Adult Basic Education

Science

Science 2100B

Weather

Curriculum Guide

Prerequisites: **None**

Credit Value: 1

Science Courses [General College Profile]
Science 2100A
Science 2100B
Science 2100C
Science 3101A
Science 3101B
Science 3101C
Science 3102A
Science 3102B
Science 3102C

Table of Contents

To the Instructor

I. Introduction to Science 2100B

Since weather affects everyone, knowing about weather and weather patterns helps us make many decisions in our lives, from what to wear to when and where to take our vacations. This course will help students understand the factors that create weather systems. It will help them understand patterns in local and global weather conditions and how to forecast local weather patterns.

The course is divided into two units. The first unit, *Local Weather*, gives students the opportunity to examine some weather lore. It looks at some of the instruments used in forecasting and what factors these instruments measure. Students examine how weather systems develop in North America and they learn how to read weather maps.

The second unit, *Global Weather*, helps students understand that weather patterns are different in different parts of the world. They examine the atmosphere and hydrosphere and look at factors that affect weather such as the angle of the Earth to the sun and the rotation of the Earth. They will be introduced to some of the technology used by meteorologists to forecast global weather.

This is a 1 credit course and, along with Science 2100A, is **a prerequisite for Science 2100C.** Science 2100A, B, and C are equivalent to Science 2200 in the current high school program**.**

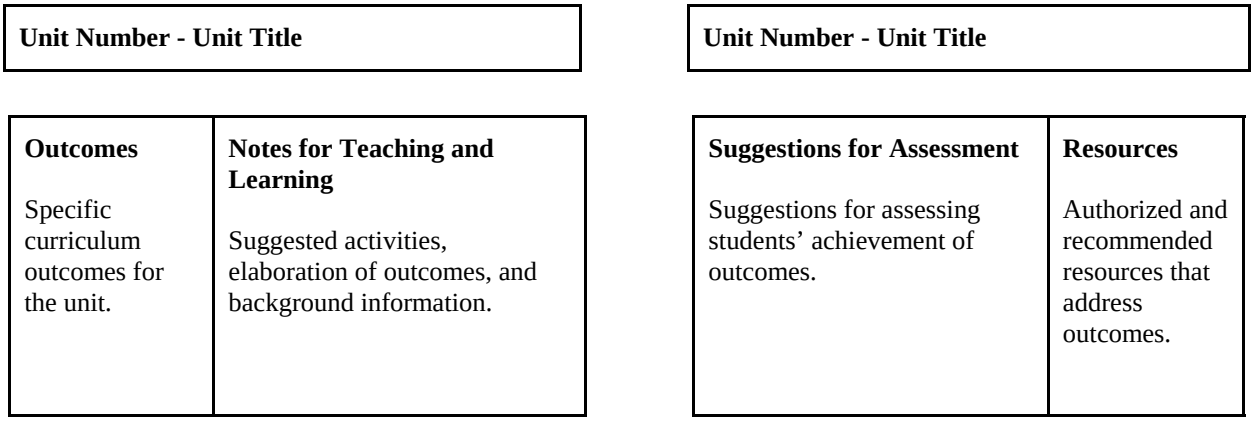
The textbook for this course is *Nelson Science 10: Concepts and Connections;* Nelson Thomson Learning; 2002.

***Note** that students are **not** permitted to receive credit for both the ABE course **Earth Systems 1109** (or Science 1206 in the current high school program) and **Science 2100B**, since there is too much overlap of content.

II. Curriculum Guides

Each new ABE Science course has a Curriculum Guide for the instructor and a Study Guide for the student. The Curriculum Guide includes the specific curriculum outcomes for the course. Suggestions for teaching, learning, and assessment are provided to support student achievement of the outcomes. Each course is divided into units. Each unit comprises a **two-page layout of four columns** as illustrated in the figure below. In some cases the four-column spread continues to the next two-page layout.

Curriculum Guide Organization:
The Two-Page, Four-Column Spread



III. Study Guides

The Study Guide provides the student with the name of the text(s) required for the course and specifies the sections and pages that the student will need to refer to in order to complete the required work for the course. It guides the student through the course by assigning relevant reading and providing questions and/or assigning questions from the text or some other resource. Sometimes it also provides important points for students to note. (See the *To the Student* section of the Study Guide for a more detailed explanation of the use of the Study Guides.) The Study Guides are designed to give students some degree of independence in their work. Instructors should note, however, that there is much material in the Curriculum Guides in the *Notes for Teaching and Learning* and *Suggestions for Assessment* columns that is not included in the Study Guide and instructors will need to review this information and decide how to include it.

