Science and Engineering cards 12th March

How many of these Challenges can you complete?

Tweet or Upload to Teams and let us know how you got on.

Good Luck!

CHALLENGE CARDS

40 engineering and science challenges from the engineers at Dyson.

THE JAMES DYSON FOUNDATION

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

SCIENCE CHALLENGE 09

BRIGHT AS A NEW PENNY

THE JAMES DYSON FOUNDATION

SCIENCE CHALLENGE 09

BRIGHT AS A NEW PENNY

Designed by Roy,
Design engineer at Dyson

The brief

Clean a penny using cola.

The method

1. Place the penny in the container.
2. Add enough cola so the penny is covered.
3. Leave overnight.
4. In the morning, you should find that your penny is clean.

Materials

- Shallow container
- Cola
- A penny – the older and dirtier the better

How does it work?

Pennies have a copper coating. As the copper gets older, it reacts with the oxygen in the air and begins to form a copper-oxygen compound. This compound is what makes the penny look dull.

Meanwhile, cola contains phosphoric acid. This acid breaks down the copper-oxygen compound chemical bonds allowing a fresh, unoxidized layer of copper to be exposed.

SCIENCE CHALLENGE 10

INERTIAL EGGS

THE JAMES DYSON FOUNDATION

INERTIAL EGGS

SCIENCE CHALLENGE 10

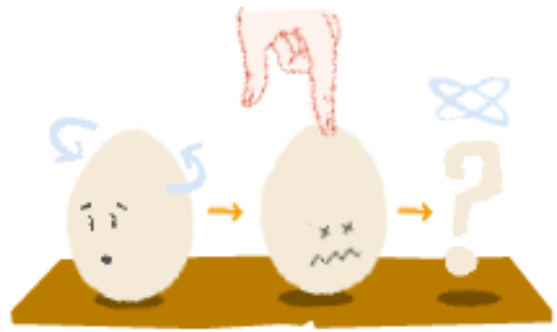
Designed by Tom, Design engineer at Dyson

The brief

Use eggs to find out about momentum and changing direction.

The method

1. Spin each egg, one hard boiled and one fresh, on a table.
2. Leave it to spin for a few seconds then momentarily stop it by placing your finger on top.
3. Release the egg and observe what happens next.



Materials

One hardboiled egg

One fresh egg – the fresher the better

How does it work?

The fresh egg will start to spin again when the finger is released, while the other will remain at a dead stop. The fresh egg has egg fluid and yolk inside it which gains momentum. When the egg is momentarily stopped, the yolk continues to turn inside the shell. When it is released, the viscosity of the fluid between the still spinning yolk and the shell causes the shell to spin again.

Design icons

Inertia is the tendency of a moving object to remain moving or a stopped object to remain stopped. In engineering, flywheels are big, heavy wheels that are spun to gain inertia. The energy is stored and released to smooth out the operation of engines that have a short burst of power during their running cycle.

ENGINEERING CHALLENGE 09

BOAT POWERED BY A CHEMICAL REACTION

THE JAMES DYSON FOUNDATION

ENGINEERING CHALLENGE 09

BOAT POWERED BY A CHEMICAL REACTION

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 (used clean bottles are best)
- Sticky tape
- A cork
- Two ice lolly sticks
- Scissors (with adult supervision)
- A drinking straw
- Vinegar
- Bicarbonate of soda
- Somewhere to sail 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.

ENGINEERING CHALLENGE 10

CARTESIAN DIVER

THE JAMES DYSON FOUNDATION

ENGINEERING CHALLENGE 10

CARTESIAN DIVER

Designed by Daryl, Design engineer at Dyson

The brief

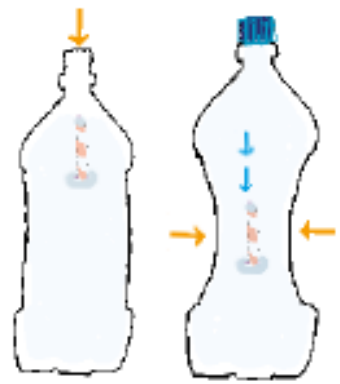
Build a Cartesian diver.

The method

1. Put a small ball of plasticine on the top of the straw to seal it.
2. Roll a sausage of plasticine and wrap it around the bottom of the straw, leaving the bottom open. This is your diver.
3. Now attempt to balance the diver so that it stays upright.
4. Place the diver vertically in the drinking glass. Add or remove weight from the base or top so that when you push it down, it just about bobs back up to the surface (and stays upright).
5. Once you are happy, place the completed diver in the two litre bottle filled to the top with water. Screw on the lid. Squeeze the bottle, and the diver will drop down to the bottom of the bottle. Release it and it floats back to the surface.

Materials

- Drinking straw cut to 30mm in length
- Plasticine
- A two litre bottle (used clean bottles are best)
- A drinking glass and water



How does it work?

This is all about density. When the diver floats, there is a volume of air trapped inside, when the bottle is squeezed, the air is compressed but the water is not.

The volume of air trapped decreases, and the displaced water reduces. The diver loses buoyancy, and sinks. When the pressure on the bottle is released, the air expands, displaces the water and the diver floats.

Design icons

Submarines are surrounded by ballast tanks, which help control their buoyancy. When filled with water, the tanks increase the density of the submarine and it sinks. When the submarine needs to rise, the water in the ballast tanks is replaced with compressed air.