil
- A piece of wire (you can prop open the lid with a pencil if you don't have wire)
- A sheet of plastic film such as a file divider, some acetate or some food wrap.

Stephen Matthews Photography

First, you will need to cut a flap out from the lid of the pizza box.

Next, stick your plastic over the hole you have just cut out.

Cover the flap with the aluminium foil on the inside, to reflect heat on to your food when it is inside the ‘oven’ . Line the box with more foil. Keep the shiny side of the foil outwards.

Hold the flap of your oven open with a piece of wire, folded and taped into place. Adjusting the length of the wire will allow you to angle the flap so that the sun can hit the food inside.

Place your completed oven in a sunny place. You can choose which sort of food to try melting. Ryan and Alex decided to melt some cheese slices on to their crumpets!

It might take a while for you oven to direct enough heat on to your food to melt it. Keep checking back regularly to see what is happening!

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RESEARCH IDEAS

Fossil fuels or renewable energy?

Find out:

* **What are fossil fuels and how were they formed?**
* **Does it matter whether we burn fossil fuels in our power stations?**
* **What are some of the issues surrounding the use of these fuels?**
* **What are the alternatives to getting our energy from fossil fuels?**

Watch this video from Student Energy to help you understand some issues surrounding different fuel types (you tube clip supervision recommended):
https://www.youtube.com/watch?v=zaXBVYr9Ij0

You can also watch videos from YPTE on how electricity is made and renewable energy here:
https://ypte.org.uk/videos/how-is-electricity-made
https://ypte.org.uk/videos/renewable-energy

Discover lots of information about the various forms energy can take and the story behind humans, energy, fuel and the environment in a series of chapters here:
https://ypte.org.uk/factsheets/energy/types-of-energy

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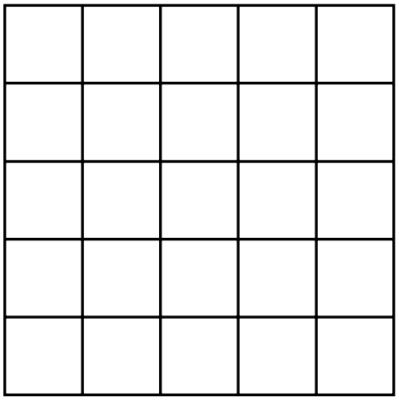
MATHS CHALLENGES

Powering the grid.

These grid based challenges are designed to encourage children to explain their methods and reasoning when solving problems.

Challenge one: Odds and Evens.

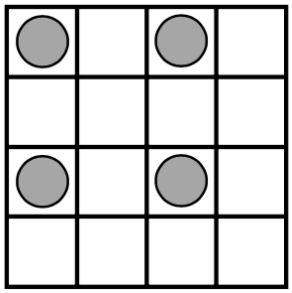


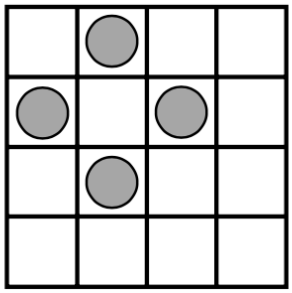
You will need up to 13 counters, pebbles or small objects and a 5 x 5 grid:

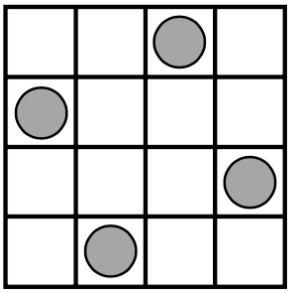
1) **Place all 13 counters.**
   You must have an **odd** number of counters in each row and column, as well as the two main diagonals.
2) **Place 10 counters.**
   This time you must have an **even** number of counters in each row and column, as well as the two main diagonals.

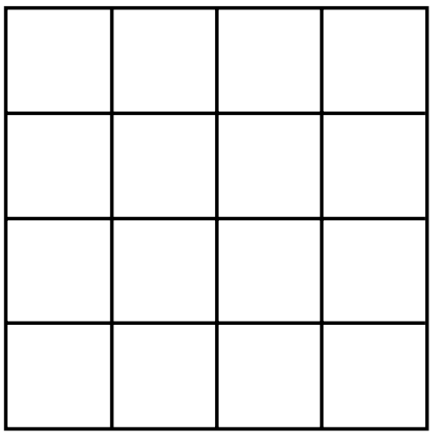
Challenge two: All Square.