IV. Resources

Essential Resources

Nelson Science 10: Concepts and Connections; Nelson Thomson Learning; 2002.

Nelson Science 10: Concepts and Connections - Teacher's Resource; Nelson Thomson Learning; 2002.

Recommended Resources

Nelson Science 10: Concepts and Connections - Student Record of Learning; Nelson Thomson Learning; 2002.

Science 2200 Curriculum Guide.

http://www.ed.gov.nl.ca/edu/sp/sh/sci/science2200jun04.pdf

Science 10 Teacher's Resource, Applied Supplement.

Nelson Publishing Web Site: http://www.science.nelson.com

Other Resources

Center for Distance Learning and Innovation: http://www.cdli.ca/

V. Recommended Evaluation

Written Notes	10%
Labs/Assignments	20%
Test(s)	20%
Final Exam *(entire course)*	50%
	100%

Weather

Unit 1 - Local Weather

Outcomes

1.1 Explain how scientific knowledge evolves as new evidence comes to light.

1.1.1 Compare the relative accuracy of weather forecasting by folklore and scientific methods.

1.1.2 Compare the ways older generations forecasted weather (folklore) with the scientific methods used today.

Notes for Teaching and Learning

Weather is a topic that most students find interesting. Many have some awareness of how forecasts are made and why it is important to be able to predict weather. They should be assured that much of what they already know will help them with the content of this unit.

Most students will be familiar with local sayings (folklore) about weather. These will be investigated by completing the *"Forecast Sayings"* activity. More old weather sayings and proverbs can be found on the websites listed in the "Related Resources" in the Teacher's Resource. Instructors should discuss students' answers with them when they complete the activity. If possible, this activity should be done as a group. Do not try to convince students that folklore does not work. Some folklore weather forecasting has a scientific basis. Lead them towards thinking about the more scientific means of predicting weather patterns and how these have improved in terms of accuracy in recent years.

When completing the *"Interpreting Weather Maps"* activity, students may have difficulty recognizing some of the symbols used. They should use G3, "Interpreting and Creating Weather Maps", pages 270 - 272, to help them.

Instructors could copy Blackline Master (BLM) 4.4a, *"Looking at Weather Maps"*, to help explain how to read weather maps.

It would be useful to have a globe and a world map in the classroom as students work through this course. Instructors should ensure that students understand why the globe is tilted.

Unit 1 - Local Weather

Suggestions for Assessment

Outcome 1.1 is achieved by the completion of the Activity I, *"Forecast Sayings"*, and Activity II,*"Interpreting Weather Maps"*, found in Appendix A. For the *"Forecast Sayings"* activity students should be given a choice between Option 1 (which requires use of the internet) or Option 2. Option 1 is a copy of BLM 4.1, "*Nature's Weather Forecasters - or Not?*", which has been reproduced in Appendix A for your convenience. Option 2 is a copy of pages 308 - 310 of the Student Record of Learning(SRL), which also has been included in Appendix A. Instructors will need to provide weather maps for a three day period for Activity II, *"Interpreting Weather Maps"*. Environment Canada's website is a good source for weather maps. Alternately, the local newspaper could be used.

Instructors should check students' work for both these activities and may assign a mark for the work.

Note: BLMs and the answers that accompany them are found in the Teacher's Resource.

There are many opportunities for research and additional assignments in this course. Instructors should develop and assign work when they feel it is necessary either for review or for extension or enrichment of a particular topic. All assignments should be given a mark that is used as part of the final evaluation for the course.

Newfoundland and Labrador's CDLI site provides good lessons covering many of the topics in this course.

Prince Edward Island's Department of Education Website also has good coverage of many of the topics covered in this course.

Resources

Science 10: Concepts and Connections, pages 198 - 205 and 270 - 272.

Science 10: Concepts and Connections, Teacher's Resource, pages 7 - 16.

The Center for Distance Learning and Innovation website:
http://www.cdli.ca/

Textbook web site:
http://www.science.nelson.com/

Activity, "*Forecast Sayings*", Appendix A.

Activity, "*Interpreting Weather Maps*", Appendix A.

