

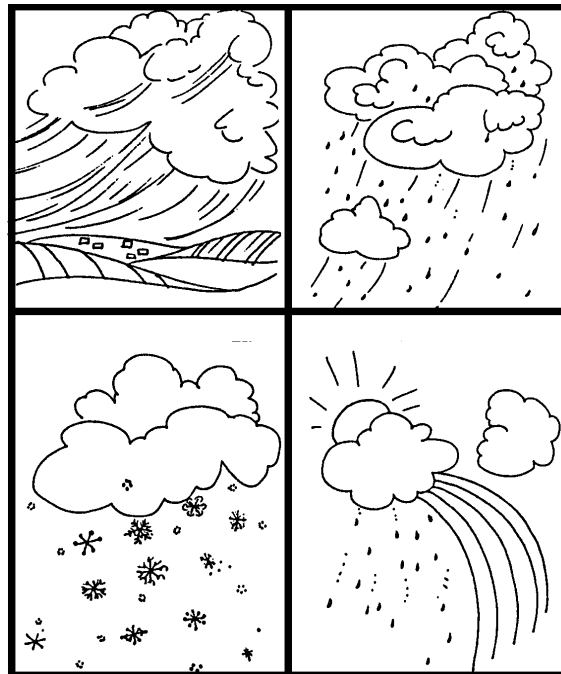


# Water Cycle

The Earth's Gift



## SIXTH GRADE ATMOSPHERE



1 WEEK  
LESSON PLANS AND  
ACTIVITIES

## WATER CYCLE OVERVIEW OF SIXTH GRADE

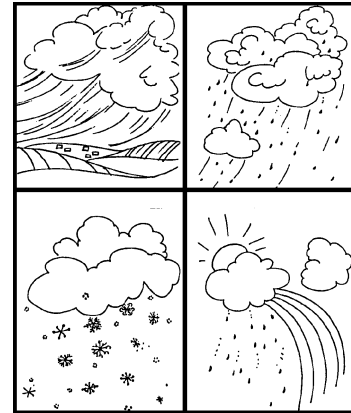
### WATER

#### WEEK 1.

PRE: *Evaluating components of the water cycle.*

LAB: *Experimenting with porosity and permeability.*

POST: *Discovering the major waterways.*



### OCEANS

#### WEEK 2.

PRE: *Exploring ocean movements.*

LAB: *Experimenting with the ocean's movements.*

POST: *Comparing the different reasons for ocean movements.*

### ATMOSPHERE

#### WEEK 3.

PRE: *Discovering the jet stream.*

LAB: *Tracing atmospheric winds.*

POST: *Discovering different air masses in the United States.*

### WEATHER

#### WEEK 4.

PRE: *Comparing weather map patterns.*

LAB: *Comparing satellite photos with weather maps.*

POST: *Researching books for weather information.*

## WATER CYCLE - ATMOSPHERE (6)

### PRE LAB

Students chart wind direction on a map.

### OBJECTIVES:

1. Exploring atmospheric motion.
2. Discovering the jet stream.

### VOCABULARY:

doldrums  
jet stream  
polar easterlies  
trade winds  
westerly winds

### MATERIALS:

crayons or colored pencils  
globe or map of world  
ping pong ball/ hair dryer  
Bernoulli's pipe



### BACKGROUND:

The Earth is a rotating sphere. The atmosphere as well as the hydrosphere (oceans and large lakes), move because of this rotation. There is a difference between local and general world-wide winds. General winds include those that stretch thousands of miles over the Earth's surface with almost permanent directional patterns. Local winds are characteristic of particular geographical regions and exert a pronounced influence on the local climate.

The pattern of the general wind circulation is primarily determined by the unequal heating of the atmosphere at different latitudes and altitudes and by the effects of the Earth's rotation (Coriolis effect). The general wind pattern includes doldrums, jet stream, polar easterlies, trade winds, and westerly winds.

