Why do clouds float?

Introduction

In this unit, students complete activities that involve conducting investigations similar to those that a meteorologist may carry out during experiments and research, leading to an interest in the life of Henry Hunt (1866-1946).

Background

Henry Ambrose Hunt (1866-1946) was one of Australia's first meteorologists.

Meteorology – the science that deals with atmospheric phenomena, especially in relation to weather forecasts.

Why clouds float

Clouds are made of water. Even the smallest fluffy cloud in the sky weighs many tonnes. How does all this water stay up there?

The reason is that the water is in the form of tiny water droplets and ice crystals. Just like tiny dust particles suspended in air, these droplets and crystals are far too small to feel the effects of gravity. Look at the smallest measure on a ruler: one millimetre. It would take hundreds of cloud droplets lined up next to each other to reach this width.

Tiny droplets in clouds join together to form larger drops. Updrafts, which are winds that move upwards, help keep these drops from falling. Eventually, when thousands of droplets combine, the drops may become large enough to fall to the ground … as rain.

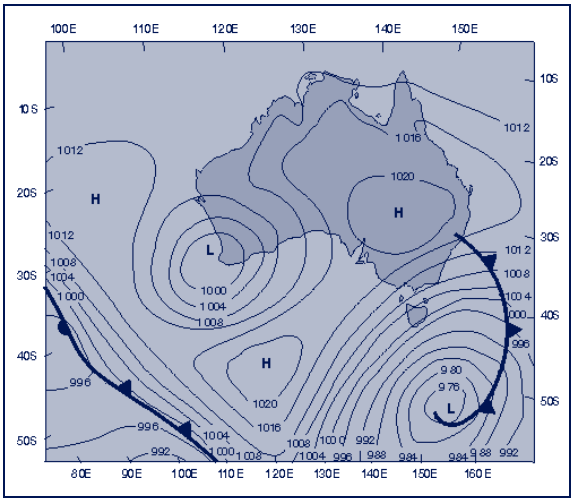
Investigation One

Weather map

Look at a weather map (each day in a newspaper).

Determine what all the symbols on the map are.

Make a table detailing the symbols and their meaning.



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Activities

Investigate the work of today's meteorologists. Compare today's meteorology with the times of Henry Ambrose Hunt. What technologies are available today that weren't available then? What difference does today's technology make to the study of weather?

Henry Ambrose Hunt

Henry Ambrose Hunt was born in London, England, 7 February 1866, and emigrated to Australia in 1884. He became a clerk at the Sydney Observatory in 1884, and went on to become a meteorological assistant in 1886 and acting meteorologist in 1904. In 1907 he became the Director of the Commonwealth Bureau of Meteorology (1907-1931). Henry Ambrose Hunt died in Melbourne, 7 February 1946.

Source: Adapted from http://www.asap.unimelb.edu.au/bsparcs/physics/P002230p.htm

Investigation Two
Measuring Pressure

You will need

Jam jar
Large piece of rubber from a balloon
Rubber bands
Drinking straw
Sticky tape
Blu tack
Cardboard and paper

Safety – Ensure that there is no danger of the rubber or rubber band snapping.

Procedure

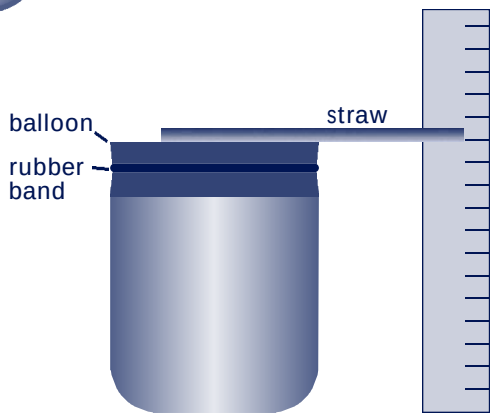
Stretch the balloon rubber over the jar and secure it with a strong rubber band.
Cut one end of the straw to a point. Tape the end of the straw to the centre of the balloon with the point away from the jar.

Support the ruler with blu tack in an upright position in front of the end of the straw. The ruler's "zero" measurement should be at the bottom.

Record the height on the ruler that the end of the straw aligns with at various times during the day.

Draw a table and record the reading at the same time of the day for at least a week.

Collect weather charts each day and check to see whether the changes in pressure that you record match those recorded by the Weather Bureau. Compare your pressure readings with those from a barometer.



How do you think that this instrument measures air pressure?

Investigation Three
Collecting weather data

Use available weather instruments (thermometer, rain gauge, barometer etc) to collect data on the daily weather.

Collect the data over a period of time.

Use the data to construct a series of graphs that show the weather information.

Compare your weather data with that from the bureau of meteorology (www.bom.gov.au) or the local paper.

DAY	TEMP	RAIN
Monday		
Tuesday		
Wednesday		
Thursday		
Friday		
Saturday		
Sunday		

Investigation Four

Soaking Rain

What You Need

Two cans of similar size
(one with both ends removed)
Water
Different outdoor places with
soil – clay, sand etc
Stopwatch

What You Do

Some of the rain that falls on soil runs off into streams. Some rain also soaks into the ground.

On the can which is open at both ends, scratch a sideways mark on its side 2-3cm from one end. Using your foot, press the can into the soil up to the mark.

Have the second can filled with water. Pour the water into the first can without spilling any. Time how long it takes for all the water to sink into the soil. Record your results.

Repeat with different soil (e.g. sand, clay).

In groups, discuss your results. Remember to talk about the time taken for the water to soak into each different type of soil. How do you explain the different times?

