Eco - weather Unit

Sc 20F

G.10 Science

Ecology/Weather: Selected Learning Outcomes

Weather

S2-4-01 Illustrate the composition and organization of the hydrosphere and the atmosphere.
Include: salt water, fresh water, polar ice caps/glaciers, troposphere, stratosphere.
GLO: D5, E2

S2-4-02 Outline factors influencing the Earth's radiation budget.
Include: solar radiation, cloud cover, surface reflectance (albedo), absorption, latitude.
GLO: D4, D5, E2, E3

S2-4-03 Explain effects of heat transfer within the atmosphere and hydrosphere on the development and movement of wind and ocean currents.
Include: Coriolis effect/convection, prevailing westerlies, jet streams, El Niño.
GLO: A2, D5, E2, E4

S2-4-04 Explain the formation and dynamics of selected severe weather phenomena.
Examples: thunderstorms, tornadoes, blizzards, hurricanes, extreme temperature events, cyclonic storms...
GLO: A2, D5, E1, E4

S2-4-05 Collect, interpret, and analyze meteorological data related to a severe weather event.
Include: meteorological maps, satellite imagery, conditions prior to and following the event.
GLO: C2, C6, C8, D5

S2-4-06 Investigate the social, economic, and environmental impacts of a recent severe weather event.
Include: related consequences of personal and societal decision making.
GLO: B2, B3, B4, C6

S2-4-07 Investigate and evaluate evidence that climate change occurs naturally and can be influenced by human activities.
Include: the use of technology in gathering and interpreting current and historical data.
GLO: A1, A4, D5, E3

S2-4-08 Discuss potential consequences of climate change.
Examples: changes in ocean temperature may affect aquatic populations, higher frequency of severe weather events influencing social and economic activities, scientific debate over nature and degree of change...
GLO: A1, A2, C5, C8

Ecology

S2-1-01 Illustrate and explain how carbon, nitrogen, and oxygen are cycled through an ecosystem.
GLO: D2, D3, D5, E2

S2-1-02 Discuss factors that may disturb biogeochemical cycles.
Include: natural events, human activities.
GLO: A2, C8, D2, D5

S2-1-03 Describe bioaccumulation and explain its potential impact on consumers.
Examples: bioaccumulations of DDT, lead, dioxins, PCBs, mercury...
GLO: B1, D2

S2-1-04 Describe the carrying capacity of an ecosystem.
GLO: D2, E2, E3

S2-1-05 Investigate and discuss various limiting factors that influence population dynamics.
Include: density-dependent and density-independent factors.
GLO: C2, D2, E2, E3

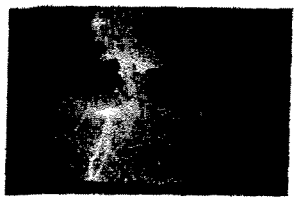
S2-1-06 Construct and interpret graphs of population dynamics.
GLO: C2, C6, C8, D2

S2-1-07 Describe potential consequences of introducing new species and species extinction on an ecosystem.
GLO: E1, E2

S2-1-08 Observe and document a range of organisms that illustrate the biodiversity within a local or regional ecosystem.
GLO: D2, E2, E3

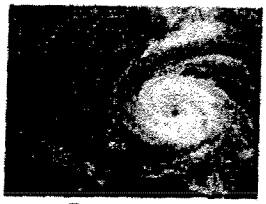
S2-1-09 Explain how the biodiversity of an ecosystem contributes to its sustainability.
GLO: B5, E1

S2-1-10 Investigate how human activities affect an ecosystem and use the decision-making process to propose a course of action to enhance its sustainability.
Include: impact on biogeochemical cycling, population dynamics, and biodiversity.
GLO: B5, C4, C5, C8



Extreme Weather Project

Grade 10 - Science



Name:

Date:

This project will be done in a group of 3 or 4. Presentations must be between approximately 10 minutes long. For this project you will choose one of the four choices. You will be provided two classes in the library to gather information and to complete your project. Please let me know ahead of time whether the LCD projector will be needed.

1. **Talk Show (interview with survivor)** – you will write out your presentation as a script and present it as a Talk Show.
   - This script must be written in your own words on approximately two pages **(using times new roman, size 12, double spaced, with 1.5" margins)**.
   - Each topic listed below must be covered by a minimum of one paragraph.
   - The script should include a minimum of one picture of the weather event you are doing and a map of where it occurs.

2. **Comic Strip** – Produce the report in comic strip form, with animations, dialogue balloons, and colour. *Comic Strip will be scanned so that it can be presented to the class via PowerPoint.*
   - This comic strip must be written in your own words on minimum 5 pages (4 frames per page).
   - Each topic listed below must be covered.
   - The Comic Strip should be in **full colour**, with appropriate dialogue.
   - The accompanying presentation will be of your comic strip to the class.

3. **Television or Radio News Broadcast** – Present a news broadcast with an accompanying script.
   - This script must be written in your own words on approximately two pages **(using times new roman, size 12, double spaced, with 1.5" margins)**.
   - Each topic listed below must be covered by a minimum of one paragraph.
   - The script should include a minimum of one picture extreme weather event you are doing, as well as, a map describing the locations it occurs.
   - The accompanying presentation is done as though you were an Anchorman and/or Anchorwoman.

4. **Historical Documentary-** Present as a video with an accompanying script.
   - This script must be written in your own words on approximately two pages **(using times new roman, size 12, double spaced, with 1.5" margins)**.
   - Each topic listed below must be covered by a minimum of one paragraph.
   - The script should include a minimum of one picture extreme weather event you are doing, as well as, a map describing the locations it occurs.

The following information must be included in your project:

* A **one-page information sheet** with relevant information and a maximum 2 pictures (maximum size 3"x3") to be handed out to the audience for use with the presentation.
* A list of every group members role and responsibilities (to be reviewed by me during and after the presentation).

Assessment

This project will be assessed on...
The 6 categories listed above, creativity, originality, meaningful pictures, organization, neatness, overall impression, and works cited**.

Works Cited

Bibliography should include at least four sources, 2 of which must be books. You may **NOT** use Wikipedia, Microsoft EnCarta, etc. If you are unsure of whether a site is appropriate or not, ask.

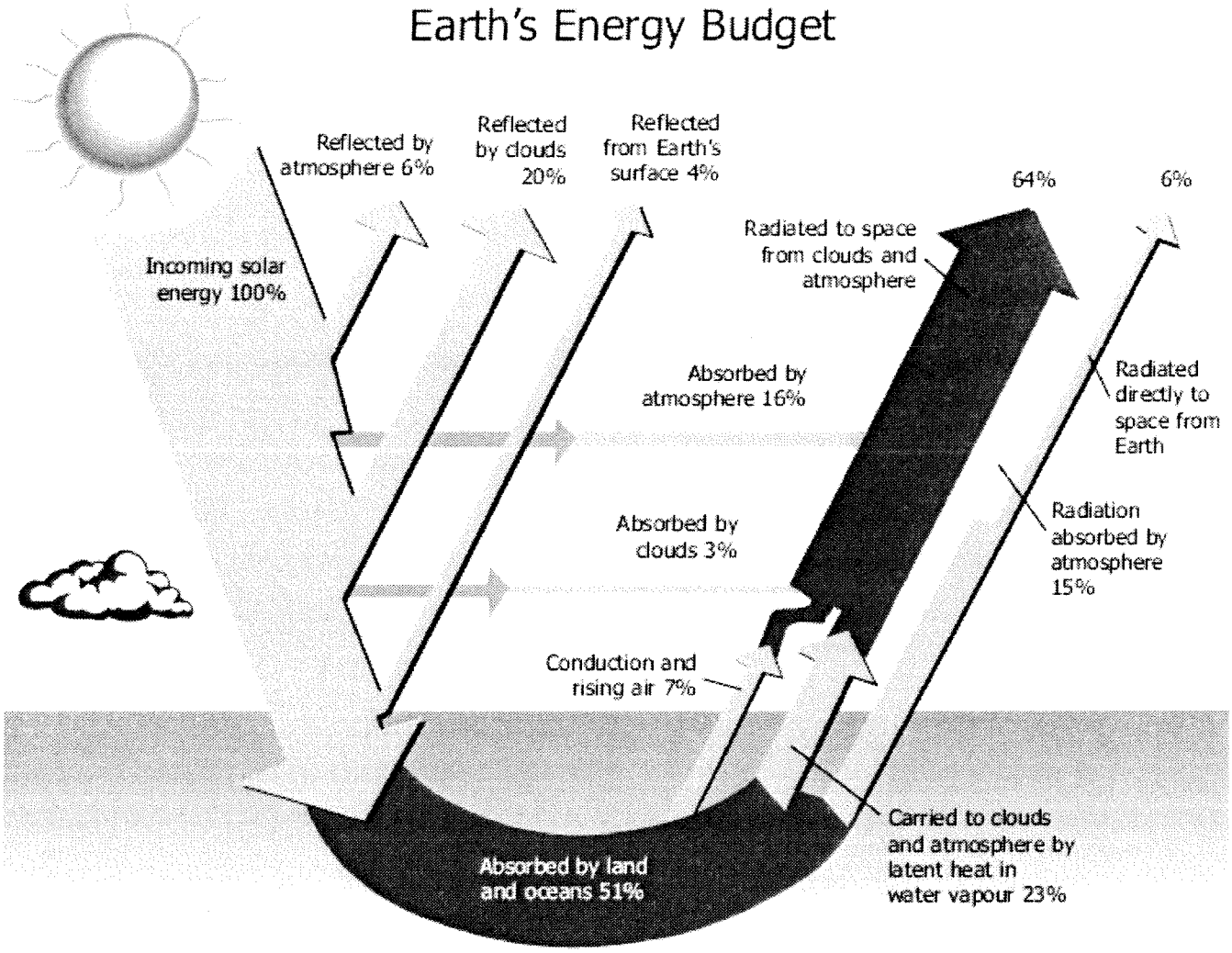
Bibliography must be presented in the following format.
Last name, first name. title, publisher, year. pages.

