Science 11 Resource Package

Earth and Space Science: Weather Dynamics

Suggested Lessons and Activities

The following lessons and activities meet some of the foundational and learning objectives as outlined for Science 11 – Earth and Space Science: Weather Dynamics. Teachers should be reminded that these are only suggested activities and that they can and should be adapted to meet individual learning needs. The order that the lessons appear in is only a suggested order. Teachers can and should integrate their own lessons and ideas within the suggested lessons outlined in this unit.

The lessons outlined in this document consist of four sections. "Foundational and Learning Objectives" provides the numbers that correspond to the objectives that are identified in *Guidelines for Developing Modified Courses: Science 11 (Basic)*. "Lesson Overview" provides a brief description of the suggested lesson or activity. "Instructional Documents" lists Teacher Support Material or Student Handout documents that are directly related to the lesson. "Supporting Resources" lists resources from various sources that may be directly related to the lesson, that may support instructional content within the lesson or that may be alternate ways of meeting all or some of the foundational and learning objectives outlined in the lesson.

The guidelines and objectives for Science 11 have been chosen to reflect the units of the renewed Science 10 (2005) curriculum. Therefore, in addition to the *Guidelines for Developing Modified Courses: Science 11 (Basic)*, teachers should use the document *Science 10: Curriculum Guide* to assist with unit planning and instruction for Science 11. *Science 10: Curriculum Guide* provides sections on key questions, key concepts, pre-instructional questions as well as suggested teaching strategies and activities for each of the foundational objectives within each unit. Curriculum documents are available on-line at http://www.learning.gov.sk.ca/.

List of Lessons for Weather Dynamics

Lesson #	Name of Lesson
1	Weather vs. Climate
2	Extreme Canadian Weather
3	Severe Weather Project
4	Planet Weather
5	Weather Journal
6	Forecasting the Weather
7	The Water Cycle
8	Weather Dynamics Circus
9	Weather Proverbs
10	Global Climate Change

Foundational and Learning Objectives

WD1 Explore the causes and impact of severe weather in Canada

1. Identify and explain those characteristics that distinguish weather from climate. (CCT)
2. Identify and explain the causes of Canadian severe weather events (e.g., tornadoes, hurricanes, blizzards, hailstorms, thunderstorms, flooding, ice storms, and droughts).
3. Identify tools scientists use to describe and classify severity of weather phenomenon (i.e., Beaufort wind scale, Saffir-Simpson Hurricane Scale, wind chill chart, humidex, UV index). (TL)

WD2 Analyze meteorological data

3. Express meteorological data qualitatively and quantitatively. (NUM)
5. Display meteorological data in a variety of formats including diagrams, tables, charts, and graphs. (NUM)
6. Analyze meteorological data for a given time span using appropriate methodologies and technologies.

WD3 Explain the principles of weather

3. Explore cultural and historical views on the origins and interpretations of weather. (PSD)
4. Identify and describe the characteristics of the atmosphere, hydrosphere, and lithosphere.
5. Describe and explain heat transfer within the water cycle.
12. Show understanding of ideas by providing alternate phrasing, drawings and diagrams, modeling, writing, etc. (COM)

WD4 Forecast local weather conditions

1. Examine the principles of weather prediction and predict local weather conditions, using qualitative and quantitative methods. (NUM)
2. Determine the accuracy of local weather predictions for a given period. (CCT)
5. Explore various cultural and historical perspectives related to weather forecasting.

WD5 Identify consequences of global climate change

1. Identify current issues related to global climate change. (PSD)
2. Identify the most important natural and human factors that influence global climate. (TL)
3. Examine and evaluate evidence that climate change occurs naturally. (CCT)
5. Select and integrate information related to global climate change from various print and electronic sources. (COM)
7. Discuss potential consequences of climate change and the need to investigate climate change.

Lesson 1 – Weather vs. Climate

Foundational and Learning Objectives: WD1: 1

Lesson Overview:

In this lesson students will use a Venn diagram to identify and explain the characteristics that distinguish weather from climate. The terms weather and climate will be clearly defined and the relationship between the two concepts will be explored.

Instructional Document(s):

1. Weather vs. Climate (Student Handout).

Supporting Resource(s):

1. A Closer Look at Earth, p.502 *Nelson Science 10.*

2. Weather and Climate, p. 220 *Nelson Science 10: Concepts and Connections.*

Lesson 2 – Extreme Canadian Weather

Foundational and Learning Objectives: WD1: 2

Lesson Overview:

In this lesson students should watch a video on severe weather in Canada. The content of the video should help students to identify and explain the causes and the impact of some severe weather events. The instructional documents provided with this lesson are designed for use with Extreme *Canadian Weather*. *Extreme Canadian Weather* is a two part video that summarizes some of the extreme weather events that have occurred in Canada. Part 1 of the video, *Wind and Water*, reviews disasters such as Hurricane Juan and the Edmonton Tornado. Part 2, *Fire and Ice*, summarizes weather events such as the 2003 forest fires in B.C. and the Quebec/Ontario Ice Storms.

Note that when using any video for instructional purposes watching the entire video may be too much at one time. Students will often benefit from watching small segments of the video with sufficient pauses and assistance with gathering important information from the video.

Instructional Document(s):

1. *Extreme Canadian Weather* (Video): Background Information (Teacher Support Material).

2. *Extreme Canadian Weather*: Video Viewing Guide - Part 1 and Part 2 (Student Handouts).

Supporting Resource(s):

1. *Extreme Weather* (Video); *Part 1: Wind and Water and Part 2: Fire and Ice*. Refer to the resources section in the *Science 11 Introduction* for further information.

Lesson 3 – Severe Weather Project

Foundational and Learning Objectives: WD1: 2, 3

Lesson Overview:

In this lesson students will explore the causes and the impact of severe weather events. The project can begin with a brainstorming session to create a list of severe weather patterns that students have heard about or experienced. From the list students will select one of the severe weather patterns to research. They will find information on the cause of the severe weather event, impact of the severe weather as well as the tools that scientists use to describe and classify the severity of the weather phenomenon.

Instructional Document(s):

1. Severe Weather Project (Student Handout).

Supporting Resource(s):

1. Extreme Weather in the News, p. 236-237 *Nelson Science 10: Concepts and Connections*.

2. Extreme Weather Events, p. 238-240 *Nelson Science 10: Concepts and Connections*.

3. Severe Weather, pp. 502-512 *Sciencepower 10*.

Lesson 4 – Planet Weather

Foundational and Learning Objectives: WD1: 1, 2, 3; WD3: 3, 4, 5, 12

Lesson Overview:

This lesson uses the *Planet Weather* series which consists of four videos: *Wind, Wet, Cold and Heat*. These programs, used in whole or in small segments, can be used to help explain some of the principles of weather and to explore the causes and impact of some severe weather events.

Instructional Document(s):

1. *Planet Weather* – Video (Teacher Support Material).

Supporting Resource(s):

6. *Planet Weather* (*Wind, Wet, Cold, Heat*). Refer to the resources section in the *Science 11 Introduction* for further information.

Lesson 5 – Weather Journal

Foundational and Learning Objectives: **W**D2: 3, 4, 5; WD4: 1, 2

Lesson Overview:

In this lesson students will collect weather data for two to ten days and record the information in their "Weather Journal". Students can collect data from various sites online or from different news sources. This activity will help students to develop skills in analyzing meteorological data and in forecasting local weather conditions. As an extension to this activity students could build their own weather equipment and use it to collect some of their data.

Instructional Document(s):

1. Weather Journal (Student Handout).

Supporting Resource(s):

1. Build a Weather Station, pp. 202-205 *Nelson Science 10: Concepts and Connections*.

2. Collecting Weather Data, pp. 518-531 *Sciencepower 10*.

3. Weather Scope – "Activity 5: Are weather forecasts always right?" Found online at: http://www.k12science.org/curriculum/weatherproj2/en/activity5.shtml

Lesson 6 – Forecasting the Weather

Foundational and Learning Objectives: WD2: 3, 5, 6

Lesson Overview:

In this lesson students will study a series of consecutive weather maps from two or more sources. By completing this activity students should begin to understand how to analyze meteorological data by identifying common symbols and observing patterns of the movement of weather systems on the maps.

Instructional Document(s):

1. Forecasting the Weather (Student Handout).

Supporting Resource(s):

1. Case Study: Three Days of Canadian Weather, pp. 208-209 *Nelson Science 10: Concepts and Connections* or Case Study: Three Days of Canadian Weather, pp. 550-551 *Nelson Science 10*.

2. Interpreting and Creating Weather Maps, pp. 270-272 *Nelson Science 10: Concepts and Connections* or Interpreting and Creating Weather Maps, pp. 683-684 *Nelson Science 10*.

3. Weather Maps and Forecasting, pp. 532-538 *Sciencepower 10*.

4. Forecast the Weather, pp. 539-540 *Sciencepower 10*.

5. Weather Map Symbols, p. 576 *Sciencepower 10*.

Lesson 7 – The Water Cycle

Foundational and Learning Objectives: WD 3: 5, 12

Lesson Overview:

This lesson makes use of *The Incredible Journey* activity from the *Project WET Activity and Curriculum Guide*. In this activity students describe the movement of water within the water cycle and identify the states of matter as it moves through the cycle. As a part of this lesson students could also be asked to describe and explain heat transfer within the water cycle.

