SCIENCE MATHS AND REAL TECHNOLOGY

WEATHER

Wild Weather and Natural Disasters

Module 3.3

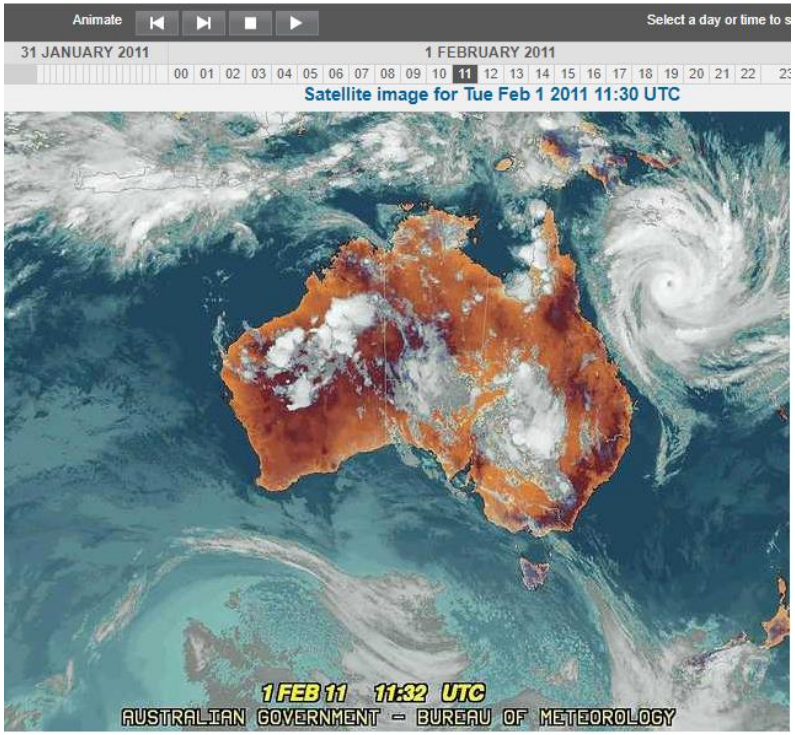
An Australian Government Initiative

Inspiring AUSTRALIA

illumin8 STEM CLUBS

Proudly developed by SMART with funding from Inspiring Australia

Severe Tropical Cyclone Yasi Satellite Loop



Wild Weather

Image sources: http://www.bom.gov.au/cyclone/history/yasi-satellite.shtml
http://www.theherald.com.au/story/3551445/lightning-camera-action-storm-chasers-cracking-shots/

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Tornado Tube

Aim: To observe the shape of a tornado using two bottles.

Materials (per group):

- 2 x 1.25L clear recycled plastic bottles
- 1L room temperature water
- 1 x tornado tube valve
- Food colouring (optional)
- Glitter (optional)

Procedure:

1. Form into groups and collect materials.
2. Fill one of the bottles with water. You may also like to add food colouring and glitter, these are optional and do not change the experiment result!
3. Connect the tornado tube valve to the bottle with water, and then connect the empty bottle to the other end of the valve.
4. Flip the bottles over, so the water filled bottle is now on top of the empty bottle. Observe.
5. Repeat the experiment, this time give the bottles a swirl in a circle. Observe and document your results!

Extension: How quickly does the water drain from the top bottle to the bottom? Does swirling the bottles change the draining speed?

Australian Cyclone Categories

Category	Strongest gust (km/hr)	Typical effects
1 - Tropical Cyclone	Less than 125 km/hr Gales	Minimal house damage. Damage to some crops, trees and caravans. Boats may drag moorings.
2 - Tropical Cyclone	125 - 164 km/hr Destructive winds	Minor house damage. Significant damage to signs, trees and caravans. Heavy damage to some crops. Risk of power failure. Small boats may break moorings.
3 - Severe Tropical Cyclone	165 - 224 km/hr Very destructive winds	Some roof and structural damage. Some caravans destroyed. Power failure likely.
4 - Severe Tropical Cyclone	225 - 279 km/hr Very destructive winds	Significant roof and structural damage. Many caravans destroyed and blown away. Dangerous airborne debris. Widespread power failures.
5 - Severe Tropical Cyclone	More than 280 km/hr Extremely destructive winds	Extremely dangerous, widespread damage and power failure.

