

Time To UnLock Your Engineering Potential!

Boredom Buster

Children's Activity Pack

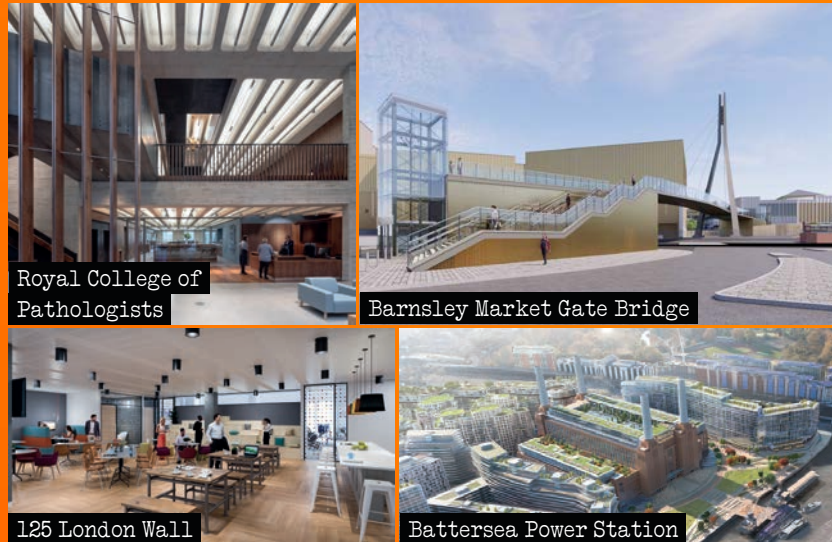
About Us

Waterman Group is an engineering and environmental company. We help to shape our world in lots of different ways, and we try to make things better for everyone now and in the future. Our team helps plan, design and deliver buildings and infrastructure like roads, bridges, railways, water and sewer systems.

We love all the exciting things about science, technology, engineering and maths (STEM) subjects and we want you to love it too!

We're excited to see how you get on. Why don't you get your parents/carers to share your creations with us?

