John Smeaton CREST Award

SuperStar Level

CREST AWARDS

LEEDS YEAR OF CULTURE 2023

Supported by Leeds City Council

About this Award

Level: SuperStar

Project title: Smeaton Park Activity Brief

Overview: In this project, learners will consider themes of sustainability, nature, engineering, energy use, public and community spaces, and design innovation to respond to a series of tasks to create a new public space in Leeds inspired by John Smeaton, the civil engineer. Learners must explore real world issues and problem solve.

Time commitment: Learners will need to complete all 8 tasks and each task is 45 mins – 1 hour.

Resources:

- Teacher Guide for each activity.
- Learner Activity Guide for each activity.
- CREST Awards Superstar Passport.
- Materials for each activity.

Activity	Description
Activity 1 Bridge Builders	Smeaton Park needs a new bridge to get people from the city into the park. Can you make a model bridge and test it to see if it carries weight?
Activity 2 Shadow Science	Inspired by John Smeaton's interest in astronomy, this challenge encourages children to experiment with shadows and understand how they work.
Activity 3 Tree Teams	Smeaton Park needs some trees, but which trees are best? Research this topic and present your ideas.
Activity 4 Waste Warriors	Can Smeaton Park be waste free? Experiment with different materials for holding food and liquids for the Smeaton Park café.
Activity 5 Wind Wizards	Make a simple windmill and test it in this challenge to show you understand wind power.
Activity 6 People Power	Conduct a research survey into what people want to see in a new park, and feed this back to your class.
Activity 7 Lighthouse Legends	John Smeaton invented the Eddystone lighthouse to withstand wind and water. Can you experiment with structures and explore strength and stability like a civil engineer?
Activity 8 Water Wise	Test the properties of water in this challenge – what happens to the flow and force of water when an obstacle is in its way? How do dams and water wheels work?

About John Smeaton

John Smeaton was born in Leeds in 1724, and from being a child was fascinated by machines, science, how things work, design and engineering. He had his own workshop in his garden and made his own lathe (a piece of machinery used for cutting or shaping wood or metal.)

He is known as the father of 'civil engineering' – he invented this term to describe the type of engineering which took place outside of the military. He went to Leeds Grammar School and left at 16, and then joined his father's law firm. However, law didn't really interest him, and he soon left to become a mathematical instrument maker.

He was a keen inventor, always wanting to find new and better ways of developing things, and he conducted tests into the efficiency of watermills and windmills, which earned him the Copley Medal in 1759. He designed bridges and water way systems and is most famous for his design of the Eddystone Lighthouse in Plymouth.

The lighthouses on Plymouth rocks were previously made of wood and were dashed by the rocks and stormy seas, so Smeaton had the challenge of making a new lighthouse which could withstand the weather. He conducted experiments to develop a new type of concrete which could be used underwater, and through this he invented hydraulic lime to fix the lighthouse to the rocks! He then made his new lighthouse out of stone in the shape of an oak tree, using inspiration from nature to design a strong and sturdy shape that was wider at the bottom and narrower at the top.

Smeaton was a great collaborator and worked across a wide variety of fields – science, technology, mechanics, maths, design, and astronomy, as well as being influenced by art and nature. He was also committed to his designs and works being 'for the public good' and didn't patent a lot of his works, so his ideas were in the public realm. He only charged a flat fee for his work, was uninterested in being famous or a celebrity, and unusually for that time, made a contract for his workers ensuring they had fair pay and conditions and sick pay.

Did you know?

John Smeaton also stopped London Bridge from falling down!

The arches of the old London Bridge were widened, and a central pier was removed to allow bigger boats to pass through, but the people of London soon found this caused the flow of water to increase and this started to damage the pillars keeping the bridge up! John Smeaton was summoned to solve the problem, and he made the trip down from Yorkshire. Recently the City of London gates had been knocked down and sold, so there was a pile of stones and rubble lying around. Smeaton ordered that they immediately buy back the stone pillars from the gates and throw them in the river to slow down the water. Lots of people got to work, using horses, carts and wagons, and the bridge was saved!

