ACTIVITY 1:

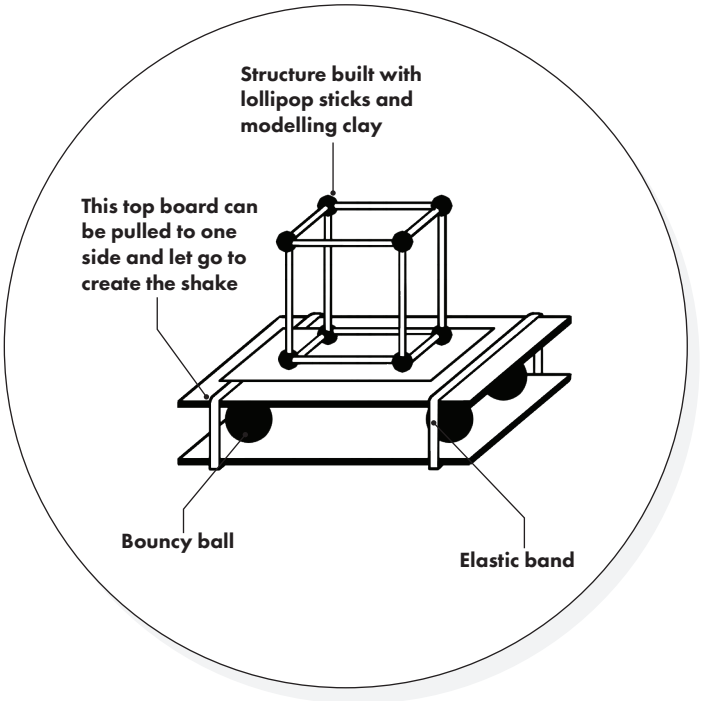
DESIGN AND BUILD AN EARTHQUAKE-PROOF BUILDING

EQUIPMENT

- Two pieces of heavy cardboard or thin wood (worn out ring binders work well)
- Four rubber balls or bouncy balls, each measuring about 2.5 cm
- Two large rubber bands
- A selection of different materials with which to build a structure, such as building blocks, sugar cubes, lollipop sticks, marshmallows, spaghetti, pipe cleaners, paper clips or playing cards

INSTRUCTIONS

- Place one board on top of the other and put two elastic bands around the short edges, about 2.5 cm from each end.
- Separate the two cardboard layers and place two balls at each end, roughly underneath the elastic bands.
- Once assembled, try pulling and releasing the top board of the table. This should cause a movement that mirrors an earthquake and can vary in severity depending on how far you pull it.
- Once the shake table is ready, build a variety of different structures using the materials provided. Be creative and build and test the stability of a variety of structures.