X: @waterman_group #WatermanSTEM or
marketing@watermangroup.com



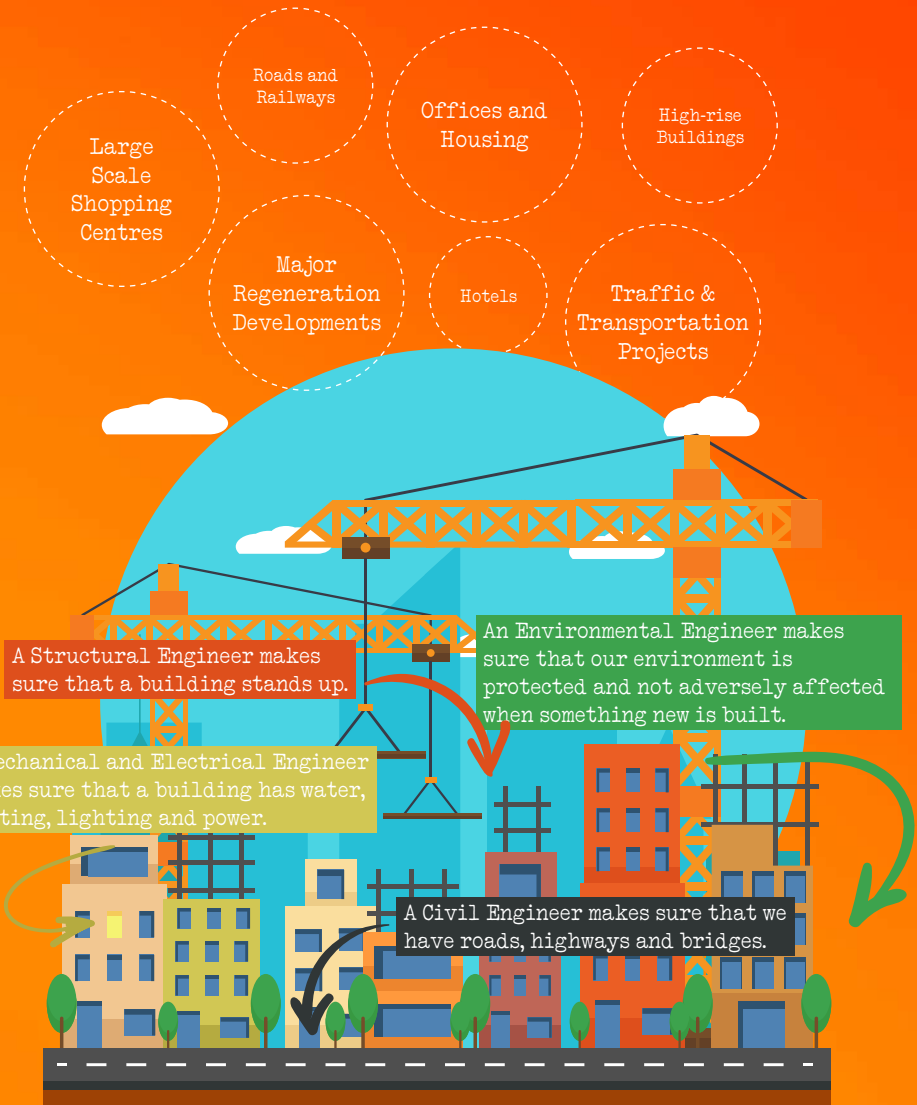
X @ Waterman_group in Waterman Group

watermangroup.com

Did You Know

You could create a lasting legacy by working on cutting edge projects within the built environment!

Our engineers are working on some of the world's most exciting projects, such as:



Structural Engineering

Structural engineers use their skills to make sure buildings stand up tall, without wobbling or falling over.

Paper tower challenge

Use limited materials to build a tower that is as tall as possible and can hold a heavy weight at the top.

The Rules:

- ✗ The tower can only be built from paper and tape. See the materials list for allowable types of paper and tape. Tools cannot be used as structural elements of the tower.
- ✗ You cannot use more than 30 pieces of paper.
- ✗ You cannot use more than one roll of tape.
- ✗ The bottom of the tower can only be taped to the horizontal surface that it rests on (floor, table, etc.). It cannot be taped to anything else (like the vertical leg of a table or a wall) or supported by a person.
- ✗ You are allowed to fold, bend, roll, cut, etc. the pieces of paper.
- ✗ Material cost is not prorated. If you cut a sheet of paper in half and only use half the sheet, it still counts as a whole sheet.
- ✗ For scoring purposes, 1 piece of paper is 1 sheet of paper.
- ✗ The tower must support one can of food (14-16 oz or 400-500 g) for at least 1 minute without collapsing. You cannot touch, modify, or repair the tower during this minute.
- ✗ The can must rest freely on the tower and be removable. It cannot be taped to the tower.

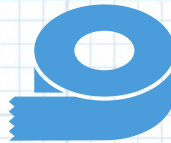
What You'll Need



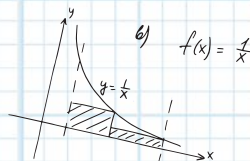
30 Sheets of paper



1 x Food Can



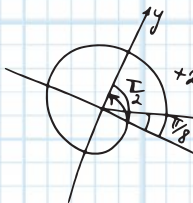
1 x Sticky Tape



For more information
on this project
please visit:

<https://www.sciencebuddies.org/>

Some Inspiration



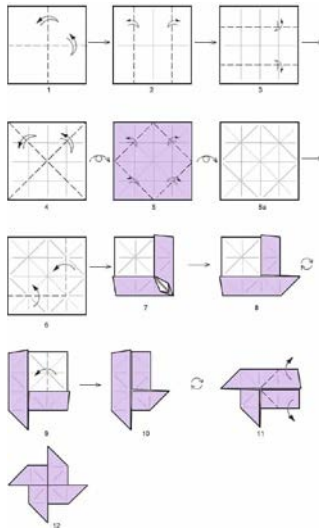
$$\frac{2 \cdot \text{cis}(-\pi/4)}{\pi \cdot \text{cis}(-\pi/4)}$$

Mechanical Engineering

Mechanical engineers work with power-producing machines like electric generators, engines and turbines. They help industries like aviation, automotive, construction, electronics, pharmaceutical and rail to come up with innovative products and designs.