As an alternate or an extension to this activity students could be given a diagram of the water cycle and be asked to modify the layout for a specific audience and recreate the cycle. Examples may include a water cycle magazine, water RAP, children's book, board game, video, quiz show, skit etc.

Supporting Resource(s):

1. *The Incredible Journey* from the *Project Wet Curriculum and Activity Guide* is available online at: http://www.projectwet.org/pdfs/Incredible%20Journey.pdf.

2. Water and the Weather, pp. 212-213 *Nelson Science 10: Concepts and Connections*.

3. The Water Cycle, p. 523 *Nelson Science 10*.

4. The Water Cycle, pp. 433-434 *Sciencepower 10*.

Lesson 8 – Weather Dynamics Circus

Foundational and Learning Objectives: WD3: 4, 5, 12

Lesson Overview:

In this lesson teachers can use the *Weather Dynamics Circus* activity which consists of a number of interactive based stations that help to explain some of the principles of weather. The activity can be used in whole or in part, with only a few stations or all thirteen being completed. The stations could be set up for students to complete or used as demonstrations as the various weather concepts are introduced. The individual station questions and the follow-up questions (found in the student handout) can be modified by adding, deleting or rephrasing questions where necessary.

Instructional Document(s):

1. Weather Dynamics Circus (Student Handout).

2. Weather Dynamics Circus Materials List (Teacher Support Material).

3. Weather Dynamics Circus – Station Posters.

Lesson 9 – Weather Proverbs

Foundational and Learning Objectives: WD4: 5

Lesson Overview:

In this lesson students will explore cultural and historical perspectives related to weather forecasting by examining some weather sayings or proverbs. Individually, or in pairs, they will read and discuss various weather proverbs to decide if they think each of them is true or false. Each student, or pair of students, could then be assigned one or more of the proverbs to research the origin of. As an extension to this activity students could be asked to collect and compile folklore and knowledge passed on from grandparents and/or elders regarding weather predictions.

Instructional Document(s):

1. Weather Proverbs (Student Handout).

Supporting Resource(s):

1. Forecasting the Weather, pp. 200-201 *Nelson Science 10: Concepts and Connections*.

2. Weather Heritage, pp. 564-566 *Nelson Science 10*.

3. Past, Present and Future, pp. 543-547 *Sciencepower 10*.

4. Farmer's Almanac: http://www.almanac.com/.

Lesson 10– Global Climate Change

Foundational and Learning Objectives: WD5: 1, 2, 3, 5, 7

Lesson Overview:

In this lesson students could watch a current documentary related to global climate change. The content of the documentary can then be used as a basis to have students identify current issues related to climate change, identify natural and human factors that influence climate change and to discuss potential consequences of climate change. The instructional documents provided with this lesson are designed for use with the documentary *An Inconvenient Truth*.

Note that when using any documentary for instructional purposes watching the entire documentary may be too much at one time. Teachers should show the documentary in small sections and then discuss each part and/or complete the questions associated with that section.

Instructional Document(s):

1. *An Inconvenient Truth* – Activity (Teacher Support Material).

2. *An Inconvenient Truth* – Documentary Questions (Student Handout).

Supporting Resource(s):

1. *An Inconvenient Truth* (2006). Refer to the resources section in the *Science1 Introduction* for further information.

2. Explore an Issue – Human Impact on Global Climate, pp. 242-243 *Nelson Science 10: Concepts and Connections* or Explore an Issue – The Human Impact on Global Temperatures, pp. 645-646 *Nelson Science 10*.

3. Forecasting the Future (Chapter 16), pp. 620 – 650 *Nelson Science 10*.

4. Weather After Global Warming, p. 447 *Sciencepower 10*.

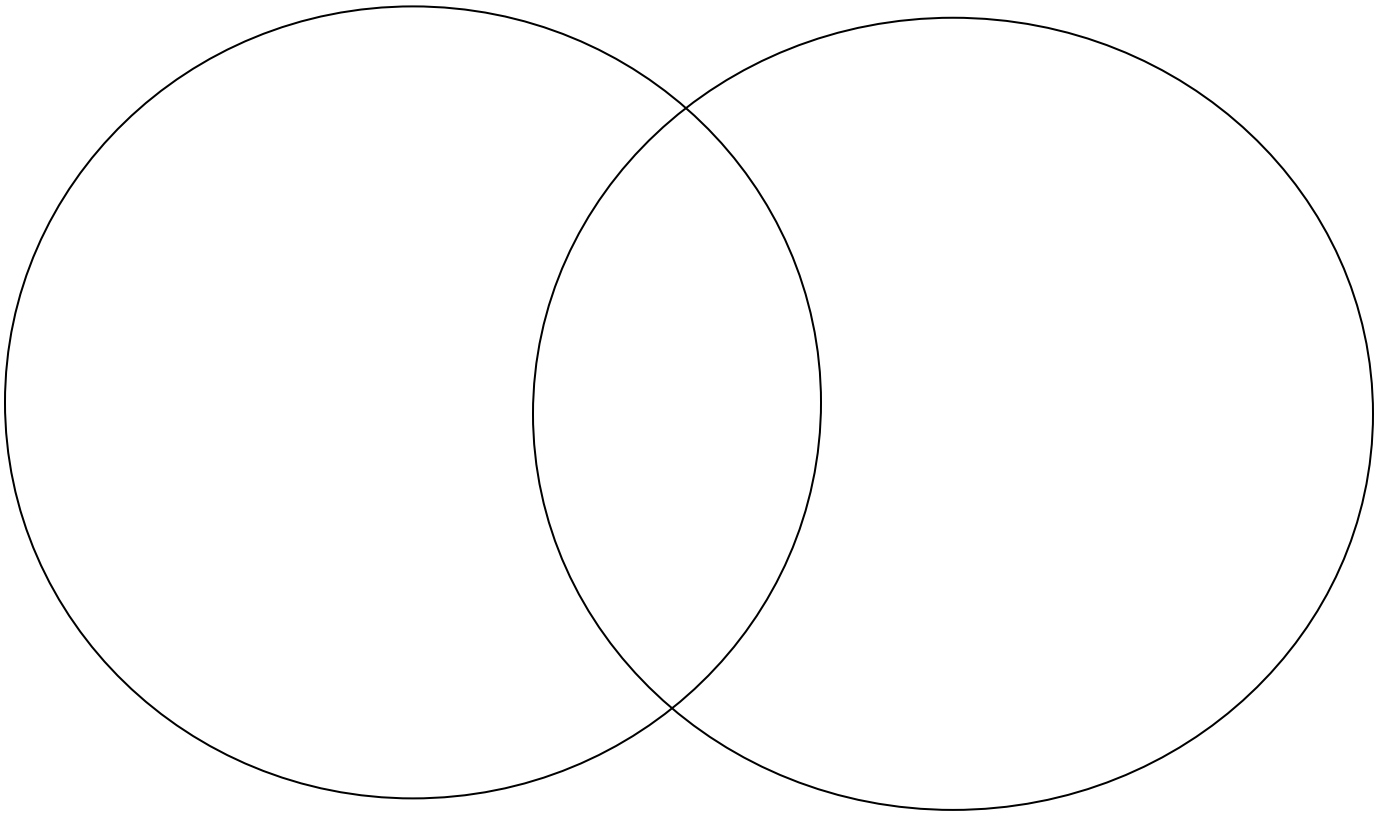
Student Handout

WEATHER VS. CLIMATE

1. Brainstorm a list of words, phrases or examples that describe weather and climate and record them in the chart below.
2. The teacher will provide you with a definition for each of the terms, weather and climate.
3. Complete the Venn diagram together as a class.

Weather	Climate
Brainstorm list:	Brainstorm list:
Definition:	Definition:

Weather **Both** **Climate**



EXTREME CANADIAN WEATHER (Video)
BACKGROUND INFORMATION

- **BC Forest Fires - Louis Creek, Barriere and Kelowna - Summer 2003**
  After three extremely dry summers, soil in the BC interior was bone dry deep below the surface setting the scene for some of the fiercest fires ever to affect populated centres. In and around Louis Creek, Barriere and Kelowna over 50,000 residents were evacuated - the largest evacuation in Canadian history. Over 250 homes were destroyed in the costliest wildfire in Canadian history.

- **Hurricane Juan - Nova Scotia, PEI - September 29, 2003**

  The hurricane, which powered up near Bermuda, surprisingly still packed winds of 158 km/hr by the time it reached Nova Scotia and PEI 3 days later. It tore down power lines, felled 100 million trees, sank dozens of yachts and flooded waterfront properties. Over 300,000 homes were left without power. Nine deaths were caused (7 indirectly).

- **Ice Storm - Ontario & Quebec January 4-9 1998**
  During an unusually mild winter freezing rain fell for 4 days straight. 80 kms of power lines were destroyed leaving 4 million people in dangerously cold and dark homes for up to a month in some parts. The storm stretched from Kingston to Quebec City. 23,000 hydro poles needed repairs costing Hydro-Quebec $500 million and Ontario Hydro $120 million.

- **Red River Flood - Manitoba - April/May 1950/1997**
  In the spring of 1950 Red River crested 9 meters above normal forcing an evacuation of 100,000 people from Southern Manitoba. History repeated itself in the spring of 1997. After a consistently cold winter, a nasty snowstorm dumped half a winters snowfall into the Red River basin in one weekend. Two weeks later it began to melt causing the highest flood levels ever in Canada. Over 28,000 residents had to leave their homes and 450 million dollars worth of damage was incurred.