Tornado Jar

Aim: To observe the shape of a tornado using a jar.

Materials (per group):

- 1 clear jam jar / container with a screw on lid
- Water
- Washing-up liquid or liquid soap
- Food colouring

Procedure:

1. Form into groups and collect materials.
2. Almost fill up the jar with water, leaving a small 1 cm – 2 cm gap, and add a few drops of food colouring.
3. Add a few drops of the washing-up liquid to the coloured water.
4. Tightly screw on the lid.
5. Swirl the container around in a circle a few times, then stop. Place the jar on a table.
6. Observe and document your results!

Image source: https://www.metoffice.gov.uk/learning/weather-for-kids/experiments/tornado

Demo: Cyclone in a Box

DRY ICE?

Dry ice is actually frozen **carbon dioxide**, the gas we breathe out.

Dry ice very cold **(–78.5 °C)** and burns your skin if you touch it.
We need to use safety gear when handling.

Dry ice gets its name because when it 'melts' it doesn't turn into a liquid like normal ice, it turns straight back into carbon dioxide gas.

It skips the liquid state altogether, and goes from solid to gas. This is called **sublimation**!

The fog you see around dry ice, is actually water vapour and carbon dioxide gas.

Image source: http://arcticdryiceinc.com/

Demo: Cyclone in a Box

Facilitator Demonstration

Aim: To observe the formation and shape of a cyclone!

Materials:

- Dry Ice (Caution: refer to risk assessment!)
- Bowl/tray
- Warm water
- Tongs
- Gloves (thick gardening gloves)
- Safety glasses
- Computer fan and 9V battery
- Box constructed of cardboard and clear plastic

Refer to coordinator notes for procedure!