Severe Weather Project Checklist

Have I Included...	Teacher Mark (2 points)
Cause or **Required Conditions** for the Weather event to occur.	
Location - Where you might expect to find the phenomena (i.e. provide a map).	
Winds Speeds associated with the weather event.	
Precipitation, if there is any, how heavy? What kind (snow, hail, rain)?, when? How much?	
Duration, how long does the phenomena last for?	
Season, when during the year?	
Specific Weather event. Location and date.	
Scale used to measure (eg. Beaufort Scale, Fujita Scale)	
Social Impact, what effect did the event have on individuals safety and well being?	
Economic Impact, what effect did the event have on the economy in the area at the time and for future? Tourism?	
	/20

Criteria	Expert (4 points)	Intermediate (2-3 points)	Novice (0-1 point)
Project is original (no other criteria are evaluated if this criteria is assessed at the Novice level)	Project is written in the student's own words	Intermediate level does not apply to this assessment criteria	Aspects of the project are the same as those of another student or the entire conclusion is the same as that of another student
Works Cited List	Final product includes a complete and concise list of sources cited in a way where they can be easily accessed	Evidence of information used in the project that was not cited	No sources cited
Aesthetics of Visual Product	Final product provides evidence of a professional design	Design elements are lacking from the final product	Final product looks like it was put together is a "last minute" sort of way
Commitment to Task	Student is engaged in task during class time, requests help when necessary, and meets all of the assigned due dates	Student is infrequently engaged in the task during class time, but meets all assignment due dates	Little or no evidence of commitment to the task, and/or due dates not met
Technical Requirements of Report *This category is marked out of 20 points (see list above)*	All technical requirement listed on the list are checked off		Less than 50% of the requirements are met

Earth's Energy Budget



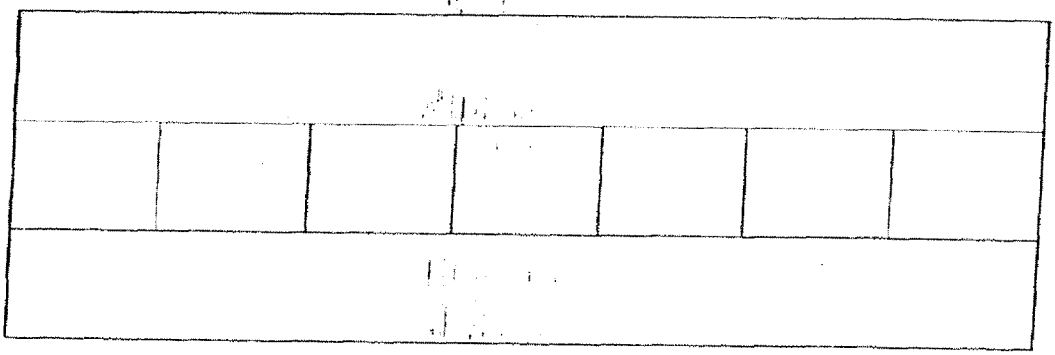
Earth's Radiation Budget

Q. What is a budget?

Solar radiation entering the earth's atmosphere can be accounted for using a budget, called the _____ _____ _____.

Energy Travelling from the Sun

Sun emits energy in the form of _____ waves.
EM Spectrum includes all types of radiant energy.



Heat Transfer

Radiant energy is transferred in 3 ways.

1. _____: highly energetic particles do NOT move, but they collide with other less energetic particles and transfer heat energy.

Example Diagram

2. _____: highly energetic particles physically MOVE from one place to another, transferring heat.

Example Diagram

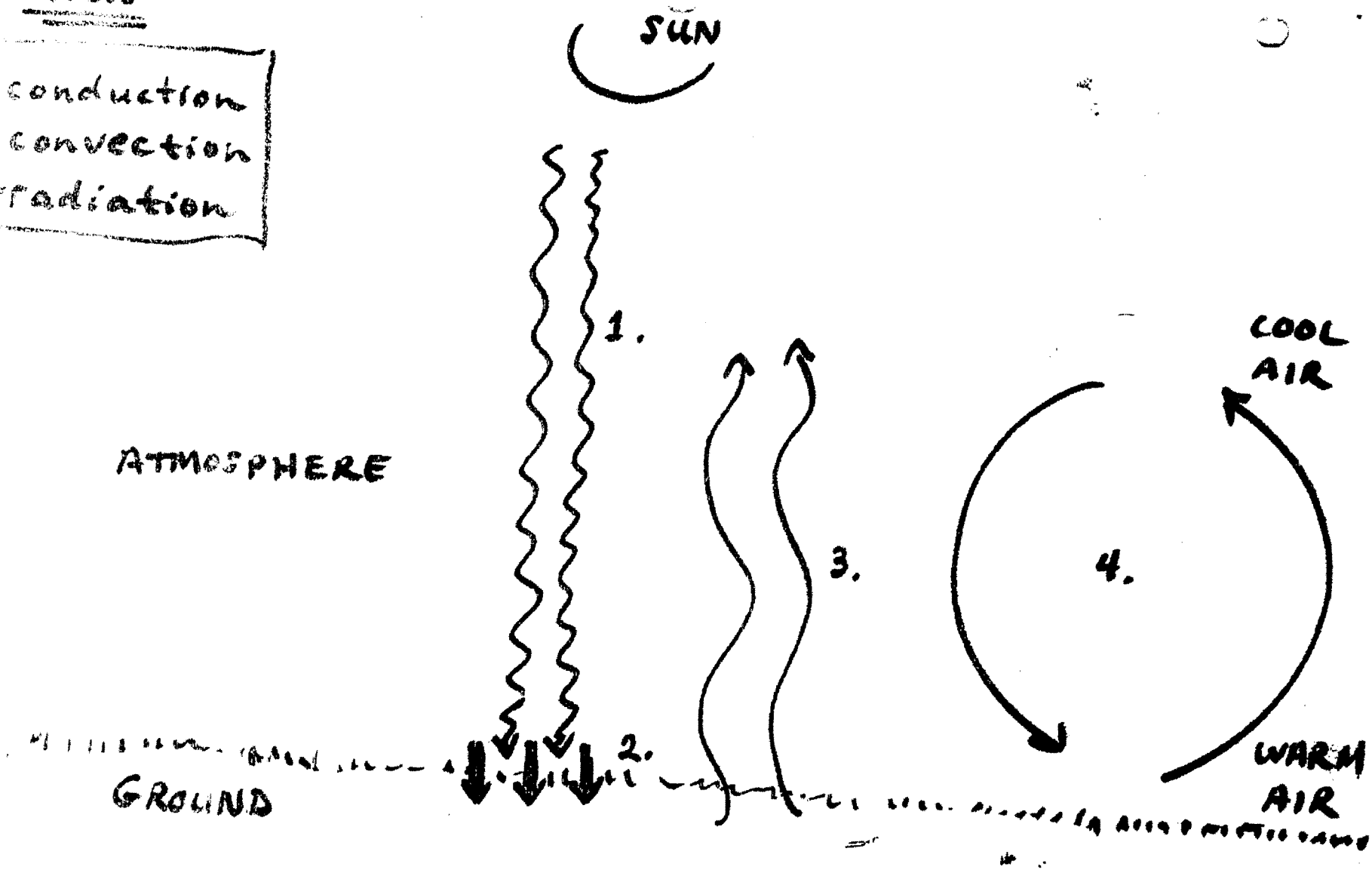
3. _____: particles emit electromagnetic waves and carry it through space. When EM waves collide with matter, they are converted to a different form of energy, usually heat energy.

Example Diagram

• Read & understand pp. 422-424 • Answer Qs.1-3 p.426

Words

A. = conduction
B. = convection
C. = radiation



Conduction, Convection, Radiation

Use the following diagram to describe where exactly conduction, convection and radiation are acting to transfer heat from one place to another.

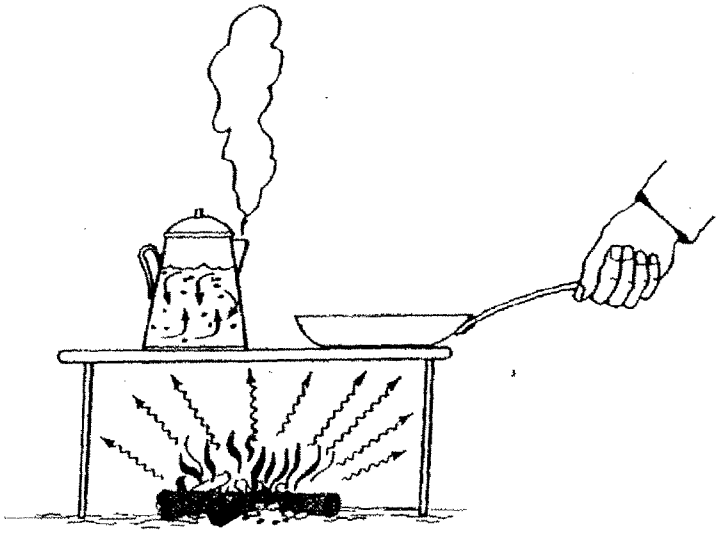


FIGURE 2-8 Conduction, convection, and radiation.

Conduction:

1.

2.

3.

Convection:

1.

2.

3.

