



OUTCOMES SCIENCE 4

EARTH & BEYOND

INSTRUCTIONAL MODULE 5: LESSON 2
TARGET YEAR GROUPS: 8 / 9 / 10 / 11 / 12

Student Name:

Tutorial Group:

From time-to-time, do you gaze into the daytime sky to marvel at an interesting cloud shape, and imagine what it looks like? Have you, like me, been captivated by the wondrous beauty of sunset painted clouds?

Most humans are fascinated by the changing face of the weather, visibly portrayed in the many different types of clouds and the patterns they make. Some people capture the changing face of the weather in photographs.

Richard Carlson has an online gallery of interestingly shaped clouds, which he calls "Cool Clouds for 'Kids' of all Ages". Which cloud shape do you find the most intriguing? Michael Thompson has an online collection of "Australian Weather Photos". Please note that the images displayed at both these web sites are copyrighted.

1. http://pals.agron.iastate.edu/carlson/look_like/index.html

2. <http://ozthunder.com/photo/photo.htm>

Other creative people capture emotional encounters with the wonders of nature by writing poetry. One such person was the poet William Wordsworth (1770-1850). Can you recall the name of his most famous poem? You might say, what has poetry got to do with science? Keep an open mind and I will show you.

Students in each Learning Group should now visit the web sites whose Internet Addresses (URL's) are given below to read and study a poem from William Wordsworth, and one from Percy Bysshe Shelley (1792-1822).

1. <http://www.flint.lib.mi.us/fpl/resources/poetry/poetryquiz/wordsworth.html>

2. <http://home.uchicago.edu/~alicelam/Poetry/Daffodils.html>

3. <http://www.vaxxine.com/steveb/cloud.htm>

1. Have you ever seen a field of daffodils blurring into the distance? What images does Wordsworth's poem bring to your mind?

2. What does the poem "The Cloud" by Percy Bysshe Shelley (1792-1822) mean to you? What science ideas about clouds and weather can be gained by reading Shelley's poem?

Can you as a budding scientist also appreciate poetry? What is the role of science in our society?

By studying science we come to understand the natural world in which we live. However, some people say that science by explaining the cause of natural things like rainbows destroys their mystical quality and aesthetic appeal.

To elaborate, before people understood the cause of rainbows, a rainbow was considered to be a mystical event. We now know that there is nothing mystical about rainbows.

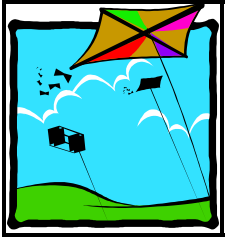
Rainbows are caused by the refraction, dispersion and total internal reflection of sunlight by raindrops.

3. But do you, as a scientist, know how air pollution can prevent rainbows from forming?

As a scientist, I experience great satisfaction in trying to understand how the wondrous things in my world, like rainbows and clouds, come into existence. To me, poetry can focus my appreciation of the world in which I live.

Students in each Learning Group may like to explore the physics of rainbows by visiting the web site whose Internet Address (URL) is given below.

<http://www.phy.ntnu.edu.tw/java/Rainbow/rainbow.html>



Shortly, you will be asked to conduct a practical investigation of the different types of clouds that you observe in your immediate daytime sky and indicate the weather associated with each cloud type.

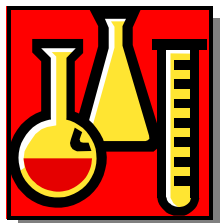
However, before conducting your investigation, you will need to research and learn to recognise the distinguishing features of the ten (10) main cloud types from their online photographs.

To do this, you will need to visit the web sites whose Internet Addresses (URL's) are listed below to view photographs of identified clouds, and then name, describe and grey pencil sketch each of the ten (10) main cloud types.