**Doldrums** refer to a quiet area where the wind doesn't blow for long periods of time. The **tradewinds** are characterized by the steadiness of their direction and speed, especially over the oceans. The **jet stream** refers to a narrow current of strong westerly winds in the upper troposphere. The **polar easterlies** refers to an easterly wind belt found between the weak polar anticyclone and the westerly depression. The **trade winds** are predominately easterly winds that blow steadily over the ocean areas. The **westerly winds** are strong winds blowing from the west.

## PROCEDURE:

1. Use the diagram on "Atmospheric Winds," to help show students the different wind systems of the Earth. Point out that the zone of the doldrums is where the pressure is lower than farther north or south. The winds in this zone are light and irregular in direction with frequent calms. The trade winds are characterized by the steadiness of their direction and speed, especially over the oceans. Notice that because the jet stream is in the upper troposphere and changes direction due to changing pressure zones, students cannot draw it on the map.

2. Students should look at the map of global wind patterns. On the blank map of the globe have students try and simplify the diagram. Give each zone a different color and have the students decide what the limits of an east-west direction would be for each zone.

3. Students may have heard of the jet stream, which is a very rapid wind that moves around the Earth from west to east at an altitude of 14-16 km. You may want to illustrate the jet stream by doing the following demonstration. (Make sure you practice before doing this.) Challenge your students to perform this task!

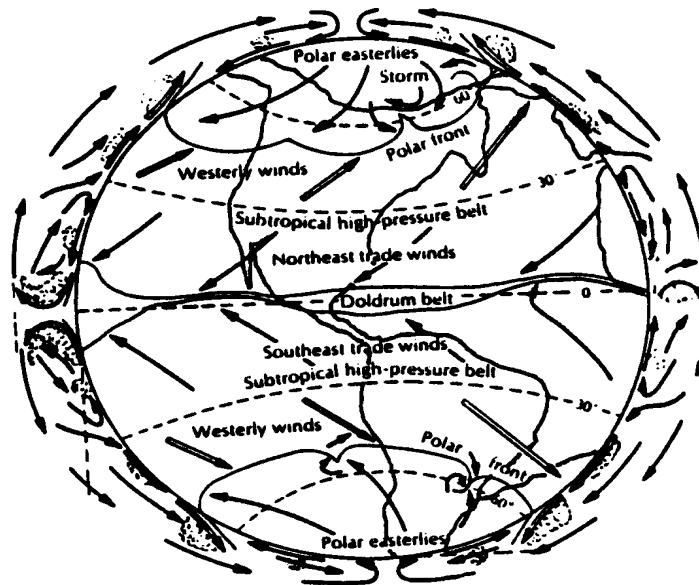
Use a 12-16 cm straw. Put one end of the piece in your mouth, tip your head back; hold a ping pong ball a few inches above the other end. Blow as hard as you can, simultaneously releasing the ball. The ball will remain suspended in mid-air. The harder you blow, the higher it "floats" above the straw. You can use a hair dryer, with more dramatic results.

This demonstrates the jet stream, when air is in rapid motion its pressure is lowered. The ball is actually imprisoned by the column of upward rushing air. As soon as it wobbles a bit to one side, the greater pressure outside the "jet stream" forces the ball back into it again.

4. Students can create their own jet stream by using the Bernoulli pipe. Students do not have to put their mouth on the pipe. They can just blow into the hole. However, if they do blow into it, make sure you have some alcohol available so you can wipe it clean between uses.

## WATER CYCLE - ATMOSPHERE (6) PRE

### ATMOSPHERIC WINDS



COLOR THE AREAS OF THE POLAR EASTERLIES, WESTERLY WINDS, DOLDRUM BELT AND TRADE WINDS



## WATER CYCLE - ATMOSPHERE (6)

### LAB

Students determine effect of nuclear disaster in the atmosphere.