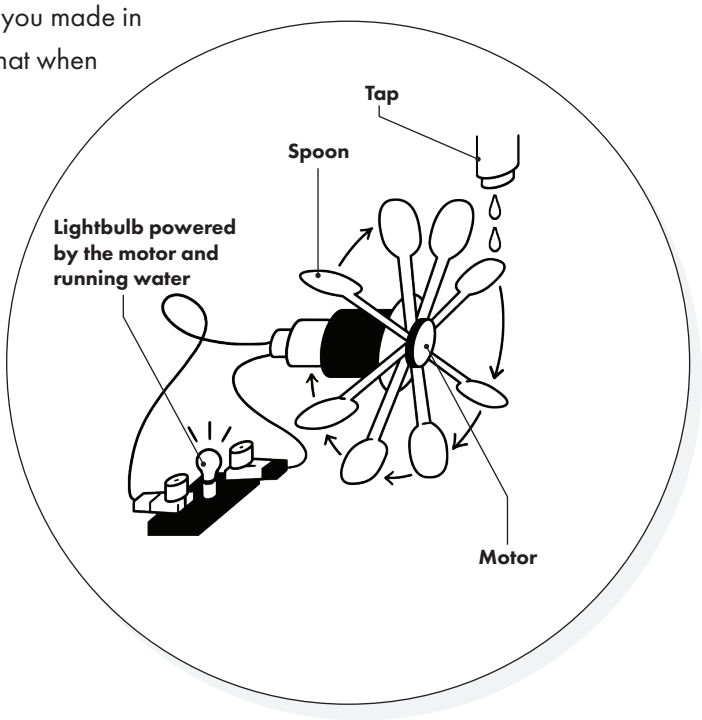
ACTIVITY 6:
HYDRO POWERED FUTURE

EQUIPMENT

- A piece of hard recycled plastic that can be cut with scissors into a circle or is already circular. The piece of plastic should be approximately 6 cm in diameter.
- Eight plastic spoons
- A plastic bottle cap or similar
- Glue gun
- Motor
- LED bulb
- Connection wire with a crocodile clip or similar
- Metal skewer

INSTRUCTIONS

1. Cut the piece of plastic into a circle with diameter of 6 cm.
2. Score the circle into 8 segments and poke a hole through the middle.
3. Use the glue gun to glue the edges of the plastic spoons to the circle along the score lines, leaving a space around the hole in the middle. Each spoon should be facing upwards. Ensure each spoon is stuck securely and reinforce with glue where needed.
4. Use scissors to cut the screw thread away from the bottle cap so that you are left with only the top circle. Glue it to the exposed edges of the spoons. This should strengthen the structure. You have now created the turbine.
5. Put the rotating part of the motor into the hole that you made in the plastic circle and secure with glue. The aim is that when you turn the turbine it will spin the motor.
6. Use the connection wires to attach each leg of the LED to the pins on the back of the motor.



Test

Run a tap and place the spoons beneath the running water. This should cause the turbine and motor to spin, which generates electricity and lights up the LED.

ACTIVITY 8 :
MODEL DNA STRAND

EQUIPMENT

Per student:

- A selection of coloured beads or modelling clay, in green, red, blue and yellow
- Two pieces of string, elastic or two pipe cleaners (ideally each 30 cm long)

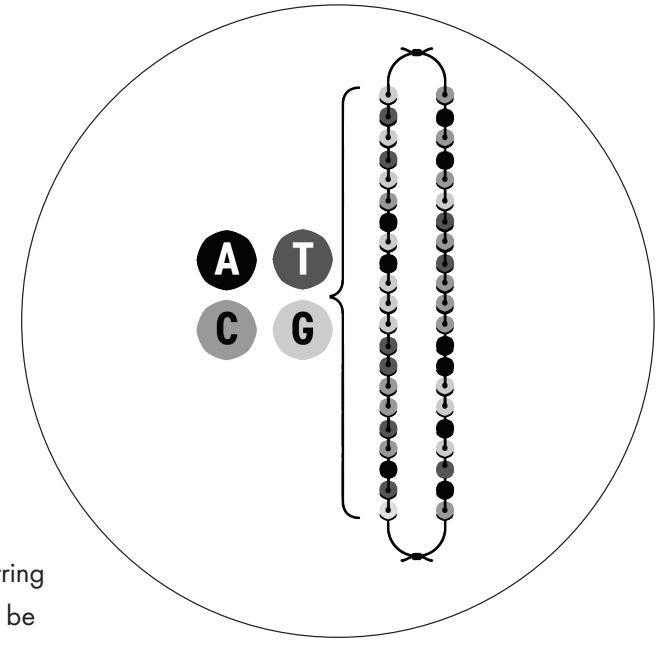
INSTRUCTIONS

Genes are made up of strings of DNA and each gene codes for a specific protein that does a particular job in the body. Genes are very long but here are some small samples from a few genes that code for proteins in your body:

- myosin (a muscle protein): GTGTGCAGAGGGTTCCTCATGCGTG
- insulin (which helps break down sugar): CTCGAGGGGC CTAGACATTG
- hemoglobin (which carries oxygen in your blood): GTGCACCTGACTCCTGAG
- lactase (which breaks down the sugars in the milk you drink): CTGCACTCCCACCTGGGCAAC

Make a model of one of the gene samples above by adding the correct colour beads to the strings in the correct order. Use different colours for the four bases:

A = Green
T = Red
C = Blue
G = Yellow



- Begin by tying the two pieces of string together at one end.
- Thread the correct sequence of coloured beads to match the gene sample that you have chosen onto one of the strings.
- Once you have threaded all of the required beads onto one string you will need to thread beads to complete each base pair onto the second string. For example, if the first bead on string one is red (T), the first bead on string two should be green (A). Remember the base pairs are (A–T and C–G).
- Keep threading beads according to your sequence until you have finished every pair. Then tie both pieces of string to stop the beads falling off.