1. <http://www.bom.gov.au/info/clouds/>
2. <http://australiasevereweather.com/techniques/moreadv/class.htm>
3. <http://www.pnr-rpn.ec.gc.ca/air/cloudchart/aj00s00.en.html>
4. [http://ww2010.atmos.uiuc.edu/\(Gh\)/guides/mtr/cld/cldtyp/home.rxml](http://ww2010.atmos.uiuc.edu/(Gh)/guides/mtr/cld/cldtyp/home.rxml)
5. <http://vortex.plymouth.edu/clouds.html>
6. <http://www.met.hu/cloudalbum/cloud.htm>
7. <http://globe.ngdc.noaa.gov/cgi-bin/m2h?gl/clouds.men>
8. <http://asd-www.larc.nasa.gov/SCOOL/cldchart.html>
9. <http://icp.giss.nasa.gov/education/cloudintro/page4.html>
10. http://asd-www.larc.nasa.gov/edu_act/class_cloud_type.html

Students in each Learning Group now compile their pencil sketches of the ten (10) main cloud types into individual student portfolios. Ask your teacher to tick (✓) your name on a class list to indicate that you have completed your portfolio of cloud sketches.

You are now ready to carry out your practical investigation of observing and identifying cloud types.



[EB: IM5: L2: Activity 1] Students in each Learning Group now conduct a practical investigation into the different cloud types that they observe in their immediate daytime sky. They then match each existing cloud type with its associated weather.

You are to complete the weather recording form given as TABLE 1 below.

TABLE 1: WEATHER RECORDING FORM

TABLE 1: WEATHER RECORDING FORM					
School:					
Postal Address:					
Elevation (m):					
Latitude:					
Longitude:					
Day	Monday	Tuesday	Wednesday	Thursday	Friday
Date					
Time (GMT/UTC)					
Cloud Type and Cloud Cover (%)					
Humidity (%)					
Temperature (°C)					
Pressure (h Pa)					
Description of Weather					
Monday					
Tuesday					
Wednesday					
Thursday					
Friday					



You will notice that the time to be recorded in TABLE 1, from the previous page, is Greenwich (GMT) or Universal Time Co-ordinated (UTC). How do you convert your Local Standard Time into GMT or UTC?

Firstly, ensure that the internal clock in your personal computer (PC) is showing the correct Local Standard Time for your time zone.

Secondly, visit the web sites whose Internet Addresses (URL's) are listed below. At these web sites, you may obtain GMT or UTC either directly, and / or indirectly, by using a Time Zones Converter.

1. <http://www.timeanddate.com/time/abbreviations.html>

2. <http://www.page-1.com/gmt/>

3. <http://www.web-search.com/timezone.html?=&GoTo.com>

4. <http://www.intervisnet.com/>

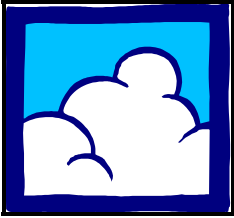
4. In TABLE 1, you are also required to record humidity as a percentage (%). What does a relative humidity of 100 % mean? What happens when air at its dew point is further cooled?

Relative humidity, which is usually expressed as a percentage, is the ratio of the mass of water vapour per unit volume of the air to the mass of water vapour per unit volume of saturated air at the same temperature. **Dew point** is the temperature at which the water vapour present in the air saturates the air and begins to condense, i.e., dew begins to form.

Students in each Learning Group could visit the web sites whose Internet Addresses (URL's) are listed below to further research relative humidity and dew point.

1. <http://www.uswcl.ars.ag.gov/exper/relhum.htm>

2. <http://www.esb.act.gov.au/firebreak/humidity.html>



Students in each Learning Group should now compare and contrast the weather data they recorded in TABLE 1, on page 4, with current weather data for the city or town in which their school resides.

They can obtain current weather data for their home city or town by visiting the "Weather Underground" web site whose Internet Address (URL) is given directly below.

1. <http://www.wunderground.com/>

In TABLE 1, you were asked to identify the main cloud types and estimate the percentage (%) of the visible sky that was covered in clouds.

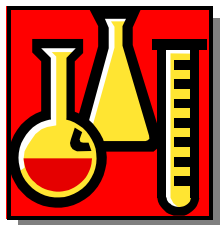
Why would various government agencies from around the world collect and display data on clouds and on patterns of cloud motion?

You can research answers to the above Question by analysing the cloud data provided at the web sites whose Internet Addresses (URL's) are listed below.