Image source: https://sciencebob.com/build-your-own-personal-fog-tornado/

Lightning

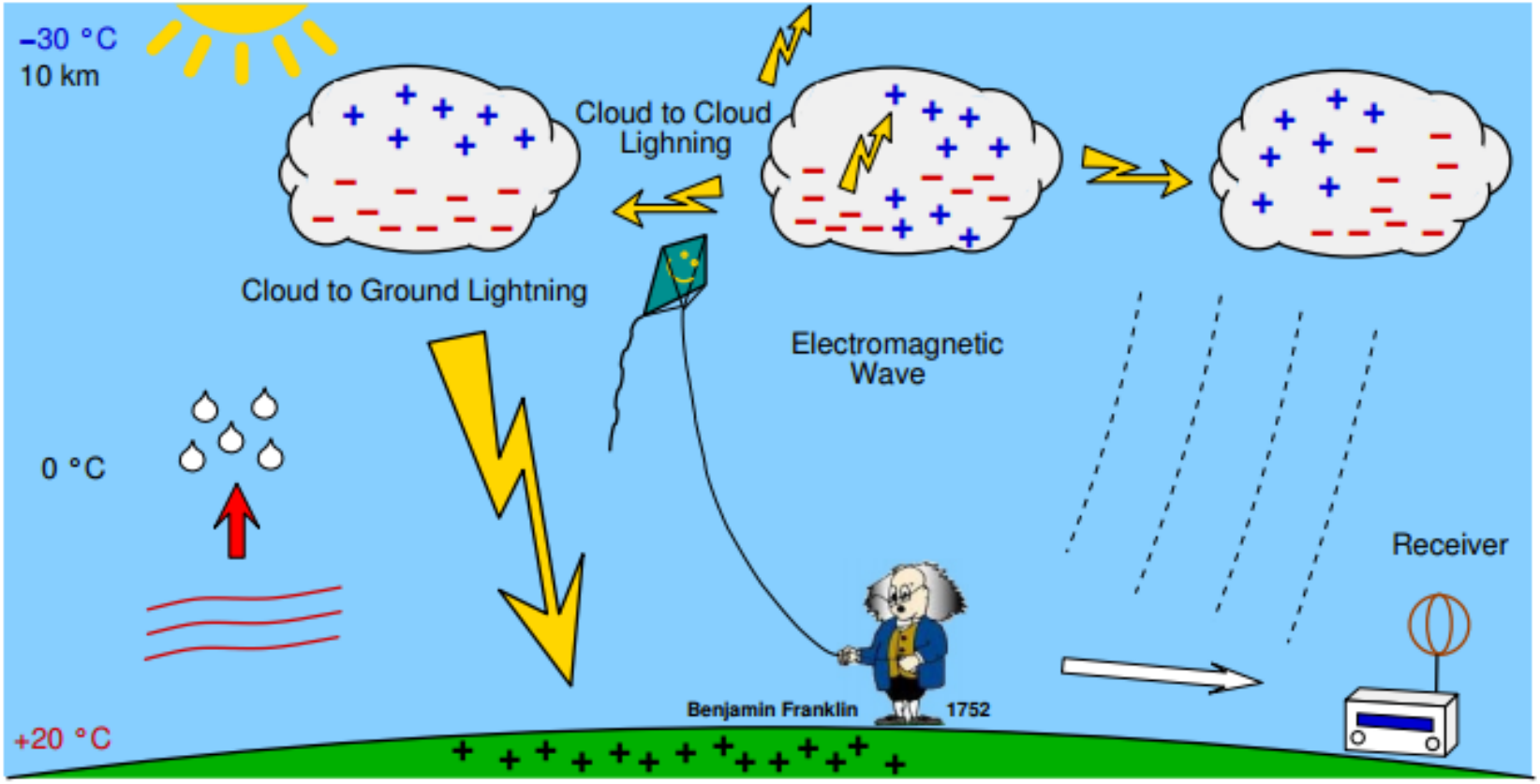
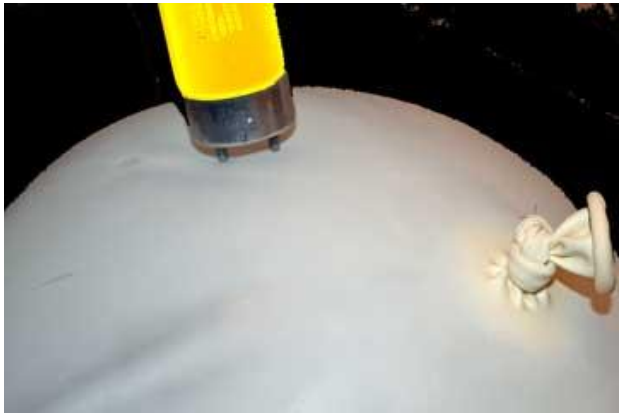


Image Source: http://en.blitzortung.org/Compendium/Documentations/Documentation_2014-05-11_Red_PCB_10.4_PCB_12.3_PCB_13.1_PCB_14.1.pdf

Static Power

Aim: To observe the power of static electricity



Materials (per group):

- 1 balloon
- 1 fluorescent light bulb (thin tube)
- 1 hairy head (or 1 woollen piece of clothing)

Procedure:

1. Form into groups and collect materials.
2. Blow up the balloon and tie off the end.
3. Darken the room / turn out the lights / pull down the blinds.
4. Charge up: rub the inflated balloon against your hair (or a woollen piece of clothing!) for 30 to 60 seconds.
5. Touch the metal prongs of the fluorescent light bulb to the balloon (being careful not to push too hard / pop the balloon).
6. Observe and document your results!

Extensions:

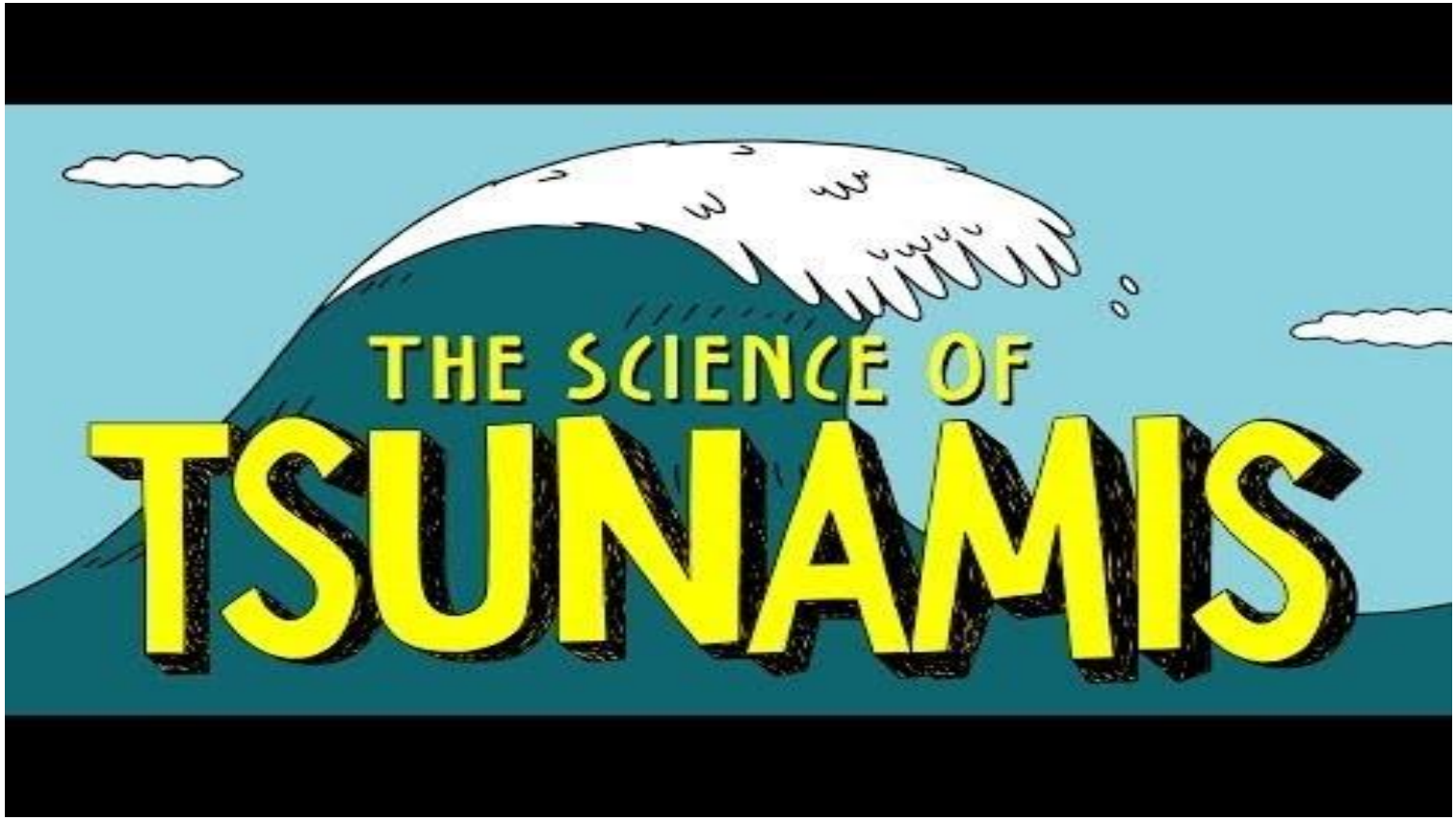
- How long can you make the globe glow for?
- What happens when you place the 'charged up' balloon near a small piece of tissue?

Image source: http://sciencewithkids.com/Experiments/Energy-Electricity-Experiments/Power-light-with-static-electricity.html

