THE
JAMES
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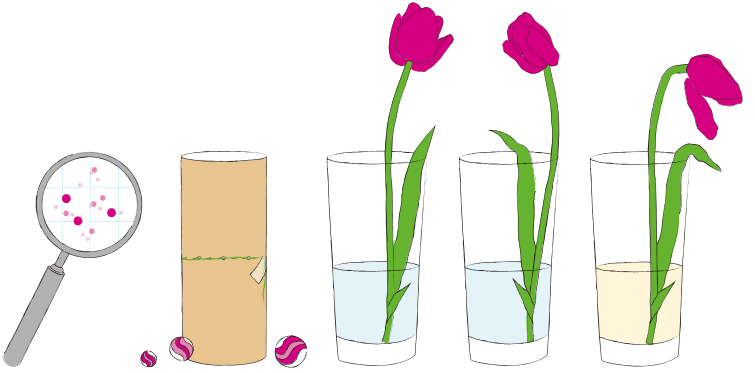
FOUNDATION

CHALLENGE CARDS

Three air pollution themed engineering and science challenges from the engineers at Dyson.



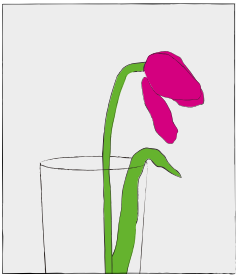
Please note that the activities contained in here are intended for children ages seven and above. Adult supervision is recommended for all projects.

About the challenges in this pack

Acidic Rain

Science challenge

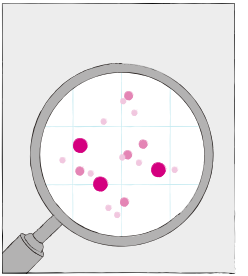
Acid rain is a form of acid deposition which is damaging to water, wildlife, forests, crops and man-made structures, caused by air pollution. We'll learn how acid rain can affect plants.



Particle Fishing

Science challenge

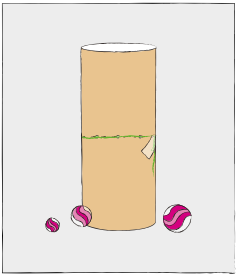
Particulate matter is a form of air pollution that includes things like dust, pollen and smoke. We will collect this particulate matter to understand what areas might be more polluted.



Marble Madness

Engineering challenge

Filters are used to help purify the air by capturing gas and particulate matter pollution. We will understand how filters capture different sized particles.



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SCIENCE
CHALLENGE

ACIDIC RAIN

Observe the effects
of acid rain on plants

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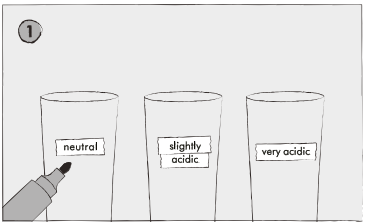
Instructions for Acidic Rain

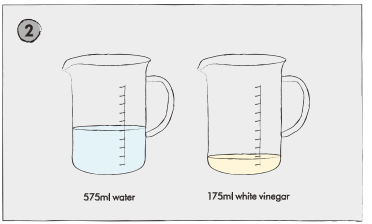
1. Place the glasses in a line and label them as 'neutral', 'slightly acidic' and 'very acidic'.
2. Fill a measuring cup with 575ml water and another one with 175ml white vinegar.
3. Pour 250ml water in 'neutral', followed by 200ml water and 50ml white vinegar in 'slightly acidic', and then the remaining water and white vinegar in 'very acidic'. Mix the contents well with a spoon.
4. Place a flower in each glass and observe for 24 hours.

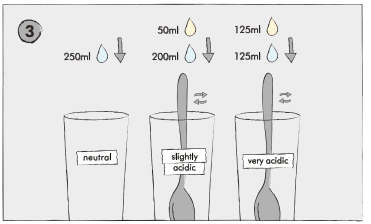
Top tip: If you can't find fresh flowers, use the petals of shop-bought flowers instead. Place these petals individually in the glasses to see the changes. Using white or a lighter coloured petal works best.

