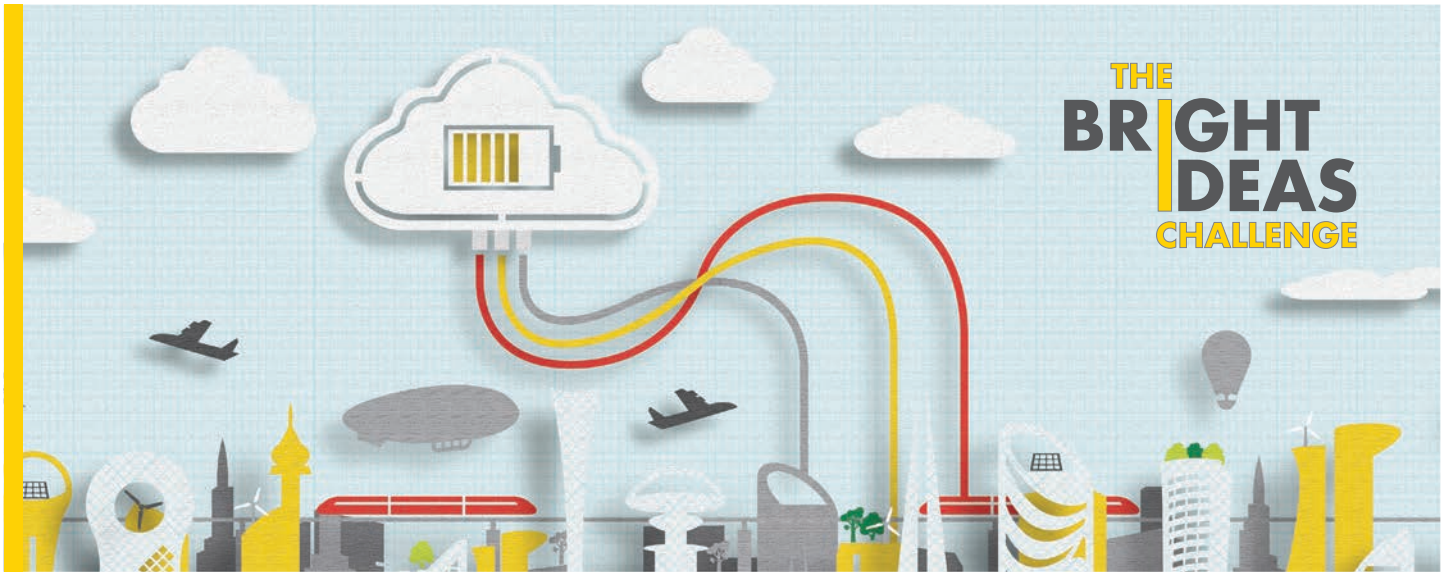


ICE-BREAKER ACTIVITY **TRANSPORT** **45 MINS**

Brief

Imagine you're in the future; it's 2050. You're living in a busy, highly populated city. People are looking for different ways to travel around the city, and you've been challenged to design and build a vehicle that has an alternative energy source. Let your mind race and work as a team to make a car with a balloon-powered 'engine'.

Design instructions

- You have 25 minutes to design and build your vehicle
- You will then need to place your vehicle on a flat 'test-track' – why not use tape as a starting line on the floor
- Vehicles should be designed to travel as far as possible, and at least over 10cm, in a straight line
- Your vehicle should be robust enough to not fall apart during the test period
- Only the materials listed can be used in your design

Materials available

- Cardboard kitchen roll tube
- Plastic bottle/juice carton
- Disposable cup
- Straws/chopsticks/wooden skewers
- Bottle tops/CD-ROMs/corks/ cardboard circles
- Blu-tac
- Sticky tape
- Scissors
- Paper, pens and pencils
- And of course a balloon (and a spare!)

Turn over the page for **Activity steps**

The Bright Ideas Challenge Singapore is a Shell initiative, organised by Science Centre Singapore STEM Inc and supported by Ministry of Education.