ACTIVITY 9 :

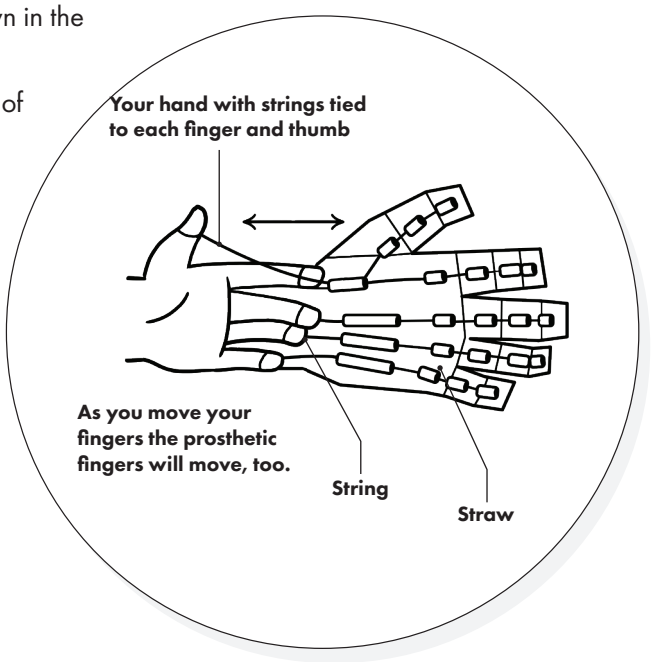
BUILDING A PROTOTYPE PROSTHETIC HAND

EQUIPMENT

- Rigid cardboard
- Paper straws
- String
- Tape
- Scissors
- Paper

INSTRUCTIONS

1. Create the prototype hand by cutting a piece of cardboard into the shape of a hand and arm. The palm should be a square roughly 10 × 10 cm, three fingers should be rectangles roughly 2 × 8 cm and the thumb and little finger roughly 2 × 6 cm.
2. Score (but don't cut) the three larger fingers into three equal pieces and the thumb and little finger in two. This will create the joints and allow them to bend.
3. Also score each finger and the thumb where they meet the palm.
4. Cut 22 small pieces of straw each 1–2 cm long.
5. Stick one piece of straw to each section of the fingers and thumb and then the rest on the palm as shown in the diagram.
6. Cut five lengths of string, each about 30 cm long.
7. Tape the end of one length of string to the end of each finger and the thumb.
8. Thread the strings through the straws on each finger and the thumb, and also through the straws on the palm as shown in the digram.
9. Tie each piece of string to the fingers and thumb of your hand (you might have to ask a friend to help you with this).
10. The fingers of the prototype hand can now be moved by pulling each length of string.



ACTIVITY 12 :
STAYING CONNECTED

FORMAL LETTER WRITING TEMPLATE

Your Address

.....

.....

.....

Date: .....

Recipient's Address:

.....

.....

.....

Subject: .....

Summary of the purpose of the letter

.....

.....

.....

Dear (Recipient's Name),

Opening Paragraph:

- Introduce yourself and state the purpose of the letter. Use a formal and professional tone.

Body Paragraph(s):

- Provide more detail about the subject of the letter, including relevant information and arguments to support your position. Each paragraph in your main body should focus on a single topic.
- Continue to use formal, clear and concise language.

Closing Paragraph:

- Summarise the main points of the letter.
- Thank the reader for their time. For example, 'Thank you for your attention to this matter.'
- Indicate what action you would like them to take, if applicable.

