

SCOUTS

Scientist

Two weeks of experiments for the activity badge.

How to earn your badge:

1. Plan and complete three science experiments or activities.
You could try making invisible ink, creating an eruption, Or design a catapult.
2. Change something about the experiment or activity and try it again, at least once. Predict what you think will happen and find out if you were right.
Show that you understand the science behind your experiment or activity.
3. Find out how one of your experiments or activities links to the real world.
Then, explain it to others. For example; If you created an eruption, how similar or different is this to how volcanoes erupt?



Programme Planner - Week 1

Arrival	House of Cards Challenge 1
Activity	1. Fizzing Fruits (volcano)
Activity	2. Build a Bridge (loads and tension)
Discussion	About the activities

Programme Planner - Week 2

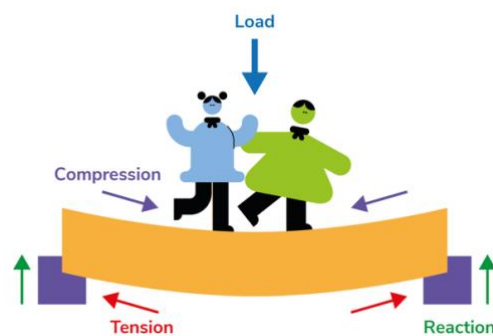
Arrival	House of Cards Challenge 2
Activity	3. Dye Another Day (natural colourings)
Activity	4. Spy Letters (invisible ink)
Discussion	About the activities

Shopping List:

- Packs of Cards
- 1. Knife, Baking Tray, Spoon, Jug, Newspaper, Goggles, Syringe, Washing Up Liquid, Bicarbonate of Soda, White Vinegar, Food Colour, Oranges & Apples
- 2. Pens and Pencils, Scrap Paper, Scissors, Ruler, Craft Materials (i.e. tissue paper, pipe cleaners, stickers), Weights (i.e. coins)
- 3. Disposable Gloves, String, Rubber Bands, Cotton Squares, Salt, Vinegar, Buckets, Wooden Spoons, Spinach, Beetroot, Onion Skins
- 4. Lemons, Spoon, Cups, Paper, Cotton Buds, String, Pegs, Hairdryer, Candles, Food Colour

Printing:

- All Instruction Sheets



How to run each part of the programme

House of Cards Challenge

How: Young people use cards to make a stacking pyramid of cards and don't shake the table.

Fizzing Fruits (volcano)

Prep: Cover the table.

How: Slice off the top and carefully cut or scoop out the flesh with a spoon. You need to scoop out at least enough flesh to hold the fairy liquid, food colouring, and vinegar and place on a baking tray. Make the volcano:

1. Squirt two teaspoons of washing up liquid into the fruit, then add a few drops of food colouring.
2. Add two or three teaspoons of bicarbonate of soda to the washing up liquid in their fruit.

The fruit volcano may start to fizz.

Create an eruption:

1. Everyone should stand back.
2. An adult should put on protective goggles. They should use a pipette or syringe to carefully add white vinegar into the fruit, one drop at a time, until it reacts.
3. Repeat the experiment with a different fruit. They could change the amount they add of the different ingredients to see how it affects the volcano.

Build a Bridge (loads and tension)

How: Everyone works as part of a team.

1. Set the scene with this mission brief:

'A Scout is planning their next adventure and is looking for an enthusiastic team to help! Your team needs to help them navigate through the jungle and cross the river passing through it. You'll need to design and build a portable bridge that can support you and your equipment whilst you cross the river. Before you embark on this adventure you need to build a model of your bridge and test it'.

2. The task requires everyone to come up with a design of a bridge to span a gap, using only the materials listed. Factor in the weight of each bridge, the budget each team has and include costs for the materials.

2. Before everyone splits into groups, agree on some design feature rules for the bridges – namely, how wide the gap they need to span is. The bridge must span a gap of 30cm, be removable after crossing without leaving structures behind, be at least 10cm wide, within 30-60g in weight, and be able to carry up to 800g as a maximum load. Everyone should use the 'Materials price list', work around costs (for example, sticky tape - £100 per roll, string - £50 per ball) and have a £6,000 budget for the whole project. Points should be deducted from teams that overspend on equipment or produce bridges that are too heavy.

3. Everyone also needs to agree upon what must have happened for a bridge to have failed. This could either be total collapse of the bridge or a certain amount of deflection in the centre of the bridge. 'Deflection' is a term engineers use for the amount a structure bows or moves under a load.

4. The group should then discuss the different forces that act on a typical bridge. These are an important factor if you're designing bridges that need to be able to bear a load without bowing or collapsing. Show everyone the bridge image to get them thinking about this.

