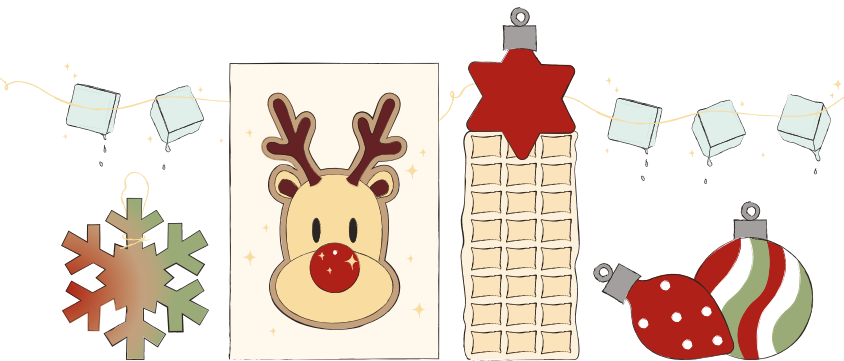


CHALLENGE CARDS

Four Christmas themed engineering and science challenges from Dyson engineers.



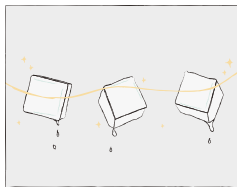
Please note that the activities contained in here are intended for children ages seven and above. Adult supervision is recommended for all projects.

About the challenges in this pack

Frozen Bunting

Science challenge

When the temperature outside falls below zero, the roads can become slippery. With this challenge, you can understand why salt has such an important part to play during winter whilst creating gravity defying frozen bunting.



Christmas Chromatography

Science challenge

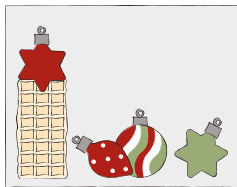
It is a common Christmas tradition to decorate a Fir tree with colourful ornaments and tinsel. You can make your own decorations this year using chromatography.



Chocolate Chimney

Engineering challenge

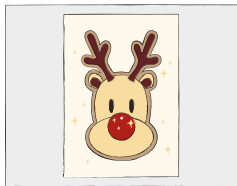
As Father Christmas makes his journey around the world, he often uses a chimney to deliver his gifts. Now you can make your own edible chimney through welding chocolate.



Circuit Christmas Card

Engineering challenge

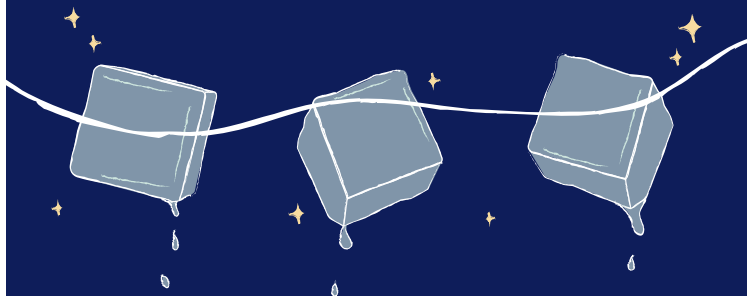
Many people give cards around Christmas to express their good wishes. With this challenge, bring your cards to life using a simple electrical circuit that will give Rudolph his famous shining red nose or make a Christmas tree with a shining star.



SCIENCE
CHALLENGE

FROZEN BUNTING

Use the effects of salt melting ice cubes
to make your own frozen bunting.



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Instructions for Frozen Bunting

1. Cut the cotton string to your desired length. The longer the string, the longer the bunting will be.
2. Fill the bowl with water and place the ice cubes in the water, allowing them to float. Then, sprinkle salt on top of one ice cube.
3. Lay string across one ice cube and hold for 30 seconds.
4. Gently lift the string out of the water and your ice cube will be attached. Repeat steps 2 and 3 to make the rest of your frozen bunting.

Materials

Medium-sized bowl

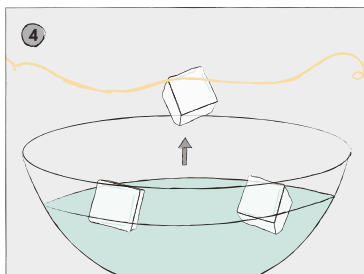
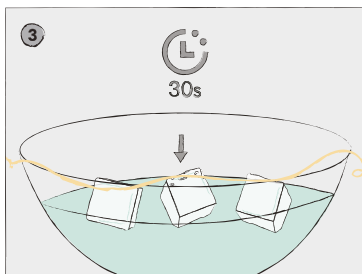
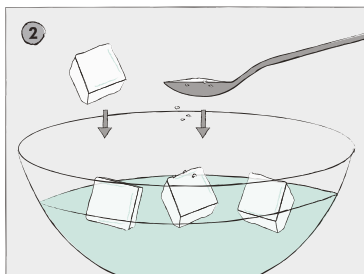
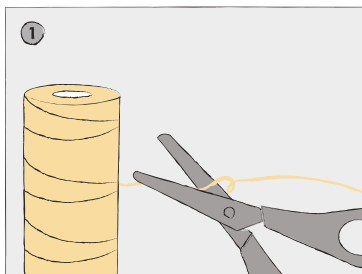
Enough water to fill the bowl

Three to five ice cubes

One teaspoon of table salt

Scissors

Cotton string



How does it work?