Smeaton died in 1792, and his work is still hugely influential today.

Activity 1: Bridge Builders – Teacher Guide

About this activity:

This activity teaches children about different types and shapes of bridges, and about forces, weights and measures. Children will design, make and test bridge shapes, and share their results with their peers.

What you need:

- A4 paper – several sheets per group (scrap paper or newspaper is fine).
- Safety scissors.
- Pens, pencils, crayons.
- Sellotape.
- Coins, small blocks or other weights to test the bridge.
- Pictures of bridges (optional).

Health and Safety

- When testing weights on bridge prototypes, make sure the weights are placed carefully on the bridge rather than dropped.
- Please use safety scissors where possible. Remind children not to walk around with scissors in their hands, but if they must, to ensure they hold them by the closed blades with the blades towards the floor. Always supervise. Always cut at a table.

What to do:

1. Introduce the challenge using the story of Smeaton Park. You could show children images of bridges and discuss how they have been constructed. Discuss what this bridge needs to do (e.g., be wide enough for wheelchairs and foot passengers, hold weight of several people, withstand wind).
2. Put children in small groups and give them paper to sketch out initial ideas.
3. Using paper, ask children to make strong shapes with the paper, and test out folding, curving, cutting and bending the paper to see what works.
4. Using paper, scissors and Sellotape, ask children to make a test bridge and test this with the weights. They will need to decide where to put the weights on the bridge and what shape they want their bridge to be.
5. Encourage children to discuss their tests and evaluate their test bridge design. Ask them what worked and what didn't work, and what they would need to change for their final bridge.
6. Now, giving children more paper, ask them to make their final bridge. Tell them they cannot use any parts of their previous test bridge, but they can use the ideas to help them.
7. Test all the finished bridges and record the results.
8. Ask each group to present their bridge to the group and explain their design ideas.

Top tips:

- Show children examples of existing bridges and ask them to discuss how they have been designed.
- You could look at Forth Bridge, designed by John Smeaton, or explore the story of John Smeaton saving London Bridge from falling down!
- Encourage children to sketch an idea first and discuss it.
- The weakest bridge would be a flat piece of paper, encourage children to think about ways of strengthening the paper – such as folding, rolling, doubling up. Think about suspending the bridge or adding pillars or arches underneath.
- When testing, make sure the weights are placed carefully on the bridge rather than dropped.

Keywords:

- Bridge.
- Weight.
- Force.
- Suspension.
- Construction.
- Mass.

Activity 1: Bridge Builders – Activity Guide

Dear Designers,

We are designing a new park in your city – Smeaton Park! The park is next to a river, and we need a way of getting people from the city across the river into the park. What type of bridge should we design? Can you come up with some ideas and test them?

Your challenge:

You need to design, test and then make a model for a new bridge which will safely carry people from the city to the park. You need to work in teams to test out and evaluate your ideas, improving them for your final design.

Discussion points:

- How many different types of bridge do you know?
- Do you know any bridges that John Smeaton designed?
- What would Smeaton have had to think about when designing his bridges?

Get started

First, try to sketch some ideas on paper and talk about them.

Activity 1: Bridge Builders – Activity Guide

Test it out:

Then test out different shapes on paper and make a test bridge.

Discuss what you need to change and then make your final bridge.

Test all the final bridges with weights. How are you going to make sure you are testing all the bridges fairly in the same way?

Record the results of the tests by making a table like this one.

Bridge	Maximum weight bridge could hold	Notes and observations
Bridge 1		
Bridge 2		
Bridge 3		

Share with your group:

Show your bridge to the rest of your group, explain what you did and how you made it.
Further your learning:

- You could research some world-famous bridges and how they were designed.
- You could read more about John Smeaton and his engineering work and do a class presentation on him and his career.

Activity 2: Shadow Science – Teacher Guide

About this activity:

This activity encourages children to observe how shadows work, thinking about the sun and its various positions during the day.