Environment Canada's imaging database:
http://weatheroffice.ec.gc.ca/satellite/

Environment Canada:
http://www.weatheroffice.ec.gc.ca/canada_e.html

P.E.I. Website:
http://www.gov.pe.ca/photos/original/ed_WeatherRes.pdf

Unit 1 - Local Weather

Outcomes

1.2 Identify the function of the following weather instruments used in a weather station:

i) thermometer
ii) hygrometer
iii) barometer
iv) wind vane
v) anemometer
vi) rain gauge

1.3 Define the terminology related to the instruments used in a weather station including:

i) warm front
ii) cold front
iii) relative humidity

1.4 Describe the dominant factors that produce seasonal weather.

1.4.1 Define and recognize a weather system.

1.4.2 Define air mass.

1.4.3 Identify air masses (tropical, polar, maritime, continental) and compare their movements across North America.

1.4.4 Identify weather conditions associated with maritime polar, maritime tropical, continental polar, and continental tropical air masses.

Notes for Teaching and Learning

Students are not required to build a weather station. However, if circumstances allow, they should be given the opportunity to do so by completing activity 4.2, "Build a Weather Station". This is most appropriately a group activity.

A rain gauge is not mentioned in section 4.2. It is a tool which collects and measures the amount of rainfall. It is simply a bottle or can with a millimetre scale. As it rains, the bottle fills and then you go out and measure the height of the water in the bottle (in mm). Snow is measured the same way but is measured in cm.

Students need to be familiar with the map of North America and be able to identify their position on it. Instructors could use BLM 4.4b, *"Map for Tracking Weather Patterns*", and Figure 1 on page 206 to review this.

In order to understand air masses and how they interact, students should be reminded that warm air is lighter than cold air and will rise above it.

Students should be given the opportunity to watch segments of a weather forecasting channel to hear the weather related terms being used. They could be provided with a written transcript of a current weather forecast highlighting the weather terminology.

Suggestions for Assessment

Activity 4.3 in the SRL can be used to review and consolidate the concepts and terminology of this section.

BLM 4.3c, *"The Winds Make the Weather"*, can also be used for review.

Students will be introduced to many new terms throughout this course. Instructors could suggest that students start a vocabulary list and add to it regularly as they work through the unit. Instructors should ensure that all necessary terms are being added to the student's vocabulary list and provide them with ideas about how to successfully remember definitions.

Resources

Science 10: Concepts and Connections, pages 206 - 209.

Science 10: Concepts and Connections, *Teacher's Resource*, pages 17 - 22.

SRL, Activity 4.3, pages 317 - 319.

BLM 4.4b, " *Map for Tracking Weather Patterns*".

BLM 4.3c, "*The Winds Make the Weather*".

Unit 1 - Local Weather

Outcomes

1.4.5 Define a front.

1.4.6 Define and distinguish between warm front, cold front, occluded front, and stationary front.

1.5 Collect and analyze weather data and predict future weather conditions.

1.5.1 Define weather map and explain how a weather map is created.

1.5.2 Locate weather symbols typically used on weather maps to indicate the following weather conditions:

i) high pressure region (indicated by H)
ii) low pressure region (indicated by L)
iii) air temperature (^{o}C)
iv) weather condition (may include rain, freezing rain, snow, thunderstorm, fog, haze, or dew),
vi) warm/cold front
vii) jet stream

1.5.3 Using regional and national weather observation maps, chart and predict the weather in a particular area.

Notes for Teaching and Learning

It is important for students to be familiar with weather map symbols so that they can more easily read a weather map. Instructors could use BLM 4.4a, *"Looking at Weather Maps"*, to review weather map symbols.

In order to complete the required work for this section, students will need to read and refer to G3, *"Interpreting and Creating Weather Maps"*, in the Skills Handbook on pages 270 - 272 of the text.

Pages 322 - 325 of the SRL can be used when completing the Case Study, *"Three Days of Canadian Weather"*.

Students should be aware that weather systems generally move from west to east.

Suggestions for Assessment

After students have completed the Case Study in the text, they could be given a series of data for their local area. These would be available in most newspapers or from internet sites. Students could use them to practice identification of weather conditions and to make predictions of the next day's conditions.

Resources

BLM 4.4a, "*Looking at Weather Maps*".

SRL, pages 322 - 327.

Skills Handbook, G3, "*Interpreting and Creating Weather Maps*", pages 270 - 272.

Unit 1 - Local Weather

Outcomes

1.6 Illustrate how science attempts to explain variations in weather patterns for a given location.

1.6.1 Describe localized air movements (thermals, sea breezes, and land breezes) and their effect on regional weather.

1.6.2 Describe the formation of lake-effect snow/ocean effect snow.

1.6.3 Describe how lake-effect snow/ocean effect snow affects local weather.

1.6.4 Apply the effects of ocean currents, air currents and latitude on the climate of Newfoundland and Labrador.

Notes for Teaching and Learning

Most students will need an explanation of convection currents. Effective demonstrations of convection can be found in most introductory chemistry texts and on the web. Instructors could also refer to the *Teacher's Resource* for explanation of convection demonstrations.

