The OPAL DIY Weather Kit

OPAL EXPLORE NATURE

The weather is something everyone relates to. It is all around us and affects us all. Meteorologists study the weather and use a variety of technical equipment to monitor changes in the weather over time and make predications for the future e.g. weather forecast. A weather forecast can include information on precipitation (rain, snow, sleet or hail), wind (direction and strength) and air pressure. This DIY kit contains ideas and instructions which, although not accurate enough to be used for professional weather forecasting, will enable you to take a closer look at your local weather and record your findings in a weather diary.

Each DIY weather kit instrument could be made and used on its own or you could make them all and form your own mini weather station. Measurements should ideally be taken daily and recorded in a weather diary.

More information on weather and DIY weather kit ideas can be found on the websites of the Royal Meteorological Society www.rmets.org and Met Office www.metoffice.gov.uk.

Micro-climate investigation

A microclimate is a space that has a different climate to the area around it. Investigate how the microclimate varies in the grounds around a house or school. Place your weather instruments in a variety of recording locations so that some are more sheltered (e.g. next to a tree) and some are more exposed (e.g. open field). Monitor the variations in precipitation, wind strength and direction etc. at different sites at regular intervals and record them in the weather diary. This can be monitored over a day, week or even between seasons. Why not set a challenge at the end of the investigation to use your findings – e.g. *Where would be the best place to put the vegetable patch?*

Staying safe

- Don't look directly into the sun.
- Many of the activities involve the use of scissors. Take care. Vulnerable people should be supervised.
- The cut edges of plastic bottles may be sharp. Trim carefully or use sturdy gloves if necessary.
- Petroleum jelly (used in the barometer) can be an eye irritant. Refer to COSHH guidelines where necessary.

Written by Louise Parker, Field Studies Council

FSC BRINGING ENVIRONMENTAL UNDERSTANDING TO ALL

Precipitation

Precipitation is any form of moisture that falls from the air to the ground. It includes snow, hail, sleet, drizzle and rain. The easiest form of precipitation to monitor is rainfall and this can be measured with a rain gauge.

Rain gauge

Although a home-made rain gauge will not give you exact measurements of rainfall, it will allow you to monitor the variation in rainfall from day to day.

What you need:

Clean clear plastic bottle
Strong tape / paperclips
Water
Ruler (marked in mm)

Instructions

1 Cut the bottle in two as shown in the diagram.

2 Upturn the neck and place it inside the rest of the bottle.

3 Use sticky tape or paperclips to fix the two pieces together, but not too tightly as you will need to take them apart to empty out the rainwater (see step **7**).

4 Pour in water to form a base level. This will prevent the accuracy of the readings being affected by the rounded bottom of the bottle.

5 Use sticky tape to fasten a ruler to the side of the gauge. The zero of the scale should be next to the base level of water.

6 Place the gauge outside in the open, away from buildings and trees. Bricks or logs can be placed around the bottle to prevent it from blowing over. Record the results each day.

7 After each reading, pour out the rainwater that has collected. You will need to take the rain gauge apart to let the water out. Now return the water to the base level ready for the next day.

Wind

Wind is the horizontal movement of air. It is the result of differences in air pressure. Air moves from areas of high pressure to areas of low pressure, and it is this movement of air which we call wind.

Wind vane to measure wind direction

What you will need:

Thin cardboard / card (A4 size)
Pencil and markers
Scissors
Glue or sticky tape
Pen cap
Garden wire (50cm) / wire coat hanger
Paper plate
Drawing pins
Optional:
Drinking straw
Plasticine (Place around base of the wire to add support)

Instructions

1 Draw an outline of an arrow on the cardboard / card (around 25cm long). Draw a picture of your choice to place at the end of the arrow.

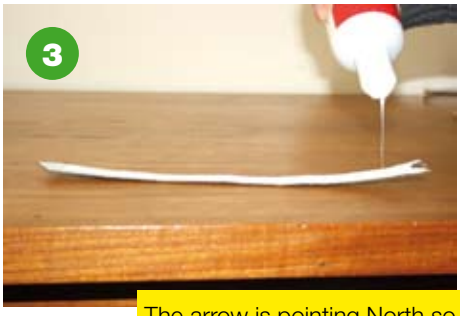
2 Cut out the arrow and shape out. Draw around the arrow and cut another one out.