Sodium chloride, also known as salt, lowers the freezing point of water, causing ice to melt even when the outside temperature is below water's normal freezing point of 0 degrees Celsius. This is why we use salt on the roads when there's snow and ice to make them less slippery.

SCIENCE
CHALLENGE

CHRISTMAS CHROMA- TOGRAPHY

Make colourful snowflakes by
separating ink molecules.



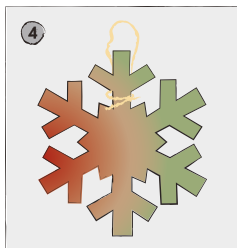
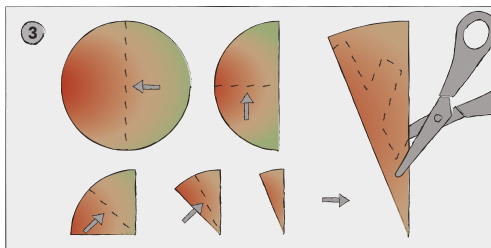
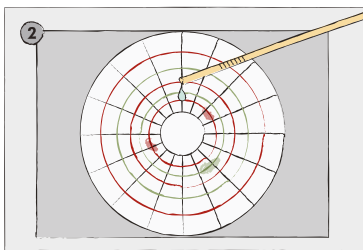
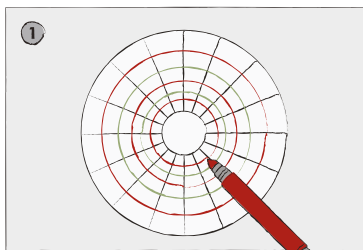
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Instructions for Christmas Chromatography

1. Draw circles in different colours on the coffee filter paper.
2. Place the filter paper over some scrap paper. Fill your straw with water and place a few drops around the middle of the filter paper. Watch the colours begin to disperse.
3. Wait for the coffee filter paper to dry. Once it's dry, fold it in half four times until you get a thin triangle. Then, cut the shape as shown on your folded triangle.
4. Unfold the folded triangle to reveal your colourful snowflake. Tie a cotton string onto your snowflake and hang it up.

Materials

- One white coffee filter paper
- Washable markers
- Scrap paper
- Straw and a cup of water
- Scissors
- Cotton string



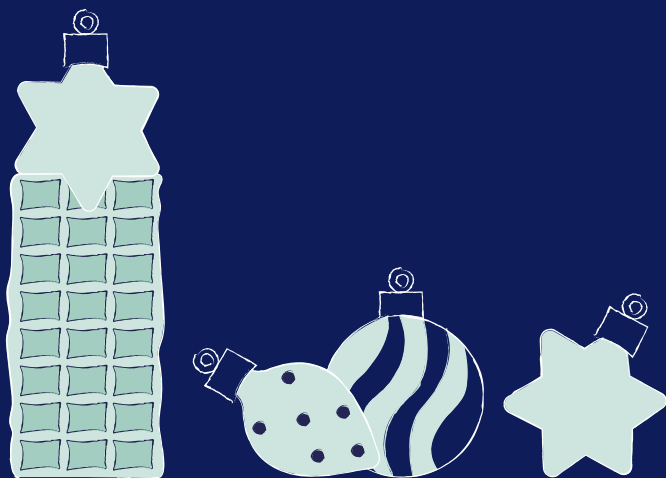
How does it work?

Chromatography is a technique used to separate mixtures. Since ink molecules weigh different amounts, as the water moves through the coffee filter paper, it drags the lighter ink molecules with it, leaving the heavier ones behind. This causes the colour to spread apart.

ENGINEERING
CHALLENGE

CHOCOLATE CHIMNEY

Use the process of welding to
make a weight bearing chimney.



Instructions for Chocolate Chimney

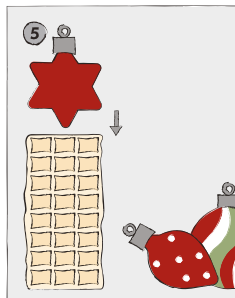
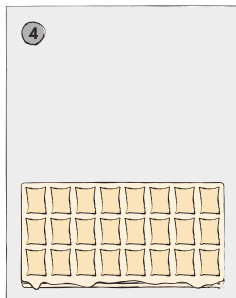
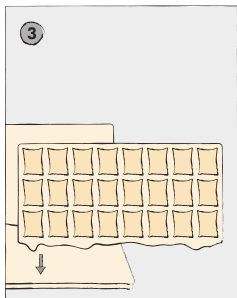
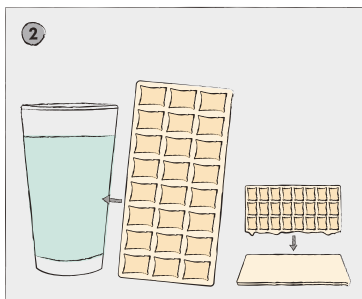
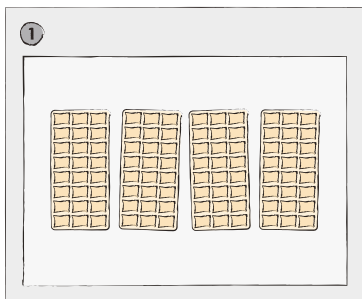
1. Place your wax paper on a flat surface and line up the four chocolate bars. Make sure that each chocolate bar is the same size.
2. Take one chocolate bar and hold the long edge against the glass of hot water until it starts to melt. Then, weld this onto another piece of chocolate.
3. Repeat step 2 twice, creating a box-shaped structure with all four chocolate bars. This is your chimney.
4. Leave your chimney to cool and set, putting it in the fridge will speed up this process.
5. Once set, stand your chimney upright and see what Christmas ornaments you can balance on top of it.