Investigation Five

Colour and Light

What You Need

1 plastic bottle painted white
1 plastic bottle painted black
Several small balloons
Rubber bands
Sunny day (or heat lamp)

What You Do

Put the balloon over the neck of each bottle.

Hold the balloons firmly in place with the rubber bands.

Place the two bottles near a heat source – sun is best. If sunlight is not available you can substitute another heat source; e.g. a hair dryer.

Observe what happens to the balloons.

Why do you think the balloon on the black bottle expanded? Does heat make air expand?

Does a black object get warmer in the sunlight than a white object? Why?

What would be a good colour to paint the family car if you wanted it to stay cool in the summer?

Other activities

Measuring aspects of the weather — For 'A Hairy Hygrometer' which measures humidity, an 'Anemometer' which measures wind speed and making a 'Tornado in a Bottle' instructions, visit http://nesen.unl.edu/teacher/activities/meteorclimate.html.

Rain Gauge — Students work individually or in groups to make a rain gauge out of a measuring cylinder in a beaker with a funnel on top. Place in an open position in the school grounds and record rainfall over several days. Students record their observations in a journal.

Brainstorm — Brainstorm why meteorologists are important. Give examples of how the work of meteorologists assist many people in their daily lives – you, your parents, pilots, farmers etc.

Key Learning Areas

SOSE — Investigate different weather patterns in other places: other Australian states/cities; other countries. Write the names of several other places on cards, place in a box, and draw lots to see which region your group will research.

Investigation Six

Measuring Wind Speed

What you need

Strong cotton or thin fishing line – about 40 cm long
Table tennis ball
Large protractor (or make your own from card using a small protractor to mark the card)
Glue and sticky tape
Thick cardboard

What you do

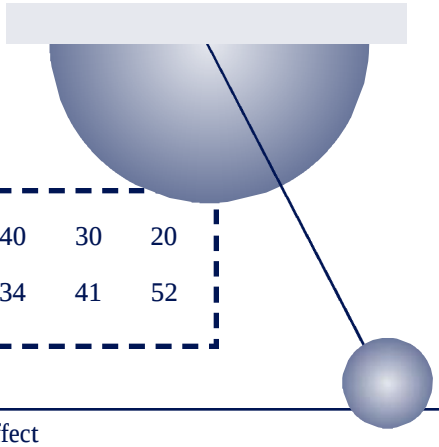
Stick the protractor with tape to the cardboard, curved side pointing down.

Tape or glue the thread to the table tennis ball.

Tie or glue the other end of the thread to the centre of the protractor.

Put the wind measuring instrument outside. When the wind blows the thread off centre, read the angle on the protractor. Convert this angle to the wind speed in this table.

Use your instrument outside and away from buildings to measure wind speed. At the same time, use the Beaufort wind scale to write down your observations about the strength of the wind.



String Angle (degrees)	90	80	70	60	50	40	30	20
Wind Speed (km/h)	0	13	19	24	29	34	41	52

Beaufort Scale

Beaufort Number	Description	Wind Speed (km/h)	Effect
0	Calm	Less than 2	Smoke rises vertically
1	Light Air	2-5	Smoke drift shows wind direction, wind vanes don't move.
2	Light Breeze	6-12	Wind felt on face, wind vanes move.
3	Gentle Breeze	13-20	Leaves and small twigs in motion, hair disturbed, clothing flaps.
4	Moderate Breeze	21-30	Dust and loose paper moved, small branches move.
5	Fresh Breeze	31-40	Small trees with leaves begin to sway, wind force felt on body.
6	Strong Breeze	41-51	Large branches move, umbrellas difficult to use, difficult to walk steady.
7	Moderate Gale	52-63	Whole trees in motion, inconvenience felt when walking.
8	Gale	64-77	Twigs broken off trees, difficult to walk.
9	Strong Gale	78-86	People blown over, slight structural damage including tiles being blown off houses.
10	Whole Gale	88-101	Trees uprooted, considerable structural damage.
11	Storm	102-120	Widespread damage.
12	Hurricane	Greater than 120	Widespread devastation.

Glossary

A glossary of meteorological terms is available at:
http://water.dnr.state.sc.us/climate/sercc/education/glossary/index.html

Investigate useful websites about the weather

Commonwealth Bureau of Meteorology, Australia: http://www.bom.gov.au/
Includes links to weather, floods, climate information, news and meteorology, with educational information and school projects. Good site for both teachers and students.

Visit the weather Dude at: http://www.wxdude.com

http://faldo.atmos.uiuc.edu/w_unit/weather.html – has more lesson ideas for teachers on weather, including links to all key learning areas.

For photographs of cloud types, visit: http://www.bom.gov.au/lam/

Review Activities

WORDSEARCH

P	R	E	D	I	C	T	I	O	N	S	A
M	E	T	E	O	R	O	L	O	G	Y	S
E	M	I	G	R	A	T	E	D	H	D	S
L	O	N	D	O	N	W	A	S	E	N	I
B	U	R	E	A	U	E	C	T	N	E	S
O	B	S	E	R	V	A	T	O	R	Y	T
U	C	L	E	R	K	T	I	R	Y	E	A
R	A	W	A	T	C	H	N	M	H	A	N
N	R	O	T	A	T	E	G	E	A	R	T
E	E	U	A	M	B	R	O	S	E	N	T

➤ Find these words about Henry Hunt and Meteorology in the Wordsearch:

HENRY
WATCH
GEAR
SYDNEY
CARE
PREDICTIONS
H U N T (scattered)
AMBROSE
ROTATE
CLERK
WEATHER
ASSISTANT
LONDON
BUREAU
LONDON
STORM
MELBOURNE
EMIGRATED
METEOROLOGY
YEAR
ACTING
OBSERVATORY