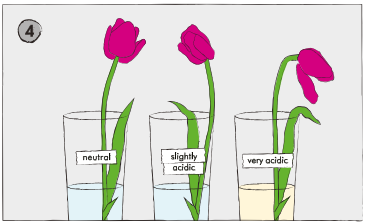
Materials

- Three freshly picked flowers
- Three glasses
- Two measuring cups
- Marker
- Masking tape
- Spoon
- 575ml water
- 175ml white vinegar









How does it work?

Acid rain is a form of acid deposition where chemicals released from pollution sources react with moisture in the atmosphere to form nitric and sulfuric acid. These acids are damaging to water, wildlife, forests, crops and man-made structures. Most drinking water has a neutral pH of 6.5–8.5. By adding an acid, in this case white vinegar, the pH is lowered into the acidic range (below 6.5). Plants are sensitive to changes in the pH of water, affecting their quality and growth.

SCIENCE
CHALLENGE

PARTICLE FISHING

Collect particles to
observe air pollution

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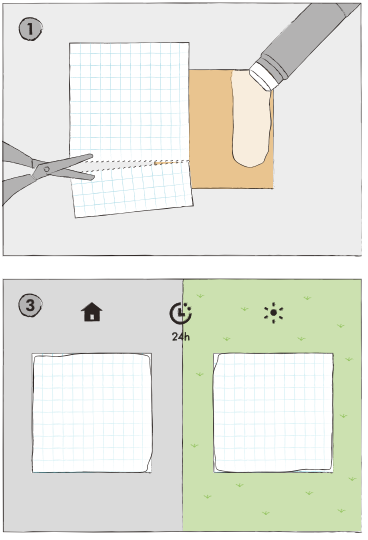
Instructions for Particle Fishing

1. Trim the graph paper to fit each piece of cardboard. Then, mount the graph paper onto the cardboard with a glue stick.
2. Using a spoon, apply petroleum jelly onto the graph paper.
3. Place one graph paper card indoors and the other card outdoors. Leave them undisturbed and retrieve after 24 hours.
4. Use a magnifying glass to count the number of particles on each card. Calculate the average by adding up the number of particles and dividing it by two (the number of cards).

Materials

- Graph paper
- Two pieces of cardboard
- Scissors
- Glue stick
- Spoon
- Petroleum jelly
- Magnifying glass



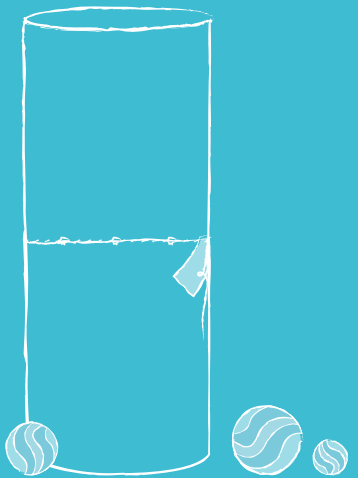
How does it work?

Particulate matter (bits of solid and liquid in the air) is a form of air pollution that includes things like dust, pollen and smoke. Many of these particles are so small they cannot be seen by the naked eye. These particle collectors allow us to observe some of the particulate pollution present in the air that we breathe.

ENGINEERING
CHALLENGE

MARBLE MADNESS

Study the movement of
air pollution through a filter



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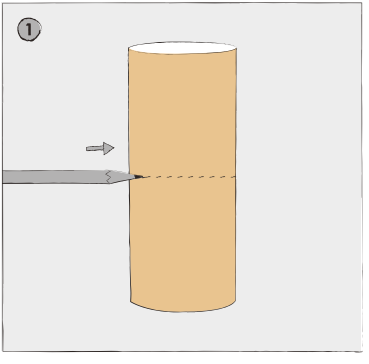
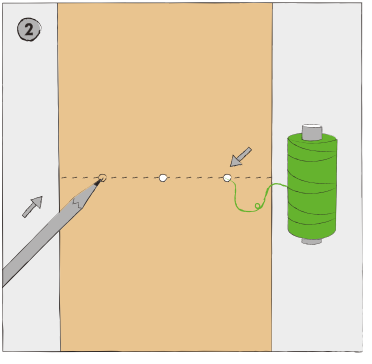
Instructions for Marble Madness