Materials

Four white chocolate bars
Wax paper
A glass of hot water
A few small Christmas ornaments

How does it work?

Welding as a fabrication process is usually metals or thermoplastics that use heat and pressure to form a secure joint once the pieces are cooled.



ENGINEERING
CHALLENGE

CIRCUIT CHRISTMAS CARD

Build your own light up Christmas card using an LED light and a battery.

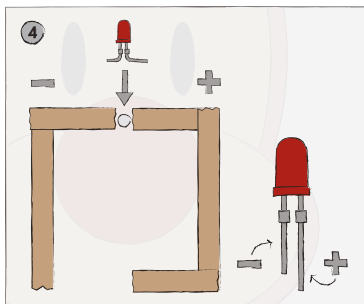
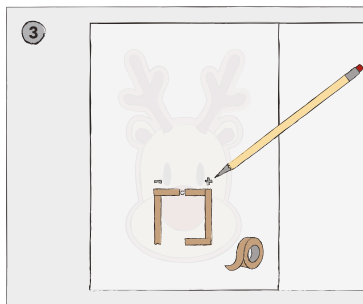
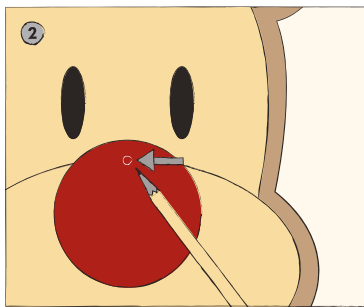


Instructions for Circuit Christmas Card

1. Colour in the Christmas card template.
Then, fold your blank card in half and glue your design onto the front of your card.
2. With adult supervision, use a pencil to puncture a small hole through the front of your card.
3. Open your card and stick the copper tape to mark the shape as shown. Use the pencil to mark the left side of the tape with a minus and the right side with a plus.
4. The LED light has one longer, positive metal prong and one shorter, negative metal prong. Place the positive metal prong over the copper tape marked with a plus and secure it in place with copper tape. Do the same for the negative metal prong.

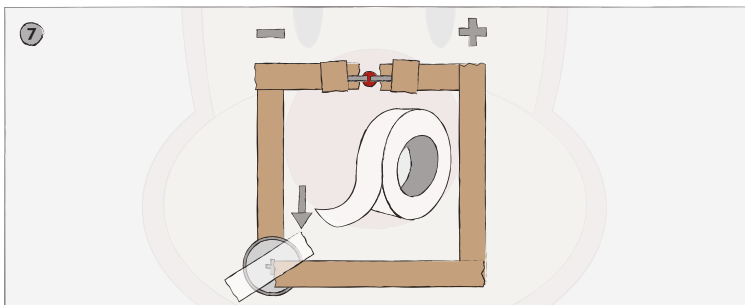
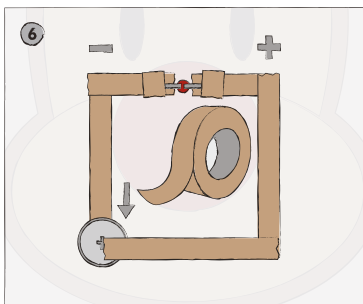
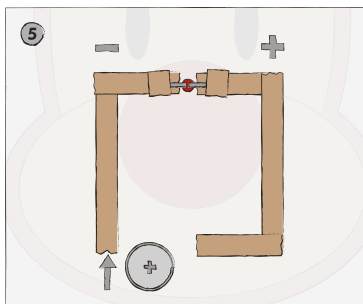
Materials

- One lithium coin battery
- One diode LED light
- Copper tape and sellotape
- Glue stick and scissors
- Colouring pens and pencil
- A blank A4 size card
- Christmas card template



Instructions for Circuit Christmas Card

5. The battery has a positive and negative side, marked with a plus for positive and minus for negative. Place the negative side on top of the copper tape marked with a minus.
6. Add more copper tape to the positive section so that it sits on top of the positive side of the battery. Make sure the positive and negative sections of the copper tape aren't touching.
7. The circuit is complete. Once the LED light turns on, secure the battery with sellotape.



How does it work?

A circuit is a complete path around which electricity can flow. Electricity passes through the conductive copper tape, linking the battery to the light.

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.

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