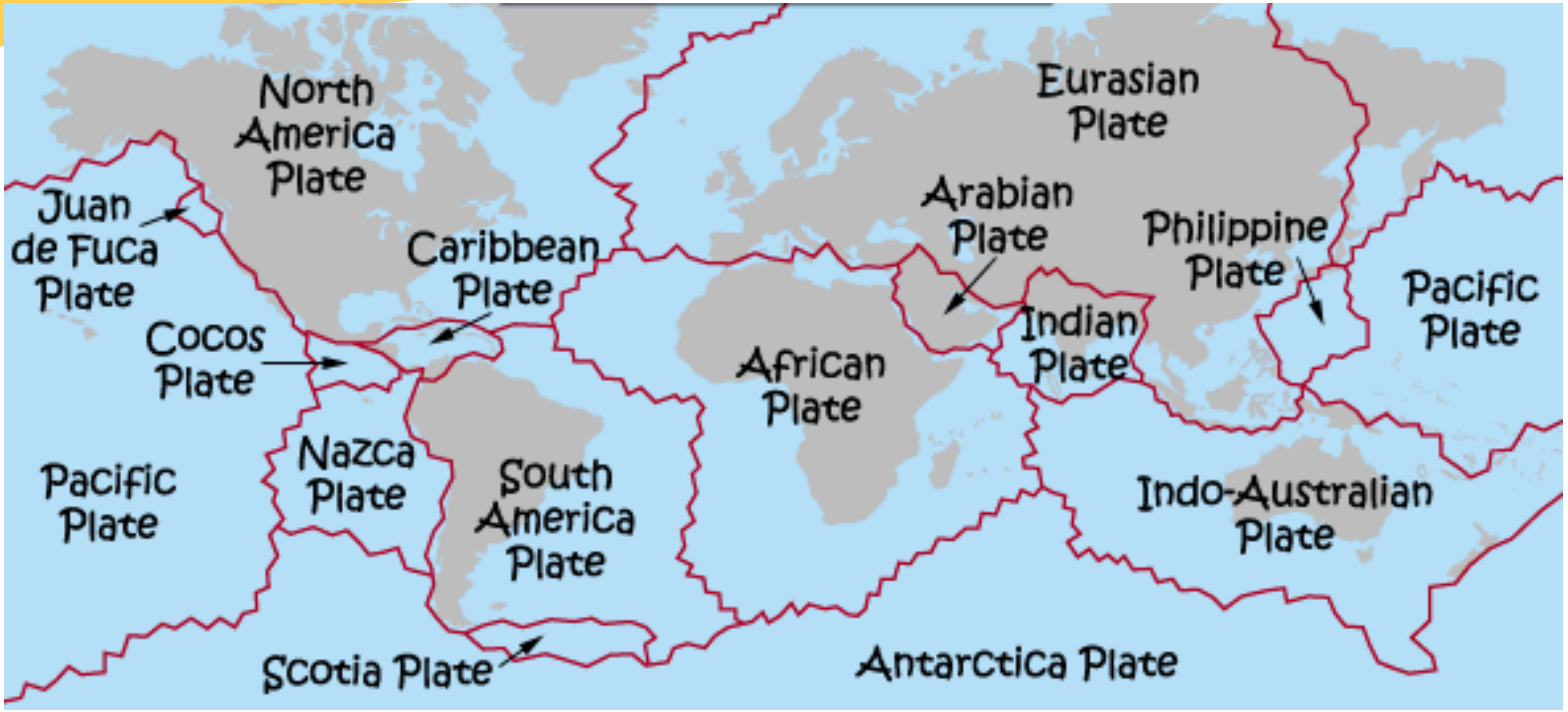
Wild Weather & Natural Disasters

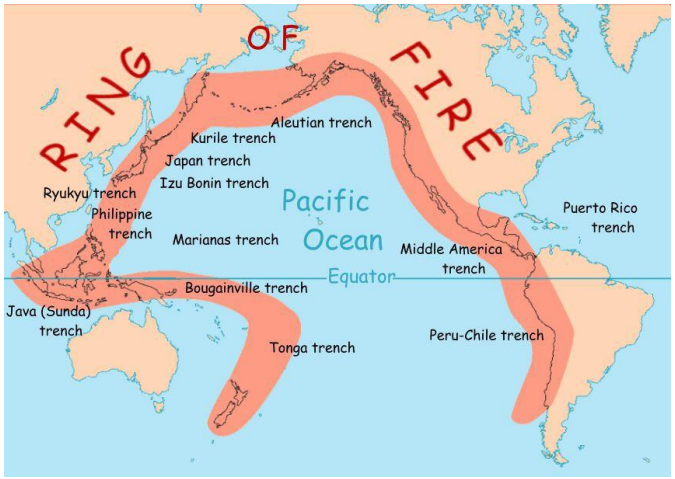
Image sources: http://www.abc.net.au/news/2017-03-31/lismore-cbd-flooded/8404106
https://pixabay.com/en/wildfire-forest-fire-blaze-smoke-1105209/