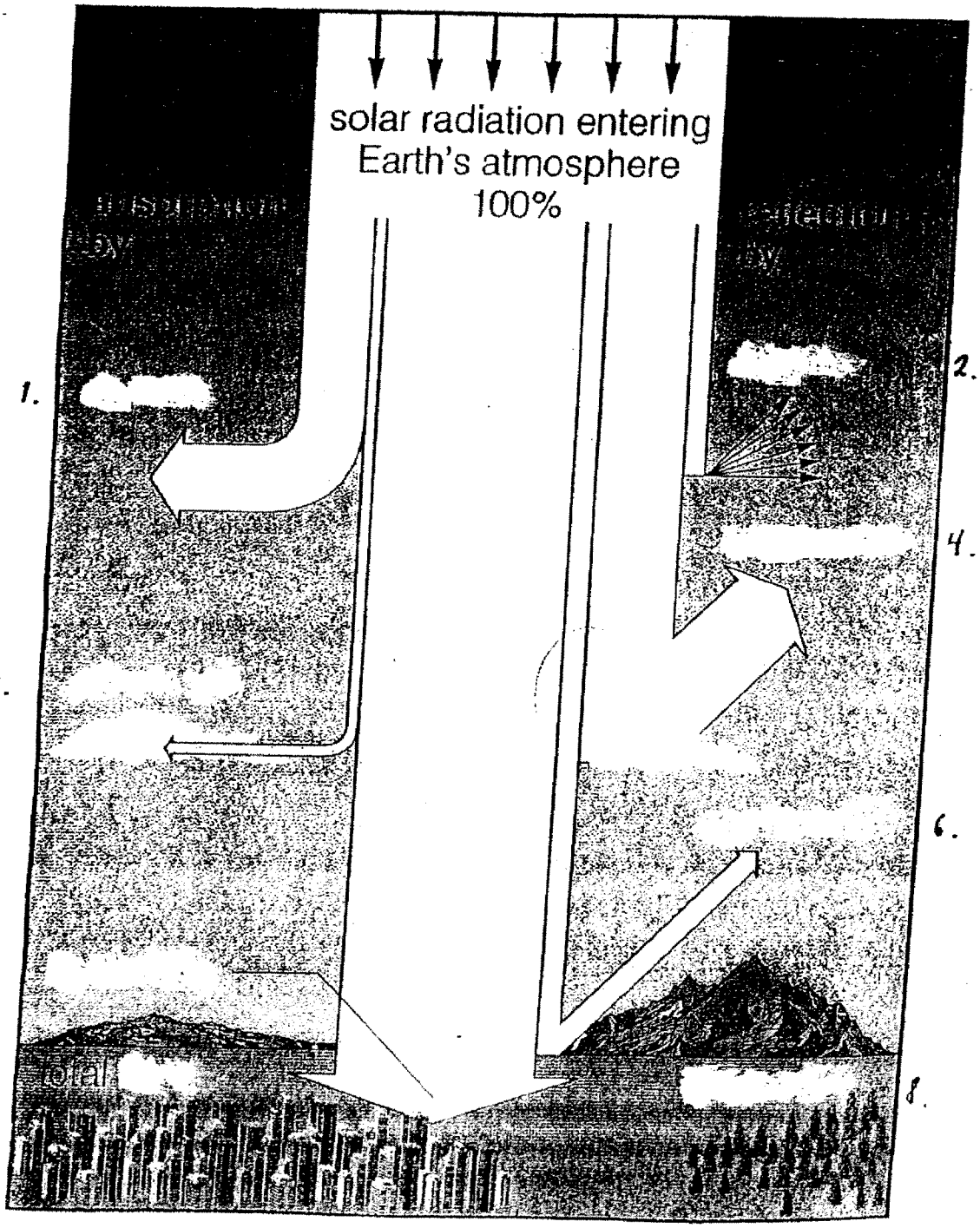
Radiation:

1

2.

3

p.424



Guiding Question—What effect does albedo have on surface temperature?

Concepts

Albedo is the fraction of incoming sunlight that is reflected, rather than absorbed.

Principles

1. Albedo is represented as a percent of Earth's total incoming energy. Thus, an albedo of 50 percent would indicate that half of all incoming radiation is reflected. In general, the more radiation that is reflected, the lower the overall surface temperatures.
2. Albedo represents an important aspect of the radiation budget.
3. Earth's Radiation Budget is a model that depicts the amount of energy the Earth gets from the Sun and the amount of energy Earth sends back to space. If Earth receives more solar energy than it sends back to space, we expect it to warm up. If Earth sends more energy than it receives from the Sun, we expect Earth to cool down.
4. In general, more lightly coloured surfaces (e.g., snow and ice) have a higher albedo than dark-coloured ones (e.g., trees, blacktop, and so on).

Facts

1. The overall albedo of Earth is thought to be about 30 percent.
2. NASA satellite instruments collect data concerning Earth's albedo.
3. The concept of albedo explains, for example, why white robes are favoured in desert regions.

Skills

1. Experimenting and making measurements
2. Drawing conclusions

Preparation

Materials

1. Thermometers (three per lab team)
2. Black- and white-coloured paper (one sheet each per lab team)
3. One paper cup of water per lab team
4. Earth's Radiation Budget graphic from this or other learning resources or websites, such as: <http://asd-www.larc.nasa.gov/erbe/components2.gif>

Room Preparation

As most of the lesson will take place outside, no room preparation is necessary. In the absence of warm, sunny weather, the room can be set up with a number of high-intensity lamps as "suns."

Note: The number of sun lamps will depend on how many students and how many groups are working on the activity. It is suggested that there should be one lamp per group.

Safety Precautions

1. Students should report broken thermometers immediately. Both broken glass and mercury have a high hazard potential.
2. If lamps are used, make sure students are careful not to let clothes or skin touch the bulb or metal shade (if any).

Procedures and Activity

Prelab discussions

1. Introduce the Earth's Radiation Budget so students will understand the concept, and how their learning resources (such as the text) explain albedo.
2. Ask students if they would be hotter on a sunny day wearing black- or white-coloured clothes. Guide them into realizing that because white is "brighter" (it has a higher albedo), it is correspondingly cooler; black garments reflect little sunlight and thus are warmer.
3. Review variables—independent and dependent. Which variables are involved here?

Activity

1. Distribute materials among students. Each lab team should wrap one thermometer tightly in black paper. A second thermometer should be wrapped tightly in white paper, and the third thermometer should be submerged in the cup of water. All three thermometers should then be put in the Sun (or underneath the lamp).
2. The temperature readings for all three thermometers should be checked and recorded every five minutes, for a total of 10 minutes. At the end of the first five-minute waiting period, students should rank the three materials (white paper, black paper, and water) in order, from the highest to the lowest albedo, as a working hypothesis.
3. Each of the three materials (white paper, black paper, and water) should be rated for albedo again at the end of the final five-minute waiting period, this time using the idea that a higher albedo will yield a lower final temperature.

Discussion

1. Which final temperature was the highest? Which was the lowest? Did your results turn out the way you expected?
2. Just in case: If the final temperature for the water proves to exceed that for the black paper, help students to understand the fact that the black paper "shields" its thermometer and thus might have influenced the results. Ask for suggestions on how to redesign the experiment to account for this (an example of a more accurate method is given under "Extension Ideas" below).

Closing

Ask students "What effect does albedo have on surface temperature?"

Assessment

1. Completion of a lab activity sheet or formal lab report.
2. Did each student contribute equally to the group effort? You may wish to add a question to each activity sheet, along the lines of "How did you divide up the work?"

Extension Ideas to Challenge Students

1. Have students graph temperature versus time for all three thermometers, and ask if all three warmed up at the same rate.
2. A more accurate method of determining albedo-temperature-colour relationships would be to put each thermometer in a cup filled with either cola, milk, or plain water. Make sure that the starting temperatures of all three liquids are identical, and that the volumes of the three are more or less equivalent. You might wish to run the experiment this way after completing it as described above, and allow students to compare results.
3. Assume (for the sake of this experiment) that the black paper (or cola) has an albedo of 0 percent. Further assume that the albedo of the white paper (or milk) is 100 percent. Have students interpolate the temperature for Earth in general (30 percent albedo) under similar light conditions, based on the two end-point temperatures.

   Interpolated Temperature (30%) = 100% albedo temperature + (0.3) x (0% temperature–100% temperature)

Purpose

Develop and apply a variety of strategies to solve problems, with emphasis on multistep and nonroutine problems.

Instructional Delivery

Co-operative Groups/Flexible Groups/Independent

Materials

Appendix 4.1: Earth's Energy Budget

Activity

Students solve the suggested mathematical word problems by looking at the Earth's Energy Budget. Students use their Earth's Energy Budget graphic to assist with answering the questions. After answering the questions, use a self-assessment or peer-assessment strategy to have students follow up on the class responses.

Assessment

Have students (independently, or in co-operative or flexible groups) create and solve an original mathematical word problem by using the information on the Earth's Energy Budget handout.

Extension Ideas

When introducing the information to the class about the long and short waves, have the students estimate and predict wavelengths. Use a piece of yarn or a coil spring toy to represent and simulate wavelength. The students can manipulate the piece of yarn or spring toy after making their predictions. This activity may be altered to predict measurement in inches, centimetres, yards, feet, and so on. There are particular unit conversion skills involved here, and students of *Applied Mathematics (20S)* could use this as reinforcement.

Student Activity Questions

1. Determine the radiation budget by looking at the Earth's Energy Budget. (Subtract the amount of solar energy from the total amount of reflected energy from the Earth in order to determine the radiation budget.)

2. What is the total percentage of the incoming solar energy reflected from the Earth by the atmosphere, clouds, and Earth's surface?

   Total Reflected: (% atmosphere + % clouds + % Earth's surface) = _____%

3. Is the total percentage of the incoming solar energy reflected from the atmosphere, clouds, and Earth's surface less than or greater than the incoming solar energy absorbed by the land and oceans?

   (% atmosphere + % clouds + % Earth's surface) < or > (% land + % ocean)

4. If the amount of incoming solar energy reflected from the Earth's surface tripled, how much energy would be reflected?

   (% incoming solar energy) x 3 = _____%

LAB: What's the Recipe for a Cloud? .....