2. <http://www.bom.gov.au/climate/change/cloud.shtml>
3. <http://isccp.giss.nasa.gov/dataview.html>
4. <http://www.nasm.si.edu/earthtoday/atmo.htm>
5. <http://www.bom.gov.au/weather/nt/inside/thelma/index.shtml>
6. http://kauai.nrlmry.navy.mil/tc-bin/tc_home

You can simulate and play with tropical cyclones at web site #7.

7. http://www.riverdeep.net/earthpulse/data/hurricanes/hurricane_lab.html



[EB: IM5: L2: Activity 2] Students in each Learning Group now plan and conduct a practical investigation to show how water vapour in air forms into dew and frost. Read all of the Questions before planning your investigation.

Your teacher will provide the following materials to each Learning Group.

- ✓ One (1) Small shiny metal can (about 250 mL).
- ✓ Enough ice blocks to half fill the can.
- ✓ One (1) 100 mL beaker filled with common salt.
- ✓ Three (3) Strips of cobalt (II) chloride (CoCl_2) paper.
- ✓ One (1) Plastic teaspoon.

1. Do you agree that moist air contains water vapour? How do you know that moist air contains water vapour? Why can't you see the water vapour contained in moist air? How could you use the materials supplied to your Learning Group to show that moist air contains water vapour?

2. What will you see forming on the outside of the shiny metal can cooled with ice only?

3. How can you test to show that the substance forming on the outside of the can are droplets of water?

4. What happens to the droplets of water on the outside of the can when you spoon salt over the ice inside the can? Why do the droplets of water undergo a change? Is the change, a physical change, or is it a chemical change?

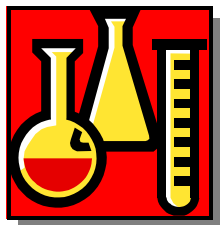
5. Can you explain why dew, then frost formed on the outside of the shiny metal can when it was cooled, firstly with only ice, and then with an ice plus salt mixture? In your explanation, you must make correct use of these science words: **dew point**, **saturated**, **condensation** and **freezing**.

You used cobalt (II) chloride paper to test for the presence of water. Dry cobalt (II) chloride paper is blue, whereas cobalt (II) chloride paper wet with water is pink. Cobalt (II) chloride paper is filter paper that has been saturated with a solution of cobalt (II) chloride and then dried.

6. Can you **explain why** anhydrous (dry) blue cobalt (II) chloride becomes pink when wet with water?

A cloud is a visible accumulation of minute water droplets and or / ice particles suspended in the atmosphere above the Earth's surface.

7. The purpose of your practical investigation [**EB: IM5: L2: Activity 2**] is to help you understand the process of cloud formation. What have you learnt about cloud formation from doing this activity? How do clouds form? Explain using labelled diagrams together with brief notes. Print this page.



MAKING A CLOUD IN A BOTTLE: A FOGGY EXPERIMENT

[EB: IM5: L2: Activity 3] Students in each Learning Group now make a cloud in a clear plastic bottle. Read all of the Questions before making your cloud.

Your teacher will provide the following materials to each Learning Group.

- ✓ One (1) 2 Litre clear plastic PET cool drink bottle with cap.
- ✓ One (1) Box of matches.
- ✓ Cold and hot water.

RESIST THE TEMPTATION. YOU MUST NOT PLAY WITH MATCHES.

WHAT TO DO!

- Pour about 60 mL of cold tap water into the clear plastic bottle.
- Screw on the cap. Vigorously shake the bottle about ten (10) times.
- Squeeze and release the bottle about ten (10) times.

1. Do you observe anything happening inside the bottle?

- Open the bottle and light a match.
- Quickly drop the match into the bottle and screw on the cap.
- Squeeze and release the bottle again.

2. Did you observe anything happening inside the bottle this time?

- Repeat the six (6) steps with hot water.

3. Can you now observe something happening inside the bottle? Was your experiment more effective with hot water?

- To release the cloud from the bottle, remove the cap and squeeze the bottle, carefully observing the mouth of the bottle.