Instructors could demonstrate a thermal updraft by holding a piece of paper over a 60 watt light bulb and showing how it flutters as the bulb heats up the surrounding air.

For most students in Newfoundland and Labrador, ocean effect snow will be a more common experience than lake effect snow. Both are formed by the same conditions. We often hear a forecast like, "Snow flurries possible where winds blow on shore." This refers to the ocean effect on Newfoundland and Labrador's weather.

Suggestions for Assessment

Instructors should assess the student's level of understanding by reading student answers to questions from the Study Guide and providing feedback.

Students are required to complete the Assignment, "*Newfoundland and Labrador Climate*". It can be found in Appendix A. The mark given for the assignment should be included to determine the final mark for the course.

This is the end of Unit 1. Instructors may give a unit test to assess students knowledge and understanding of the material covered in this unit. The mark given for the test should be included to determine the final mark for the course.

Resources

Science 10: Concepts and Connections, pages 210 - 211.

Science 10: Concepts and Connections, *Teacher's Resource*, pages 23 - 26.

Website for lake/ocean effect snow: http://www.meted.ucar.edu/norlat/snow/lake_effect/index.htm

Assignment, "*Newfoundland and Labrador Climate*", Appendix A.

Unit 2 - Global Weather

Outcomes

2.1 Investigate energy transfer within the water cycle.

2.1.1 Using a diagram, provide a brief description of the water cycle.

2.1.2 Identify solar energy (sun) as the driving force behind the water cycle.

2.1.3 Define and explain evaporation, condensation, and precipitation.

2.1.4 Define hydrosphere.

2.1.5 Describe and distinguish between the main types of precipitation; drizzle, rain, freezing rain, snow, hail, dew, and frost.

2.1.6 Explain how relative humidity is related to the dew point and how each is influenced by temperature.

2.1.7 Describe how humidity affects our comfort in different weather conditions.

Notes for Teaching and Learning

Many students will have some familiarity with the water cycle. Instructors should ensure that students understand the process well and use proper terminology to describe it. Students may have the misconception that water is "used up". Use the concept of recycling to help them understand that this is not the case. The water on earth today is the same water that we had 100 or 1000 years ago.

There are many web sites that could be useful in helping students understand the water cycle, such as the Prince Edward Island government web site at http://www.gov.pe.ca/photos/original/ed_watergr8.pdf.

Students would benefit from working through Investigation 4.8. It would give them the opportunity to observe experimentally how the surface area of a body of water, wind and temperature affect relative humidity. This investigation would best be done in a group setting and should be completed if possible. Pages 337 - 340 of the SRL can be used by students as a lab report for this investigation.

Instructors could do the activity, *"Finding the Dew Point"*, on page 215 of the text, as a demonstration, with students taking the measurements (or have students do it themselves). Students should relate this activity to mirrors "steaming up" during a hot shower or the fogging of car windows. Students could use page 334 in the SRL to record the results.

Suggestions for Assessment

Instructors should assess the student's level of understanding by reading student answers to questions from the Study Guide and providing feedback.

BLM 4.6a, *"The Water Cycle"*, can be used as a review of the water cycle.

Students could also be given BLM 4.6b, *"Forms of Precipitation"*, for review and reinforcement.

The Extension Activity, *"Water and the Weather"*, on pages 330 - 331 of the SRL can be used for review of types of precipitation. Students should be encouraged to work on this activity in pairs if possible.

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Resources

Science 10: Concepts and Connections, pages 212 - 217.

Science 10: Concepts and Connections, *Teacher's Resource*, pages 27 - 35.

The Center for Distance Learning and Innovation website:
http://www.cdli.ca/

BLM 4.6a, "*The Water Cycle***"**.

BLM 4.6b, "*Forms of Precipitation*".

SRL,
Extension Activity,
"*Water and the Weather*",
pages 330 - 331.

SRL, Investigation Report,
pages 337 - 340.