.name:

Pre-lab Questions:

1. Which will probably have more humidity (water vapor) in the air above it ? Circle one.

. . . . . A) a part of the ocean having colder surface waters

. . . . . B) a part of the ocean having warmer surface waters

2. In order for a cloud to form, the humid air must be cooled below its **???** point. Circle one.

thermal . . . . . condensation . . . . . dew

3. As air is compressed (squeezed), will it become warmer, or will it become cooler?

4. As air is allowed to expand, what happens to its temperature?

5. What are **condensation nuclei**? Give two examples.

Materials: 2 liter (untinted) plastic pop bottle with lid, book of matches, 250 ml beaker (or larger), hot water, ice water

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Procedures/Observations:

1. Trial #1: Pour 200 ml of cold water into the plastic bottle, and then firmly screw on the lid. Shake the bottle for 30 seconds. Squeeze the bottle for several seconds to increase the pressure, and then release it to allow the air inside to expand. Squeeze and release several times as you watch the air in the bottle. What happens?

Observations:

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2. Trial #2: Unscrew the cap from the bottle. Light a match, blow it out, and then hold the smoking match inside the tilted bottle for about 3 seconds. Quickly replace the cap. Squeeze and release as you did in procedure #1.

Observations:

"dew point" in your answer.

.

8. You can see clouds because they are made up of **???** or **???**. Circle two answers.

water vapor . . . . . .water droplets . . . . . ice crystals

.

9. As air rises in the atmosphere, is it compressed, or does it expand?

.

10. What effect does this have on the air's temperature?

.

11. Circle the letters of the five situations listed below that will contribute to cloud formation.

A. Moist air is forced upward as it encounters the Cascade Mountain Range.

B. Tomorrow's forecast calls for an area of high pressure to be centered over your region.

C. The westerlies cause air to flow down the east side of the Rockies into Browning, Montana.

D. During the afternoon, air over a large air force base begins to rise because it is so much hotter than air over the surrounding forest.

E. In autumn, the Santa Ana winds blow down from the mountain slopes of interior California out to the sea.

F. Intensely heated air over the equator rises in an area called the intertropical convergence zone.

G. As part of the global circulation pattern, air 30 degrees north of the equator is sinking in an area called the horse latitudes.

H. An intense low pressure system moves across the Midwest.

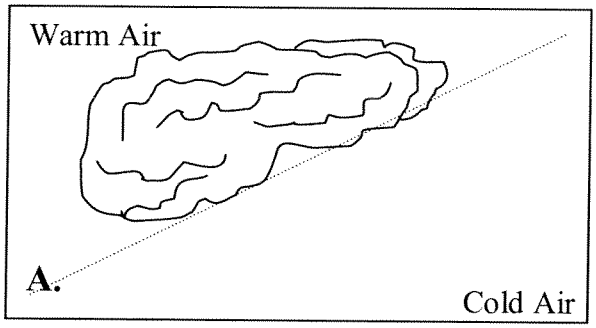
I. A cold air mass from Canada pushes into a mass of warm humid air over Nebraska.

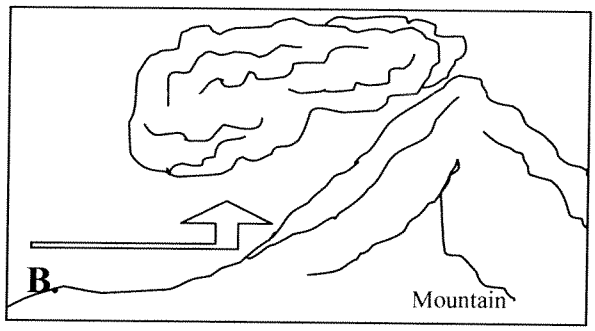
Name: _____ Date: _____ Period: _____

Cloud Formation: Atmosphere Worksheet #1

***Directions**: Use your notes from class and the textbook to answer the following questions. Be sure to use complete sentences where applicable.*

Examine the diagram below. Then, answer the questions that follow.





1. What is happening to the air in both A and B that leads to the formation of clouds? _____

_____

_____

2. What is causing the air to rise in A? _____

_____

_____

3. What is causing the air to rise in B? _____

_____

_____

Matching: For each item in Column A, write the letter of the matching item in Column B.

	Column A	Column B
4. _____	All forms of water that fall from clouds	a. Stratus
5. _____	Low, layered clouds	b. Cirrus
6. _____	Small Cloud droplets join to form larger ones	c. Precipitation
7. _____	Wispy, high altitude clouds made of ice crystals	d. Cumulus
		e. Coalescence

8. A large mass of air that moves from high pressure areas to low pressure areas is called a(n) _____.

a. cloud b. air mass c. precipitation d. wind

9. The process of water changing from a gas to a liquid is _____.

a. condensation b. precipitation c. coalescence d. evaporation

10. The type of cooling that occurs as an air mass moves over a cool surface is called _____ cooling.

a. forceful b. adiabatic c. advective d. evaporative

11. When cloud droplets combine to form larger drops, they fall to Earth as _____.

a. ozone b. precipitation c. condensation d. water vapor

12. The rotation of the Earth causes the _____ which deflects moving air to the right in the Northern Hemisphere.

a. Coriolis effect b. Doppler effect c. Butterfly effect d. evaporative effect

13. Narrow bands of fast, high-altitude, westerly winds called _____ flow at the boundaries between wind zones in the middle latitudes.

a. westerlies b. jet stream c. polar easterlies d. doldrums

14. _____ are winds that lie between the poles and 60 degrees latitude.

a. westerlies b. jet stream c. polar easterlies d. doldrums

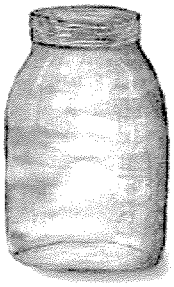
15. Is the following true or false? All clouds form the same way. _____

Create a Portable Cloud!

The purpose of this experiment is to observe how moisture, cooling temperature, and condensation nuclei play a role in cloud formation.

Stuff you need

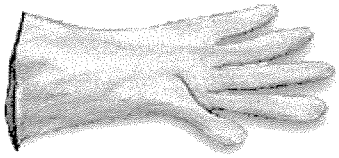
Gallon jar



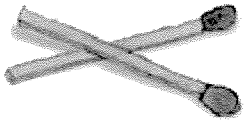
Food coloring

Hot and cold water

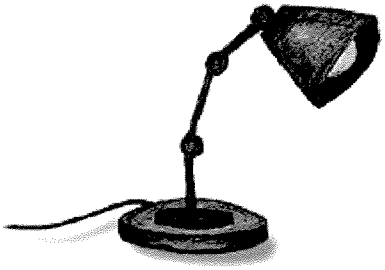
Rubber glove



Matches

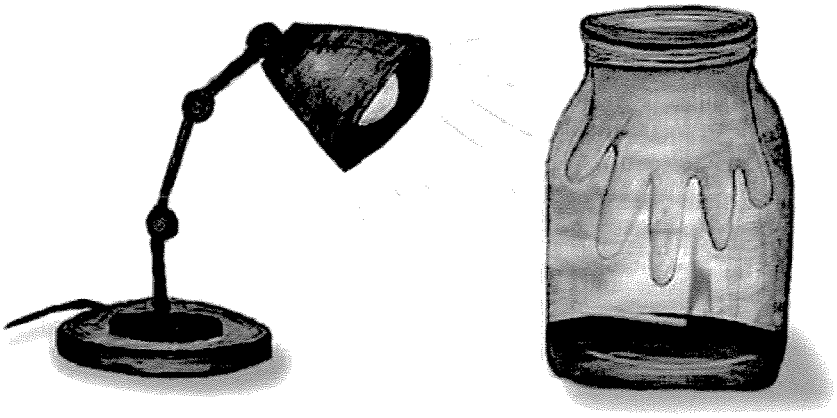


Lamp



Rubber band

Make it happen



1. Pour 100 ml of cold water into the jar. Add food coloring to the water.

2. Swirl the water in the jar for one minute to allow some water to evaporate.

3. Stretch the open end of a rubber glove over the mouth of the jar, with the glove fingers hanging down into the jar.

4. Place a rubber band around the mouth of the jar to secure the glove.

5. Turn on the lamp so it shines through the jar.

6. Insert your hand into the glove. Pull quickly outward without disturbing the jar's seal. Record your observations.

7. Quickly push your hand back down into the jar. Record your observations.

8. Carefully remove the glove from the jar.

9. Drop a lit match into the jar and quickly seal it again with the rubber glove as before.

10. Insert your hand into the glove. Pull quickly outward without disturbing the jar's seal. Record your observations.

11. Repeat the entire procedure using hot tap water instead of cold water.

What's happening?

What do you see happening inside the jar?

Water vapor is created as water heats under the lamp. Swirling the water also help water molecules to move into the air from the water's surface.

When you pull the glove out of the jar, the air pressure is lowered inside the jar. The jar contains the same number of air molecules, but they have more space between them (they are less dense). Molecules collide with each other less frequently and slow down, causing the air temperature to go down.

When you press the rubber glove into the jar, you are increasing the air pressure. The air becomes more dense as the molecules are crowded together. This also causes the air to heat up as molecules collide with each other more often.

The smoke particles provide tiny nuclei on which water vapor molecules condense, when the air temperature cools. This forms a little cloud.

What does this have to do with the weather?

There must be three main ingredients present in order for clouds to form:

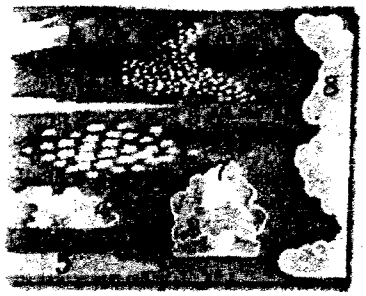
• Moisture - There must be sufficient water vapor in the air to build a cloud.

• Cooling air - The air temperature must decrease enough for water vapor to condense.