Earthquakes & Tsunamis



Video: https://ed.ted.com/lessons/how-tsunamis-work-alex-gendler





Tectonic Plates

Image sources: http://www.worldatlas.com/aatlas/infopage/tectonic.htm
https://www.nationalgeographic.org/encyclopedia/ring-fire/

Richter Scale

Richter Magnitude	Earthquake effects
0-2	Not felt by people
2-3	Felt little by people
3-4	Ceiling lights swing
4-5	Walls crack
5-6	Furniture moves
6-7	Some buildings collapse
7-8	Many buildings destroyed
8-Up	Total destruction of buildings, bridges and roads

Image source: http://www.sms-tsunami-warning.com/pages/seismology-measurement#.Vp2HCPl9670

Designing for Wild Weather!

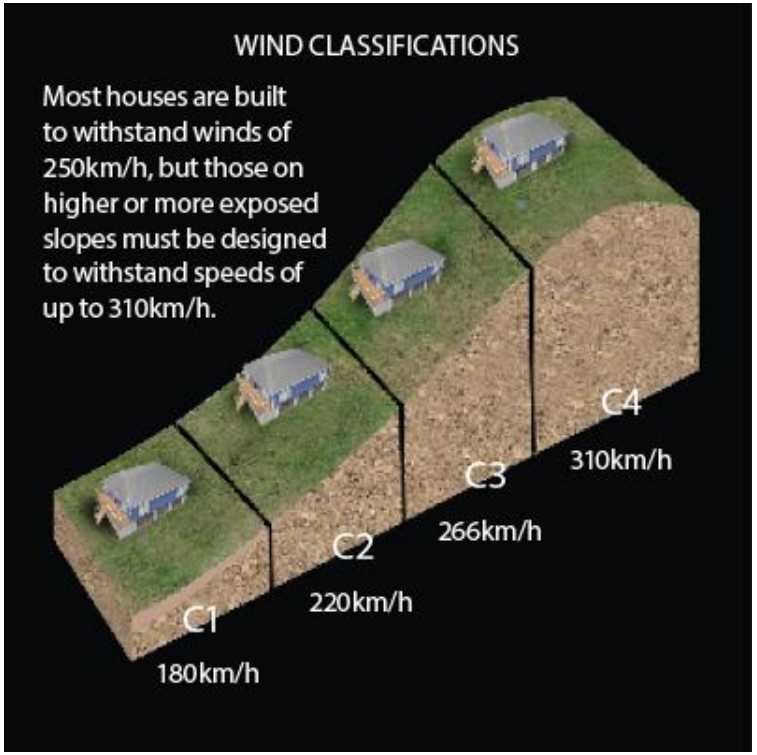


Image sources: www.pixabay.com
http://www.australiangeographic.com.au/topics/science-environment/2016/02/how-to-cyclone-proof-your-house

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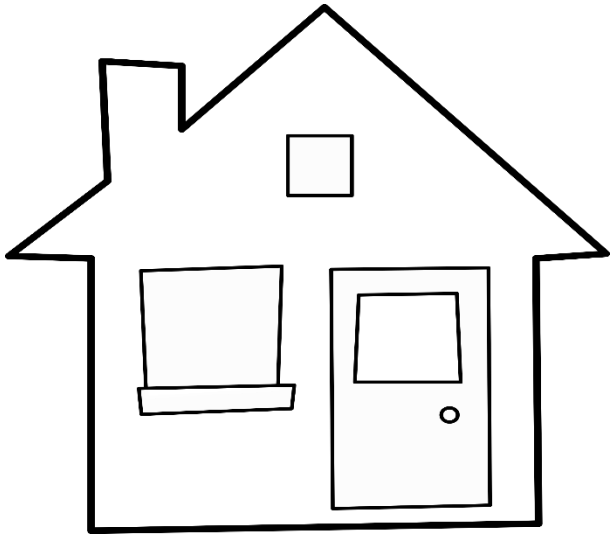
Disaster Proofing Challenge!