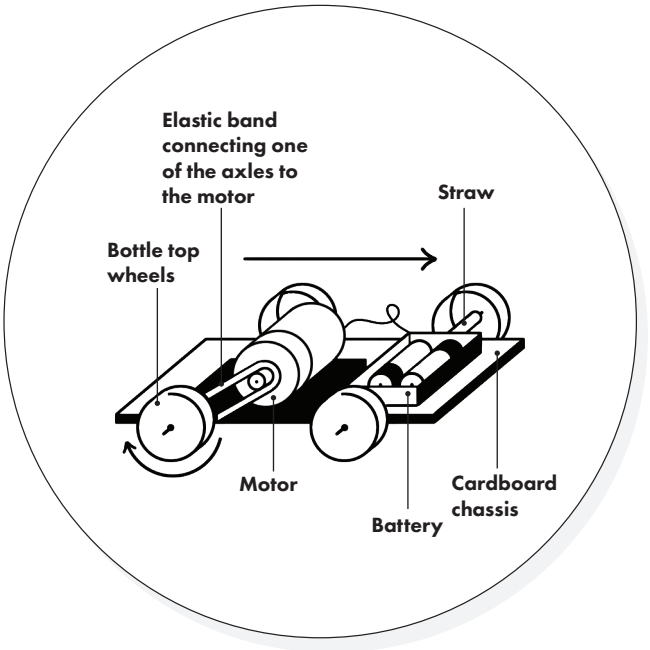
Sincerely,

- Your signature (if writing by hand) or your typed name.

ACTIVITY 14 :
BATTERY POWERED CAR

EQUIPMENT

- Wooden skewers
- Four bottle tops of equal size
- Elastic band
- Battery
- Cardboard
- Glue gun
- Motor
- Connection wires with a crocodile clip or similar
- Paper straws
- Scissors



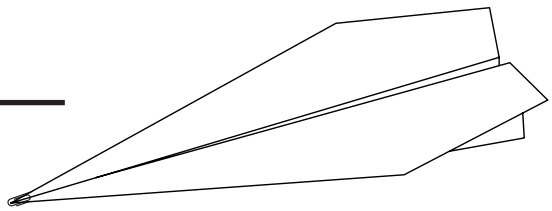
INSTRUCTIONS

1. Cut a rectangle out of cardboard and glue two straws onto it – one at the front and one at the back. This is the chassis (base frame) of the car.
2. Using the scissors, carefully poke a hole in the centre of each of the four bottle tops.
3. Poke one wooden skewer through one of the bottle tops and hot glue in place. Then thread the skewer through one of the straws. Poke the other end of the skewer through another bottle top and glue in place.
4. Poke the other wooden skewer through another bottle top and hot glue in place. Then thread the skewer through the other straw.
5. Put an elastic band on the skewer and then poke the skewer through the final bottle top and glue in place. You have now made your wheels and axles.
6. Flip the chassis over. Make a simple circuit that includes a motor, a battery and a switch and glue it all to the top of the chassis. You will need to attach your elastic band to the rotating part of the motor, so ensure that you glue it close enough.
7. Put the elastic band around the motor so that when it turns it causes the back wheels and axle to turn. Ensure that the elastic band can turn freely.
8. Now, when you turn the switch to 'on' your car should move! Make any adjustments required to ensure that it runs smoothly.
9. Lastly, decorate your car and make an aerodynamic covering for it out of cardboard or any other materials that you like.
10. Test your vehicle and get ready to race!

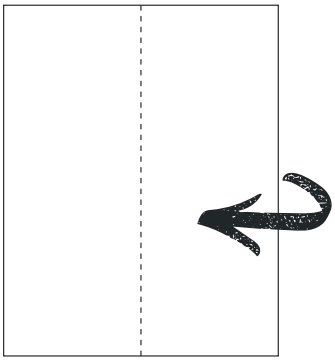
ACTIVITY 15 :

AERODYNAMICS IN AEROSPACE ENGINEERING

Paper plane worksheet 1

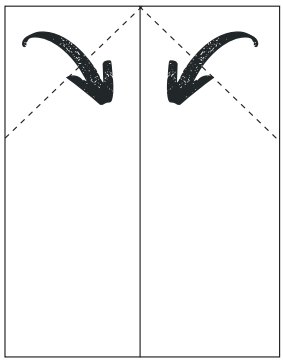


1



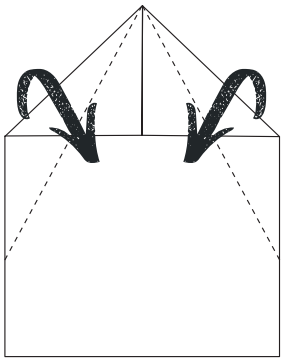
Start with a sheet of A4 paper and fold it in half lengthways and then open it out again.