• Condensation nuclei - Tiny particles, invisible to the human eye, such as dust, dirt, and pollutants, provide surfaces on which water molecules can gather and condense into water droplets.

CLOUD TYPES QUIZ

- How many of the 8 clouds can you name?



CLOUD ALTITUDES

- *Low-level* clouds are found below 2 km
- *Mid-level* clouds are situated from 2 to 6 km high & have an *alto_* prefix
- *High-level* clouds are above 6 km in altitude

CLOUD SHAPES

- *Cumulus* clouds are found at all-levels and have a puffy or billowy appearance
- *Stratus* clouds are featureless, sheet-like clouds
- *Cirrus* is a term for delicate-looking, high altitude clouds made of ice crystals

CLOUD NAMES

- Clouds that carry rain or snow have the word *nimbus* somewhere in their name
- *Altitude, precipitation,* and *shape* terms are combined to name clouds

Air Masses and Clouds

The interaction between different air masses is where weather of any kind begins.

Air mass: a parcel of air with a certain _____ and humidity.

Humidity: the amount of _____ vapour in air. At 100 % humidity the air can not hold any more water and it rains. Temperature and pressure affect humidity.

Clouds

Meteorologists classify clouds according to _____, _____, and potential for _____.

There are three general cloud shapes:

1. _____: A DENSE, white, fluffy, flat-based cloud with a multiple rounded top and a well-defined outline.

2. _____: A sheet-like cloud formation consisting of a horizontal layer of GRAY clouds.

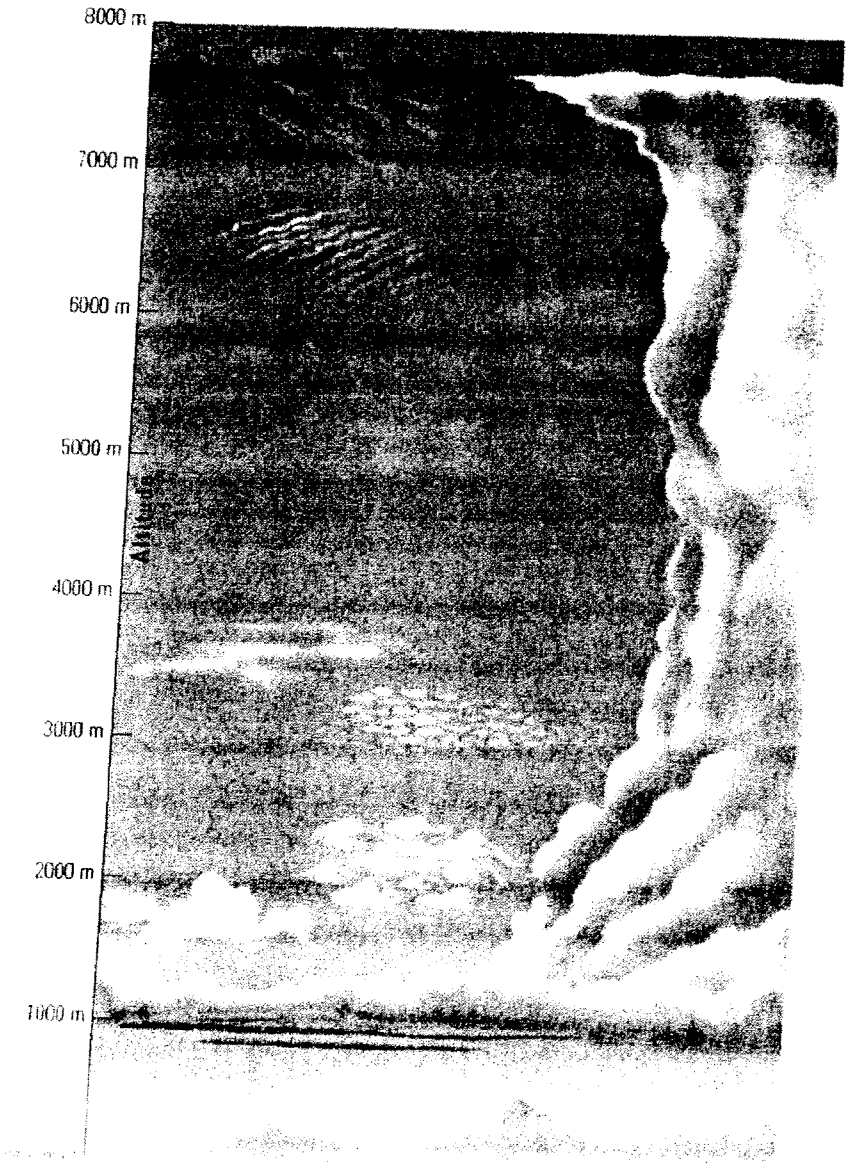
3. _____: A HIGH-ALTITUDE cloud composed of narrow bands or patches of thin, generally white, FLEECY parts.

Either stratus or cumulus clouds may cause _____.

Using the term _____ combined with cloud the cloud _____ name means the cloud carries rain.

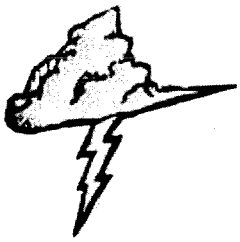
Blackline Master 13.11b

Classification of Clouds



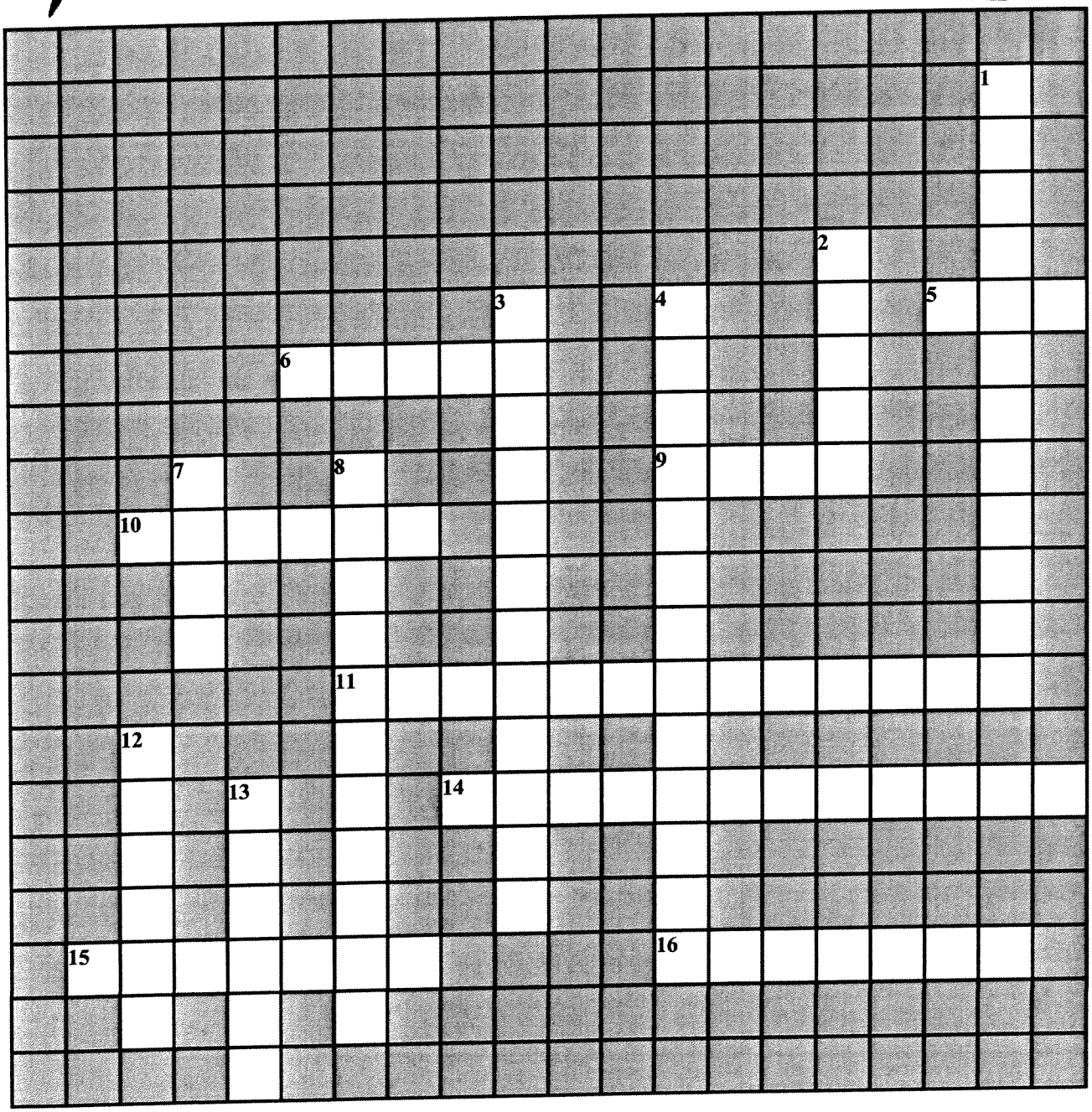
Name _____

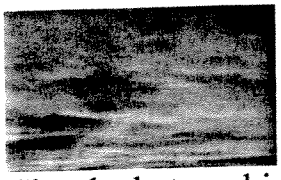
Date _____



Clouds

Complete the puzzle.





Clouds that are high in the sky and can be a sign that precipitation is on the way. They are usually thin and often have a fibrous appearance.

13. A mass of condensed water vapor, which floats in the air as tiny ice crystals.

Highs and Lows (pp.498-500)

Air moves from an area of high/low pressure to an area of high/low pressure.

As cool/warm air descends it becomes more/less dense and draws air from above.

This describes a high/low pressure system.

At the base of a high pressure system air is pushed out. WHY?_____

Because of the Coriolis effect, the air at the base of a high pressure system veers to the left/right in the Northern Hemisphere.