### OBJECTIVES:

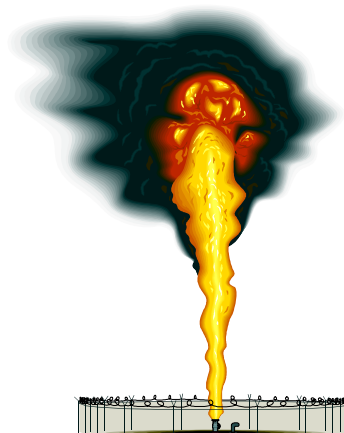
1. Tracing atmospheric winds.
2. Exploring how particles move in the atmosphere.

### VOCABULARY:

ash  
Coriolis Effect  
disaster  
nuclear

### MATERIALS:

ash distribution map of Mt. St. Helens  
world map



### BACKGROUND:

The rotation of the Earth affects the movement of the atmosphere. The Coriolis motion plays a similar role in the atmosphere as it does in the oceans. Air is much more fluid than water and can move more rapidly. The atmosphere also has different factors affecting it, such as temperature differences, topography, and location (i.e., over land or water). A basic cause of wind movement in the atmosphere is the difference of temperature. Warm air rises, which causes movement. Air can move horizontally from high to low pressure areas. Moving air already in motion is deflected by the Coriolis Effect. The Coriolis Effect deflects particles in the northern hemisphere to the right, and to the left in the southern hemisphere. These three basic factors, Coriolis motion, pressure differences, and differences in temperature, create the patterns that are shown in the students' lab sheet, "World Wide Air Movement."

We can learn about the movement of particles in the atmosphere, especially the troposphere (about 0-17 km) and the stratosphere (about 17-48 km) by charting particle movements. Sometimes a natural event, like a volcano explosion can help determine the wind patterns. Mt. St. Helens is a volcano that violently erupted in 1980. Ash from the explosion was transported to very far distances. Maps of the direction of movements provided valuable information on the wind patterns in the troposphere and stratosphere.

Collecting data from one event and then using that data to predict the outcome of another event is an experimental tool in science. Meteorologists use this type of data collection to help them predict future events.

## PROCEDURE:

1. Look at the Mt. St. Helen's maps and answer the appropriate questions on the lab sheet. Go over the distribution maps with the students before they answer the questions. Can the ash flow be connected with wind direction? Get the students to compare the different maps. The air currents played a direct role in transporting ash over thousands of miles. Ash from volcanoes can be helpful and harmful. The ash contains minerals that when incorporated in soil, increases plant growth. However, the fine particles can get into lungs and cause respiratory damage.

2. After the students look at the Mt. St. Helens and air flow maps, have them trace the direction that fallout from a "Nuclear" disaster would travel. The knowledge they learned about the volcano eruption should help them predict what would happen during an event that would become airborne. Talk about the importance of the atmosphere and how it moves fine-grained particles. Students need to carefully look at the direction of the wind patterns. You may want to add other locations on the map.

3. Students need to look at the ash data and then make an inference of what might happen in a separate event. Students should think about whether nuclear fallout is similar to ash. Some of the students may even ask what type of nuclear disaster. Do you mean a warhead or a nuclear plant that fails? Encourage your students to look at the similarities, but also the differences. Understanding the two models can help make a more accurate prediction. This might lead into a discussion about effects of nuclear war or other pollution that can be carried by the atmosphere. So be prepared!

## **WATER CYCLE - ATMOSPHERE (6)**

**PROBLEM:** How far can ash, airborne pollutants, or other small particles travel?

**PREDICTION:** \_\_\_\_\_

### **EXERCISE I.**

**MATERIALS:** Ash distribution map of Mt. St. Helens

**PROCEDURE:** Look at the map and answer the following questions:

1. What happened to the volcanic ash that erupted from Mt. St. Helens?

\_\_\_\_\_

2. Where was the most ash deposited? \_\_\_\_\_

3. Why was more ash deposited onto one side? \_\_\_\_\_

\_\_\_\_\_

4. Is volcanic ash always harmful? Explain. \_\_\_\_\_

\_\_\_\_\_

5. Did any of the Mt. St. Helens ash get blown to the San Francisco Bay Area? (Why/why not?) \_\_\_\_\_

**EXERCISE II. MATERIALS:** Map of world air currents, blank map of the world

**PROCEDURE:** On your map there is a sad face. This represents the site of a make-believe nuclear disaster. Harmful particles were released into the air. Using the map of world wide air currents, determine which cities or countries were affected most by this disaster. Explain why you chose these cities.