2



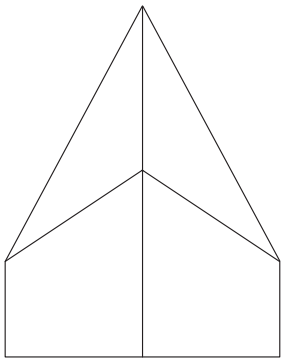
Fold the top two corners into the middle.

3



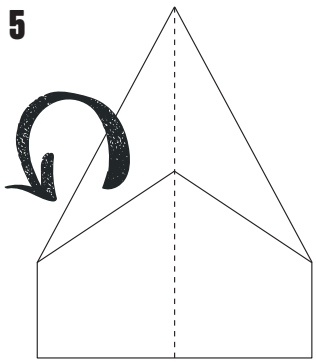
Fold the top two corners into the middle again.

4



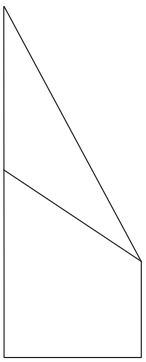
Your paper should now look like this.

5



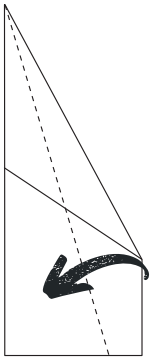
Fold the paper in half.

6



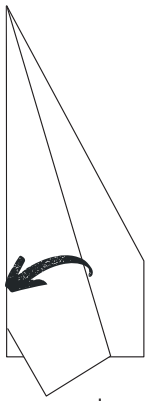
Your paper should now look like this.

7



Fold one side down along the dotted line shown. Do the same with the other side.

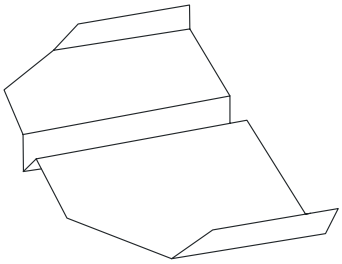
8



Bend the wings down to make the plane shape. Your paper aeroplane is ready to fly!

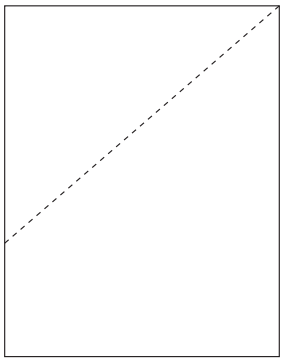
ACTIVITY 15 :

AERODYNAMICS IN AEROSPACE ENGINEERING



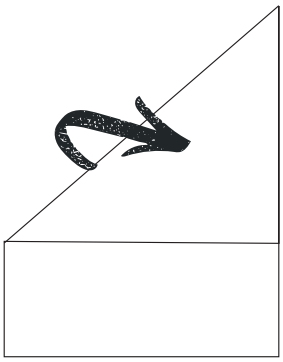
Paper plane worksheet 2

1



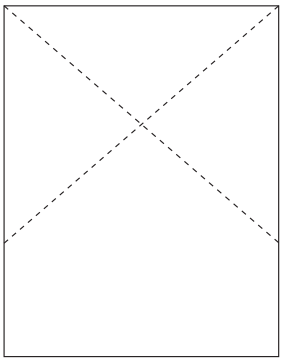
Start with a sheet of A4 paper and fold the top down to meet the right-hand side.

2



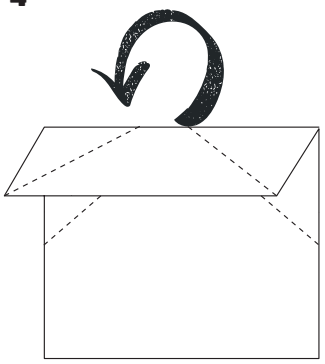
Press down the fold to form a triangle shape then unfold.