5. Now that everyone's clear on the kind of bridges they need to make, everyone should split into small groups of three or four people. Give each group their set of squares from the 'Bridge type cards' to pair up and give them some inspiration as they try to come up with a bridge design of their own. Groups should use pens, pencils and paper to sketch their own designs.

6. Each group should settle on a design by having each person create their own, individual designs, and then pooling them together, so that the best ideas can be seen by everyone and agreed upon. This is known as 'divergent-convergent' thinking. Hopefully, this should allow groups to produce bridges that use a combination of everyone's best ideas.

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7. Once a finished concept has been drawn, teams should decide which materials will work best for their bridge design, how big they should make it and how the different parts should be made. Each person should be assigned specific tasks, whether that's managing the budget, sourcing materials, construction or testing.
8. Begin building the bridges, with each person in each team taking responsibility for their tasks.
9. Once the building is completed, bridges should be tested to see that they meet the criteria set out by all the groups for all the groups. Bridges should be weighed to check that they're light enough to be portable. Budgets should be checked against the total budget to see that no-one has overspent. Set up bridges one at a time on the replica river made earlier. The bridge should span the full width.
10. To test load, set up the bridge over the river and add the agreed-upon weight in small amounts. Take care at this point not to break anything, as it may be possible to improve the bridges so that they pass this test.
11. Groups should take back their bridges and think of at least one thing they can change or improve to help the bridge meet the agreed-upon criteria. This may be a feature that failed under testing, or came close to failing. Ideas should be tested independently before being added to the finished bridge.
12. Test the improved bridges to see how they do this time around. Groups need to decide whether their changes made a difference – for better or worse. In any time that's left, groups should keep testing, trying new ideas or features and check their findings, until they can draw conclusions on the best possible materials, scale and features of their design.

Dye Another Day (natural colourings)

Prepare the fabric: To prepare your chosen fabric, mix half a cup of salt with eight cups of water and bring it to the boil. Add the fabric and leave to simmer in the solution for at least half an hour, stirring often, before dyeing. Anyone using vegetable-based dyes should mix one part vinegar with four parts water instead of salt, add the fabric, leave to simmer and stir in the same way, before dyeing.

Any piece of white natural cotton or linen could be used. Remove fabrics carefully from the hot water with tongs and place them in a sieve. Supervise this bit closely! Run under some cool water from a tap. When cool, wring out the excess water.

The fabric is now ready to be tied. Using a copy of the 'Tie-dye folding instructions,' everyone should use rubber bands or string to tie it up tightly to create their pattern.

Prepare the dye: To prepare the dye, put on the gloves and begin cutting the natural materials into small pieces on your chopping board. Put the pieces in a pot and pour over water. This is usually two parts water for every one part of the material, but for powders like turmeric, use three or four cups of water for every one or two tablespoons.

Bring the mixture to the boil and simmer for at least half an hour. The longer it simmers, the more colourful the dye should turn out.

When done, carefully strain the dye into a large container that the fabric fits into, and leave to cool.

How: Tie and dye the fabric

1. Everyone ties the fabric to one of the patterns.
2. Everyone will need to wear gloves. Place the tied-up fabric into the container with the dye and leave it to sit for a while.
3. Once the fabric has turned the desired colour, carefully remove each piece of fabric from the dye and rinse it with cool water. Do this until the runoff water runs clear.
4. Remove the rubber bands or string and hang the fabric to dry. Hang the fabric outside if possible. Think about covering the floor beneath any fabric drying inside.

Spy Letters (invisible ink)

How: Get into pairs.

1. Give out some paper and paintbrushes. Natural or recycled paper that's unbleached will work best, as it's not been treated with chemicals.
2. Pour out the bottle of lemon juice into a few bowls or cups, then give them out. You could add a few drops of water, as this will make it even more invisible and harder to see.
3. For older groups, they could chop and use fresh lemon. They'd need to carefully cut it in half on a chopping board with a knife, and juice half of it into a cup or small bowl.
4. Everyone should use the lemon juice to write their message on a piece of paper. It could be a simple hello, their favourite thing to do in Scouts, a fun fact about themselves, or something they like about the person they're writing to, such as 'You tell the best jokes'.
5. Once people have written their message, they should write the name of the person it's to in pen and leave to dry. You could hang them on the washing line. It can take up to 30 mins for the messages to dry. As it dries, the lemon juice becomes harder to see.
4. Once the messages are dry, people should collect the message that has their name written on it in pen.

Reveal your message

1. When the messages are dry, people can use the hair dryer to reveal them.
2. In turns or in small groups, people should peg their message to the washing line. This is so it can't blow away.
3. Carefully use the hairdryer to gently warm up the paper, to reveal the message. Always have adult supervision and hold the hairdryer away from the paper to stop the paper from catching on fire. You can move the hairdryer around the paper to reveal the message.
4. Once everyone's revealed their message, gather back in a circle. Anyone who wants to can reveal their message. They could try to guess who it's from.