As a result, high pressure systems move in a clockwise/counterclockwise direction, called a(n) _____.

Quick Questions

1. Why do high pressure systems cause clear skies?

_____

_____

2. Why do high pressure systems cause weather to stay the same for days?

_____

_____

A high/low pressure system occurs when the hot/cold ground heats the air through _____.

The hot/cold air rises, creating an area of high/low pressure at ground level.

The _____ effect causes the air to curve to the right/left, resulting in a _____ rotation in the Northern hemisphere.

Thus the opposite of an anticyclone is formed, called a(n) _____.

Quick Questions

1. How do low and high pressure systems compare in size to each other?

_____

_____

2. Which type of pressure system is more unstable? Provide a reason explaining its instability?

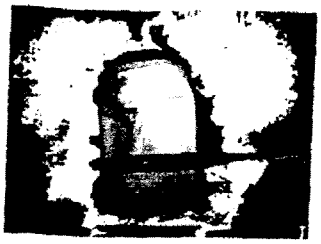
_____

_____

3. Sketch a diagram of a high pressure and a low pressure cell.

High Pressure Cell

Low Pressure Cell



THE CRUSHING CAN AND THE THIRSTY TEST TUBE

Objectives:

- Examine pressure differences and their effects on common objects.

Discussion Question:

1. What is pressure?

2. Explain using a series of detailed steps how the can was crushed by the gases of the atmosphere or how the water rose in the test tube. Use a labelled diagram to support your explanation.

DATE: NAME: CLASS:

CHAPTER 15
REINFORCEMENT

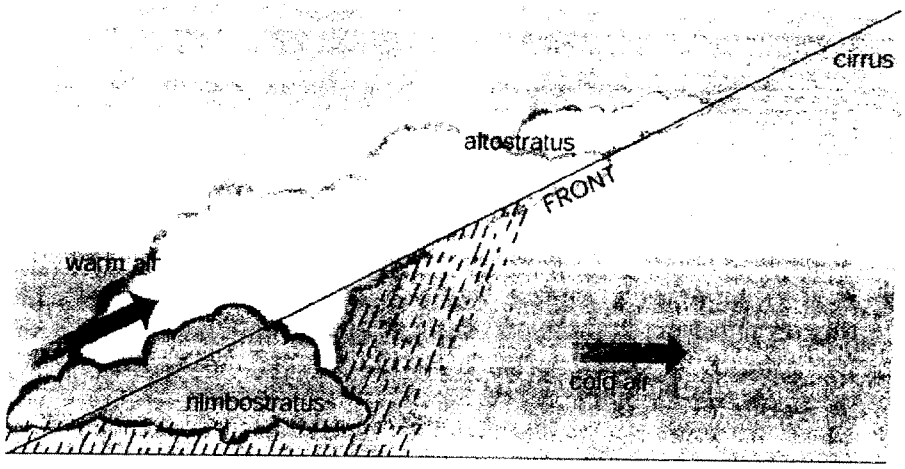
Description of a Warm Front

BLM 15-5

Goal • Increase your understanding of warm fronts.

What to Do

Fill in the blanks to complete the following paragraph. Use the diagram below, the information in your textbook, and your class notes to help you. **Note:** The thickness of a cloud refers to the distance between the top and bottom of the cloud.



A warm front is created by a (1) _____ air mass moving (2) _____ a cooler area. Since the warm air is (3) _____ dense than the cold air, it rises up over the (4) _____ air rather than pushing it aside as a (5) _____ front does. As the air rises, it (6) _____ and water condenses out of it. Examine the diagram above, from right to left. This will give you an indication of what an approaching warm (7) _____ looks like. A day or two before the arrival of a warm (8) _____, the previously clear skies get a few wispy (9) _____ clouds. These clouds thicken, covering more of the (10) _____. They move lower until a layer of (11) _____ clouds covers the sky like a featureless grey blanket. Eventually the clouds are so thick that (12) _____ or (13) _____ begins. As the cloud base gets lower, the clouds become (14) _____ clouds. If it is very cold, (15) _____ _____ or (16) _____ might develop. At about the time that the precipitation stops, the temperature (17) _____.

DATE: NAME: CLASS:

CHAPTER 15
REINFORCEMENT

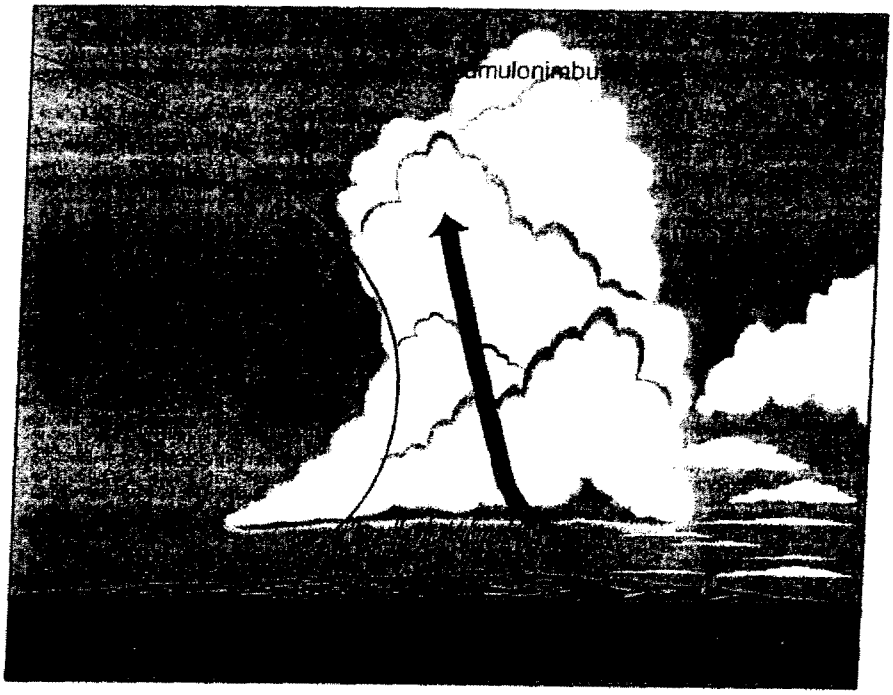
Description of a Cold Front

BLM 15-6

Goal • Increase your understanding of cold fronts.

What to Do

Fill in the blanks to complete the following paragraph. Use the diagram below, the information in your textbook, and your class notes to help you.



A cold front is formed when a mass of (1) _____ air runs into a mass of (2) _____ moving or stationary warm air. Since cold air is (3) _____ than warm air, the warm air is forced (4) _____ and over the cold front. Another result of the cold (5) _____ being denser than the warm air is that the cold front is steeper — more nearly (6) _____ — than a warm front. Because the warm, (7) _____ air is forced to (8) _____ rapidly, the clouds that are formed are often (9) _____. Cold fronts can move (10) _____, but they can also move quickly — up to (11) _____ km/h. Thus the rain can last a (12) _____ time or it can be over quickly. The sudden change of (13) _____ with a passing cold front can lead to intense (14) _____, as well. If the cold front is very different in temperature from the warmer air, (15) _____ and even (16) _____ can be formed.

DATE: NAME: CLASS:

CHAPTER 15
REINFORCEMENT

BLM 15-10

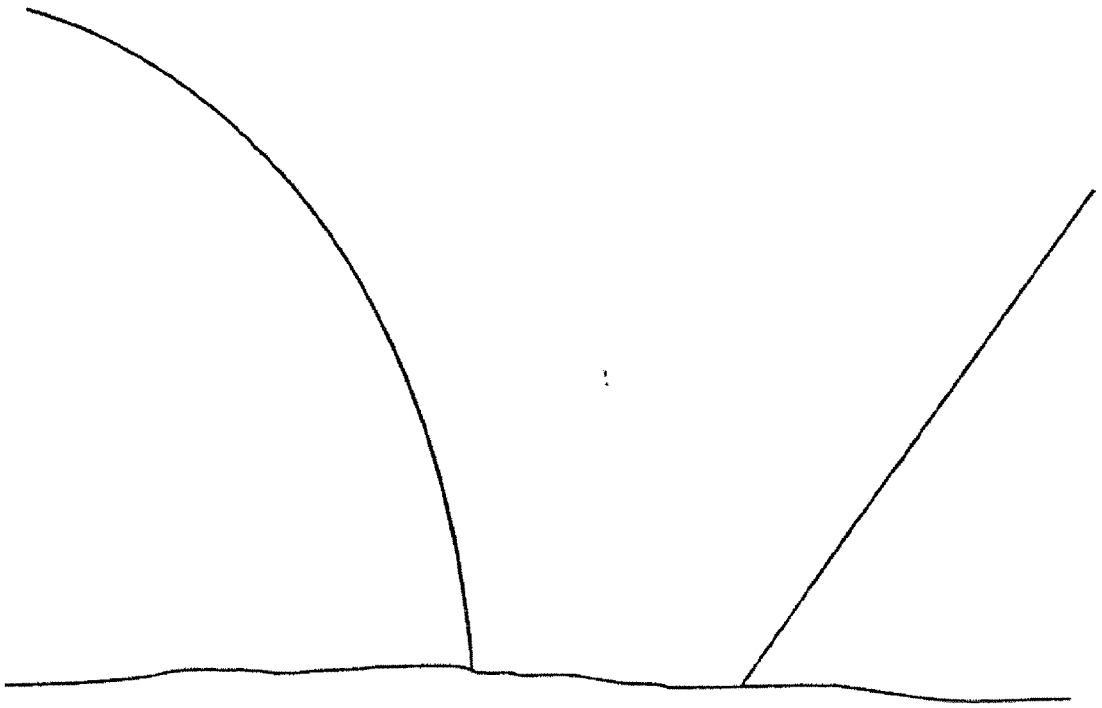
Temperature Profile of a Frontal System

Goal • Relate your knowledge of cloud formation and precipitation to your understanding of fronts.

