



# Year 6 Design Technology Lockdown Learning Tasks



## SPAGHETTI BRIDGES

ENGINEERING CHALLENGE 03

Designed by Kristian,  
Design engineer at Dyson

### The brief

Construct a free standing bridge out of spaghetti, strong enough to support a 250g bag of sugar.

### The method

Think about bracing strands together for strength. Some shapes are better at absorbing loads – triangles are particularly strong. Rubber bands make for good junctions.

### Top tip

Be patient. Through trial and error, you'll become proficient at working with spaghetti.

### Materials

Spaghetti  
Small rubber bands or bag ties  
Sticky tape  
250g bag of sugar

### How does it work?

Bridges manage two important forces: compression and tension – pushing and pulling. Too much of either and they buckle or snap.

### Design icons

Why not take inspiration from these iconic bridge designs?



Beam bridge



Truss bridge



Cable stayed bridge



Arch bridge



Suspension bridge



Cantilever bridge

## CARDBOARD BOAT

ENGINEERING CHALLENGE 07

Designed by Ben,  
Design engineer at Dyson

### The brief

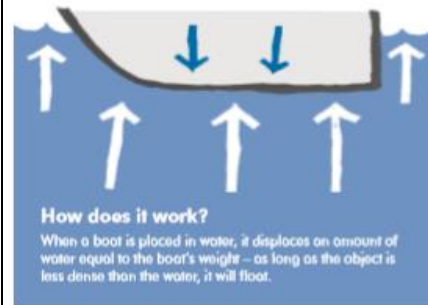
Construct a boat to support up to 250g without sinking.

### The method

1. Draw out the basic shape of your boat on the cardboard, and cut it out.
2. Create walls for your boat from more cardboard.
3. Stick the bottom of the boat and the walls together with tape or glue.
4. Back everything with wax paper or foil – be careful not to leave any gaps where the water can get in.
5. Place the 250g weight in the boat.
6. Set your boat afloat.

### Top tip

Think about stability. Some shapes are more stable than others when a load is applied.



### How does it work?

When a boat is placed in water, it displaces an amount of water equal to the boat's weight – as long as the object is less dense than the water, it will float.

### Materials

Cardboard  
Wax paper  
Tape or glue  
Rubber bands  
Foil  
Scissors (with adult supervision)  
Craft knives (with adult supervision)  
A 250g weight

### Design icons



The SS Great Britain was the first iron steamer to cross the Atlantic. Designed by Isambard Kingdom Brunel in 1845, it was the first ship to combine an iron body with a screw propeller.

## MARBLE RUN

ENGINEERING CHALLENGE 02

Designed by Coco,  
Design engineer at Dyson

### The brief

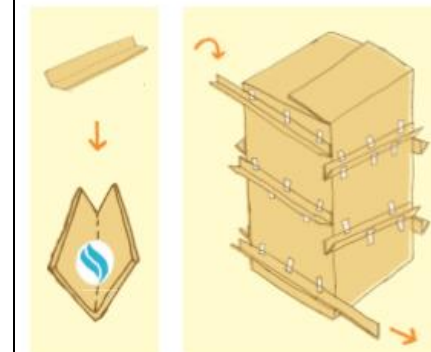
Use a cardboard box and cardboard struts to create a marble run. The marble must run for 60 seconds.

### The method

1. Use sticky tape to attach the cardboard struts to the cardboard box, creating a run for the marble.
2. Place the marble at the top of the run and time how long it takes for it to reach the bottom.
3. Keep improving your design until the marble takes exactly 60 seconds to reach the bottom.

### Top tip

If you can't find cardboard struts, make your own by folding four inch wide strips of cardboard in half to create a V shape.



### Materials

Large cardboard box  
Cardboard struts  
Sticky tape  
Marbles  
Scissors (with adult supervision)

### How does it work?

To help you to control the time your marble takes to run its course you'll need to consider a few factors:

Potential energy = mass x gravity x height

The heavier your marble and higher your slope, the more energy your marble will have.

Friction

The rougher or stickier the surface, the slower your marble will travel.