**CONCLUSIONS:** Locations affected most.

\_\_\_\_\_

\_\_\_\_\_

Explain why.

\_\_\_\_\_

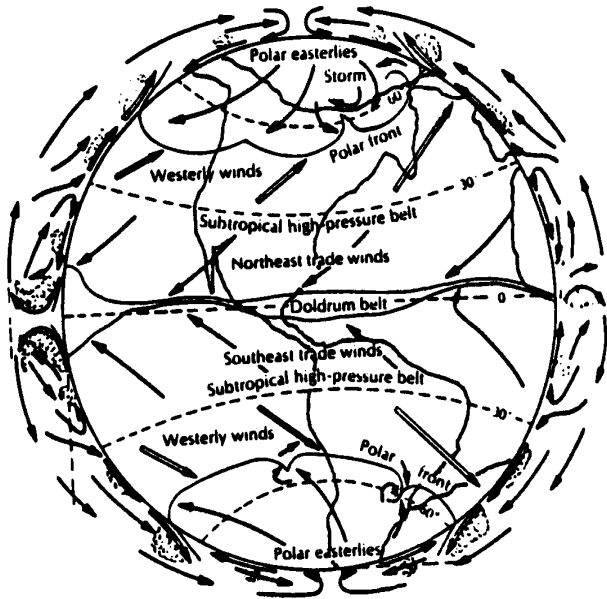
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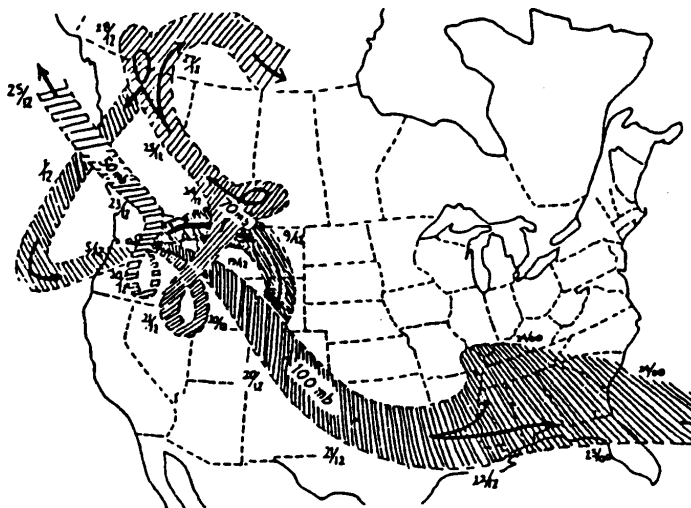
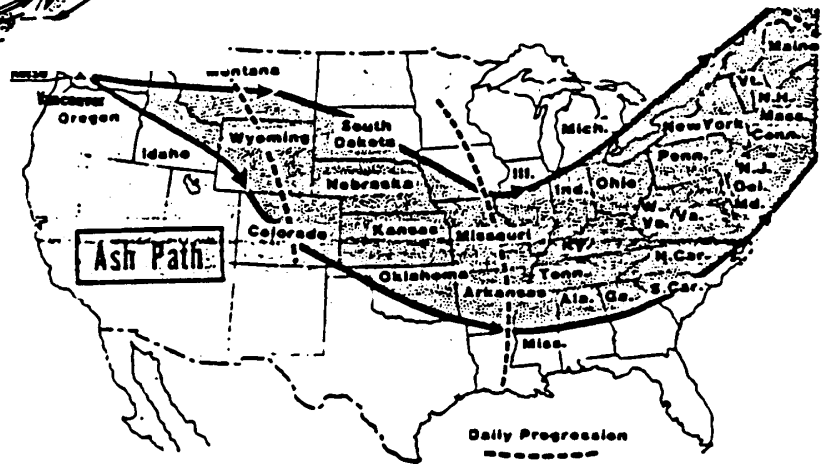