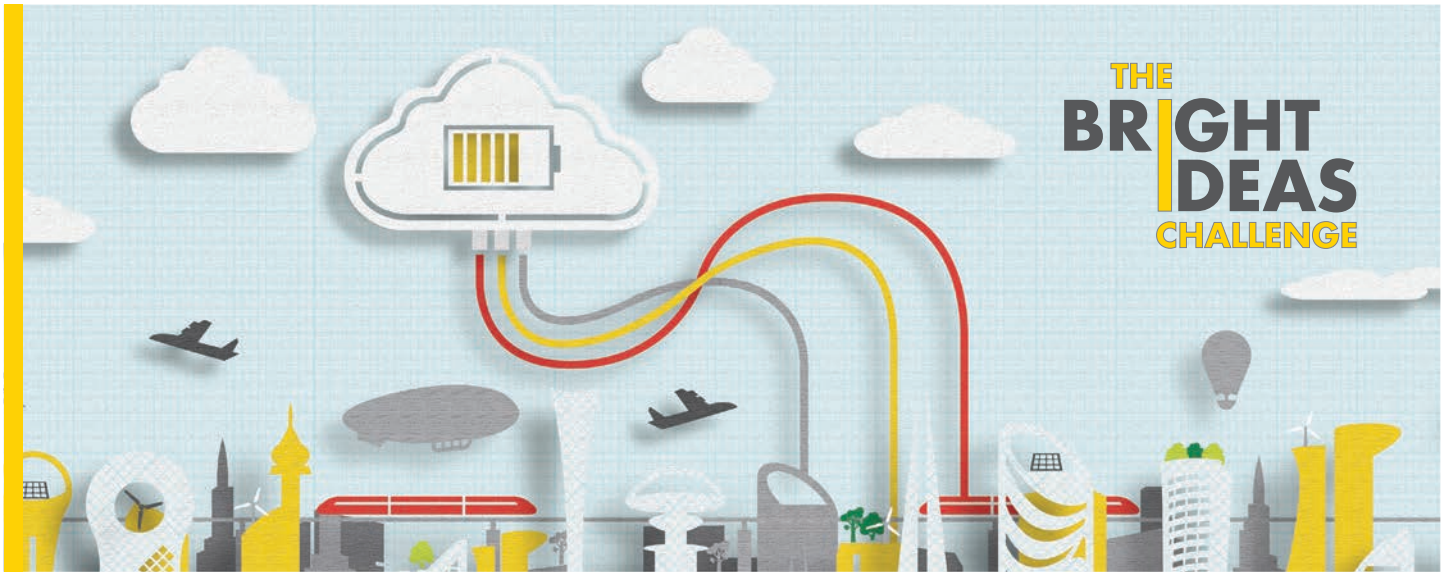
Activity steps

1. Consider the design brief and review the design instructions. Work as a team to discuss what it is you're being asked to do. Think about the science behind the problem and how this could inform your design.
2. Look at the materials available and talk about how you could use these. Start to sketch a design for your vehicle.
3. Refine your solution by continually adapting and improving your design. Check you're leaving yourselves enough time to complete the task.
4. Only when all team members are happy with the car design, start to build it. If the final design doesn't work as well as planned, don't be afraid to innovate!
5. Place your vehicle on the test-track starting line. Record the distance your car travelled, and make notes about any of the other teams' designs that worked well. What might you do differently next time?

Hints

- Use your **physics** subject knowledge about **forces** to:
  - Think about forces as pushes or pulls, which come from two objects interacting
  - Create diagrams using force arrows, applying the concept of balanced and unbalanced forces
  - Remember Newton's third law: for every action, there is an equal and opposite reaction
- Use your **design and technology** experience to:
  - Identify and solve design problems
  - Develop and communicate design ideas

Please ensure that all relevant safety measures and precautions are taken when completing the ice breaker activities. This includes the use of appropriate protective equipment such as safety goggles.



ICE-BREAKER ACTIVITY **WATER** **40 MINS**

Brief

Imagine you're in the future; it's 2050. Earth's population continues to grow rapidly, and fresh water is becoming an increasingly valuable commodity. Industries are looking for different sources of clean water, and you've been challenged to design and build a water filtration system. Put your creativity to the test and work as a team to make a basic system using only everyday recycled materials.