Design and construct a building that can withstand some of the wild weather we face in Australia.

Design a structure to withstand:

- *Cyclonic winds*
- *Flooding*



Wind Proofing

The roof of a building is often the first thing to come off in strong winds. Having the roof on a 30 – 45° angle and securing it firmly to the frame of the house are simple ways to reduce damage.

Hip Roof

High Gable Roof

A hip roof is more wind resistant than a high gable roof

Wind Proofing

Windows and doors are also weak spots for wind damage. If wind enters the internal area of the house it causes much more strain on the structure and often ends up with severe damage.

To avoid this, shutters and other window coverings are often used.

Image source: http://www.perthhomeguard.com.au/super-cyclonic-shutter-series/

Wind Proofing

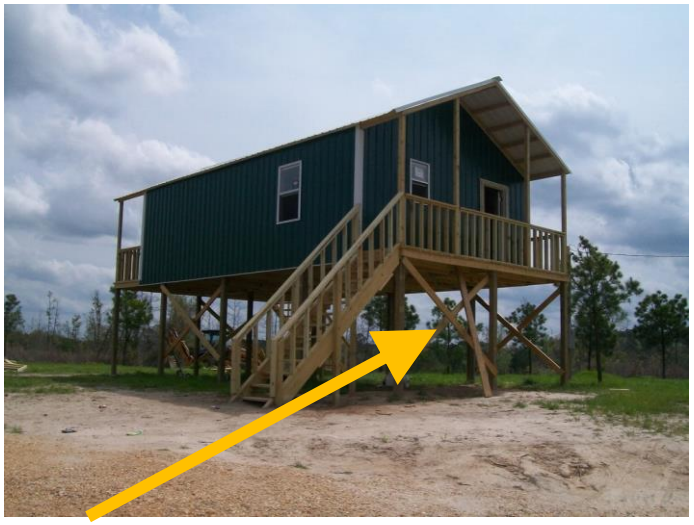
Sometimes buildings can be blown off the ground. To avoid this, the building needs to be secured to the ground with strong foundations.

This can be directly onto the ground or on piers or stilts.

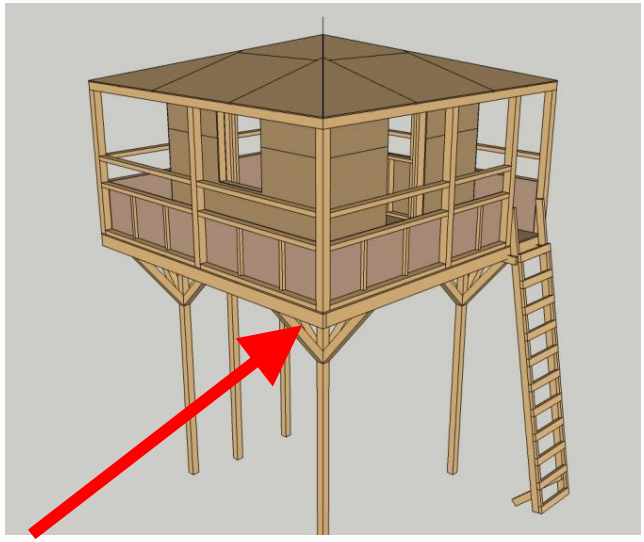
Image source: http://www.buildingproductsplus.com/beach-home-materials/

Flood Proofing

Houses and other buildings in flood-prone areas are sometimes built on stilts or built on raised land. Stilts need to be braced to ensure they are stable. Knee bracing is best when flooding occurs as it allows flood debris to flow past without dragging on the structure.



Diagonal Bracing



Knee Bracing

Image source: https://www.newhorse.com/profile/b.515.r.27711.u.54030f.html
http://www.scottpod.com/model_details/stilt_playhouse/stilt_playhouse_details.html

The Challenge

- Design a disaster-proof building out of the materials provided.
- You'll be given a supply of non-recycled materials which cannot be restocked.
- You can access as much recyclable material as you wish.
- Your building must have a roof, four walls and at least one window and one door.
- Your building must withstand two tests – the flood test and the cyclonic winds test.