What you need:

- A large piece of paper.
- A light source e.g., a torch.
- A cardboard cut-out shape of a tree.
- A pencil to draw the shadow.

Health and Safety

- Remember to remind children to never look directly at the sun or into the torch.

What to do:

1. First, introduce the theme of this activity – the sun and how it moves to create different shadows throughout the day. The sun rises in the east, starts off low and then moves overhead, and then sets in the west. Introduce the narrative, that the landscapers in Smeaton Park need help with designing elements of the park to ensure there is shadow at different times of the day.
2. Put children into groups of 3-4 and give each group the equipment they need. Alternatively, this can be done as a whole class if you have less resources.
3. The large piece of paper needs to be fixed to a wall or the board. Next, children need to hold up the cut out of the tree and shine the torch directly at it. Another child needs to draw round the shadow of the tree on the board.
4. Now, let the children experiment with moving the torch left to right, up and down, and closer and further away from the cut out of the tree, and to record the different shadow shapes. Explain that their torch is mimicking the sun moving round the earth in a 24-hour period.
5. Finally, ask children to use their results to draw a diagram which shows the sun shining on a tree in different positions at morning, noon and evening and the effect this has on the shadow size and shape. Ask groups to share back their results with the class.

Activity 2: Shadow Science – Teacher Guide

Top tips

- The room will need to be dark for maximum impact.
- This activity can be tied in with more work on space, the sun and moon if this is relevant to your teaching.
- Remember to remind children to never look directly at the sun.

Keywords:

- Sun.
- Shadow.
- Source of light.
- Rotation.
- Transparent.
- Opaque.

Activity 2: Shadow Science – Activity Guide

Hi teams!

Did you know John Smeaton was also a keen astronomer, meaning he was interested in space, the sun, moon and stars and often conducted his own experiments. He even built an observatory - a special building for looking through telescopes at what's happening in space - in his garden. At Gardens R Us we have been tasked with designing a garden in Smeaton Park! We know shade is important to protect us from the sun, but what is the relationship between the sun, objects and shadows? Can you do an experiment to tell us the answer?

Thanks!

Your challenge:

To conduct an experiment showing how light creates shadows and to record and share your results.

Discussion points:

- What do you know about the sun and how it moves?
- Does the sun give us the same amount of light each day?
- Do we get shadows at night-time? If not, why not?
- Are shadows different at different times of the day?

Get started

Get a torch, and check your equipment works by holding the tree cut out in front of the large piece of paper and shining the torch on it – and it should create a shadow.

Test it out:

Draw round the shadow of the tree on the board.

Now, experiment with moving the torch left to right, up and down, and closer and further away from the cut out of the tree and record the different shadow shapes. Think about how the sun moves from East to West during the day.

Share with your group:

Draw a diagram which shows the sun shining on a tree in different positions at morning, noon and evening and the effect this has on the shadow size and shape.

Further your learning:

You could also experiment with moon gazing and the night sky, looking at the moon each night and sketching its position and shape, and creating a chart over a month.

Activity 3: Tree Teams – Teacher Guide

About this activity:

This activity encourages children to learn about UK native trees, the best trees to plant and what trees do for our environment.

What you need:

- Access to the internet.
- Native tree identification guide.
- Paper or notebook, pens or paper for the data collection.

What to do:

1. Introduce the task using the letter from the council.
2. Ask children which trees they have heard of, and do they know if they are UK native trees?
3. Give children the UK native tree identification guide, and either do a walk around the school site to see if they can spot any, or ask children to conduct this at home.
4. Ask children to plan a way of collecting data, and then conduct some research into different types of trees, what distinctive characteristics they have, and why they are important.
5. Ask children to share their results and make their own recommendations for the trees which should be planted in Smeaton Park.

Health and Safety

- Ensure children don't touch any poisonous berries or toxic leaves if looking at trees.
- Follow your school's own guidelines and risk assessments for outdoor activities.
- Ensure children access the internet safely when researching trees.