Design instructions

- You have 20 minutes to design and build your water filter
- You will then need to submit your filter for testing
- Your filter should remove all particulates from the unclean water
- Your filter should improve unclean water by a minimum of two grades – you can use the grading spectrum provided to visually measure
- Only the materials listed can be used in your design

Materials available

- Muddy water samples (with small stones and humus)
- Sand
- Gravel
- Charcoal
- Glass beakers
- Plastic bottle
- J-cloth
- Sponge
- Scissors
- Grading spectrum
- Paper, pens and pencils

Turn over the page for **Activity steps**

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Activity steps

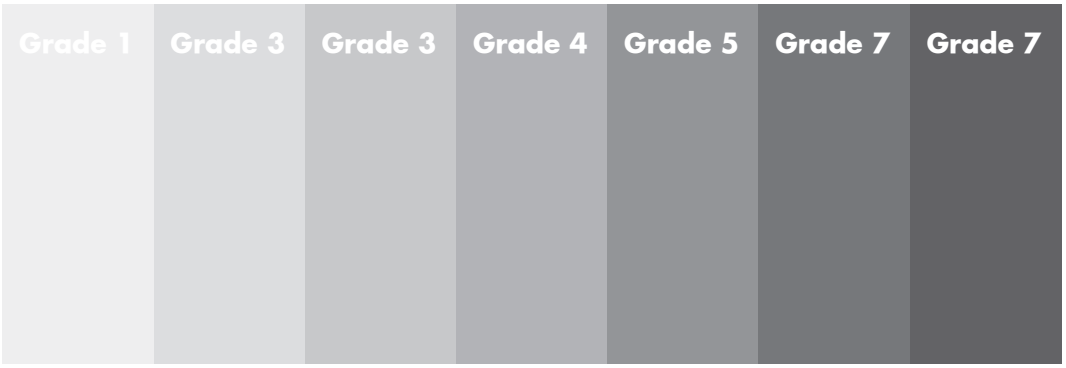
1. Consider the design brief and review the design instructions. Work as a team to discuss what it is you're being asked to do. Think about the science behind the problem and how this could inform your design.
2. Look at the materials available and talk about how you could use these. Start to sketch a design for your filter.
3. Pre-trial your ideas using samples of muddy water. Refine your solution by continually adapting and improving your design. Could you use multiple filters, so the muddy water gets cleaner in steps? Check you're leaving yourselves enough time to complete the task.
4. Only when all team members are happy with the filter design, start to build it. If the final design doesn't work as well as planned, don't be afraid to innovate!
5. Submit the filter to your teacher for testing. Record the improvement your filter made to the muddy water using the grading spectrum. You should make notes about any of the other teams' designs that worked well. What might you do differently next time?

Hints

- Use your **chemistry** subject knowledge about **separation of mixtures** to:
  - Consider what you know about pure substances and mixtures, including the dissolving and diffusion of particles
  - Use simple techniques for separating mixtures: filtration, decanting, distillation
- Use your **design and technology** experience to:
  - Identify and solve design problems
  - Develop and communicate design ideas

Water grading spectrum

1. Hold the beaker of muddy water against the chart. Which grade is it closest to?
2. Hold the beaker of your filtered water against the chart. Which grade is it closest to?
3. Has it improved by two grades? How many grades has it improved by?



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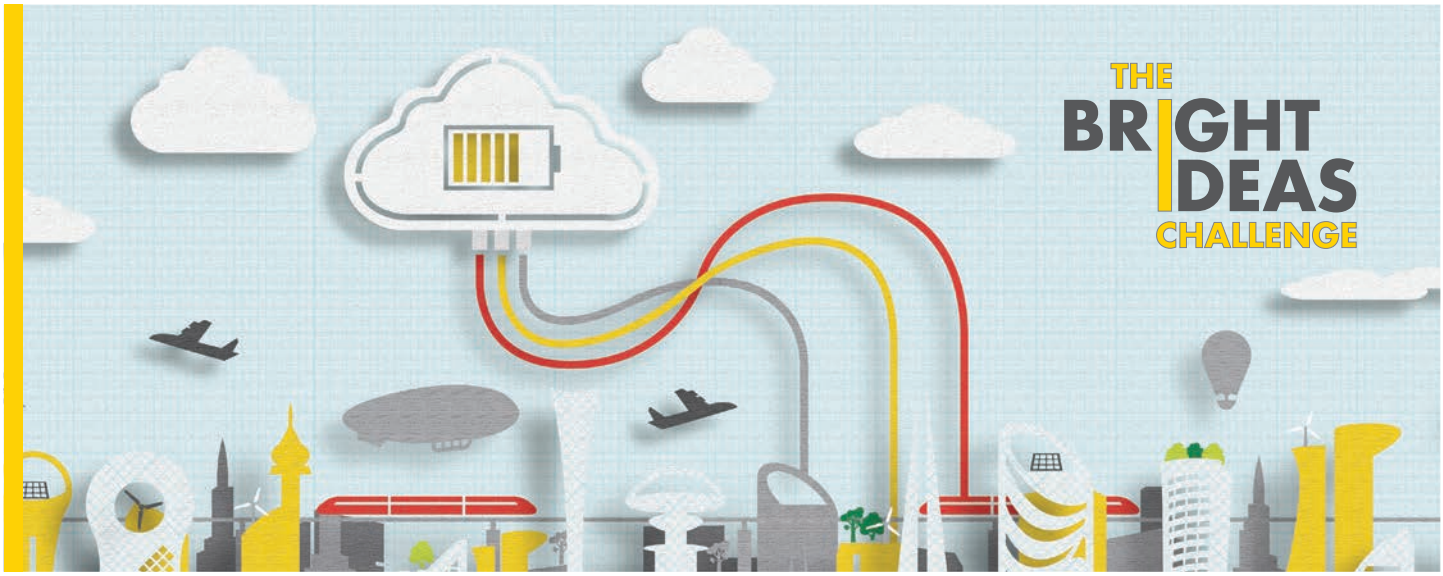

