Electricity Challenge

Challenge – Can you build a circuit?

Build a circuit using the equipment provided. First build the circuit with ONE bulb and then repeat using TWO bulbs. Try placing the bulbs at different positions in the circuit.

Rules

- You can only use the materials provided.
- You will have 5 minutes to discuss the design for your circuits.
- You will have 10 minutes to build your circuits.

Materials available for each team

- 1 battery holder and 2 batteries
- 5 leads
- 2 bulb holders
- 2 bulbs

What did you observe?

- How bright were the bulbs?
- Did the number of bulbs affect the bulbs brightness?
- Did the position of the bulbs in the circuit affect the bulbs brightness?
- Describe the circuit where you observed the brightest bulbs.

Challenge – design an electric powered Alien

The challenge is to design and construct an electric powered Alien so that it travels most efficiently over the track. The winning team will build the best designed Alien that travels from the starting line to finishing line in the shortest time.

Rules

- You can only use the materials provided.
- You will have 1¼ hours to design and construct your Alien.
- You can try out your Alien on a smooth surface.
- You can make changes to your design to improve the Alien's speed and performance.
- Decorate and give your Alien a name.

Hints

- How does the position of the motor and battery holder affect the performance?
- How could you improve your design?
- After the race, work out your Alien's speed.

Materials available for each team

- 1 brush
- 1 motor
- 1 motor clip
- 1 battery holder
- 1 battery
- 1 cam
- Decorations – e.g. feathers, pipe cleaners, eyes

Tools

- Glue
- Double-sided tape
- 1 pair of scissors

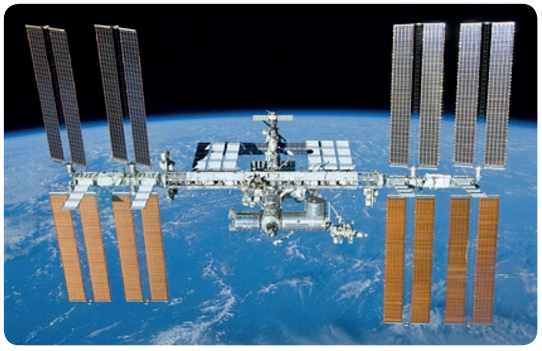
Space Challenge

Did you know?

Astronauts have been travelling to and working on the International Space Station (ISS) since November 2000.

The astronauts must go on space walks to repair the equipment outside the station such as damaged solar panels.

The ISS is designed to enable the astronauts to enter and leave the ISS safely.



Space Station Challenge

Imagine an astronaut has been stranded outside the ISS. Design and construct a space craft with a door or doors which can open and close remotely to allow the astronaut to enter.

The door(s) must be able to close when the astronaut is safely inside.

Rules

- You can only use the materials provided.
- You will have 1½ hours to design and construct your model.
- Your design will score up to 30 points if the doors open and close remotely.
- You can achieve up to 30 points for design and 30 points for construction and efficient use of materials.

Note: remotely means you cannot touch the doors to open or close them.

Materials available for each team

- 10 x jumbo plastic straws
- 5 x A4 cards
- Blu tack
- Glue stick
- Masking tape x 1m
- Plastic tubing x ½m
- 20ml syringes
- 10ml syringes
- Tee splitter
- Aluminium foil
- Gold/silver foil
- Astronaut/Engineer

Tools

- Scissors
- Design sheets

Space Challenge Extension

Did you know?

The Mars Rover was designed to explore the surface of Mars and to search for rocks and soils that hold clues to past water activity on Mars. Because the surface of Mars is covered in sand and rocks, it makes driving difficult and so the Mars Rover has been specially designed for the surface of Mars.

Mars Rover Challenge

To design and construct a Mars Rover so that it travels most efficiently over the track. The winning team will build the best designed Mars Rover that travels from the starting line to finishing line in the shortest time.

Rules

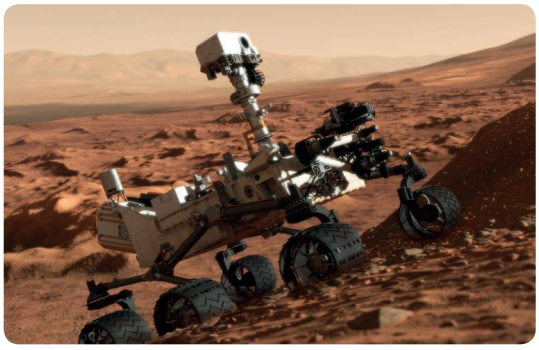
- You can only use the materials provided.
- You will have 1 hour to design and construct your model.
- Decorate and give your Rover a name.