What to Do

Use the terms below to complete the following diagram of a frontal system.

cold air	warm air	cold air
altostratus clouds	cirrocumulus clouds	cumulonimbus clouds
cirrus clouds	light rain	intense rain
cold front	warm front	nimbostratus clouds



DATE: NAME: CLASS:

CHAPTER 15 ASSESSMENT

Highs, Lows, and Fronts

BLM 15-13

Goal • Assess your knowledge of fronts and the weather associated with them.

What to Do

Answer each question in the space provided.

1. Complete the following table about fronts.

Name	Clouds before front arrives	Air that rises	Weather after front passes	Time required to pass
warm front	cirrus, altostratus			
			cold, clear	
		warm		variable, often long

2. (a) What does the H on a weather map represent?

(b) What sort of weather will you find there?

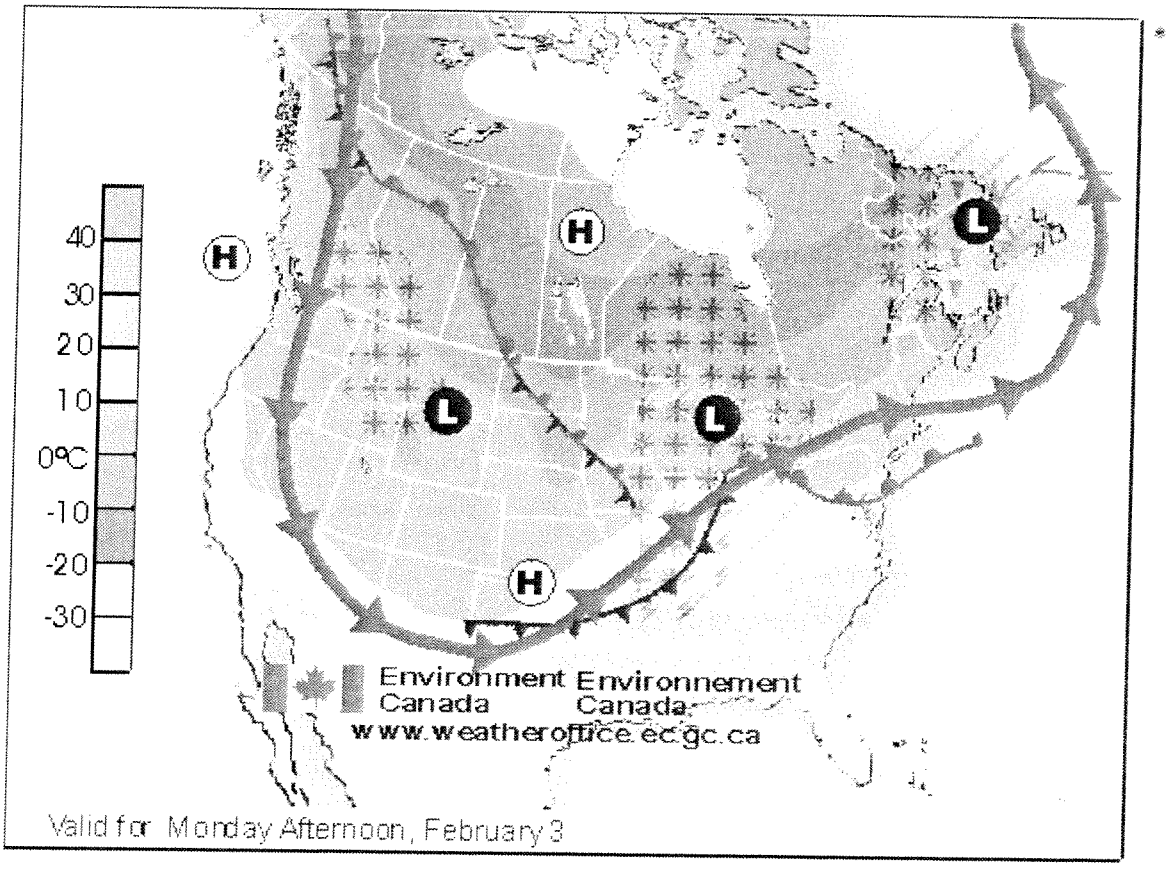
3. One morning, you wake up and the sky is clear. By noon, clouds that started like jet trails are making streaks across the sky. By dinnertime, the clouds have thickened into a lower, grey, featureless blanket over the sky. What is happening in terms of fronts? What do you think the weather will be like that night and the following day?

Introduction

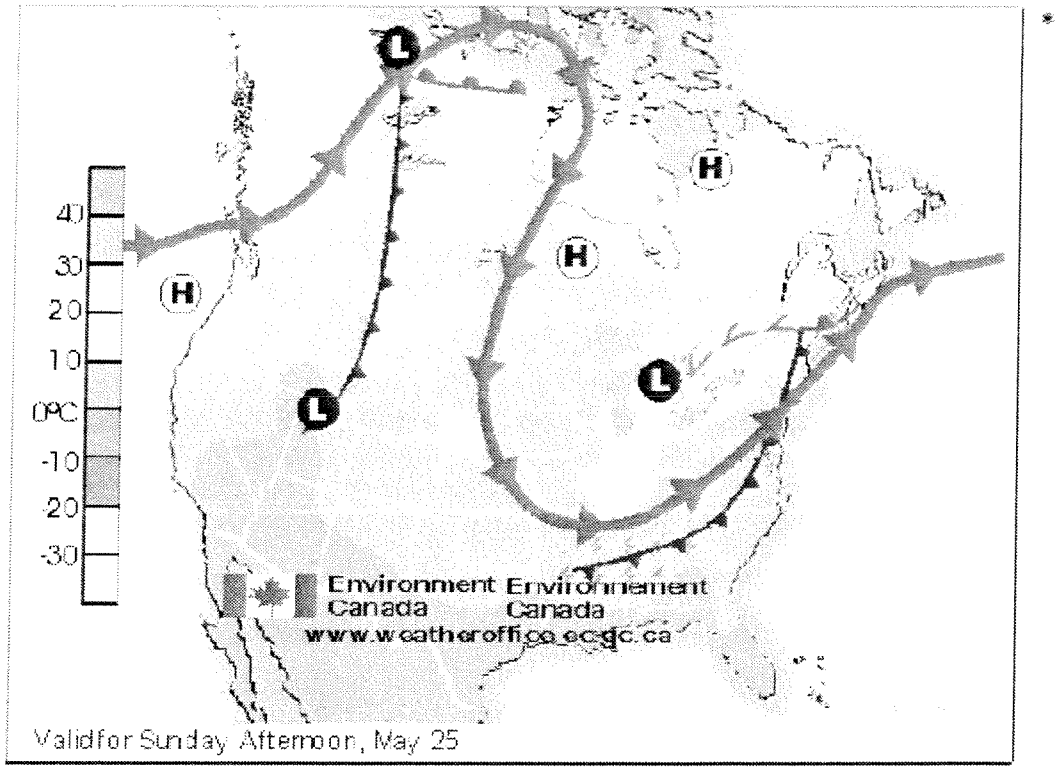
This sequence of weather maps and associated questions are designed to give you an introduction into effectively reading information from a weather map. By the end of this activity sequence, you will be able to go significantly beyond a typical "weather channel" approach to the features on a weather map.

Begin by looking at what you would typically see on a weather-related website or TV station forecast image. The ones that follow are available through Environment Canada's weather chart website found at:
<http://weatheroffice.ec.gc.ca/charts/index_e.html>.

What follows is a legend that allows you to interpret the features of these types of simplified "at-a-glance" weather maps.



* Graphic reproduced from <www.ec.gc.ca> (Government of Canada with permission from Natural Resources Canada), © 2001. Reproduced by permission.



Legend

- High Pressure
- Low Pressure
- Warm Front
- Cold Front
- Trowal - Trough of Warm Air Aloft
- Jet Stream
- Rain
- Freezing Rain
- Snow
- Thunder Showers

Weather Map Challenge **Name** _____

Use a weather page to answer each question.

1. What time did the sun rise today? _____ What time will the sun set tonight? _____

2. Which city in the US is expected to have the highest temperature?
   City = _____ Temp = _____

3. Which city in the US is expected to have the coldest temperature?
   City = _____ Temp = _____

4. What symbol is used for high pressure? _____

5. List 4 cities that are close to a high pressure center.

6. What type of weather is associated with a high pressure area?

7. What symbols are used for precipitation?

8. List 4 cities that are close to a low pressure center?

9. What type of weather is associated with a low pressure area?

10. Use the map to write a weather forecast for your area tomorrow.

Using the same weather page, write four more questions and provide the answers.

1.

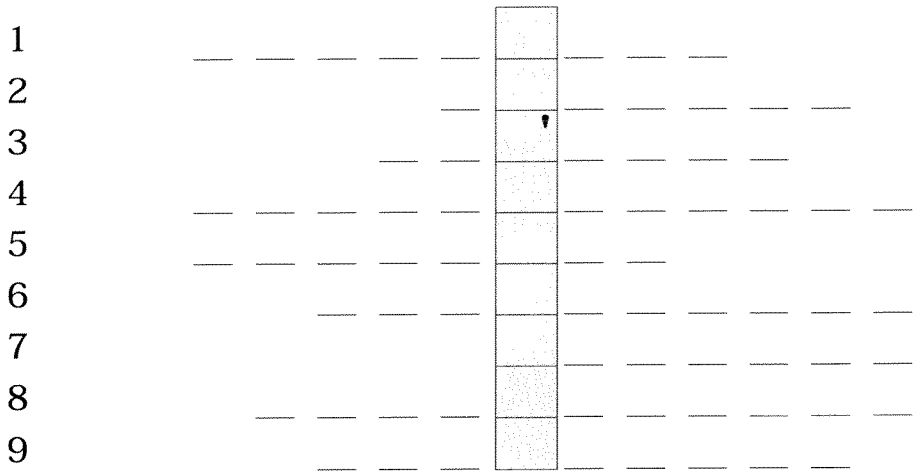
2.