Keywords:

- Trees.
- Environment.
- Food cycles.
- Ecosystem.
- Evergreen.
- Deciduous.

Activity 3: Tree Teams – Activity Guide

Hi tree teams!

We at the council are planting some new trees for Smeaton Park – a brand new park in the city inspired by the work of John Smeaton, the famous civil engineer! John Smeaton was inspired by nature himself; did you know he designed the famous Eddystone lighthouse in the shape of the strong oak tree? We want to know which trees we should plant. We want some which are green all year round, some to give shade in the sun, some which will feed the birds, and some which will last a long time! Can you help?

Your challenge:

Your challenge is to learn about UK native trees, what trees do for the environment and why this is important, research types of trees and present your findings with recommendations for which trees should be planted.

Discussion points:

- How many trees can you name?
- What does native mean? Do you know any native trees?
- Can you think of any reasons why trees are important?

Get started

Get a torch, and check your equipment works by holding the tree cut out in front of the large piece of paper and shining the torch on it – and it should create a shadow.

Type of tree	Is it green all year?	Is it good for shade?	Does it provide food?

Activity 3: Tree Teams – Activity Guide

Test it out:

Now use your data collection method and research different types of trees on the internet, recording your findings as you go.

Share with your group:

Share your results with the rest of your group and see what data they have collected too. As a class, make recommendations to the Council for up to 5 different trees which could be planted in Smeaton Park.

Further your learning:

- You could investigate tree planting schemes or charities to plant a tree in your school or look at different plants which are also good for the local environment.
- You could make a presentation on how trees are good for climate change and share this with your class.

UK native tree identification guide

Here are just some common trees you can see in the UK – can you spot any of these in your local area?

Beach

Elder

Hawthorn

Holly

Oak

Scots Pine

Silver Birch

Willow

Yew

Activity 4: Waste Warriors – Teacher Guide

About this activity:

In this activity children will learn about the impact of landfill waste and how this can be avoided.

What you need:

- A selection of materials such as paper, card, cardboard, corrugated cardboard, cloth, linen, beeswax paper, polystyrene and plastic.
- Cold water.
- Bread or an object that can mimic the size and weight of a sandwich.
- Paper or a notebook to record the results.

What to do:

1. Introduce the activity using the advert from the Smeaton Park Café.
2. Discuss plastic pollution and how this fits into the climate crisis – that plastic takes up to 400 years to decompose and produces harmful greenhouse gas emissions that are contributing to global warming.
3. Ask children if they have been to cafes or takeaways and had food or drink which was not served in plastic containers. What are the alternative options?
4. Give each small group a selection of materials as described above, and either two pieces of bread to act as a 'sandwich' or another object which can mimic a sandwich – such as a small book. Ensure each group has access to water, either from a tap or a large jug.
5. Explain that the group will experiment with various recyclable and reusable materials which can be used as food and drink containers. Some are recyclable (such as paper) and are reusable (such as beeswax paper or cloth).
6. Ask the groups to test out all the materials for carrying a sandwich and carrying liquid – which work, and which don't work? Ask children to record the pros and cons of each material.
7. Encourage children to share their results with the rest of the group.

Health and Safety

- To ensure that children don't slip have a mop nearby or do this activity outside.

Activity 4: Waste Warriors – Teacher Guide

Keywords:

- Climate crisis.
- Plastic waste.
- Greenhouse gas.
- Landfill.
- Recycle.
- Reuse.
- Compostable.

Top tips:

- You could bring in example materials from cafes or takeaways such as plastic containers, plastic bottles, cardboard food boxes, compostable coffee cups and bamboo utensils if you can – to give children more choice of what to experiment with.
- Encourage children to think of other solutions to this problem as well – such as stopping the sale of plastic water bottles and just providing a water fountain or asking customers to bring their own coffee cups.

Keywords:

- Climate crisis.
- Plastic waste.
- Greenhouse gas.
- Landfill.
- Recycle.
- Reuse.
- Compostable.