- **Hail Storm - Calgary, Alberta - September 7, 1991**
  For 30 minutes on holiday Labour Day hailstones pounded the city causing over $400 million dollars worth of damage.

- **Black Friday Tornado - Edmonton, Alberta - July 31, 1987**
  For one-hour winds roared at up to 400km/hr as this tornado touched down 6 times in the city on a Friday afternoon. With only an hours warning, a combination of severe thunderstorms, a cold & fast jet stream and hot, humid air created a tornado that killed 27, injured 253 and left 250 million dollars worth of damage.

- **Ocean Ranger - Newfoundland - February 15, 1982**
  Off the coast of Newfoundland 100 km/hr winds stirred up a violent storm late at night. On the Grand Banks, the Ocean Ranger, the world's mightiest drilling rig, was pounded by waves more than 20 metres high. At the height of the storm, the "indestructible" rig capsized. Tragically, all 84 men on board perished in the frigid waters.

- **Hurricane Hazel - Southern Ontario - October 15, 1954**
  Hazel developed over the Caribbean a week before it hit Toronto. Hurricanes usually diminish as they move over land but Hazel still packed 70 miles/hr winds. 8 inches of rain came down in 24 hours on

top of already sodden ground. Bridges were washed out and entire neighbourhoods were flooded leaving families clinging to rooftops through the night. The storm left 81 dead, 4000 families homeless and 100 million dollars worth damage.

- **Dust Bowl - Prairies 1933-37**
  For five years straight only half the normal amount of rain fell, jeopardizing the livelihood of farmers throughout the Prairies. Topsoil eroded leaving some areas of the Prairies a virtual desert. Dust storms regularly covered everything outside and inside every home. Some farm families with no income and little food or water became emaciated while livestock starved to death. 400,000 people abandoned their homes to seek shelter elsewhere.

- **Deadliest Heat Wave -Saskatchewan, Manitoba & Ontario**
  July 5-17, 1936
  A heat wave means 3 or more days in a row in which temperatures rise to 32 degrees C or more. During this one, temperatures ranged from 32-42 degrees C for almost 2 weeks. 780 Canadians died making it the deadliest heat wave in Canadian history. On July 5 the following year temperature in Midale Saskatchewan hit 113 degrees F (45 C) - the hottest day on record in Canada still.

- **Worst Blizzard**
  Blizzards have hit every part of the country but some are definitely worse than others. In Winnipeg on March 4 1966, 36 cm of snow whipped up by 120km/hr winds paralysed the city for 2 days. On March 4 1971 Montreal was struck by 47 cm of snow and winds up to 110 km/hr with power outages for 2-7 days. In PEI on February 22 1982, 60 cm snow and 80km/hr winds created drifts as high as 7 meters.

Student Handout

EXTREME CANADIAN WEATHER
VIDEO VIEWING GUIDE

Part 1: Wind and Water

Complete the following table, in point form. The video will be paused at appropriate places to allow you gather information for each weather event.

When?	Where?	Significance of Event

Student Handout

EXTREME CANADIAN WEATHER
VIDEO VIEWING GUIDE

Part 2: Fire and Ice

Complete the following table, in point form. The video will be paused at appropriate places to allow you gather information for each weather event.

When?	Where?	Significance of Event

Student Handout

SEVERE WEATHER PROJECT

Overview:

For this project you will research one type of severe weather event and present your findings to the class.

Procedure:

1. As a class you will brainstorm some severe weather events that you have experienced in your life, have read about or have seen on television. Try to focus on events that have occurred in Canada.

2. Individually, or with a partner, select a severe weather event to research.

3. Research your severe weather event to find information on the following topics:
   - **How is the severe weather produced?** Be specific and detailed in your response and provide diagrams.
   - **Where** in the world is this severe weather most likely to occur and why? Provide a diagram or map, if possible.
   - **Describe the effects** of the severe weather. Be sure to include damage caused, risk of injury, economic losses etc.
   - **Explain safety precautions** that should be taken before, during and after the event.
   - How do meteorologists **describe and classify the weather event**? Many severe weather events have scales for measuring associated with them.
   - **Provide some specific examples** of severe weather events of your type. Include where the events occurred and how people were affected by the weather event.
   - Include any **other interesting information** that is important for your severe weather event.

4. Create a pamphlet, poster, PowerPoint presentation, video or television broadcast that includes all of the required information that you have researched.

PLANET WEATHER - VIDEO

Series Background:

Join investigative reporter, Donal MacIntyre as he is blasted, roasted, frozen and soaked on an epic journey to experience and understand the wildest weather the planet can throw at him. In the series Planet Weather, the tough man of journalism meets his match in a new series exploring how the world's weather works and what it is that drives it.

From a grueling marathon in the heat of the Sahara to paragliding through the fury of the monsoon, he is tested to the limit. Donal triumphs where others have failed, the first man to withstand hurricane force winds of 136 mph in a wind tunnel, parachuting through freezing air in the Arctic and swimming beneath the ice.

The series also introduces people who have experienced wild weather - the woman who has been struck by lightning three times, the survivor of the most destructive hurricane of the century and the man who rescued 20 people from a disastrous flood in Norfolk and 50 years later is re-united with those he saved.

From amazing locations around the world, using stunning computer graphics and rare archive, Donal reveals a new perspective on the world's weather and explains the strange and often unbelievable connections between totally different parts of the world. (BBC Enterprises)

Resource information:

Wind (Video). (Planet Weather Series). BBC Enterprises (MGR), 2002. 50 min. Dup. order no. V3307. Expires August 31, 2010.

Wet (Video). (Planet Weather Series). BBC Enterprises (MGR), 2002. 50 min. Dup. order no. V3306. Expires August 31, 2010.

Cold (Video). (Planet Weather Series). BBC Enterprises (MGR) , 2002. 50 min. Dup. order no. V3304.

Heat (Video). (Planet Weather Series). BBC Enterprises (MGR) , 2002. 50 min. Dup. order no. V3305. Expires August 31, 2010.

Program One – *Wind*

What can wind do at its worst? Tornado and hurricane survivors recount scenes of incredible devastation, while Donal meets force-12 winds head on in a wind tunnel. He explores the journey the winds take from their birth at the equator where he finds himself adrift in the doldrums to the North Pole where he witnesses arguably the most beautiful vision on earth, a space rainbow, better known as Aurora Borealis.

Along the way he revisits the devastating events that were unleashed by Hurricane Andrew in the USA and finds out how the fastest wind on earth, the jet stream, was put to deadly use by the Japanese in the Second World War.

We will see how the wind can turn from the cooling breeze of a summer day to a devastating tornado and how a wind from space can literally flatten the planet.

Viewing Guide Questions: (*used after viewing the program or on a quiz or test)*

All winds are born
a) at the equator
b) within the jet stream
c) at the doldrums
d) at the polar icecaps

The fastest winds on Earth are found in
a) the doldrums
b) hurricanes
c) tornadoes
d) the jetstream

Program Two - *Wet*

Ride with the storm clouds from the wettest place in the world to the parched Texan desert, where farmers hope to harness the power of nature to create rain. From the first drop of a monsoon to the floods that kill millions each year, water brings life and death in equal measure.

Donal takes a ride with the rains from the wettest place in Europe, the Norwegian town of Bergen where it rains 265 days of the year, and onto the wettest place in the world - India, where 25 billion tons of water falls each day during the monsoon period.

He follows the route of the Thermohaline Conveyor, which leads to the warm seas of the Caribbean and the awesome power of floods. The devastating effects were seen in Honduras in 1998, where 75 inches of rain fell in a week.

In Texas the opposite is true, there is no rain, which is why local farmers are hoping to find a solution by exploring ways of manufacturing rain!

Viewing Guide Questions: (*used after viewing the program or on a quiz or test)*

The polar icecaps contain frozen
a) fish
b) freshwater
c) sea water

d) all of the above

Minute Paper:

Now that you have watched *Planet Weather: Wet*, please explain the causes of flooding and why flooding can be so dangerous.

Program Three - *Cold*

Avalanches and ice storms are only a few of the spectacular phenomena that come with winter. But what about pure cold? After half an hour in his underwear at minus 18 degrees, Donal has to be rescued or die, as his body begins to shut down. So how do people live and work at 40 below?

Donal experiences life at the extremes of cold, from ice storms to avalanches, frostbite to heart attacks - cold is a killer. His first stop is Greenland to see how the Inuit survive in temperatures of minus 40. He spends 24 hours with the Sirius sledge patrol who live for three months in this harsh environment. Donal is tested to see the effect extreme cold has on the body and meets two men who survived wild weather conditions in New York, when winds reached up to 145 mph in a freak storm.

At Mount Washington he experiences the extremes of winter weather while exploring the hidden danger locked into ice and snow and talks to the survivors of Canada's worst weather crisis, the ice storm of 1998.

Viewing Guide Questions: (*used after viewing the program or on a quiz or test)*

The source of all cold weather in the northern hemisphere is the
a) arctic
b) antarctic
c) jet stream
d) equator

The weather in the Arctic is typically
a) cold and stormy
b) cloudy with lots of snowfall
c) blizzards
d) sunny with little snowfall

Severe frostbite is when
a) skin tissue freezes
b) no oxygen is delivered to the affected area
c) gangrene and decomposition can set in
d) all of the above

When the human body is exposed to extreme cold, an individual will
a) shiver to try to retain body heat
b) have their muscles stiffen
c) feel sleepy, eventually becoming unconscious
d) all of the above

In the 1998 Montreal icestorm, the greatest threat to people was
a) loss of power supply in frigid conditions

b) build up of ice on all outdoor surfaces
c) slips and falls breaking bones
d) loss of essential services (e.g., telephones, ambulances, etc.)