3



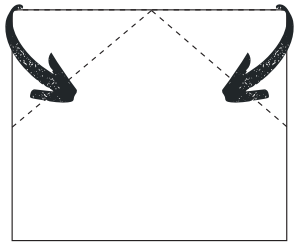
Do the same on the opposite side.

4



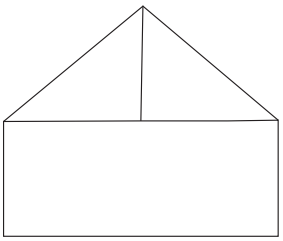
Fold the top of the paper down along the middle of the cross made by the diagonal folds.

5



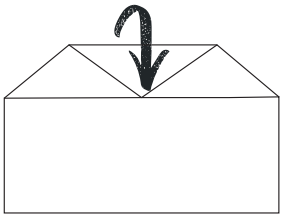
Turn the paper over and fold eah of the top corners into the middle.

6



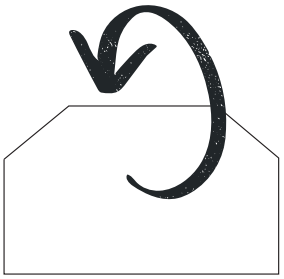
Your paper should now look like this.

7



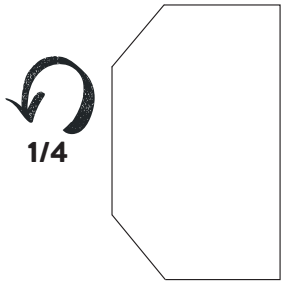
Fold the tip of the triangle down to the bottom of the triangle.

8



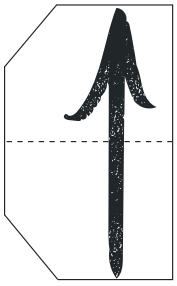
Turn the paper over.

9



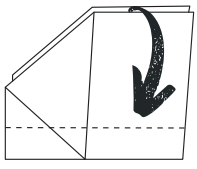
Turn the paper round so that the 'nose' is pointing left.

10



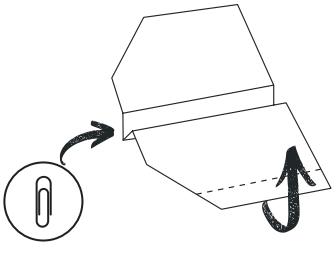
Fold it in half from bottom to top.

11



Fold each wing down about 3 cm from the bottom.

12



Fold the wing tips up about 2 cm from the ends. You can add a paperclip to the nose to help it fly.

ACTIVITY 18 :
WASTE-REMOVAL TECHNOLOGY

TYPES OF SENSORS

Sensors are devices that measure a physical quantity (such as temperature, force or light). The sensor collects information, which is processed to create an output. This can then trigger a response. For example, if a force sensor on a vacuum robot detects that the robot has bumped into something, it makes the robot turn and move in another direction.

Here are some common types of sensors:

- Distance sensor – Tells you how far away something is.
- Sound sensor – Tells you how loud something is.
- Temperature sensor – Measures the temperature of the environment.
- Chemical sensor – Detects different chemicals in the air or water.
- Accelerometer – Detects when something (such as a car, plane or robot) is moving around or tilting. Accelerometers can also detect vibrations and can be used in fitness watches and smartphones.
- Motion sensor – Detects when something moves in front of it. Automatic vehicles use motion sensors to detect objects in the vehicle's path.
- Light sensor – Detects changes in light levels.
- Pressure sensor – Measures atmospheric pressure or the pressure of gases or liquids, for example car or bike tyre pressure, blood pressure or the pressure of other fluids such as oil or fuel.
- Force sensor – Detects when the sensor comes into contact with something.
- Infrared sensor – Emits an invisible beam of infrared light and detects when the beam is interrupted by a person or object. They are commonly used in sliding and swing doors.
- Geomagnetic sensor – Measures magnetic fields.