ICE-BREAKER ACTIVITY **FOOD** **45 MINS**

Brief

Imagine you're in the future; it's 2050. The global population has increased and the vast majority of people on Earth are living in a city. Governments are looking for innovative farming techniques that use less land. You've been challenged to design and build a mini greenhouse that would allow you to grow certain crops all year round from your windowsill.

Design instructions

- You have 25 minutes to design and build your greenhouse
- You will then need to submit your greenhouse for testing – will the structure withstand being opened and closed for watering?
- Your greenhouse must be big enough to hold a small container of seedlings, as they grow to full size
- Your greenhouse must be designed to enable a seedling to grow successfully in an indoor environment
- Only the materials listed can be used in your design

Materials available

- Yoghurt pots
- Clear plastic bags
- Cling film
- Straws/toothpicks/ice lolly sticks
- Sticky tape
- Scissors
- Small container with compost and seeds e.g. cress
- Paper, pens and pencils

Turn over the page for **Activity steps**

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Activity steps

1. Consider the design brief and review the design instructions. Work as a team to discuss what it is you're being asked to do. Think about the science behind the problem and how this could inform your design.
2. Look at the materials available and talk about how you could use these. Start to sketch a design for your greenhouse.
3. Check the dimensions and make sure the container of seedlings will fit and think about how you'd water the crops. Refine your solution by continually adapting and improving your design. Check you're leaving yourselves enough time to complete the task.
4. Only when all team members are happy with the greenhouse design, start to build it. If the final design doesn't work as well as planned, don't be afraid to innovate!
5. Submit your greenhouse for testing. The structure should withstand being opened and closed for watering. How did other teams approach the build and how did they plan to water their crops? Make notes about any of the other teams' designs that worked well. What might you do differently next time? The ultimate, long-term test is to see if your seeds will grow!

Hints

- Use your **biology** subject knowledge about **photosynthesis** :
  - Remember that almost all life on Earth depends on the ability of organisms, like plants and algae, to convert sunlight into essential sources of energy
  - Think about the adaptations of leaves for photosynthesis
- Use your **design and technology** experience to:
  - Identify and solve design problems
  - Develop and communicate design ideas