Water Cycle:
http://www.gov.pe.ca/photos/original/ed_watergr8.pdf

Unit 2 - Global Weather

Outcomes

2.2 Examine some of the technology that has made forecasting of weather more reliable.

- 2.2.1 Describe the role of meteorologists.
- 2.2.2 Define: weather satellite, weather balloon, and radar.
- 2.2.3 Briefly describe how weather satellites function to collect weather data.
- 2.2.4 Describe why the accuracy of weather forecasts has improved in recent years.
- 2.2.5 Describe the role weather satellites, weather balloons and radar play in improving long term weather forecasts.

2.3 Examine some factors that affect weather and climate across Canada.

- 2.3.1 Distinguish between the terms weather and climate.

Notes for Teaching and Learning

Instructors could relate the topic of current technology for collecting meteorological data back to the folklore that students examined at the beginning of the course. While some folklore is good at predicting the weather in the next 12 to 24 hours, the data collected by satellites, radar and weather balloons allow for more accurate longer term predictions.

Instructors could use satellite images from television or online sources to show the data that meteorologists use to predict weather events. They could also show a current radar image of a specific location by accessing Environment Canada's Weather Radar Site.

Students should know that meteorologists are highly trained and educated. Meteorologists study atmospheric conditions using a vast array of technologies in an effort to understand weather patterns and climate.

Instructors should ensure that the distinction between weather and climate as well as the interconnectedness of these two terms is clear to students. Students should relate the factors that affect climate in a particular area to the type of weather conditions that area can expect to experience during the year.

Suggestions for Assessment

Students could complete pages 345 - 346, *"Professional Forecasting and Technology"*, in the SRL as an assignment or for review.

Instructors should ensure that all necessary terms are being added to the student's vocabulary list.

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Resources

Science 10: Concepts and Connections, pages 218 - 227.

Science 10: Concepts and Connections, *Teacher's Resource*, pages 36 - 48.

The Center for Distance Learning and Innovation website:
http://www.cdli.ca/

SRL,
pages 345 - 346,
"*Professional Forecasting and Technology*".

Unit 2 - Global Weather

Outcomes

2.3.2 Briefly describe how each of the following factors influences the weather and climate of a particular area;

i) latitude
ii) ocean currents
iii) wind and air masses
iv) elevation
v) relief
vi) closeness to water

2.4 Identify the relationship between atmospheric pressure and weather.

2.4.1 Define atmosphere and atmospheric pressure (air pressure).

2.4.2 Explain how atmospheric pressure is related to weather.

2.5 Identify the factors that cause seasons.

2.5.1 Explain how the Earth's tilt and its revolution around the Sun affects seasonal changes.

2.5.2 Investigate how the angle of the sun affects temperature change on earth.

Notes for Teaching and Learning

In general, the further north you go (increasing latitude) the colder it becomes as compared to more southerly locations. Winds generally cool a location. Winds carry weather conditions from one location to another. Warm ocean currents originate in warm water and warm the land as they flow by. Cold currents cool areas down. When warm and cold currents meet, fog will develop. Use local examples to illustrate these concepts. For example, students on the Labrador coast and on the northeast coast of the island will be affected by the cool moist air from the cold Labrador Current. Students in the southeast areas of the island will be experience higher than normal amounts of fog from the meeting of the warm Gulf Stream and the cold Labrador Current.

Many students will have difficulty with the concept that air has mass and takes up space. Instructors could carry out a simple demonstration (or have students complete it) to clarify this concept. Weigh a deflated rubber balloon, inflate it and weigh it again.

Instructors could use a physical model to demonstrate how the earth revolving around the sun creates seasons.

Students and/or instructors could access satellite views of Earth showing a variety of information including day/night views.

Outcome 2.5.2 is achieved by completing Investigation 4.12, *"Earth's Tilt and the Season's"*.

Suggestions for Assessment

Students are instructed in the Study Guide to complete questions (a) to (f) in the Case Study, *"Weather Across Canada"*, on pages 220 - 221 of the text. They could be given pages 347 - 349 of the SRL to be used as a report for the Case Study (omitting (g)).

Ask students how it can be -25°C in Winnipeg and 15°C in Vancouver at the same time or why it can be 10°C in St. John's and -10°C in Ottawa at the same time.

Students could be assigned the questions in *Understanding Concepts* on page 221 for review. Pages 350 - 351 in the SRL can be used for completion of these questions.

Students are required to complete the **Core Lab**, Investigation 4.12, *"Earth's Tilt and Seasons"*, pages 226 - 227. Pages 356 - 357 in the SRL can be used as a report for the investigation.

Students could be assigned the questions in *Understanding Concepts* on page 227 for review. Page 358 in the SRL can be used for completion of these questions.