Activity 4: Waste Warriors – Activity Guide

Wanted: Supplier of recyclable or reusable food and drink containers!

We are opening a new cafe in our new park, Smeaton Park, and are looking for a company to supply non-plastic food and drink containers. We want to have a zero-waste policy and not use any plastic that will go to landfill. Can you help? If John Smeaton were alive now, we are sure he'd have an innovative solution for this problem, but do you?

Your challenge:

To experiment with different materials to use as food and drink containers, record your results and then share with your group, deciding which is the best.

Discussion points:

- Why is plastic bad for the environment?
- What are the alternatives to plastic for serving food and drink?
- What do you think the pros and cons of different materials would be?
- What will you be looking for when you test out each material?

Get started

First, get a selection of materials ready for testing

Decide how you are going to test each one and what you are going to record. For example, you might want to make notes or take pictures, or you might want to record your results in table.

Test it out:

Now test out each material by either filling it with water to see if it would carry liquid or wrapping it around the two slices of bread to see if it would be suitable for carrying food. How does each one perform? What do you notice? Would it be different if the food or drink were hot or cold? Make notes of your findings.

Share with your group:

Share your findings with the rest of the group and see if others came to the same conclusions as you. Discuss what other options there would be for reducing waste in the café.

Further your learning:

You could think of a food menu which would reduce waste by using the same ingredients in multiple recipes, or research vegan or plant-based recipes.

Activity 5: Wind Wizards – Teacher Guide

About this activity:

In this simple activity, children will design and make a windmill and test it to demonstrate wind power. Children can either do this activity alone or in groups or pairs.

What you need:

- Squares of paper, around 20cm squared – one for each person (or pairs if you'd prefer).
- ard or paper to make the tube, or toilet roll tubes – one for each person (or pairs if you'd prefer).
- Split pins, or drawing pins and blu-tack to stick them in to.
- Safety scissors.

What to do:

1. Explain that you will be making models of wind turbines and introduce the letter from the Smeaton Park developers. Introduce John Smeaton and his work and explain that he conducted lots of tests and experiments to test the efficiency of machines such as windmills and watermills.
2. Discuss what wind power is and why we need it with the group, you can link this to the climate crisis and topics around renewable energy if you have explored this with children.
3. Give each child or pair the kit they need – one square piece of paper, one pin, and one piece of paper or card to make the tube (or a toilet roll tube if you'd prefer).
4. Give out the activity guide so that children can follow the instructions to make their windmills.
5. Now ask each group to test their windmills, either by blowing on them, taking them outside if there is a breeze, or by using a fan.
6. Discuss which windmills work best and why this is.
7. You could extend the task by using a timer or stopwatch and seeing which windmill is the most efficient and generates the most power – the one which has the most revolutions in a timed period.

Health and Safety

- Be careful with the drawing pins and scissors – ensure children are always supervised.

Activity 5: Wind Wizards – Teacher Guide

Top tips:

- You can find free templates online for making the pinwheel if this is easier.
- There are lots of variations of this activity, you can also make windmills with paper cups, or even extend the task and use STEM kits and motors if you'd like to challenge the group!

Keywords:

- Wind power.
- Kinetic energy.
- Rotor.
- Convert.
- Green energy.
- Turbine.
- Motor.

Activity 5: Wind Wizards – Activity Guide

Dear Investigators

The great John Smeaton conducted tests on the efficiency of windmills and watermills, and as we are creating a brand-new park in his name – we think we should install a wind turbine! We've heard that one wind turbine can power a small farm or house, so we think it should be fine to generate enough electricity to power the café and toilets at Smeaton Park. We'd like you to design a model for a wind turbine and test it to see if it works, how does that sound?

Yours,
Smeaton Park Developers

Your challenge:

Create a small windmill that turns when wind blows, test it out and record what works and what doesn't work!

Discussion points:

- Do you know what windmills were originally used for?
- What sort of energy does wind create?
- Why are wind turbines becoming more popular?
- Why do we need to rely more on types of 'green energy'?