3.

4.

Storms **Name** _____

What am I?



Use the clues to determine each "stormy" word in the puzzle.

1. Discharge of electricity built up during a storm.
2. Seasonal wind usually associated with warm temperatures and heavy rains.
3. A column of violently rotating air in the shape of a funnel that extends from the bottom of a cumulonimbus cloud to the ground.
4. Local storm with tall clouds, heavy rains, and thunder and lightning.
5. Storm in which there is considerable falling and/or blowing snow.
6. A flood that occurs within a few hours of heavy rain.
7. A hurricane that occurs in the Pacific Ocean.
8. A rotating, cone-shaped column of air extending downward from a cloud; when it touches the ground it is called a tornado.
9. Widespread, intense low pressure area originating in the tropics to produce a storm with heavy rains and high winds of 75 mph or more.

EXTRA CREDIT: What is the "mystery word"? Give its definition for an extra credit point!

Daily Weather Log Name(s) _____

Use the weather instruments provided or ones you have created to keep a record of the weather conditions.

Day	Time	TEMP	PRECIP	AIR PRESSURE	HUMIDITY	Wind
1-AM						
1-PM						
2-AM						
2-PM						
3-AM						
3-PM						
4-AM						
4-PM						
5-AM						
5-PM						
6-AM						
6-PM						
7-AM						
7-PM						

TEMP - Record temperatures in both Celsius and Fahrenheit

PRECIP - Record total amount of precipitation and indicate the type of precipitation you have observed (rain, sleet, snow, etc.)

AIR PRESSURE - Record the air pressure and indicate if it has raised or dropped since the last reading.

HUMIDITY - Record the percent humidity.

WIND - Record the wind speed (miles per hour) and direction.

Day	Time	TEMP	PRECIP	AIR PRESSURE	HUMIDITY	Wind
8-AM						
8-PM						
9-AM						
9-PM						
10-AM						
10-PM						
11-AM						
11-PM						
12-AM						
12-PM						
13-AM						
13-PM						
14-AM						
14-PM						

Sunlight & Soil Name(s) _____

Use the weather instruments provided to keep a record of each condition.
Try to take your measurements at the same time every day.

Day	Time	Air Temperature	Soil Temperature	Length of Day	Cloud Cover
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

Air Temperature - Record temperatures in both Celsius and Fahrenheit.

Soil Temperature - Record temperatures in both Celsius and Fahrenheit.

Length of Day - Consult a newspaper or almanac to find this information.

Cloud Cover - Estimate the percentage of cloud cover at the time of your observation.

Assignment:

Use the information you have created to construct a two graphs to show:
(1) the relationship between length of a day and soil temperatures and
(2) the relationship between air temperature and soil temperature.

Answer the following questions related to this experiment.

(1) Did you discover a relationship between the two variables: length of a day and soil temperature? Explain.

(2) Did you discover a relationship between the two variables: air temperature and soil temperature? Explain.

(3) Does the amount of cloud cover play a role in your experiment?

(4) Was the soil temperature consistent throughout the recording area? Did your measurements match those taken by fellow students? Why or why not?

(5) What other questions related to this experiment would you like to investigate?

Staple your graph page to this paper!

Name: _____ Section: _____ Date: _____

Severe Weather Review Questions

1. What is severe weather? Name the 4 major types.
2. What are the main ingredients of all thunderstorms?
3. What are the two most common ways thunderstorms form?
4. What makes a severe thunderstorm SEVERE?
5. What creates downdrafts in a thunderstorm?
6. What causes lightning and thunder?
7. I say "heat-lightning"... you say _____?
8. What is the main ingredient necessary for a tornado to form?
9. How are tornadoes classified? How are hurricanes classified? (Formal Names)
10. Where do all hurricanes form?
11. How are tropical depressions different from a tropical storm?
12. What creates storm surge during a hurricane?
13. Which weather alert signifies a more immediate response to impending weather...a severe weather watch... or a severe weather warning?

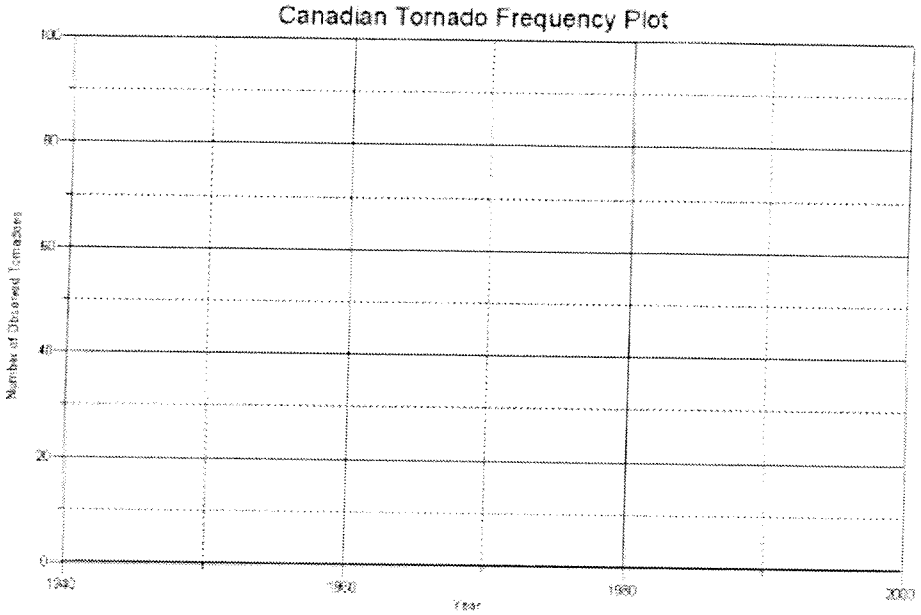
DRAW AND LABEL THE MAJOR PARTS OF A HURRICANE BELOW

The Data*

Year	Number of Recorded Tornadoes in Canada	Year	Number of Recorded Tornadoes in Canada
1950	10	1974	28
1951	10	1975	68
1952	15	1976	45
1953	31	1977	54
1954	16	1978	95
1955	14	1979	58
1956	23	1980	61
1957	22	1981	39
1958	15	1982	55
1959	19	1983	61
1960	27	1984	76
1961	20	1985	42
1962	29	1986	71
1963	27	1987	72
1964	45	1988	68
1965	26	1989	86
1966	36	1990	52
1967	22	1991	69
1968	58	1992	39
1969	61	1993	57
1970	42	1994	96
1971	40	1995	40
1972	28	1996	59
1973	59	1997	46

Working with the Data

1. The table of data represents an approximately 50-year baseline of tornado sightings that are considered reliable. The data come from every region of Canada where tornado funnel clouds have been spotted.
2. Load these data into a spreadsheet program of your choice, a graphics calculator, or a plotting program such as *Curve Expert*© or *Graphical Analysis*™.
3. Produce a scatter plot of the data, paying attention to the axes on which the "year" and "number of tornadoes" should be placed.
4. As an alternative, use plotting technology to produce a histogram (vertical bar graph) of the same data.
5. On the grid below, reproduce a rough sketch of the scatter plot, label the axes, and comment briefly on any patterns that appear in the data plot (e.g., are there any unusual years of many tornadoes?).



Comments on the Appearance of the Scatter Plot:

- _____
- _____
- _____

6. Using your graphics calculator or plotting software, produce the **linear regression** (least squares line of best fit) for the data, and record the following (to two decimal places):

   a. Equation of the line in the form $y = mx + b$

   _____

   b. Determine the value of the **slope**:

   _____

e. Determine the **significance** of the slope (state in words, and point out whether the slope is positive or negative):

d. Determine the value of the correlation coefficient, "r", to three (3) decimal places:

r = _____

e. Does the value of "r" give you confidence that there is indeed a correlation between the calendar year and the frequency of tornadoes in Canada? State clearly the evidence for your decision.

f. What other factors could be affecting these data? Is there a possibility that the data or your "best fit" line are biased in some way?

g. According to your model, how many tornadoes can we expect in the year 2051?

Is this a realistic projection into Canada's severe weather future? How far back in time does your model indicate no Canadian tornadoes?

Expectations

Students will

- Use or construct a wide variety of graphs, charts, diagrams, maps, and models to organize information
- Demonstrate an understanding of the regions theme as applied to tornadic activity frequency in Canada
- Identify and describe regions where natural hazards such as tornadoes exist

Assessment

- Formative self-assessment of the final map (see Appendix 6.9: Rubric for Map Drawing).
- Formative assessment by teacher of the explanation of the method used in drawing up the three regions (see Appendix 6.6: Assessing Region Explanations).

Teaching/Learning Strategies

1. Using the Tornado Plotting Map of Canada, and the Canadian Tornado Distribution Graph, students outline three regions on the blank map of Canada according to tornado risk. Teachers may wish to include the density map of Canadian tornadoes for student use, or clip it off for later discussion and/or assessment of student results. The three regions could be colour coded.

   1 — high risk of tornadoes

   2 — moderate risk of tornadoes

   3 — little or no risk of tornadoes

2. Students describe the method used to outline their regions (how they went about drawing the lines on their map).

3. Display the maps to enable students to see the similarities and differences from one map to another.

Resources

- Tornado Plotting Map of Canada
- Atlas, particularly the world or regional distribution maps of physical and human activities that are often found in the front or back sections, or within the regional sections of the atlas
- Textbooks with maps of this type
- Internet information from tornado sites (e.g., The Tornado Project at <www.tornadoproject.com/index.html>)
- Data sets found in this activity: Canadian Tornado Occurrence (Table 1) and Canadian Tornado Distribution by Province/Region 1950–1997 (Table 2)