London, England has more deaths due to cold than any other European city because
a) London is foggy and damp
b) the weather is colder than other cities
c) people do not dress appropriately
d) they eat too many fish and chips

Snowflakes start their life as crystals, the most common snowflake shape is the
a) six-sided flake
b) plate
c) column
d) combination of the plate and column

Some snowflakes can be as strong as
a) concrete
b) ice
c) paper
d) glue

Program Four - *Heat*

The sun's energy can kill - in our own cities as well as in the hot deserts of the equator. But the gravest danger may be the warming Earth, with its rising sea levels, angry skies, superstorms, and devastating hurricanes.

Donal traces the arrival of summer from the extremes of heat in the desert to the idea of a perfect summer in the temperate climates of the north. He visits the jungles of the Belize where the sun's energy is most intense and where the weather is both wet and hot. Fortunately this weather is rare but in 1995 Chicago experienced a heat wave which killed 165 people.

Heading for the desert he attempts the Marathon des Sables, an exhausting and dangerous seven-day test of ability, to see what effect dry heat has on the weather, from mirages to the deadly desert sandstorm that is the haboob.

Finally Donal explores the energy behind lightning before getting first hand experience of being struck by it.

Group Response:

Now that you have watched the series Planet Weather, please explain if it is easier to protect life and property against damage from a hurricane or a tornado?

1. Designate one group member as a recorder. His/her job is to record the comments made by the group members during the activity.
2. Discuss the question as a class.
3. As a group review your comments and highlight the science comments that you made (formal or informal).
4. As a group, create a conclusion highlighting what you have learned.

5. Hand in a summary your comments.

Minute Paper:

The normal human body temperature is 37ºC. Severe weather extremes causing a change in this core temperature by as little as 2ºC in either direction can endanger health and possibly lead to death.

a) Name the two conditions leading to these changes in temperature.
b) Describe the causes and effects of these two conditions.

Viewing Guide Questions: (*used after viewing the program or on a quiz or test)*

What is the power behind our weather?
a) water
b) wind
c) sun
d) all of the above

The sun's rays are the most intense at the
a) poles.
b) equator
c) desert
d) tropics

Desert sand from the Sahara desert is carried by the wind and deposited in
a) Australia
b) Hawaii
c) France
d) Caribbean

On average lightning strikes the Earth
a) once every second
b) ten times every second
c) one hundred times every second
d) one thousand times every second

Which of the following are symptoms of dehydration?
a) increase in the body's core temperature
b) excessive sweating and thirst
c) confusion
d) all of the above

Which of the following provides complete protection from harmful UV radiation?
a) application of sunblock
b) tanning only in tanning salons
c) application of sunscreen
d) staying indoors except for cloudy days

Assessment Checklist:

- ☐ Student is cooperating with others
- ☐ Student is following instructions
- ☐ Student asks relevant questions (i.e. he/she has answered the viewing guide questions and is clarifying or asking a relevant question.)
- ☐ Student is on task
- ☐ Comments:

Student Handout

WEATHER JOURNAL

Day: _____ Date: _____

Factor	**Today's Weather** (collected from weather equipment or another source)	**Today's Weather** (from Environment Canada)
Temperature (^{o}C)		
Wind Direction		
Wind Speed		
Humidity %		
Barometric Pressure (kPa)		
Cloud Cover		
Precipitation		

Date	**Temperature (^{o}C)**
Today's Forecast High	
1 Year Ago	
2 Years Ago	
3 Years Ago	
4 Years Ago	
5 Years Ago	
Average of Last Five Years	

General Observations and Description of Weather:

_____

_____

_____

_____

_____

Five Day Forecast for _____

	Forecast Low	Forecast High	Probability of Precipitation
Monday			
Tuesday			
Wednesday			
Thursday			
Friday			
Actual Data for Friday			

Answer the following questions:

1. How accurate were the predictions on Monday? Explain your answer.

   _____

   _____

   _____

2. Did the predictions change as the week went on? What happened to the accuracy of the predictions by the end of the week?

   _____

   _____

   _____

3. What does this tell us about the reliability of weather forecasts, and weather forecasting?

   _____

   _____

   _____

4. If you had to make an accurate guess based on a weather forecast, on what day would you have felt comfortable doing so?

   _____

   _____

   _____

Student Handout

FORECASTING THE WEATHER

In this activity you will examine weather maps for three consecutive days from at least two different sources (ie a weather web site, newspaper etc.). You will study the maps in order to begin to learn to identify common symbols on weather maps and to identify patterns of weather system movement.

Source #1

Source Name: _____ Date(s): _____

1. Look at the map for the first of three days. In the chart below record all of the symbols (and color codes) that appear on the map. Beside each symbol, record its meaning according to the legend. If the meaning is not found in the legend, indicate that it is missing and use another reference source to determine the meaning.

Symbol	Meaning

2. Arrange your set of maps in chronological order. Study the changes from Day 1 to Day 3. Record the patterns that you observe, including motion of fronts, pressure systems, and precipitation. Indicate the direction of the motion. Be detailed in your response.

Source #2

Source name: _____ Date(s): _____

3. Repeat #1 in the chart below.

Symbol	Meaning

4. Arrange your set of maps in chronological order. Study the changes from Day 1 to Day 3. Record the patterns that you observe, including motion of fronts, pressure systems, and precipitation. Indicate the direction of the motion. Be detailed in your response.

5. Compare and contrast the details and forecasts presented in the maps from the various sources. Which of the sources would you prefer to use for weather information? Why?

Student Handout

WEATHER DYNAMICS CIRCUS

As you move from one station to the next, perform the simple experiment that is described and answer the question(s) that are found there. You have only about 5 minutes at each station. Start at any station, but make sure that you're following the procedure and answering questions for that station. Please progress from one station to the next in numerical order.

1. **Dew Point:** Fill the aluminum can with tap water until it is about ¼ full. Wipe off the outside of the can. Add enough ice to fill the can near the top. Place a thermometer in the can and use a stirring rod to mix the ice. Observe the outside of the can. Record the temperature when moisture appears on the outside of the can. This is called the Dew Point temperature, the temperature at which dew forms.
   a) Draw a diagram of this apparatus and label the diagram.
   b) Under what conditions would knowing the dew point help with making a weather prediction?

2. **Convection Currents in Air:** Light the small candle and gently place it in one of the bottom holes so that the heat rises up the chimney. Let it burn undisturbed for a minute. Take a piece of paper towel, twist it into a roll and dampen most of it with tap water. Light the dry end and blow it out right away. Bring the smoke from the smouldering paper towel near the other chimney (not the one above the candle). Observe the smoke.
   a) Draw a diagram of this apparatus and label the direction of the smoke.
   b) Why does the smoke move in this pattern?

3. **The Bernoulli Principle #1:** Place eight drinking straws on the table parallel to one another and about 1 cm apart. Set an empty pop can on four of the straws (upright) and another pop can on the other four straws. Blow air between the two cans.
   a) Draw an overhead view to show what happens.
   b) Bernoulli said "*Where the speed of a fluid or gas is high, the pressure is low. Where the speed is low, the pressure is high.*" Use this concept to explain what happened.

4. **The Bernoulli Principle #2:** Hold a drinking straw upright in the beaker of coloured water. Place the other drinking straw so that the air you blow through it passes above the first straw (like making a sound with an empty bottle or playing a flute). Observe.
   a) Draw a diagram that shows what happens to the water.
   b) Bernoulli said "*Where the speed of a fluid or gas is high, the pressure is low. Where the speed is low, the pressure is high.*" Use this concept to explain what happened.

5. **Cloud in a Bottle:** Place a very small amount of hot tap water (5 mL) in the pop bottle. Close the lid firmly and shake it for about 20 seconds. With the lid tightly screwed on, squeeze the sides of the bottle. Observe. Open the bottle and place a small amount of the smoke from a smouldering match or wet paper towel into the bottle. Replace the lid, shake, and then squeeze it again. Observe.
   a) How do your observations with and without the smoke differ?
   b) What must be present in the atmosphere in order for clouds to form?
   c) How does pressure change in the upper atmosphere when clouds form?

6. **Relative Humidity:** Take a small piece of cotton batting and make it wet using room temperature tap water. Use the elastic to fasten the batting securely to the bulb of one of the thermometers. Spin

the thermometers using the handle attached to them (make sure the handle is firmly attached). Spin for about one minute. Record the temperatures:
Wet bulb reading: _____ ^{o}C Dry bulb reading: _____ ^{o}C

a) Use table 1 on page 560 (Nelson) to estimate the relative humidity in the room.
b) Under what environmental conditions would the relative humidity outside become 100%?

7. **Air Pressure #1:** Do this demonstration over a sink. Fill an Erlenmeyer flask completely full of water. Place the index card over the top of the flask. Hold it firmly in place and invert the flask. Release the card. Observe.
   a) What happens (or doesn't happen) to the water in the flask? Why?

8. **Air Pressure #2:** Observe the demonstration showing a simple homemade barometer. Push on the rubber membrane. Observe the needle on the barometer.
   a) What happens to the atmospheric pressure inside the chamber when you push on the membrane? What effect does this have on the needle?
   b) Explain why the needle moves.