Get started

First, make your tube which hold your windmill – either use a toilet roll tube or roll up a piece of paper or card and tape it into place. Using safety scissors, carefully make a small hole about one inch down from the top of the tube – this is where your pin will go through to hold your windmill. Next, you need to make your sails using your square piece of paper:

1. Use a ruler to draw two diagonal lines across the page in both directions.
2. From each corner, cut halfway along the lines to halfway to the middle of the paper.
3. Bend each of your corners into the middle and hold them down – bend don't fold to create a sail shape.
4. When all 4 corners are in the middle, push the pin through the centre to hold them in place.
5. The push your pin through the hole in your tube and open out the sides of the pin to keep it in place.

Activity 5: Wind Wizards – Activity Guide

Test it out:

Now your windmill is finished – you can see if it works! Either blow air onto the sails, take it outside if there is a breeze, or use a fan to blow air on to the windmill. Note down your findings – does it work? How fast do the sails move? Is there anything you could do to improve the efficiency?

Share with your group:

Share your windmill model with the rest of the group, look at other people's work and see how efficient they are.

Further your learning:

You could make a wind farm by putting all the windmills together and blowing air across all of them or conduct some tests with a timer to look at the energy efficiency!

Activity 6: People Power – Teacher Guide

About this activity:

This challenge is inspired by John Smeaton's ethos of creating things "for the public good." Children will conduct a research survey and record and sharing the results. The focus is on what members of the local community would want to see in a new public space, encouraging learners to think about use of public spaces, design, and community.

What you need:

- Paper/notebook or clipboard.
- Pens or pencils.
- Computers if preferred– could be used to design and make surveys or record results.

What to do:

1. First, introduce John Smeaton's ethos of works "for the public good." You could discuss this and about how Smeaton was hugely influential in civil engineering and didn't patent any of his work, so people were free to use and adapt his designs.
2. Then, introduce the story of Smeaton Park, and the dilemma of the developers. They want to develop a new park but don't know what to put in it. Can the children help by conducting a survey and presenting their results?
3. Discuss the questions children might want to ask and help them design their survey.
4. Then give children time to conduct their surveys – this could be done during school time and by surveying members of their class or school, or they could survey people at home. Once the surveys are complete, ask children to collate their results – this could be via a tally chart, pie chart, bar chart or by using percentages. Use whatever method is appropriate for your group and learning stage.
5. Ask children to share their results and then have a final discussion about the findings.

Health and Safety

- Remember to instruct children never to approach strangers to conduct their surveys.

Activity 6: People Power – Teacher Guide

Top tips:

- Children could decide how to present their results in a creative way through doing a presentation or making a poster.

Keywords:

- Community.
- Public Spaces.
- Survey.
- Evaluation.
- Statistics.
- Percentage.

Activity 6: People Power – Activity Guide

Dear Investigators

You may have heard, but we have secured the funds to develop a new public space to celebrate the work of John Smeaton, Smeaton Park! The only problem is... we don't know what to put in it! We think we should ask the public what they'd like to see, as John Smeaton believed in "The Public Good" - so this should be visible in the park too. Can you conduct a survey asking what people would like to see in a park and share your results? This will really help our plans!

Thank you,
Smeaton Park Developers

Your challenge:

Conduct a survey with either members of your school or members of the community to find out what people want to see in a new park, then record and share your results.

Discussion points:

- What do you understand by "for the public good"?
  Why was this important to John Smeaton?
- What do you think we should see in a new park?
- Why is it important to ask people their views and opinions?
- Who you think you should ask to get a wide range of responses?
- What are the different ways of asking questions in a survey?
- How can you record your results?

Activity 6: People Power – Activity Guide

Get started

First, design your survey and plan the questions that you want to ask.