## WATER CYCLE - ATMOSPHERE (6)

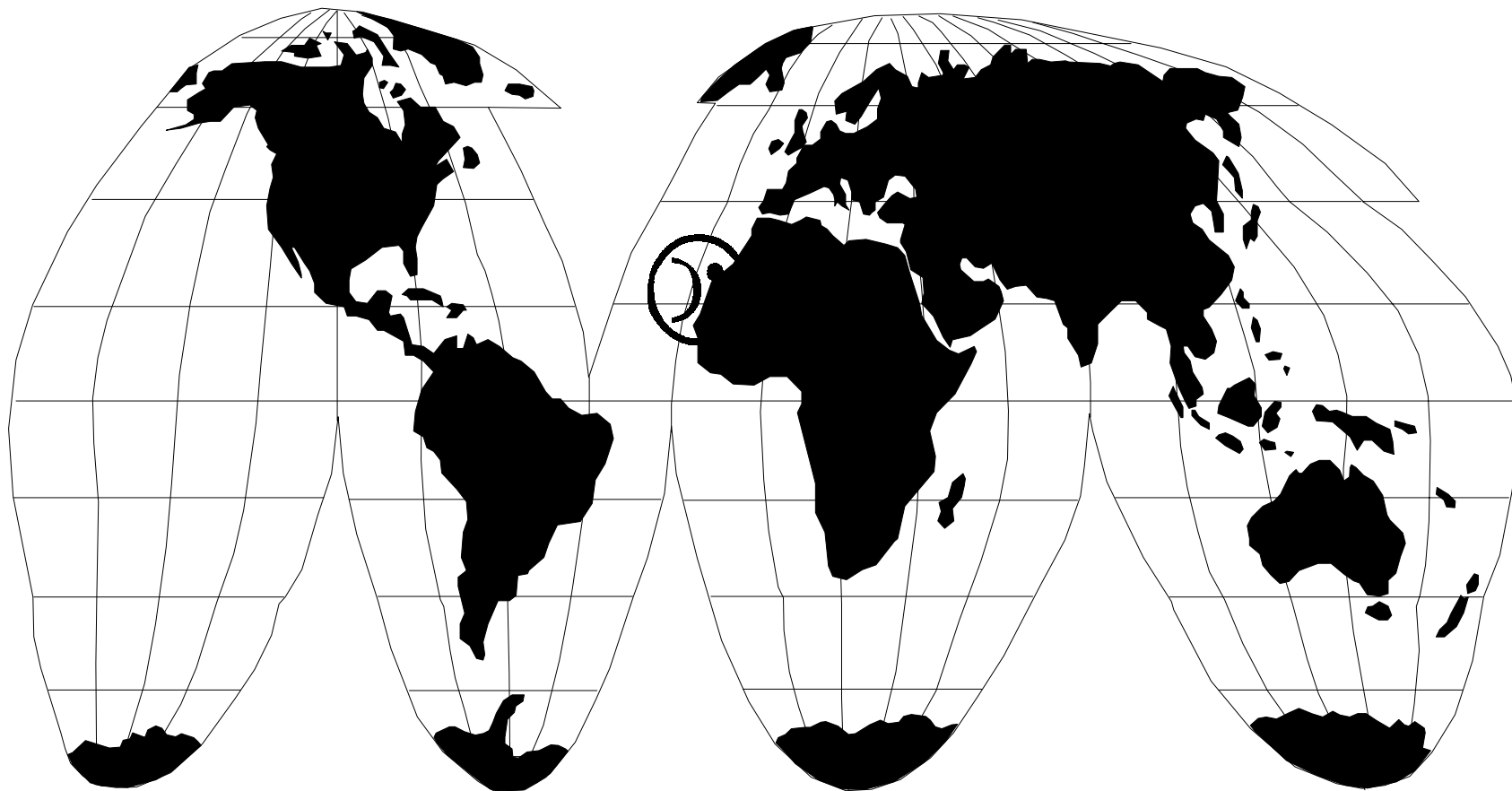


WORLD-WIDE AIR CURRENT MAP

Mt. St. Helen's Ash  
Fallout



Mt. St. Helen's ash in the  
stratosphere



## WATER CYCLE - ATMOSPHERE (6)

### POST LAB

Students use a worksheet to determine air masses in North America.