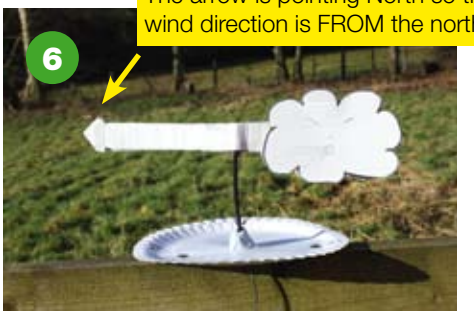
3 Glue the 2 arrows together and leave a small opening in the middle.

4 Glue or tape the pen cap into the opening. Attach the picture at the end of the arrow.

5 Label the paper plate with the compass directions. Choose an area of open ground away from buildings and trees.

6 Coil one end of the wire around a fence post leaving 10cm of wire pointing up in a straight line. Cut the drinking straw 1cm shorter than the wire and place over the wire to add support. Make a small hole in the middle of the paper plate with a pencil and place the plate on top of the wire. Use a compass to find North and arrange the plate in the correct position. Secure the plate with drawing pins. Place the pen top and arrow on top of the wire. Record the direction the wind is blowing FROM.





Wind sock

A wind sock can be used to monitor the wind direction and can be a rough guide to wind speed. If the plastic strips hang down there is no wind, if they flutter the wind is light and if the wind sock extends fully the wind is strong.

What you will need:

Empty plastic bottle (2 litre) - cleaned and without label
Plastic bag
Scissors
Hole punch
String (10cm)

Instructions

1 Cut the top and bottom off the bottle. Trim with scissors to make sure there are no sharp edges.

2 Use the hole punch or scissors to punch two holes at opposite sides. On the bottom end of the plastic bottle punch sixteen holes all the way round.

3 Cut out sixteen 2 cm wide strips from the plastic bag.

4 Thread a plastic strip through each hole and tie securely leaving one end dangling down.

5 Thread the string through and tie at each side.

6 Hold the wind sock in the direction of the wind or hang on a tree/post and observe.

Compare your results

The bubble chase activity (See OPAL Climate Survey pack) is a great activity to track the wind direction. How does this compare with the wind direction you have found using the wind sock or wind vane? Are the results the same? Which do you think is most accurate and why?

Check you results with today's weather forecast or a weather monitor to see how accurate they are. Weather stations measure the wind speed at 10 metres above the ground – why might this be? Why might the wind be different higher up?

Anemometer to measure wind speed

What you will need:

30 cm of strong thread or fishing line
Ping pong ball
Glue and sticky tape
Protractor
Piece of strong cardboard

Instructions

1 Cut out a cardboard to make a rectangle of 25 cm x 15 cm.

2 Fix the protractor to the cardboard with sticky tape, with the curved side facing outwards and just touching the edge. You may also wish to copy the wind conversion chart (right) onto the cardboard.

3 Fix cardboard handles to each side of the rectangle.

4 Tape the thread to the centre of the zero degree reference line of the protractor.

5 Tape the other end of the thread to the ping pong ball.

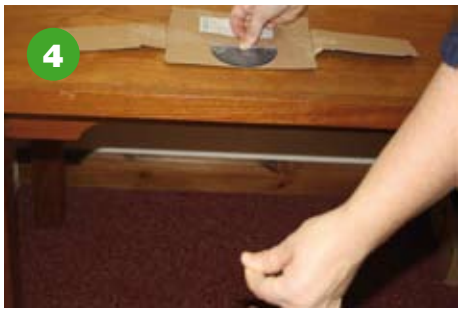
6 Make sure that the thread and ping pong ball can swing freely

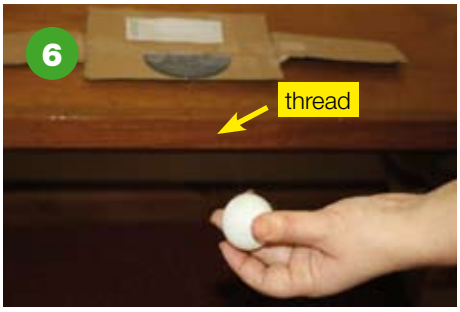
7 Hold the cardboard in the direction that the wind is blowing from, allowing the ball to be caught by the wind.

8 Convert the angle the thread makes to a wind speed.

If you have one, compare your readings to those made with a 'real' anemometer – how does it compare? Otherwise, compare your readings with the Beaufort Scale.