Hints

- What happens when you use the different sizes and types of wheel?
- Try out the different propellers.
- How does the position of the motor and batteries affect the performance?

Materials and tools available for each team

- Corriflute (250mm x 130mm) x 1
- Corriflute (130mm x 20mm) x 3
- Corriflute joiners
- Motor x 1
- Motor clip x 1
- Batteries x 2
- Wheels 75mm x 4
- Wheels 7539mm x 8
- Spiked tyres x 4
- Axles 190mm x 2
- 3-blade propeller x 1
- 1-blade propeller x 1
- Design sheets



Marble Roller Coaster Challenge (1)

Did you know?

All roller coasters involve going round loops bends and twists at high speeds. Most roller coasters work by gravity. During the ride no motors are used to power it. After the ride, a motorised system is used to return the car to its original position ready for the next ride.

On the roller coaster you also experience acceleration and this produces a strong g-force. This can either press you into your seat or make you feel that you are about to fly out of it. This occurs when the roller coaster is travelling at a high speed when the riders are going round a loop or twisting around a bend in the track.

Challenge – How high can you build a tower?

To construct the highest tower you can using 1 pack of playing cards. The tower must remain free standing after the 10 minutes construction time has ended.

Materials available for each team

- 1 pack of cards
- 1 piece of masking tape – 20 cm
- 1 ruler

Rules

- You can only use the materials provided, in the most efficient way.
- You will have 5 minutes to discuss the design of your tower.
- You will have 10 minutes to construct your tower.
- The tower must remain free standing after the 10 minutes construction time.
- The team that has built the highest tower with be the winning team.

Design

In your planning you should discuss your ideas and decide on which of your ideas will meet the challenge.

Performance

Does the tower perform the task as stated in the Challenge?

Marble Roller Coaster Challenge (2)

Which has the strongest g-force?

Look at the list below. Which one has the strongest g-force? Put them in order, with the highest at the top, using the picture cards.

- Loop roller coaster
- Space Shuttle on take-off
- Fighter jet
- Washing machine
- Commercial aircraft on take-off

Challenge – Design a slow marble run

To design and construct a slow marble run. Your marble must travel as slowly as possible and for as long as possible. It must be deposited, and stay, in a container at the end of its run.

Rules

- You can only use the materials provided, in the most efficient way.
- You will have 1 hour to design and construct your model.
- Your design will score 5 points for every second that the marble takes to complete the run.
- The marble must travel without assistance once released.
- 10 points will be awarded if the marble is deposited and stays in the container.

Materials available for each team

- A3 card x 1
- A4 card x 4
- Plastic straws x 10
- Polystyrene/plastic cup x 1
- Marble x 1
- Glue stick
- Masking tape
- Scissors
- Design sheets

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Marble Roller Coaster extension workshop

Background

The typical roller coaster works by gravity. There are no motors used to power it during the ride. Starting from rest, it simply descends down a steep hill, and converts the (stored) gravitational potential energy into kinetic energy. A small amount of energy is lost due to friction, which is why it is impossible for a roller coaster to return to its original height.

Challenge – how much height to loop the loop?

Design and construct a marble roller coaster to loop the loop. Your roller coaster must have at least 1 loop. Find out how much height is needed in order for the marble to run through a loop in the range of 30–50cm (approx. 60 minutes).

Materials available for each team

- Masking tape
- Foam pipe insulation
- Ruler
- Marble x 1

Rules

- You can only use the materials provided.
- You will have 30 minutes to design and construct your model.
- Your model will have at least ONE loop.
- The marble must travel without assistance once released.
- The marble must reach the end of the run.
- You will explain your design and construction, and how you could improve up on it when it is tested.

Instructions

1. Set up the track.
   Curl the track into a loop – hold in place using masking tape
   Raise up one end of the track to make a ramp coming down into the loop
   Tape the top of the ramp in place to the wall or other piece of furniture.
2. Measure the diameter of the loop, height of the starting point for the track (rise) and the horizontal distance from the track starting point to the beginning of the loop (run)
3. Run a single marble down the track 10 separate times. How many times does it successfully go through the loop?
4. Change the height and repeat. What starting height was needed for the marble to make it through the loop most of the time? Write your results in this table.

Loops	Height of starting point (rise)	Distance from starting point to start of the loop (run)
1 loop diameter …cm		
1 loop diameter …cm		
2 loops diameter …..cm and …cm		

Extension – 30 minutes

5. Repeat with a different diameter loop.
6. Repeat with 2 loops.