4. Did you observe the cloud leaving the squeezed bottle?

FOCUS QUESTIONS

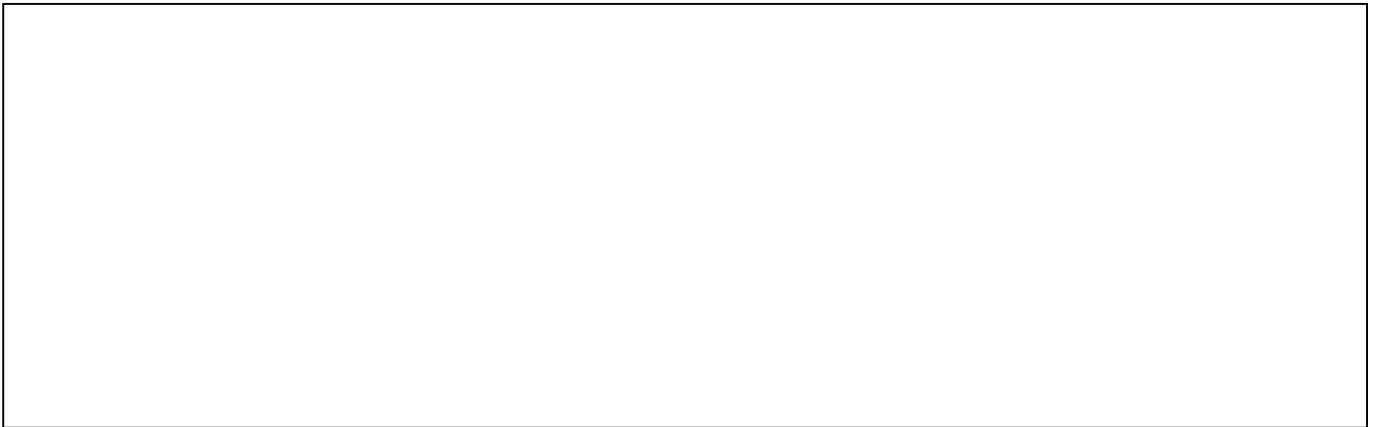
5. Why does shaking the bottle help a fog to form inside the bottle?

6. Why does the smoke help the fog to form? What are the smoke particles called in this situation?

7. Why was the experiment more effective with hot water than with cold water?

8. Would you agree that squeezing the bottle increased the air pressure inside the bottle? Why does squeezing the bottle slightly warm the air inside the bottle? Why does squeezing the bottle cause the cloud in the bottle to disappear?

9. The purpose of your practical investigation **[EB: IM5: L2: Activity 3]** is to help you understand the process of cloud formation. What have you learnt about cloud formation from doing this activity? How do clouds form? Explain using labelled diagrams together with brief notes.



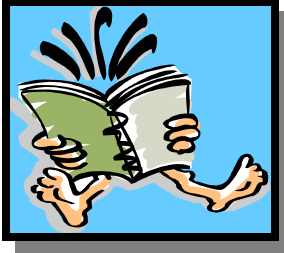
You should now understand that: **Clouds form when warm moist air is lifted higher into the troposphere where it is colder.** You will recall that: **In the troposphere air temperature decreases with altitude.**

10. Can you **describe**, with labelled diagrams together with brief notes, the four (4) ways by which moist air can be lifted to form a cloud? Divide the text box into four. Print this page.



Students in each Learning Group should now check the accuracy of their explanations to Activities 2 and 3 by visiting the web sites whose Internet Addresses (URL's) are listed below. You should also open and print a copy of web site #3 and then complete the Cloud crossword.

1. <http://www.shm.monash.edu.au/education/schools/dewfrost.htm>
2. <http://www.shm.monash.edu.au/education/schools/petcloud.htm>
3. <http://www.shm.monash.edu.au/education/schools/clouds/question.htm>



REFLECT AND RE-LEARN

Students in each Learning Group are to firstly identify and list, as a dot-point summary, all those key science concepts (ideas) that they have come to understand by studying this Earth & Beyond Science Instructional Module.

Secondly, they are to identify and list those words and concepts (ideas) that are unclear to them. They then seek help from other students in their Learning Group, and then from other Learning Groups.

Your teacher will assist you, only after your science class has expended every effort to clarify the difficult content on their own.