Make a windmill

1. The wind is a magnificent element, wouldn't you agree? Its power can be devastating, but it can also be utilized for our benefit. One of the best examples is the windmill. Turning pure wind power into electrical energy.
2. Now fold a square sheet of paper in half horizontally, and unfold. Fold in half again vertically, and unfold. Now you will get a horizontal line and vertical line on the paper.
3. Fold the left and right edge of the paper towards the center dot. Unfold. Now we have 4 vertical folds on our square paper.
4. Do the same for the top and bottom edge of the paper and fold them towards the center dot. Unfold. Now we have 4 more horizontal folds.
5. Now fold a square sheet of paper diagonally, to get an X-shaped crease. Unfold. Flip the paper on the other side.
6. Fold the four corners towards the center of the paper. Unfold.
7. Turn the paper over. You are now ready to shape the paper into a windmill base.
8. Refold the crease located one-quarter of the distance from the bottom edge of the paper. And Refold the crease located one-quarter of the way from the right edge of the paper at the same time.
9. A small flap of paper will be formed. Swivel it towards the right side of the paper. You can also swivel the flap downwards, but be sure to stay consistent with which direction you fold subsequent flaps.
10. Rotate the paper 90 degrees clockwise.
11. Repeat steps 6 and 7 and a second flap will be formed.
12. Rotate the paper 90 degrees clockwise again.
13. Repeat steps 6 and 7 one more time. This will form two more flaps.
14. And our Windmill is finished. Press with your finger on all edges of Windmill once again so it keeps its shape.
15. Now use a pin to attach it to the Straw.



For more information
on this project
please visit:

<https://www.stemlittleexplorers.com>

What's something that surrounds us all the time but we hardly ever notice or think about it?

Air!

In fact, air is pressing on us all the time. And 'air pressure' is what we call the weight of the air molecules pressing down on everything on earth.

This activity provides a quick and simple way to demonstrate the concept of air pressure and to show how air is pressing on everything at all times.

Activity Instructions

Step 1:

Keeping the cap on, insert several drawing pins into the bottle. Insert the pins straight in and insert them toward the bottom of the bottle, as this will provide maximum effect later on.

Step 2:

Once the pins are in, have your child check for leaks. There shouldn't be any.

Step 3:

Now comes the fun part! Have your child remove the pins.

Watch their amazement as no water leaks out - other than maybe a drop or two - despite the presence of several holes in the bottle!

Step 4:

Now, have your child remove the cap from the bottle. And voila! As soon as the cap comes off, the water starts leaking out the pin holes!

The science behind the activity:

Because the air pressure pushing the water to stay in the bottle is stronger than the water pressure pushing the water out, the water stays put inside the bottle.

Pins in a BOTTLE

What You'll Need



Some drawing pins (3-5 is a good number, but you can use more if you wish)

Plastic water bottle, filled with water and with the cap on

Tip: Do this activity outdoors or someplace where you don't mind water spillage.



Civil Engineering

Civil engineers use their skills to manage floods, design roads and railways, and ensure we have clean water and safe waste disposal.

Sewer Stopper

What You'll Need

Can you imagine living with no toilet in your house? I thought not! In the history of big cities like London or in the developing world where waste wasn't/isn't flushed away then diseases can spread fast. This is one of the reasons that the work of civil engineers saves more lives than doctors.

During the COVID-19 lockdown period, sewer blockages rose by 20 percent! This is because people used kitchen roll and wet wipes instead of toilet roll, not knowing the problems this causes for our sewer system.

Toilet roll is made so that it breaks up when it comes into contact with water. Then it can easily move through the sewer system. Things like kitchen roll and wet wipes do not and get blocked in the sewer tunnel.

This can combine with left-over fat from cooking if it is poured down the sink. Civil engineers call this a fatberg - a large solid lump of nastiness! Yuk! Fatbergs can get so big that they block an entire section of sewer and it needs to be dug up and removed.

6 bowls / cups | An old ice-cream tub
Toilet roll | Kitchen roll | Wet wipes
Salt | Sugar | Scissors or craft knife

Activity Instructions

Add 500ml of water into each of your 6 bowls, label each bowl and put in:

Bowl 1 - 2 sheets Kitchen Roll
Bowl 2 - 4 sheets Toilet Paper
Bowl 3 - 2 sheets Kitchen Roll, 2tbsp Salt,
Bowl 4 - 4 sheets Toilet Paper, 2tbsp Salt;
Bowl 5 - 2 sheets Kitchen Roll, 2tbsp White Sugar;
Bowl 6 - 4 sheets Toilet Paper, 2tbsp White Sugar.

Salt represents the chemical that are used to treat sewage at a treatment works. Sugar represents the other waste we find in our sewers.

Take a photo of each bowl once a day for a week and take notes on what is happening. After a week we are going to see what would happen when this waste went down a sewer.

Ask a grown up to help you for this part: Draw around a 2p coin in the middle of an old ice-cream tub. Move the coin by 2cm and do the same, twice over. Get your grown up to cut out these shapes to make holes in your tub.