9. **Air Pressure #3:** Squeeze the side of the (Cartesian diver) detergent bottle and explain what happens using concepts of air pressure.

10. **Convection in Water**: **Part one is to be done by every second group…one group will set it up and the following group will take it apart.**

    I: Half fill the large container with lukewarm tap water. Place a sock full of ice cubes at one end of the container and the sock containing the hot rock at the other end. Place a drop of dye in the lukewarm water near the sock full of ice cubes. Observe.
    a) Draw a sketch of your observations.

    Each group does part two.

    II: Fill the split tank container with hot water on one side and cold water with a drop of dye on the other side. Pull up the divider and observe.
    b) Sketch these observations.
    c) What do you think happens in the ocean when one area of water heats up?

11. **Wind Speed:** This is to be done outside the doors—please go quickly, no talking in the hallways. Use the anemometers provided to measure the wind speed in three locations. Record your observations in kph. (1 mph = 1.6 kph)
    a) Observations: near the school:_____kph
       3 meters away:_____kph
       6 meters away:_____kph
    b) Explain any differences in the values you've calculated.

12. **Differential Heating:** Notice that the lamps have equal intensity light bulbs in them and that they are the same distances from the three surfaces. This demonstration has been set up for you for about an hour.
    a) Fill in the following chart:

Type of surface	Temperature (^{o}C)

b) Explain the differences in the temperatures that you recorded.

13. **Densities of fresh and salt water:** Fill the plastic tub half full lukewarm tap water. Place 2 heaping spoonfuls of salt and half a cupful of tap water in the beaker provided along with several drops of dye. Stir quickly to dissolve the salt. Hold a long stemmed funnel at a corner of the plastic tub so that is near the bottom. Slowly add the dyed salt water mixture to the funnel. Observe.

    a) What happens to the stream of salt water?
    b) Explain how the densities of fresh water and salt water must differ in order for the dye to move in this way.

[go to station #1 after finishing here]

Follow-up Questions

1. Use your results from demonstrations 2, 3 and 12 to explain the following: When you are near a large body of water (a sea or large lake) during a sunny day there is usually a breeze blowing off the water toward the land. This is called a **sea breeze**. The opposite happens at night, breezes blow from the land out to the water (**land breeze)**.

2. Use your results from demonstrations 1, 4 and 5 to explain the following: In some areas, notably just east of the Great Lakes, there is an area called the snow belt. Despite the fact that weather systems, such as low pressure cyclonic storms, affect this area just as frequently as areas around it, the snow belt usually gets at least double the precipitation that other areas. (Hint: what direction are the prevailing winds in S. Ontario?)

3. When building huge skyscrapers in large metropolitan areas, considerable care must be taken in locating these buildings in relation to the other buildings around them. Use your results from demonstration 11 to explain why this is so.

4. We all know that fish need dissolved oxygen to survive and that oxygen is produced when green plants do photosynthesis. How is it possible that fish (e.g., Lake Trout) can survive at the bottom of deep lakes where there is no light and therefore no photosynthetic plants? Use your observation of demonstration 10 to help provide an answer.

5. When water evaporates (as in demo #6) does it absorb or release energy? What would happen when water condenses? Use your answers to explain the presence of warm **Chinook** winds on our side (east side) of the Rockies.

   How would the melting of glaciers due to global warming affect any ocean currents? Refer to your results from station 13 in answering this question.

TSM
Teacher Support Material

WEATHER DYNAMICS CIRCUS - MATERIALS LIST

1. **Dew Point:**
   a. Aluminum can, ice, thermometer

2. **Convection Currents in Air**
   a. Cardboard box with two holes cut in the top—use paper tubes to make chimneys in each hole. Cut out one side of the box and cover with plastic wrap so to see in. Place a candle under one of the chimney.
   b. Paper towels, matches, water in case of fire
   c. **Note:** The room **will** get smoky after 30-40 minutes of this demo.
   d. **Note:** Boreal/Northwest Gas Convection Apparatus (~$70)

3. **Bernoulli Principle #1**
   a. 8 drinking straws, two empty pop cans

4. **Bernoulli Principle #2**
   a. beaker of dyed water, narrow diameter glass rod, plastic straws

5. **Cloud in a Bottle**
   a. two litre pop bottle with screw cap (label removed), hot water and 5 mL dropper, matches
   b. **Note:** This is **very** difficult to see.

6. **Relative Humidity**
   a. sling psychrometer

7. **Air Pressure #1**
   a. Erlenmeyer flask, water, index cards (or waxed playing cards)

8. **Air Pressure #2**
   a. two balloons, beaker, plastic straw, tape, funnel, bell jar

9. **Air Pressure #3**
   a. two litre pop bottle with screw cap, water, eyedropper (end blocked up with plasticine)
   b. **Note:** This also works with a ketchup pack instead of eyedropper
   c. **Note:** This is a **very** difficult concept to explain

10. **Convection in Water**
    a. small aquarium or large Tupperware tub, water, electric heater, two socks, ice, dye or food colouring, split tank, boiling water, cool tap water, dye

11. **Wind Speed**
    a. Anemometer

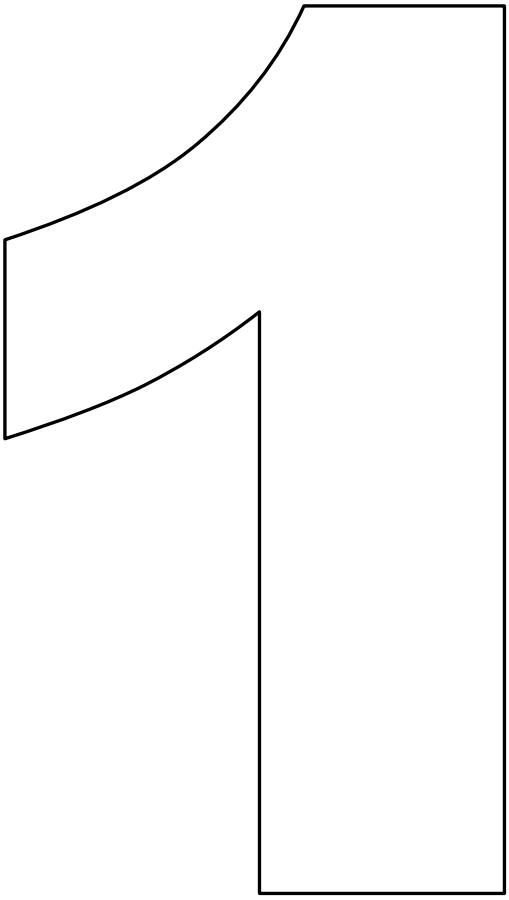
12. **Albedo and differential Heating**
    a. finger bowls containing soil, sand, and water, 3 lamps, 3 thermometers

13. Densities of fresh and salt water

a. plastic tub or small aquarium, lots of salt, dye, beaker, long stemmed funnel, stirring rod

Weather Dynamics Circus

Station Posters



Station One: Dew Point

Fill the aluminum can with tap water until it is about ¼ full. Wipe off the outside of the can. Add enough ice to fill the can near the top. Place a thermometer in the can and use a stirring rod to mix the ice. Observe the outside of the can. Record the temperature when moisture appears on the outside of the can. This is called the Dew Point temperature—the temperature at which dew forms.

a) Draw a diagram of this apparatus and label the diagram.

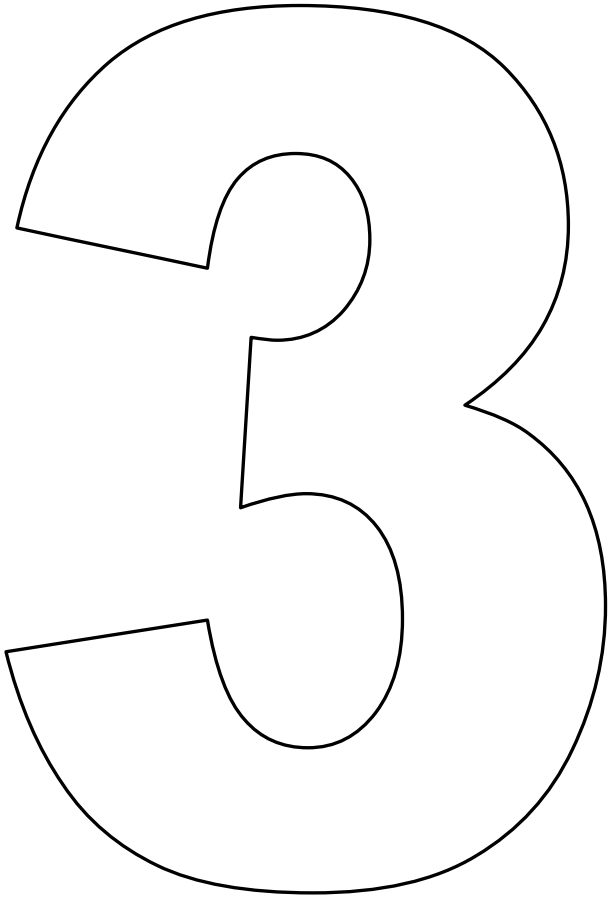
b) Under what conditions would knowing the dew point help with making a weather prediction?