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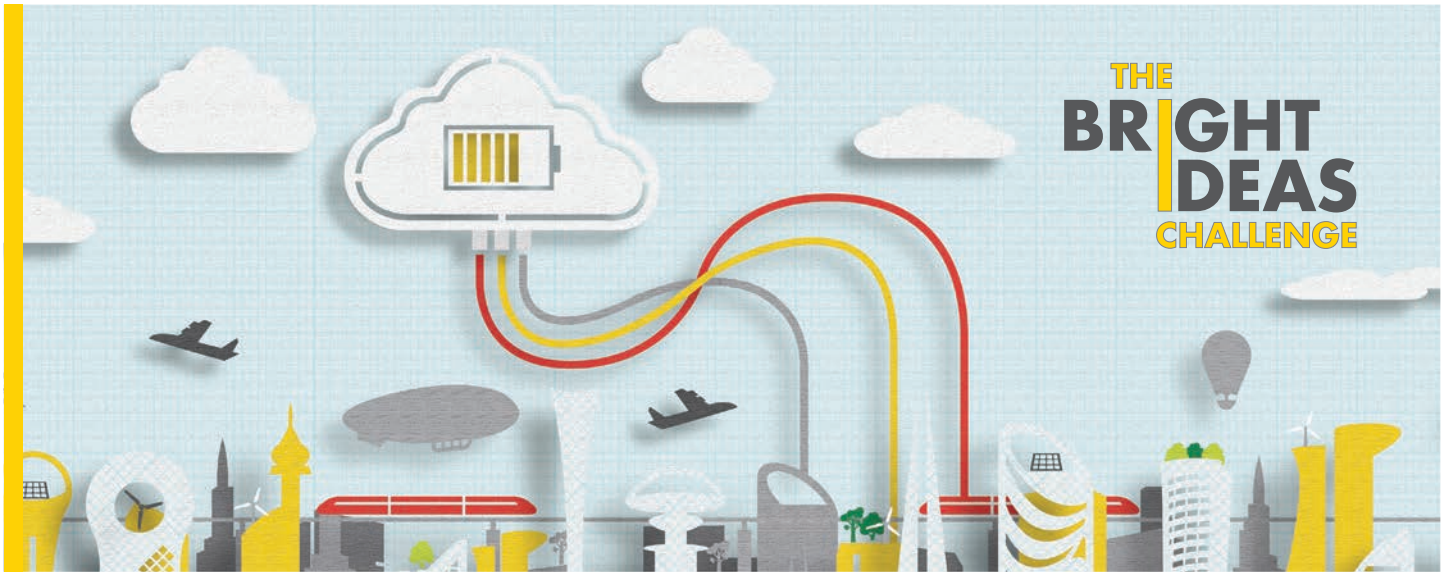

ICE-BREAKER ACTIVITY **BUILDINGS** **45 MINS**

Brief

Imagine you're in the future; it's 2050. You're living in a busy, highly populated city. As space is in high demand, people are looking for different places to live. You've been challenged to design a platform for a house built on a flood plain, so that the house is elevated above the water during a flood.

Design instructions

- You have 25 minutes to design and build your living platform
- You will then need to submit your model for testing
- Your model should stand up in the water for 5 minutes, and the living platform should remain dry
- Your model should withstand weights being placed on it (as it would need to support a house)
- Only the materials listed can be used in your design

Materials available

- Tray of water and masses (for testing)
- A4 sheets of recycled paper or newspaper
- Plastic bag
- 2 meters of sticky tape
- Scissors
- String
- Paper, pens and pencils

Tip: There is a limited amount of sticky tape, it is probably best to use it as an adhesive rather than for weight bearing or waterproof coating.

Turn over the page for **Activity steps**

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Activity steps

1. Consider the design brief and review the design instructions. Work as a team to discuss what it is you're being asked to do. Think about the science behind the problem and how this could inform your design.
2. Look at the materials available and talk about how you could use these. Start to sketch a design for your living platform.
3. Will your platform remain as strong when the base is submerged in water? Will it still be able to hold a load? Refine your solution by continually adapting and improving your design. Check you're leaving yourselves enough time to complete the task.
4. Only when all team members are happy with the design, start to build it. If the final design doesn't work as well as planned, don't be afraid to innovate!
5. Submit your model for testing. Record how long it stands up for, and note how dry the platform remains. Make notes about any of the other teams' designs that worked well. What might you do differently next time?
6. After 5 minutes, your teacher will add weights to the models that are still standing, to see how much mass they can take before they collapse.

Hints

- Use your **physics** subject knowledge about **forces** to:
  - Think about forces as pushes or pulls, which come from two objects interacting
  - Create diagrams using force arrows, applying the concept of balanced and unbalanced forces
  - Think about how forces act on objects to 'deform' them or change their shape
  - Remember that forces are measured in Newtons, and mass is measured in kilograms
- Use your **design and technology** experience to:
  - Identify and solve design problems
  - Develop and communicate design ideas