Place an empty bowl below your ice cream tub. Pour the content of Bowl 1 through the holes in the ice cream tub. Use a watch or a phone to see how long it takes. Repeat with the other 5 bowls. Which one drained the fastest?

Remember to put the contents of the waste into the correct bins after - not into your toilet or down the sink!

ice
Institution of Civil Engineers

ice
Institution of Civil Engineers

Road Runners: Irritating Ice

This experiment shows the effect that ice can have on buildings and roads.

When civil engineers design roads and buildings, we have to think carefully about how long it needs to last. Lots of things - like the weather - can affect this, and we need to think about this in our designs.

When water freezes it grows - or expands. So in the winter, when water gathers in small cracks in a road, it can freeze and make the crack bigger. Over time, this will push the road around and start to break it up, forming pot holes. These can be very expensive to fix.

Activity Instructions

Step 1:
Fill up a balloon with water and tie it.
Get a grown up to help you

Step 2:
Design and build a Lego house around your water balloon, making the walls as tight as possible around the water balloon. Make sure you give your house a good roof and floor. You could even include some rooms, windows or a chimney.

Step 3:
With the help of a grown up, put your balloon and house in the freezer and leave overnight.

Step 4:
In the morning, ask your grown up to very carefully take your Lego house out. The balloon will have grown as the water froze into ice. But what damage did it cause to your house?

What You'll Need

Some Lego
+
A Balloon
+
Water
+
Ruler
+
Freezer

Challenge yourself:

Is there a way that you could design your Lego house to make it stronger and less likely to crack?

What happens if you repeat the experiment but add 30g salt to the water in your balloon?

Adding salt to water makes it harder to freeze, so adding it to roads, bridges or other structures in winter helps protect against the damage that ice causes.

Environmental Engineering

Environmental Engineers use their skills to protect and improve the natural environment around new buildings, roads and railways.

Build A Home For Bugs!

Insects and other minibeasts need safe spaces to shelter, hide from predators and raise their young. You can help them by building a bug hotel in your garden or outside area.

Log pile lodge

To make a log pile, simply collect small logs, large sticks and pieces of rotting wood. Pile them up in a damp, shady area of your garden, then stuff some dead leaves in the nooks and crannies to make it cosy.

Good for: centipedes, woodlice and beetles who like to burrow into decaying wood. Log piles may also attract birds, frogs and hedgehogs looking for a tasty snack!

Pine cone palace for ladybirds

Gather some pine cones and bundle them together closely so the scales interlock a bit. Stuff some dried leaves in the gaps. Place the pine cones in a quiet corner of your garden shed or garage and watch who moves in.

Good for: ladybirds and lacewings who will love to crawl into the crevices and hide among the leaves.

Twig tower block

Gather some sticks and find an undisturbed, sheltered spot outdoors. Pile them up and stuff the gaps with smaller twigs and dry leaves.

Good for: ladybirds and lacewings who will love to crawl into the crevices and hide among the leaves.



Visit your new bug homes, and see what moves in over time. How many different types of bugs can you count?



For more ideas visit:

<https://www.woodlandtrust.org.uk/>

You Don't Have To Be A Scientist To Help Science!



There are lots of creatures that we need to keep a sharp eye on. It's important for scientists to record the changing numbers of animals, as well as where they seem to be living. It's a very big job but you can help by giving them a hand!

There are so many kinds of wildlife that you can count, ranging from birds and bugs to butterflies, and so many organisations that need your help with their surveys. We've listed a few here to get you started, including the RSPB's own Big Garden Birdwatch.

Time to get counting!

Did you know in the 2016 Big Garden Birdwatch, people like you counted a whopping 8,262,662 birds! The humble house sparrow was the most common, with around four appearing in each garden.



Scan Me

Do a wildlife survey

What did you see

How many birds of the same kind did you see at t

 House sparrow I saw	
 Blue tit I saw	
 Black-headed gull I saw	
 Starling I saw	
 Woodpigeon I saw	

Your name

More Activities

If your thirsty for more activities check out these websites for ideas and advice:



BBC Bitesize



Girls Friendly
Society



Little Bins



Home School 4 Me



Institution of
Civil Engineers



Play Dough
to Plato



RSPB



RSPCA



Science Buddies



Stem Laboratory



Woodland Trust

Use your phone's camera to scan the QR Codes or
click the names to view the activity.