Resources

SRL, Case Study, "*Weather Across Canada*", pages 347 - 349.

Core Lab: Investigation 4.12, *"Earth's Tilt and Seasons"*, pages 226 - 227.

SRL, pages 350 - 351.

Canadian Space agency website: http://www.space.gc.ca/asc/eng/educators/default.asp

Satellite views of earth: http://www.fourmilab.to/cgi-bin/uncgi/Earth

SRL, pages 356 - 357.

SRL, page 358.

Unit 2 - Global Weather

Outcomes

2.6 Recognize the role of clouds in weather.

2.6.1 Describe the formation of clouds.

2.6.2 Classify clouds into their two general types: cumulus and stratus.

2.6.3 Describe the conditions necessary to form fog.

Notes for Teaching and Learning

Students should relate what they have already learned about the water cycle to what they are learning about the formation of clouds.

Unit 2 - Global Weather

Suggestions for Assessment

Students could be asked to complete Try This Activity, *"Observing Clouds"*, on page 229 of the text. Page 359 in the SRL can be used for completion of this activity.

Instructors should assign a mark out of 10% for the written notes generated from answering the questions in the Study Guide. Students should also be assigned a mark for lab reports and/or other assignments.

Students should be given a final comprehensive exam that is worth at least 50% of the final mark for the course.

Resources

Science 10: Concepts and Connections, pages 228 - 229.

Science 10: Concepts and Connections, *Teacher's Resource*, pages 49 - 51.

Appendix A

Activity 1, Option 1

Instructions: Read each statement in the table and indicate whether you think it is true or false by writing T or F in the appropriate space. Then use some of the web sites provided by your teacher to research the statements to determine if your thoughts were accurate.

Nature's Weather Forecasts - or not?

Proverb or Saying	True or False?	Answer from research	Explanation
Geese fly higher when the weather is foul.			
Moss dry, sunny sky; Moss wet, rain we'll get.			
Sea gull, sea gull, sit on the sand; It's never good weather when you are at hand.			
Cows with tails to the west, weather's the best; Tails to the east, weather's the least.			
Smoke curling downward means bad weather's approaching.			
No weather is ill, if the wind be still.			
When windows won't open, and the salt clogs in the shaker, the weather will favor the umbrella maker!			
The last Sunday in the month indicates the weather for the next month.			
Flowers smell best just before the rain.			
When leaves show their back, rain we won't lack.			
Bees do not swarm before a storm.			

Activity I - Option 2

Forecast Sayings

Consider this weather saying: Halo ‘round the Sun or Moon, rain or snow coming soon.

The weather explanation for this saying comes from the idea that the first clouds to appear when a warm front meets a cold air mass are wispy cirrus clouds. The ice crystals in these clouds bend the light from the Sun or Moon, forming a circular halo that warns that unsettled weather is approaching.

Try to match these weather sayings with their correct weather explanations. Write the letter corresponding to each of the sayings under the correct weather explanation in the chart on the next page.

Weather Saying

A. Red sky at night, sailors delight;
Red sky in morning, sailors take warning.

B. Mare’s tails and mackerel scales make tall ships take in their sails.

C. Early thunder, early spring.

D. After frost - warm; after snow - cold.

E. When high clouds and low clouds do not march together,
prepare for a blow and a change in the weather.

F. When teeth and bones and bunions ache,
expect the clouds to fill the lake.

G. In like a lion, out like a lamb.

H. Rain long foretold, long last,
short notice, soon past.

I. Rainbow in the morning gives you fair warning.

Weather Explanations

Early March in Canada is still winter and therefore tends to have harsh, cold winds. By the end of the month, it is spring and the weather is less harsh.
Wispy cirrus clouds can be followed by a thicker layer that forms bright, clumpy patterns and sometimes looks like scales on a fish. These formations often appear before thicker, lower clouds, winds and eventually rain.
The passage of a warm front usually brings rainstorms. These storms bring big clouds that sit overhead for hours before it rains. Cold fronts generally move more quickly. If rainfall comes quickly and rains heavily, it usually doesn't last long.
Your blood is under pressure from the pumping of your heart. Outside air pressure presses against you and equalizes the pressure. When air pressure becomes weaker, the pressure outside and inside your body are not as equal and the body can swell a bit. This welling can cause sensitive spots to ache. Some people insist they can feel these changes in pressure.
Sunlight at sunset passes through dust particles in a clear sky. This scatters the other colours in the spectrum so all we see is red. The dust is a sign of dry weather to the west because the sun sets in the west. Morning light from the east that strikes wispy cirrus clouds also spreads the light and causes the sky to appear red. These clouds usually come before a warm front carrying rain.