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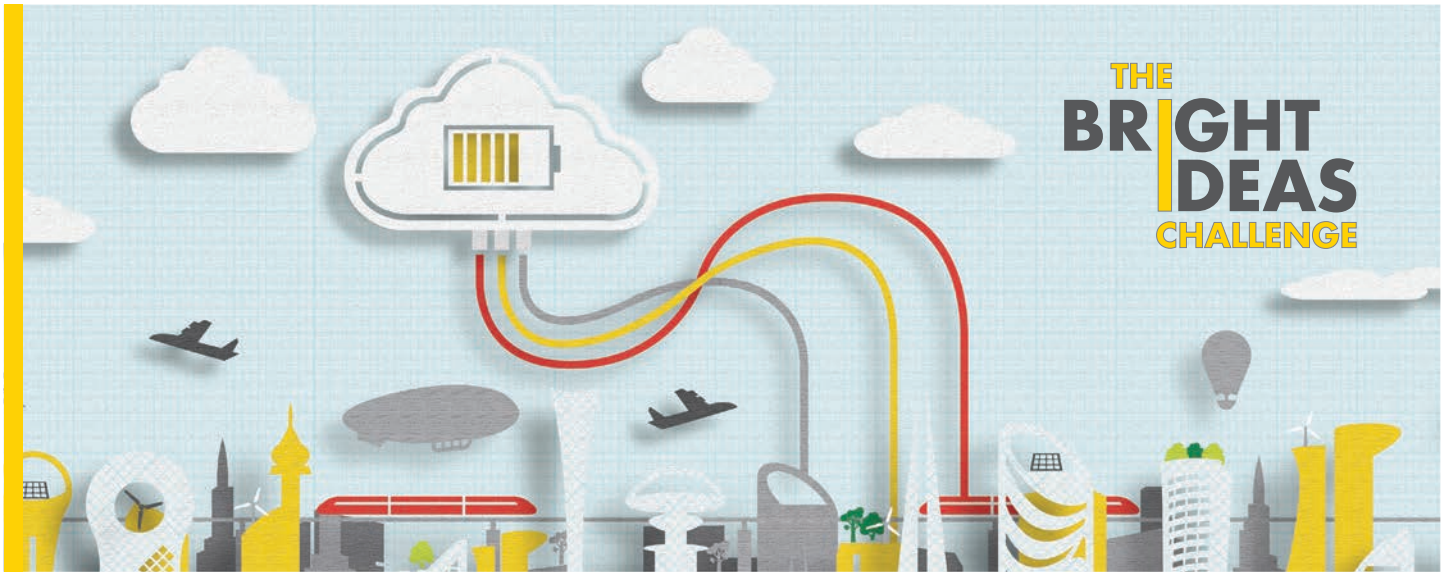

ICE-BREAKER ACTIVITY **POWER GENERATION** **45 MINS**

Brief

Imagine you're in the future; it's 2050. You're living in a busy, highly populated city. People are looking for new ways to charge their electronic devices and you've been challenged to design and build an alternative source of battery power. Put your creativity skills to the test and work as a team to make a battery from the materials listed below.

Design instructions

- You have 15 minutes to design and build your battery
- You will then need to submit your battery for testing
- Your battery should generate sufficient electricity to power a light-emitting diode (LED)
- Only the materials listed can be used in your design

Materials available

- Galvanized nails and washers
- Copper wire and copper pennies
- Plastic ice cube trays
- Vinegar
- Water
- Salt
- Citrus fruit (oranges, lemons, etc.)
- Potatoes
- Light-emitting diodes (LED)
- Multimeter for testing

Turn over the page for **Activity steps**

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Activity steps

1. Consider the design brief and review the design instructions. Work as a team to discuss what it is you're being asked to do. Think about the science behind the problem and how this could inform your design.
2. Look at the materials available and talk about how you could use these.
3. What different elements do you need to make a simple electric circuit? How will this connect to your battery?
4. Only when all team members are happy with the design, start to build it. If the final design doesn't work as well as planned, don't be afraid to innovate!
5. Submit your battery to your teacher for testing using a multimeter. The brightest LED wins!

Hints

- Use your **physics** subject knowledge about **circuits** to remember:
  - A circuit needs to be a complete loop to enable the electricity to flow
  - The brighter the light the higher the number and voltage of cells used in the circuit
- Use your **chemistry** subject knowledge about **chemical reactions** to:
  - Apply the concepts related to electrolysis
  - Remember that chemical reactions take place in only three different ways: proton transfer, electron transfer and electron sharing
- Use your **design and technology** experience to:
  - Identify and solve design problems
  - Develop and communicate design ideas

Please ensure that all relevant safety measures and precautions are taken when completing the ice breaker activities. This includes the use of appropriate protective equipment such as safety goggles.