Station Two: Convection Currents in Air

Light the small candle and gently place it in one of the bottom holes so that the heat rises up the chimney. Let it burn undisturbed for a minute. Take a piece of paper towel, twist it into a roll and dampen most of it with tap water. Light the dry end and blow it out right away. Bring the smoke from the smouldering paper towel near the other chimney (not the one above the candle). Observe the smoke.

a) Draw a diagram of this apparatus and label the direction of the smoke.

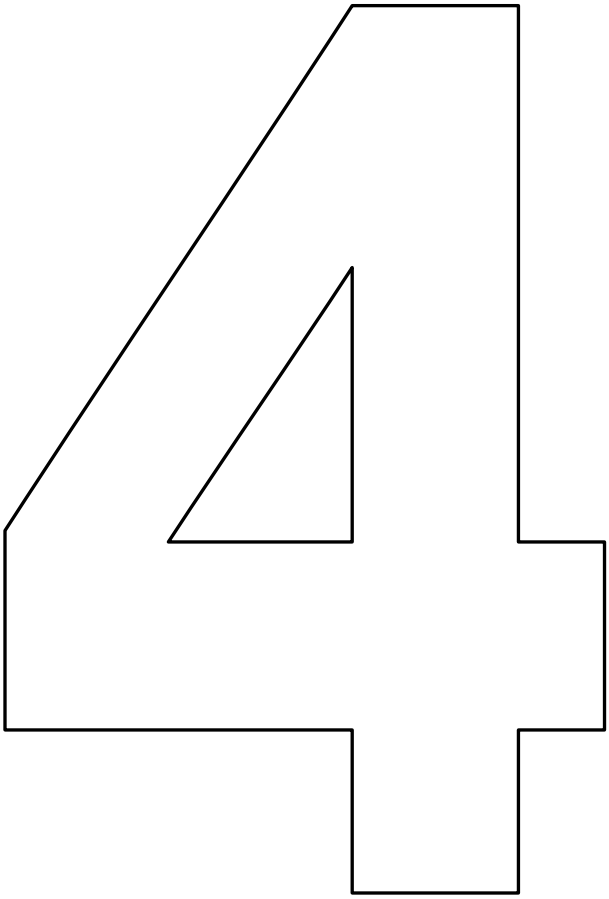
b) Why does the smoke move in this pattern?



Station Three: The Bernoulli Principle #1

Place eight drinking straws on the table parallel to one another and about 1 cm apart. Set an empty pop can on four of the straws (upright) and another pop can on the other four straws. Blow air between the cans.

a) Draw a top view to show what happens.
b) Bernoulli said "*Where the speed of a fluid or gas is high, the pressure is low. Where the speed is low, the pressure is high.*" Use this concept to explain what happened.



Station Four: The Bernoulli Principle #2

Hold a drinking straw upright in the beaker of coloured water. Place the other drinking straw so that the air you blow through it passes above the first straw (like making a sound with an empty bottle or playing a flute). Observe.

a) Draw a diagram that shows what happens to the water.

b) Bernoulli said "*Where the speed of a fluid or gas is high, the pressure is low. Where the speed is low, the pressure is high.*" Use this concept to explain what happened.

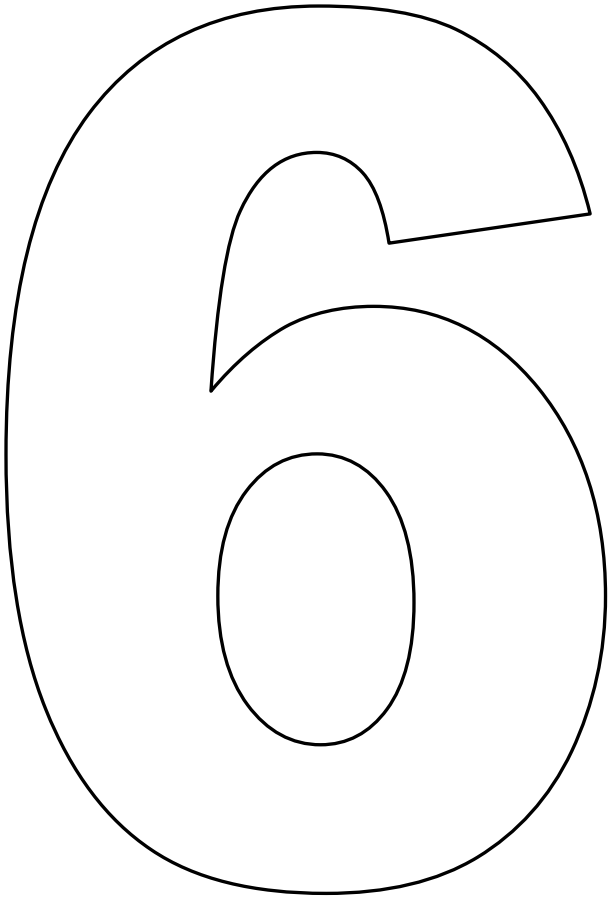
Station Five: Cloud in a Bottle

Place a very small amount of hot tap water (5 Ml) in the pop bottle. Close the lid firmly and shake it for about 20 seconds. With the lid tightly screwed on, squeeze the sides of the bottle. Observe. Open the bottle and place a small amount of the smoke from a smouldering match or wet paper towel into the bottle. Replace the lid, shake, and then squeeze it again. Observe.

a)How do your observations with and without the smoke differ?

b)What must be present in the atmosphere in order for clouds to form?

c)How does pressure change in the upper atmosphere when clouds form?



Station Six: Relative Humidity

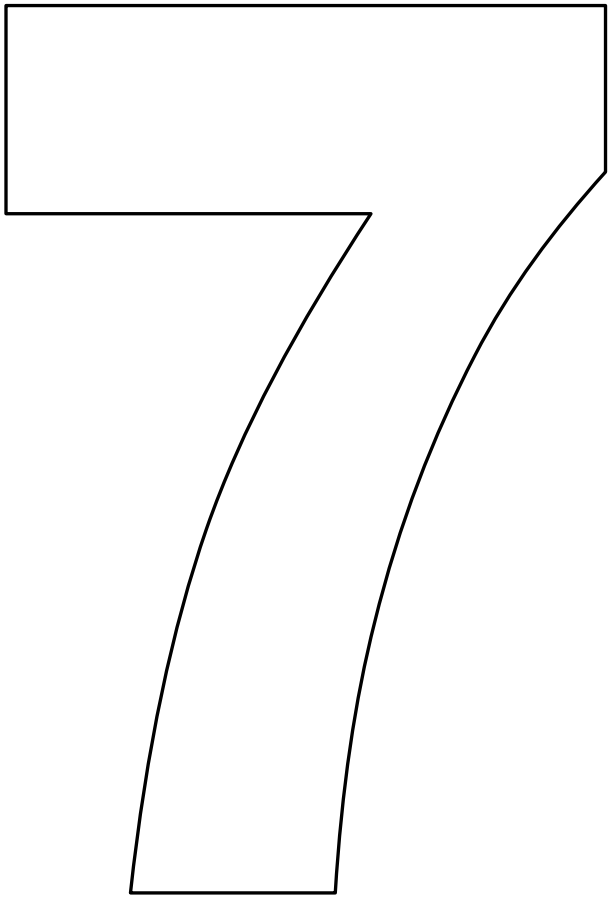
Take a small piece of cotton batting and make it wet using room temperature tap water. Use the elastic to fasten the batting securely to the bulb of one of the thermometers. Spin the thermometers using the handle attached to them (make sure the handle is firmly attached). Spin for about one minute. Record the temperatures:

Wet bulb reading:_____ ^{o}C

Dry bulb reading: _____ ^{o}C

a)Use table 1 on page 560 (Nelson) to estimate the relative humidity in the room.

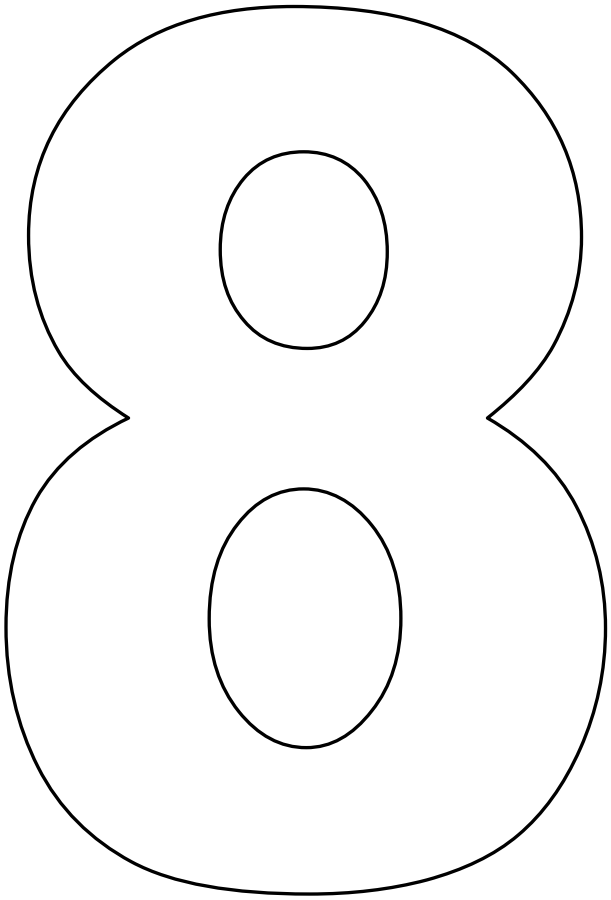
b)Under what environmental conditions would the relative humidity outside become 100%?