In Canada, we usually have thunderstorms after a hot, humid day. Thunderstorms need a certain amount of heat to develop. It usually takes warm, moist air to generate the kinds of clouds that produce lightning and thunder. The earlier in winter we hear thunder, the warmer it must be, indicating an early spring.

Rainbows appear when the sunlight reflects off falling raindrops and bounces back to your eyes. To see a rainbow, the sun must be behind you. If this happens in the morning when the sun is in the east, the rain must be falling in the west. In Canada in the mid-latitudes, weather generally travels from west to east and therefore is coming your way.

Clouds are blown in the direction of the wind. An incoming front is usually indicated by winds that shift and change direction. The upper winds move in a different direction from the lower winds. Incoming fronts usually bring with them a change in weather.

Frost usually appears when the skies are clear and high pressure brings in warmer air. It only snows when there is some cloud cover. That cloud cover usually indicates a cold air mass that doesn't move away quickly.

Activity 2, Part I

Instructions: List all the symbols in the map. Then record the meaning of each symbol. **Note: See your instructor for copies of the weather maps needed for this activity.**

Interpreting Weather Maps

Weather Symbol	Symbol Meaning

A. According to yesterday's weather map, what was the forecast for your area for today?

B. How accurate was the forecast?

C. Based on the patterns over the three days, predict tomorrow's weather.

Activity 2, Part II

How Accurate are Advanced Forecasts?

Newspapers and weather forecasters on television provide four or five day forecasts in an effort to provide advance notice of what weather to expect. Begin the activity on Monday and fill in the forecast for the following Friday in the first column. On Tuesday, write Friday's forecast in the second column and continue each day until Friday itself. On Friday evening (or Saturday morning) record Friday's actual weather.

Record the maximum temperature, minimum temperature, type of precipitation, degree of cloud cover, and any comments.

Fill in the day of the week and date in the space following "Forecast for" above the table.

Forecast for: _____

	Forecast on Monday	Forecast on Tuesday	Forecast on Wednesday	Forecast on Thursday	Forecast a.m Friday	Actual on Friday
Maximum temperature						
Minimum temperature						
Cloud cover						
Probability of precipitation						
Comments						

1. How did the forecast change from Monday through the morning of Friday?

_____

_____

_____

2. Write a paragraph to summarize the accuracy of the forecasts as Friday approaches.

Assignment

Instruction: Read the article, "*Newfoundland and Labrador Climate*", and write answers for the **Analysis** questions at the end of the article.

Newfoundland and Labrador Climate

Newfoundland and Labrador has some of the most variable climate and weather conditions in Canada and the world. As one favorite saying goes "If you don't like the weather, wait 10 minutes and it'll change". The physical geography, closeness to the Atlantic Ocean, air movements, and global location help explain many of the unique features of our province's climate and weather.

Geography

The island portion covers 5 ½ degrees of latitude, about the same as the Great Lakes. Labrador covers about 9 degrees of latitude. The southern extremity lies close to the forty-seventh parallel, approximately the same latitude as Seattle and Paris. The northern extremity lies close to the sixty-first parallel, about the same as Yellowknife. The island covers an area of 111 390 km^2, while Labrador has 294 330 km^2, with elevations ranging from sea level to above 1600 m. This geographical spread contributes to the variability in climate and weather from one region to another. For example, Labrador winters tend to be drier and colder than the island. Central and western regions of the island tend to be snowier in the winter and hotter in the summer than Eastern regions.

Ocean Influences

It is said the people here live on, by, and from the sea. On the island, no place is more than 100 km from the ocean, and therefore every part of the island is subject to the year-round influences of the cold waters surrounding the island and down the Labrador coast. Many of the communities of Labrador are on the coast or close to it. Surface water temperatures on the eastern side of the island range from summer highs of 11°C to 13°C inshore and 8°C to 11°C offshore with winter lows of -1°C inshore and +2°C offshore. Sea temperatures on the western side are warmer than the eastern side by 1°C to 3°C. The open sea keeps winter air temperatures a little warmer and summer air temperatures slightly cooler along the coast than inland. This is due to the two major ocean currents that pass our province. (Find Newfoundland and Labrador in Figure 1 on page 232 of your text and look closely at the Labrador Current and the Gulf Stream). From the north, bringing cold Arctic water, is the Labrador Current. This current helps keep our province slightly cooler in the summer than other parts of Canada. From the south, bringing warm tropical water, is the Gulf Stream. This current helps keep some areas of the island slightly warmer in the winter than other parts of Canada.