There are lots of different ways of asking the questions, such as open questions (what would you like to see in a park?) or multiple-choice questions. Here are a couple of examples:

1. What features would make you visit a new park in town?

2. When you visit a park, what do you think are the most important features? Tick the three most important features to you:

Toilets	Cafe
Play area	Woods
Benches	Lake

You could handwrite or type your survey. If your school has the facilities, you could design your survey online and share it via an email link.

Test it out:

Carry out your survey – think about how many responses you need to make your results worthwhile. Remember to never approach strangers to ask them to complete your survey.

Share with your group:

What were your results? Were there any common themes across the group? Share your results with the rest of your class, either through talking about them, or presenting a poster or visual representation of your results.

Further your learning:

You could conduct a research study of local parks in your area and do an audit of what features they already have – how many parks have a play area, or a lake?

Activity 7: Lighthouse Legends – Teacher Guide

About this activity:

Inspired by Smeaton's Eddystone lighthouse, children will design, make and test different towers made from A4 paper and test them for strength, stability and suitability.

What you need:

- Pieces of a4 paper.
- Scissors.
- Materials for testing and paper and pen to record results.

What to do:

1. First, introduce the Eddystone Lighthouse design, John Smeaton's famous lighthouse which he built in Plymouth in 1756. Discuss the success of this design and encourage children to reflect on why it was so successful, and why previous lighthouses failed.
2. Then, give out a few pieces of paper per group and scissors (under supervision).
3. Ask children to design and make a tower shape from one piece of paper which will stand up.
4. When each group has one design, ask them to evaluate why it stands up right.
5. Then, encourage children to design, make and test at least 4 different types of towers – in different shapes, sizes, heights, and using the paper in unusual ways.
6. Encourage children to devise their own ways of testing their towers and recording their data – what are they looking for? How will they record their results?
7. When the tests are complete, ask children to share their results with the rest of the class.

Health and Safety

- Please use safety scissors where possible. Remind children not to walk around with scissors in their hands, but if they must, to ensure they hold them by the closed blades with the blades towards the floor. Always supervise. Always cut at a table.

Activity 7: Lighthouse Legends – Teacher Guide

Top tips:

- Encourage children to think about centre of gravity as a key concept for this work.
- You could provide more materials such as building blocks, Sellotape, card, blue tack if resources allow but this is not essential .
- Encourage children to think about different ways of using the paper – such as corrugating, folding, fanning, making a box, cylinder or prism shape.
- You can use this activity to teach the children about variables – because they have to develop their own ways of testing, they will need to ensure their tests are fair.

Keywords:

- Shape
- Stability.
- Height.
- Weight.
- Gravity.
- Structure.

Activity 7: Lighthouse Legends – Activity Guide

Dear Investigators

Here at the Smeaton Park development team, we've had the great idea to design and build a lighthouse for the new park in the style of Smeaton's Eddystone Lighthouse. We need it to be strong and stable against the weather, and this got us wondering.... which shapes are most stable? Can you conduct some tests looking at towers and their strength and stability, and let us know what you find out?

Yours,
Smeaton Park Developers

Your challenge:

To design, make and build different shaped towers to test the strength and stability of different shapes.

Discussion points:

- Can you think of any famous buildings which have been there a long time? What shapes are they?
- What shapes do you think are stronger than others?
- What does centre of gravity mean and why is this important?
- Why was Smeaton's Eddystone lighthouse design successful?

Get started

First, get your equipment ready – pieces of A4 paper and some scissors.
Try to make a tower out of one piece of paper – what makes it stand up?

Now, design and make at least 4 different types of towers from the paper.
Try to make them all different.

Activity 7: Lighthouse Legends – Activity Guide

Test it out:

Next, develop a way of testing your paper towers. Decide what criteria you are going to use to test them: Are you going to give each one a score out of 3 for strength, stability, and height? Are you going to try to balance pencils on top? Are you going to blow on them to see how they can withstand wind?

Remember to make your tests fair – to get reliable results you need to do the same test with each tower.

Share with your group:

When you have completed your tests, share your results with your group. Are there any similarities in the results across the class?