Station Seven: Air Pressure #1

Do this demonstration over a sink. Fill an Erlenmeyer flask completely full of water. Place the index card over the top of the flask. Hold it firmly in place and invert the flask. Release the card. Observe.

a)What happens (or doesn't happen) to the water in the flask? Why?

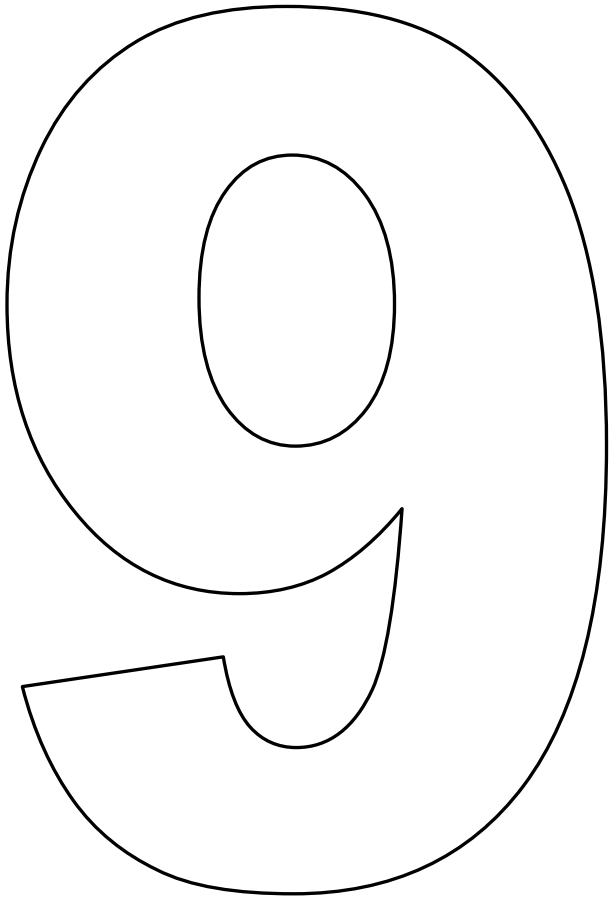


Station Eight: Air Pressure #2

Observe the demonstration showing a simple homemade barometer. Push on the rubber membrane. Observe the needle on the barometer. Compare this barometer with the real barometer on display.

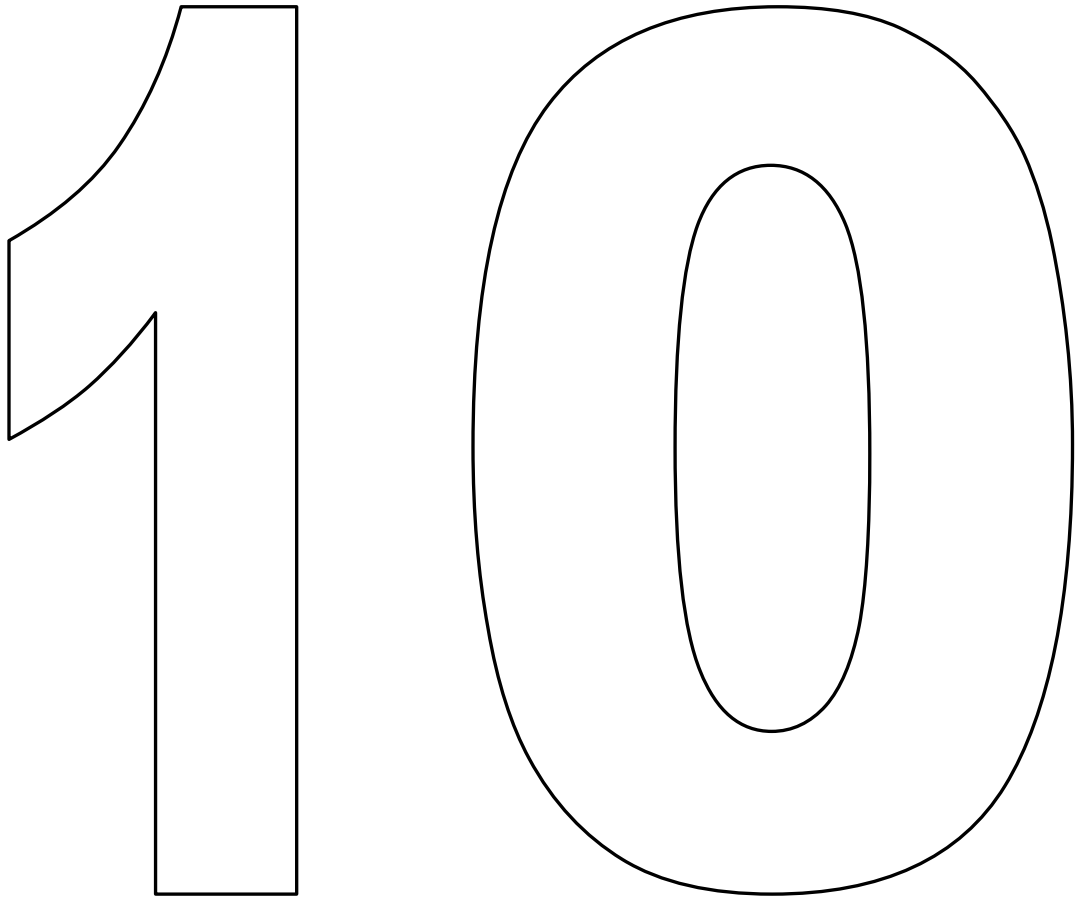
a)What happens to the atmospheric pressure inside the chamber when you push on the membrane? What effect does this have on the needle?

b)Explain why the needle moves.



Station Nine: Air Pressure #3

Squeeze the side of the (Cartesian diver) detergent bottle and explain what happens using concepts of air pressure.



Station Ten: Convection in Water

Part one is to be done by every second group…one group will set it up and the following group will take it apart.

I: Half fill the large container with lukewarm tap water. Place a sock full of ice cubes at one end of the container and the sock containing the hot rock at the other end. Place a drop of dye in the lukewarm water near the sock full of ice cubes. Observe.

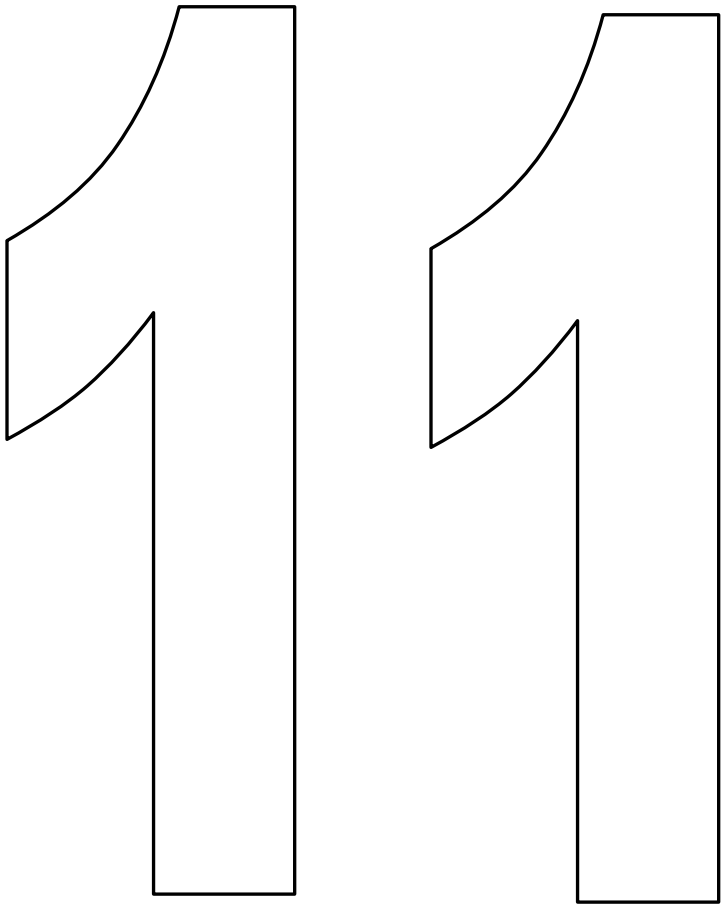
a)Draw a sketch of your observations.

Each group does part two.

II: Fill the split tank container with hot water on one side and cold water with a drop of dye on the other side. Pull up the divider and observe.

b)Sketch these observations.

c)What do you think happens in the ocean when one area of water heats up?