Thread angle (degrees)	Wind speed (km / hour)
90	0
80 or 100	13
70 or 110	19
60 or 120	24
50 or 130	29
40 or 140	34
30 or 150	41
20 or 160	52





Beaufort Scale spinner

The Beaufort Scale uses observations of the environment to get a measure of wind speed.

What you will need:

2 paper plates
Ruler
Scissors
Paper fastener
Marker – fine-tip or felt-tip
Coloured pencils and paints

Instructions

1 Divide one paper plate into 12 sections using the ruler.

2 Number the segments from 1 to 12.

3 Draw a picture of each point on the Beaufort Scale on the widest part of the paper plate. Write a brief description of the wind and wind speed.

4 Cut out a smaller circle from the second paper plate. Cut a V shape the same size as a one section of the plate.

5 Place the smaller circle on top of the plate and attach with a paper fastener.

6 Use the scale to find wind speed. Turn the dial to find the Beaufort Scale reading.

Beaufort Scale	Description	What you see or feel	Wind Speed	
			(mph)	km / hour
0	Calm	Calm. Smoke rises vertically	Less than 1	< 1
1	Light air	Smoke drifts but wind vanes do not move.	1-3	1 - 5
2	Light breeze	You can feel the wind on your face. Leaves rustle. Wind vanes move.	4-7	6-11
3	Gentle breeze	Leaves and smaller twigs in constant motion. Wind extends a light flag.	12-19	12-19
4	Moderate breeze	Wind picks up dust and loose paper. Small branches begin to move.	13-18	20-28
5	Fresh breeze	Smaller trees sway.	19-24	29-38
6	Strong breeze	Large branches in motion. Whistling heard in overhead wires. Using an umbrella is difficult.	25-31	39-49
7	Near gale	Whole trees in motion. Effort needed to walk against the wind.	32-38	50-61
8	Gale	Twigs broken from trees. Cars veer on road. Very difficult to walk.	39-46	62-74
9	Strong gale	Light structural damage. Chimneys and roof tiles damaged.	47-54	75-88
10	Storm	Trees uprooted. Considerable structural damage.	55-63	89-102
11	Violent storm	Widespread structural damage	64-72	103-117
12	Hurricane	Considerable and widespread damage to structures. Destruction.	73 and over	>118

Air pressure

Although air is invisible, it still has weight (1m^3 of air weighs about 1kg). Air pressure varies daily, and is due to the weight of air in the atmosphere above us. High pressure is usually associated with warm dry weather and low pressure with wet and cloudy weather.

Barometer

Barometers are used to monitor changes in air pressure. This home-made barometer uses a balloon to trap air in a glass jar. When air pressure drops, the air in the balloon expands, so the pointer moves down. When air pressure increases, the air in the balloon contracts, so the pointer moves up.

What you will need:

Glass jar
Petroleum jelly
Balloon
Drinking straw
Drinks carton (1 litre)
Sticky tape

Instructions

1 Cut the tight opening off the balloon.

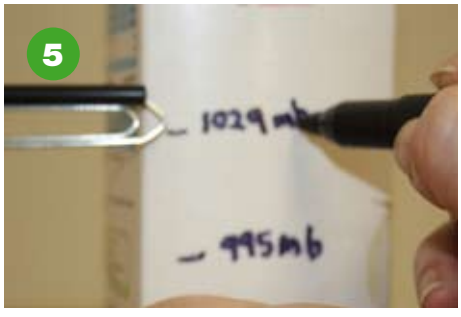
2 Place a small amount of petroleum jelly onto the top edge of the jar. This will help to form a seal. Stretch the balloon over the top of the jar. The balloon should form a flat surface over the jar. Secure the balloon with an elastic band.

3 Fix the straw onto the balloon platform at the top of the jar with sticky tape. Make sure the end of the straw is stuck onto the middle of the balloon to get maximum displacement (movement) when the air pressure changes.

4 Fix a paper clip to the other end of the straw.

5 For this barometer to work it needs to be kept at a stable temperature (inside not outside). Stand the drinks carton next to the straw to see where the arrow points to. Mark this point. Check the local weather report to see what the air pressure is at the moment. Record this value next to the marker.

6 Monitor changes in the movements of the pointer and check the local air pressure readings to fill in values. When you have a range of values you can continue to use the barometer to monitor air pressure and check if the barometer readings are accurate.



Weather diary

Date	Time	Rainfall (mm)	Wind direction	Wind speed	Beaufort Scale	Air pressure	Other weather observations