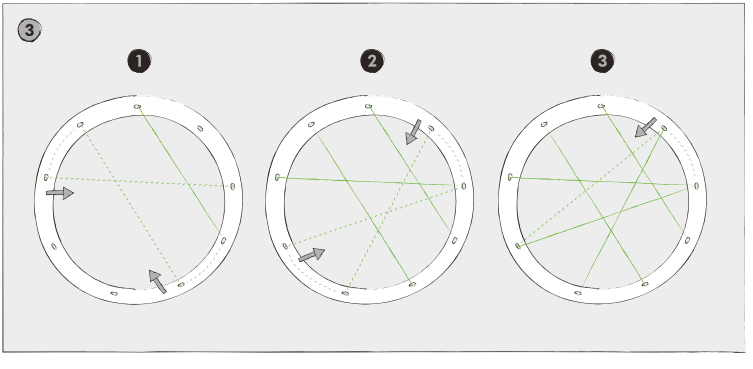
1. Divide the toilet paper roll into two equal parts and draw a line across the middle.
2. Use a pencil to poke holes around the diameter of the toilet paper roll. Ensure that each hole is around 3cm apart and is big enough to thread the string.
3. Thread the string through the holes and cross the toilet paper roll each time with a minimum of six crossovers.

Materials

- Toilet paper roll
- Pencil
- Scissors
- String
- Sticky tape
- Three marbles of different sizes





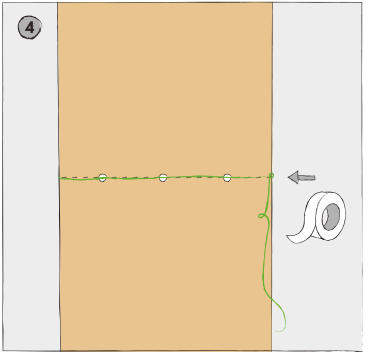


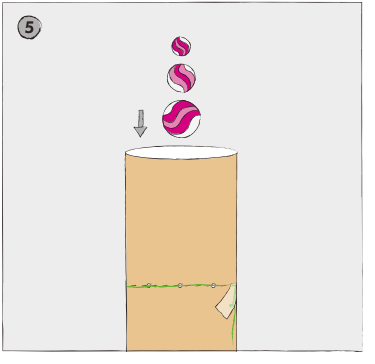
Instructions for Marble Madness

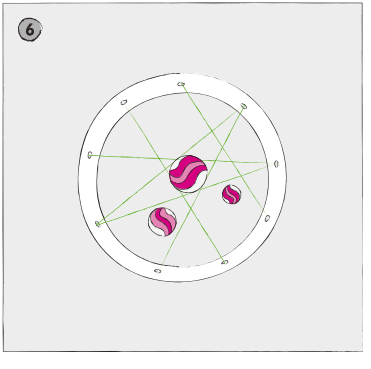
4. Tape down the ends of the string on the toilet paper roll. Make sure that the string is kept tight and under tension.
5. Drop the marbles through the toilet paper roll, starting with the largest going to the smallest.
6. If a marble falls all the way through, add more crossovers with the string.
7. Repeat the process until all the marbles are captured in the toilet paper roll.

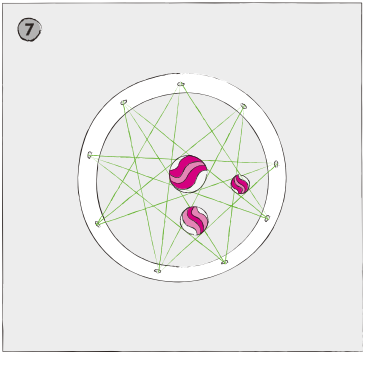
How does it work?

High efficiency filters in air purifiers use multiple layers of overlapping and interwoven fibres to capture particles from the air. Particles come in many shapes and sizes, sometimes as small as PM0.1 microns. By varying the layers of filter and the number of strands, the more effective the filter is at removing the smallest of particles from the air.









We want to inspire the next generation of engineers and scientists and we want to do this through hands-on learning and experimentation.

James Dyson
Chief Engineer

The James Dyson Foundation encourages young people to think creatively and invent. Through free educational resources and workshops, we introduce the exciting reality of a career in engineering.

These challenges were designed by Dyson engineers to encourage inquisitive young minds to get excited about engineering.

If you enjoyed them, download a set of 40 cards from our website www.jamesdysonfoundation.com.

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