Because of the effect of the ocean on our climate, the island of Newfoundland experiences a maritime climate where there are generally milder winters and cooler summers. Labrador's climate has more Arctic influences due to the larger land mass and air movements from it. A marine climate generally causes more changeable weather, lots of precipitation in a variety of forms (sometimes all at once), higher humidity, lower visibility, more cloud, less sunshine, and strong winds than a continental climate.

Air temperatures on the island are directly affected by the presence of the Atlantic Ocean. Winter temperatures on the island of Newfoundland show the day-to-day variability that is characteristic of a stormy maritime climate. Movements of moist, mild Atlantic air of the ocean are frequent. There is also a noticeable difference between island and coastal temperatures. In the interior, winter temperatures average between -6°C and -10°C, whereas on the southeast coast, where the moderating influence of the ocean is greatest, the winter average is between -2°C and -4°C. The lowest Newfoundland temperature on record is -41.1°C, set at Wooddale (central Newfoundland) on February 4, 1975.

Prevailing Winds

There are a few physical barriers to protect the island of Newfoundland from weather systems sweeping across it. Its situation on the eastern side of North America favors strong seasonal changes in the visiting air masses. Due to prevailing westerly winds that move air from across North America and up from the equator, there are plenty of low clouds, heavy precipitation, and strong winds over the island of Newfoundland. This is evident by the number of storms that pass over and near the island on an annual basis. Indeed, many of the storms that cross North America during the year from west to east, or develop and intensify off the East Coast of the United States, pass near the island while they move out to the North Atlantic. The result is that Newfoundland and Labrador has a deserved reputation as one of the stormiest parts of the continent. It also has some of the most changeable weather anywhere.

At all times of the year Newfoundland is near one of the principal ***storm tracks***. The severity and frequency of storms is greatest between November and March, although they may occur at any time of the year. In fact, some of the most severe storms ever recorded, have been observed off our coasts. The movie "The Perfect Storm" is a good example of how strong storms develop off Newfoundland and Labrador.

Winter ***cyclones*** are fast-moving storms (up to 80 km/h) that bring abundant and varied precipitation in the form of snow, sleet, freezing rain or rain. They pose a serious threat to fisherman, commercial shipping and offshore oil and gas exploration activities. Winds often mount to gale and sometimes hurricane force. Hardly a winter goes by without at least three or four East Coast gales. Blizzards occur frequently in Newfoundland and Labrador. A common part of winter public forecasts include weather warnings and blizzard warnings. The official Environment Canada definition states a ***blizzard***, in general, is a winter storm lasting for at least three hours with winds exceeding 40 km/h and visibility reduced to under a kilometer by falling

or blowing snow. Typically air temperatures of -7°C are required, however falling snow is not. Many blizzards result from already fallen snow blowing around. The application of the term blizzard differs from region to region across Canada.

Occasionally, throughout the year, large rotating storm centers are prevented from moving out of the region by an upper atmosphere air mass. The resulting cool, cloudy, and rainy weather associated with the system may persist for a week or more.

During the summer and early fall, Newfoundland weather is typically less stormy. However, in the fall, there are tropical storms that begin near the equator and develop in the Caribbean. These may bring windy, wet weather while they pass by the island. They eventually die or gain new strength in the North Atlantic. Over the past thirty-five years, an average of one tropical storm per year has passed within 300 km of Newfoundland and Labrador. One of the most notorious of these was the "Independence Hurricane' that struck eastern Newfoundland on September 9, 1775. About 4000 sailors, mostly from the British Isles, were reported to have drowned. On September 5, 1978, another violent storm, Hurricane Ella, passed south of Cape race. Her winds exceeded 220 km/h. At John's, 45 mm of rain fell and winds reached 115 km/h..

Storm Tracks: The paths that storms take as they move from one region to another.	**Cyclones**: In the Northern Hemisphere, a closed counter-clockwise movement of air.
Blizzard: A winter storm lasting for at least 3 hours with winds exceeding 40 km/h and visibility reduced to under 1 km by falling/blowing snow.	

Analysis

1. Identify four things that influence the climate of Newfoundland and Labrador.

2. What ocean currents directly affect the climate of Newfoundland and Labrador?

3. Are climate conditions the same throughout this province? Explain.

4. How do wind patterns affect our climate?

5. What is a storm track?

6. What is a blizzard?