### OBJECTIVES:

1. Comparing different type of air masses.
2. Discovering different air masses in the United States.

### VOCABULARY:

anticyclone  
cold  
continental  
cyclone  
dry  
moist  
polar  
tropical



### MATERIALS:

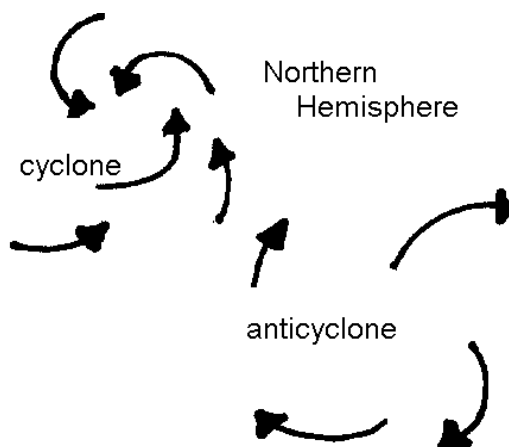
worksheet  
Internet

### BACKGROUND:

The type of air mass over an area is dependent on the (1) latitude and (2) whether it is over a continental or marine area. This exercise is just to familiarize students with the different type of air masses that occur over the United States.

You may want to discuss that warm air causes low pressure areas and that cold air causes high pressure areas. Generally a high pressure area moves toward a low pressure area, When the two air masses meet, they will form a FRONT, which will cause weather changes.

Another term for a low pressure center is called a cyclone and for high pressure area it can be called anticyclones. The pressure decreases from the outside toward the center in a cyclone. In an anticyclone the pressure increases from the outside toward the center. Winds blow from high pressure to low pressure and are deflected to the right or left by the earth's rotation. This deflection is similar to the deflection in the oceans. In the



Northern Hemisphere the result is that winds blow in and counterclockwise around a low and out and clockwise around a high as shown on the diagram on the right.

Local winds may "adjust" the situation. Local winds may be classified as slope winds, coast winds and mountain winds. Slope winds represent the slow drainage into the valleys of air which have been chilled by contact with the cool ground. Sea breezes are caused by land becoming considerably warmer than the sea. The breeze reaches its maximum strength in the early afternoon and usually persists into the evening before dying away. Mountain winds are caused when a "funnel" is produced by the topography of the mountain sometimes causing a very persistent wind for days.

The underlying cause of winds is the unequal heating of the Earth's surface and the fact that the Earth rotates. But the amount of heat varies considerably, and there are many other factors. This is the reason why weather persons do not have a good record for predicting and forecasting the weather. It's a hard job!

### **PROCEDURE:**

1. The key objective is for students to see that the atmosphere is very complicated. The worksheet shows students where stable air masses are located in North America. Other factors like Coriolis effect that cause movement of the air masses set up air masses that collide, causing fronts.

2. Students should look at the worksheet and determine the type of stable air masses found in North America.

3. Ask students about the weather patterns that occurs at the boundaries of the air masses. Usually they are very unstable and cause severe weather patterns, except for the hot, dry air masses.

4. Have the student try and predict the climate for specific areas. They would be able to check the weather patterns by looking at the following web site:

<http://www.cdc.noaa.gov/USclimate/USclimdivs.html>

a. Students could compare the temperature and/or precipitation the year they were born and last year.