Angle of the slope

The less steep the angle of the slope, the longer the marble will take to reach the bottom.

# MAKE A PERISCOPE

ENGINEERING CHALLENGE 21

Designed by Guy,  
Design engineer at Dyson

## The brief

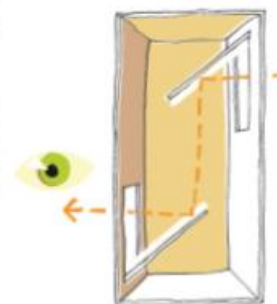
Design and build your own periscope to see around corners.

## The method

1. Remove the box lid.
2. Place one mirror on the side and near the bottom of the shoebox and trace around it. Place the second mirror at the opposite end of the shoe box and trace around that too.
3. Cut out the traced sections to make a door flap. Slant the doors at 45 degree angles.
4. Tape the mirrors onto the slanted doors.
5. Adjust the mirrors. Keep moving them into place until you can see out of the top hole when you look in through the bottom hole.
6. Seal the mirrors into place using PVA glue.
7. Glue the shoebox lid back on.

## Materials

Shoebox  
Two small mirrors  
A pencil  
Scissors  
(with adult supervision)  
Tape  
PVA glue



## How does it work?

Light reflects away from a mirror at the same angle that it hits the mirror. In your periscope, light hits the top mirror at a 45 degree angle and reflects away at the same angle, which bounces it down to the bottom mirror. The reflected light hits the second mirror at a 45 degree angle and reflects away at the same angle, into your eye.



# BUILD A COMPASS

ENGINEERING CHALLENGE 16

Designed by Adam,  
Design engineer at Dyson

## The brief

Build a compass.

## The method

1. Fill the bowl with water.
2. Magnetise the needle by stroking it over the bar magnet about 50 times. Make sure the needle is orientated with the needle pointing to the north of the bar magnet on each stroke.
3. Drop the needle onto the surface of the water – from as close as you can – to let it rest on the surface tension.

## Materials

Water  
Straight bar magnet  
Steel needle  
A bowl



## How does it work?

Once the needle is magnetised it naturally wants to align with the Earth's stronger magnetic field. This field, called the magnetosphere, is created by electrical currents that are generated by a churning molten iron core deep inside the planet. The Earth acts as if it has a bar magnet running through it with the magnet's south pole located near the planet's geographic north. Since opposites attract, the north pole of a magnetised needle is attracted to it.



# BOAT POWERED BY A CHEMICAL REACTION

ENGINEERING CHALLENGE 09

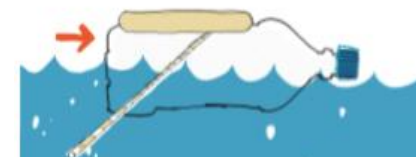
Designed by Rob,  
Engineering reliability  
manager at Dyson

## The brief

Build a boat powered by a chemical reaction.

## The method

1. Tape the cork and ice lolly sticks together to form a triangle.
2. Tape the triangle to the middle of one side of the bottle.
3. Make a hole in the end of the bottle, at the opposite side to the triangle, so it will sit below the water.
4. Push the drinking straw through the hole so the end inside the bottle touches the inside wall.
5. Pour in vinegar and add bicarbonate of soda. Screw the bottle top back on tightly.
6. With a thumb covering the end of the drinking straw, shake the bottle.
7. Once the reaction starts, drop the boat in the water and watch it propel forward.



## How does it work?

When the vinegar and bicarbonate of soda come into contact, a chemical reaction occurs and carbon dioxide is released. This causes pressure to build, gas to be forced down the straw and the boat to be propelled across the water.

## Materials

Small plastic bottle  
Sticky tape  
A cork  
Two ice lolly sticks  
Scissors  
(with adult supervision)  
A drinking straw  
Vinegar  
Bicarbonate of soda  
Somewhere to soil it – such as a bath tub or sink

## Design icons



Rockets use a chemical reaction during lift off. Combining fuel and oxygen causes combustion and exhaust gases are released. These gases exit the engine nozzle at high speed and push the rocket skyward.