Further your learning:

You could experiment with different materials to see which materials are strongest, or think about different shapes such as triangles, circles, squares and hexagons and see which is strongest.

Activity 8: Water Wise – Teacher Guide

About this activity:

This activity will teach children about materials, dams and the force of water as they experiment with materials to stop the flow of water.

What you need:

- A plastic bottle per group.
- A range of materials to cover the top of the bottle – e.g., paper, straws, foil, blu tack, card, pebbles.
- Sellotape to fix the materials to the bottle.
- A sink or large washing up bowl to catch the water – or do this outside!
- Paper/notebooks and pens to record results.

What to do:

1. First introduce the narrative and the concept of water converting into energy, explaining what dams and weirs are. Explain that you are going to test out different materials that could be used to stop the flow of water, like a dam does.
2. Give out the equipment, ensuring each group has a plastic bottle half full of water, a range of materials to choose from, Sellotape, and a way of recording their results.
3. Set the children off testing out the different materials, encouraging them to record their results as they go along.
4. Share the results as a class, talking about which materials and methods were most effective.

Health and Safety

- To ensure that children don't slip have a mop nearby or do this activity outside.
- Do this outside if it's a nice day to reduce mess and risk of slipping.

Activity 8: Water Wise – Teacher Guide

Top tips:

- If you use a large washing up bowl to catch the water which escapes, you can reuse it by pouring it back into the bottles
- You could demonstrate the force of water and kinetic energy by using a bottle with a sports cap and squeezing it out – and asking how this is different to water being free flowing
- If you have more equipment, you could also experiment with making a dam – there are lots of guides online for doing this!

Keywords:

- Force.
- Energy.
- Hydropower.
- Flow.
- Dam.
- Kinetic energy.

Activity 8: Water Wise – Activity Guide

Hi Team !

Did you know that John Smeaton is also famous for developing water wheels, using water as a way of generating power? They used to be used to operate mills and grind grain, but now water can be used to generate electricity (hydropower!) For water to generate electricity it must have force behind it, and one way of doing this is to alter the flow by creating a dam! Smeaton Park is surrounded by a river, and so we'd like to create a hydropower source. We need your help to conduct some initial tests into water flow and what materials to use, can you help?

Many thanks,
Smeaton Park Energy Department

Your challenge:

Test out different materials and see which are the best at stopping and altering the flow of water.

Discussion points:

- Is it possible to speed up or slow down the flow of water?
- Do you know how dams work? Can you explain this to a friend?
- Why is a drop from high to low important for generating energy from water?
- Why does water need to be moving to be converted into energy?
- Why are renewable energy sources important?

Get started

First, make sure you have all your equipment ready – your water bottle needs to be half full, and you need to have a variety of materials to experiment with.

Conduct one initial trial by sellotaping or holding a piece of card on top of the water bottle, and then holding it upside down over a sink or bucket, or outside. Does this stop the water from flowing? For how long?

Activity 8: Water Wise – Activity Guide

Test it out:

Now conduct a variety of tests by using different materials and methods for stopping and altering the flow of water out of the bottle. Try using blue tack, making a cork out of paper, foil, plastic, a ball of string, twigs, anything you can get hold of!

Try different ways of securing and holding the material against the bottle.

What would happen if you covered only half of the bottle opening and then squeezed it – would narrowing the opening alter the flow of water?

Think about what you want to measure and find a way to record your results, you could use a table like this:

Material	Test 1 – fully covered bottle opening	Test 2 – half covered bottle opening	Test 3 – scrunched up inside neck of bottle
Cardboard	Held water in for 3 seconds then fell off	Fell off after 2 seconds	Slowed water down – took 93 seconds to empty
Sellotape	Held water in for 30 seconds	Slowed water down	Slowed water down – took 75 seconds to empty

Share with your group:

Share your findings with the rest of your group – what conclusions have you drawn from this experiment?

Further your learning:

You could get a large container of water and make a dam, experiment with using stones, twigs, blue tack or plasticine to stop the flow of water.

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