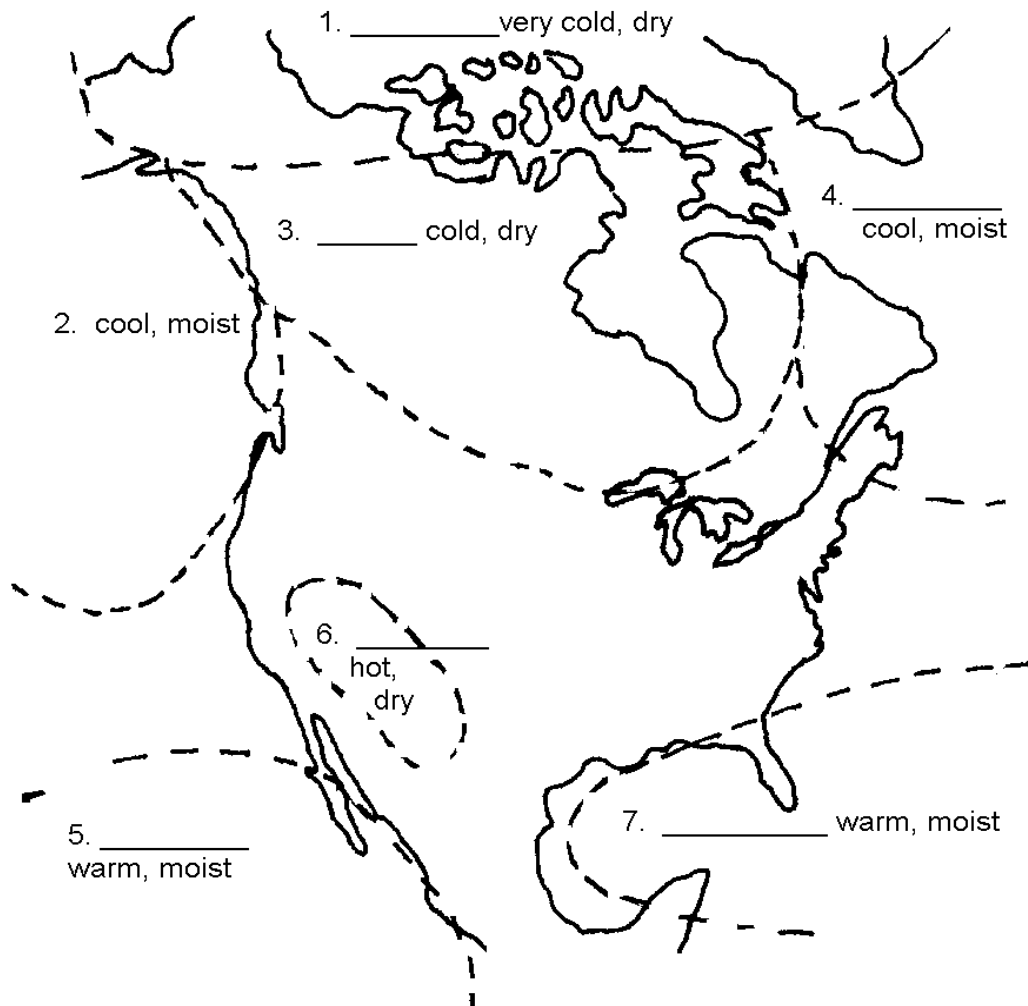
### **ANSWERS:**

The air masses listed here reflect the average climate. Notice in the central portion of the United States the air masses are too unstable to generalize. The answers are: 1.(cA); 2.(mP); 3.(cP); 4.(mP); 5.(mT); 6.(cT); and 7.(mT).

## WATER CYCLE - ATMOSPHERE (6)

NAME THE AIR MASS.

AIR MASSES ARE NAMED FOR THEIR SOURCE: TROPICAL (T), POLAR (P), ARCTIC (COLDER THAN POLAR) (A).



MOISTURE IS REPRESENTED BY: CONTINENTAL (c) AND MARINE (m).

EXAMPLES:

1. AIR FORMED OVER THE TROPICAL OCEAN = mT

2. AIR THAT IS COLD, DRY, CONTINENTAL = cP

LABEL THE MAP OF THE UNITED STATES WITH THE CORRECT SYMBOLS.