On each of these grids, the counters lie at the four corners of a square.









What is the greatest number of counters you can place on this grid without four of them lying at the corners of a square?

Questions adapted from Mathematical Challenges for Able Pupils, DFE, 2000.
Solutions at end of the pack!

WORD CHALLENGES

OW POWER:
The word 'Power' contains the sound 'ow'. How many other words can you find that contain the same SOUND? Help your child to write all of their suggestions down. You can include different spellings of the sound, such as the 'ou' in 'out' or 'sound' Help your child to sort the words into different lists depending on the spelling of the sound, then practise reading words containing ow and ou here (Youtube link, supervision recommended):

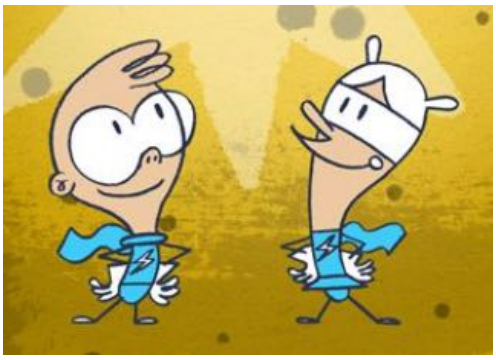
https://www.youtube.com/watch?v=ySRd-Amrd28

Safety Poster:

Help people in your house stay safe around electricity by exploring the activities on this website and then using what you have learned to make a safety poster or leaflet for your family,

http://www.switchedonkids.org.uk/electrical-safety-in-your-home

Energy Saving Superheroes:



European Commission

In this fun cartoon, the family is wasting energy all the time until they realise the impact it is having on the planet and decide to take action! Watch the cartoon and then design your own comic strip or write a story about energy saving superheroes and how they convince people to start saving energy! (Youtube clip, supervision recommended):

https://www.youtube.com/watch?v=1-g73ty9v04

ART AND CRAFT

Static Electricity Moving Pictures:

If you have balloons at home you can use them to explore static electricity and make some moving pictures! When you rub an inflated balloon on your hair, or certain fabrics (fleece works well) electrons with a negative charge build up on the surface of the balloon. These will attract light objects with a positive charge - such as your own hair, as Henry and Charlie in St Albans discovered!

Watch a video here, to see some more interesting things to try using a balloon and static electricity (Youtube clip, supervision recommended):
https://www.youtube.com/watch?v=wxAgdiYJjp0

Lottie from St Albans discovered that because tissue paper is attracted to the static electricity of a balloon, you can use it to make moving pictures! She chose to make a shadow puppet of a fairy and used tissue paper for its wings. When the balloon was rubbed on a jumper and then held near the fairy wings, they moved!

You could make lots of different moving pictures in this way -such as butterflies or birds.

Make a model windmill:

Use a recycled milk or juice carton to make a model of a windmill. If you attach the paper sails quite loosely, they should really spin in the wind.

You will need:

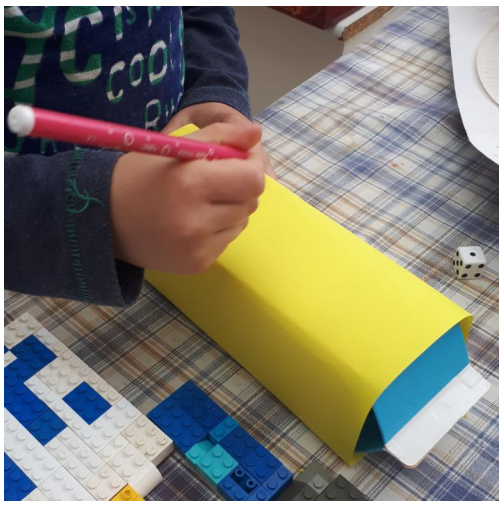
- A milk or juice carton
- A sheet of paper
- Scissors
- A wooden skewer, knitting needle or pencil
- Elastic bands
- Paints or paper to decorate your windmill, if you would like to.
- Some glue or tape

First, cut a piece of paper into a square and fold it along its diagonals like this:

Then, use your scissors to cut half way along each fold.