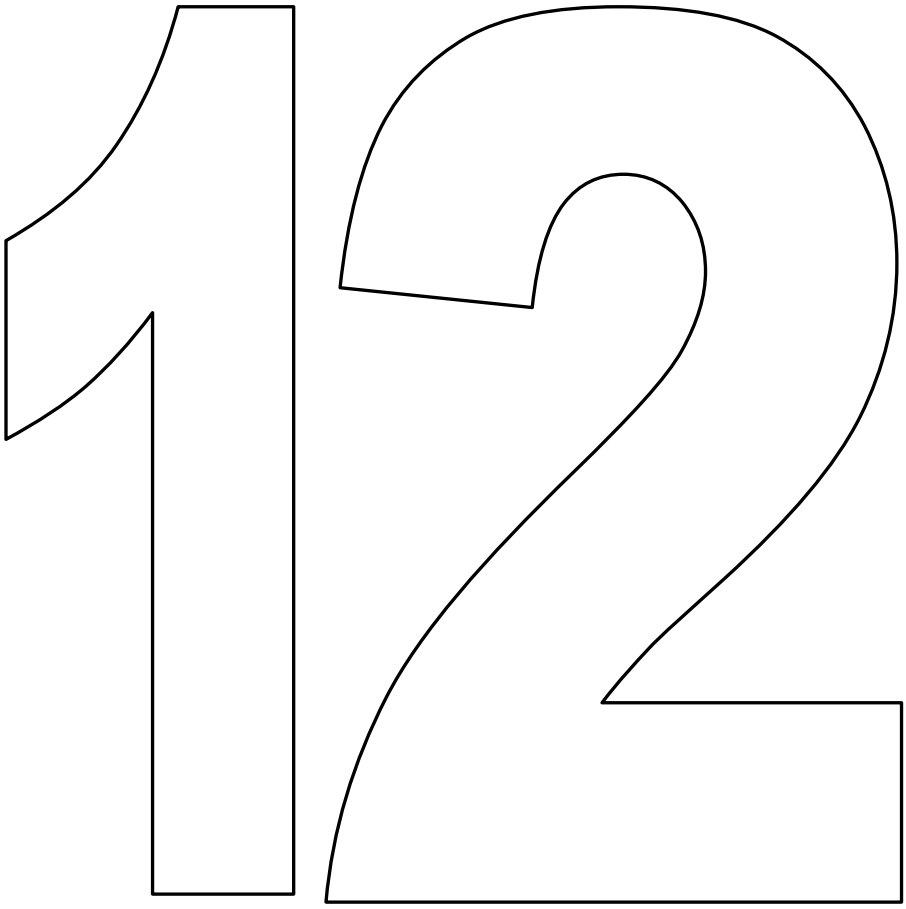


Station Eleven: Wind Speed

This is to be done outside the doors—please go quickly, no talking in the hallways. Use the anemometers provided to measure the wind speed in three locations. Record your observations in kph. (1 mph = 1.6 kph)

a) Observations: near the school:_____kph
3 meters away:_____kph
6 meters away:_____kph

b) Explain any differences in the values you've calculated.



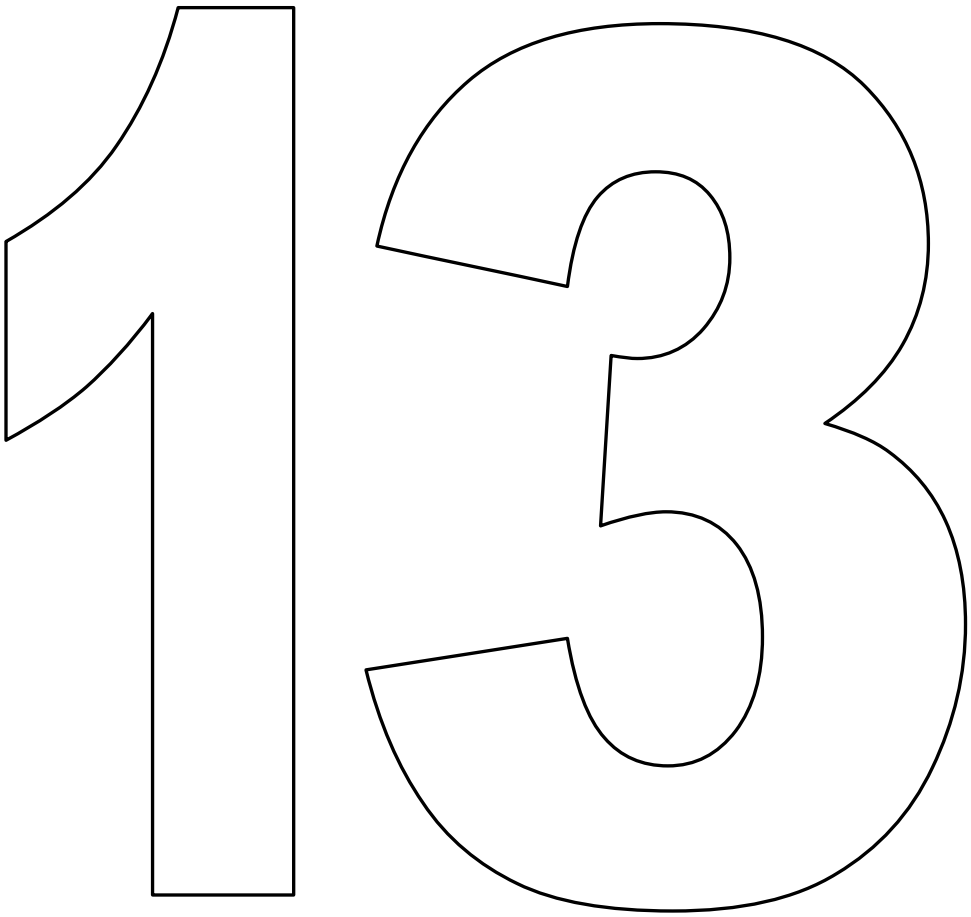
Station Twelve: Differential Heating

Notice that the lamps have equal intensity light bulbs in them and that they are the same distances from the three surfaces. This demonstration has been set up for you for about an hour.

a) Fill in the following chart:

Type of surface	Temperature (^{o}C)

b) Explain the differences in the temperatures that you recorded.



Station Thirteen: Densities of fresh and salt water

Densities of fresh and salt water: Fill the plastic tub half full lukewarm tap water. Place 2 heaping spoonfuls of salt and half a cupful of tap water in the beaker provided along with several drops of dye. Stir quickly to dissolve the salt. Hold a long stemmed funnel at a corner of the plastic tub so that is near the bottom. Slowly add the dyed salt water mixture to the funnel. Observe.

a) What happens to the stream of salt water?

b) Explain how the densities of fresh water and salt water must differ in order for the dye to move in this way.

[go to station #1 after finishing here]

Student Handout

WEATHER PROVERBS

Proverb or Saying	Do you think that this proverb is true or false?	Origin
The moon and the weather may change together, but a change of the moon will not change the weather.		
A ring around the sun or moon means rain or snow coming soon.		
When the grass is dry at morning light, look for rain before the night.		
Dew on the grass, rain won't come to pass.		
Sea gull, sea gull, sits on sand. It is never good weather while you are on the land.		
The higher the clouds the better the weather.		
Cold is the night when the stars shine bright.		
Chimney smoke descends, our nice weather ends.		
When the ditch and pond offend the nose, Then look out for rain and storm blows.		

TSM
Teacher Support Material

AN INCONVENIENT TRUTH
ACTIVITY

Overview:

Students will view the documentary *An Inconvenient Truth* by Al Gore.

Objectives:

- Identify current issues related to climate change.
- Identify the most important natural and human factors that influence climate change.
- Discuss the potential consequences of climate change and the need to investigate climate change.

Activity Description:

Students will view the documentary *An Inconvenient Truth.* To guide their learning the documentary should be stopped or paused at appropriate places to assist students with answering the questions provided.

Extension:

Have students create a personal action plan to demonstrate their commitment to reducing climate change. They should identify ways they can reduce their greenhouse gas emissions at home, school and in their community. Conversely, they could create a pamphlet to educate others about climate change, write a letter to their local newspaper, send a letter to their MLA or MP or some other activity.

Student Handout

AN INCONVENIENT TRUTH
DOCUMENTARY QUESTIONS

Name: _____ Date: _____

Answer the following questions. The documentary will be stopped at appropriate places to discuss the questions.

1. What image started the modern environmental movement?

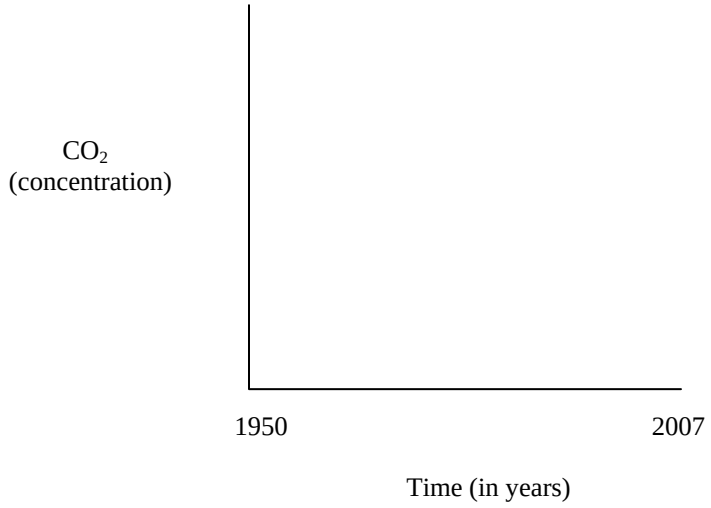
2. How thick is the atmosphere in comparison to Earth?

3. How can trapping of the sun's energy by Earth's atmosphere be a GOOD thing?

4. How can trapping of the sun's energy by Earth's atmosphere be BAD thing?

5. On the graph below, show how the amount of carbon dioxide in the atmosphere has changed in the past 50-60 years.

CO_2 vs. Time



6. What is the relationship between carbon dioxide (CO_2) in the atmosphere and the temperature?

7. List at least three impacts that global climate change could have in the world.

8. List at least three things that can be done to reduce the impact of climate change.