Fold every other tip of the paper into the middle one at a time...

...securing them in the middle with glue, tape or a split pin like this.



Decorate your carton so that it looks like a windmill tower. You could paint the carton, or it might be easier to cover it with paper and then draw on to that.

Wrap the elastic band around the blunt end of your wooden skewer so that the windmill is secured in place.

Finally, poke the skewer through the windmill sails and then the carton itself to attach the two pieces together. A second elastic band can secure the back in place and you can trim off any extra wood. Make sure the skewer can move freely in the hole and place your windmill outside on a breezy day to see it turning!

Thank you to Felix and Dylan in Devon for their great windmill making skills!

GAMES

Electric sweeties:

For this game, you will need a selection of sweets that are each a different colour. One player goes out of the room and the others decide which colour sweet will be the 'electric' sweetie. The first player returns and starts to select sweets to keep or eat right away. This continues until they touch the 'electric' one, at which point everyone makes a loud 'BZZZZZ' sound and the player has to put that sweet back and stop their round. More sweets can be replaced before the next player's turn.

BUZZ:

This game can be played in a pair or in a larger group with turns being taken in order round a circle. You can play as a simple counting game with young children, or use it for multiplication factor practise.

For a simple counting game, choose a number, say 8. One child begins and counts aloud 'One,' then the next child says, 'Two,' the next child 'Three,' play continues around the circle with the children saying the next number in line as quickly as possible until the chosen number, in this case 8, is reached. Instead of saying the number aloud the child due to count says, "Buzz." The next person starts at one again and play continues as before, the aim being to count in sequence, follow the play around the group (or back and forth, if in a pair) and speak as quickly as possible without making a mistake. So in this example, play would go – 1,2,3,4,5,6,7,buzz! 1,2,etc

For multiplication practice the aim of the game is to count to 50 (or 100...) Except all multiples of the chosen number must be replaced by the word 'Buzz.' For example, if the buzz number was multiples of 5, play would go – 1,2,3,4,buzz,6,7,8,9,buzz,11,12...etc.

If a child makes a mistake play begins (for the whole group) again at 1.
For an even trickier variation, choose two sets of multiples to exclude – say multiples of 3 and of 5 – multiples of 3 are replaced with the word 'fizz' and multiples of 5 with the word 'buzz.' For numbers that are multiples of both 3 and 5, the respondent says 'fizz-buzz.' For this example, play would proceed as follows – 1,2,fizz,4,buzz,fizz,7,8,fizz,buzz,11,fizz,13,14,fizz-buzz,etc.

LEARNING LINKS

There are a large number of resources available for online learning at this time. We'd always recommend that you support your child with this and only follow links from reputable names. **Any links provided here have been checked for suitability.**

This series of clips from BBC Bitesize is designed to introduce ideas about electricity to younger children:
https://www.bbc.co.uk/bitesize/topics/zjrrd2p

This series of clips helps explain how fossil fuels are used in the production of electricity, as well as exploring some renewable sources of energy
https://www.bbc.co.uk/bitesize/topics/zshp34j/articles/zntxgwx

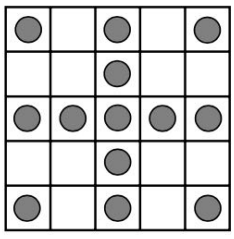
A great site for exploring some sources of electricity and thinking about safety around the home, plus a 'socket overload calculator' to see whether you might be plugging too many deceives into the same socket, risking a fire.
http://www.switchedonkids.org.uk

These video clip shows some ways that electricity might be used in contexts outside the home - in this case, in a theatre :
https://www.stem.org.uk/resources/elibrary/resource/30649/how-electricity-used

Answers to Maths Challenges:

Challenge one: There are several possible solutions such as:

1.



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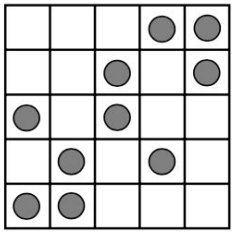

Challenge two:
One solution might be: