

Earth Science 11 - Week 3: April 27 – May 1

Anticipated time required: 3 hours

New learning objective: **Global wind systems, types of air masses and weather patterns**

Goals to be completed:

1. Understand and describe the motion of the 3 main global wind systems, as well as recognize how they impact global climate regions.
2. Name and describe the main types of air masses that form, and identify the types of weather systems they cause when they interact

This PDF package contains several notes, examples and videos. Please read through the lesson package and watch all of the videos included within it. The formal portions to submit are indicated throughout the package. These can be sent to Charlie.feht@yesnet.yk.ca either as a scanned and uploaded PDF attachment to email, or as a jpeg image file.

Upcoming next week:

Climate vs. Weather

Factors impacting climate change

Section 1: Global Wind Systems

1. Please watch the following introductory video that will recap the atmospheric property of temperature we looked at last week. The video describes how radiation of the sun's energy, and albedo of the earth create global regions that are unevenly heated. The video is 2:50 in length.

<https://www.youtube.com/watch?v=7fd03fBRsuU>

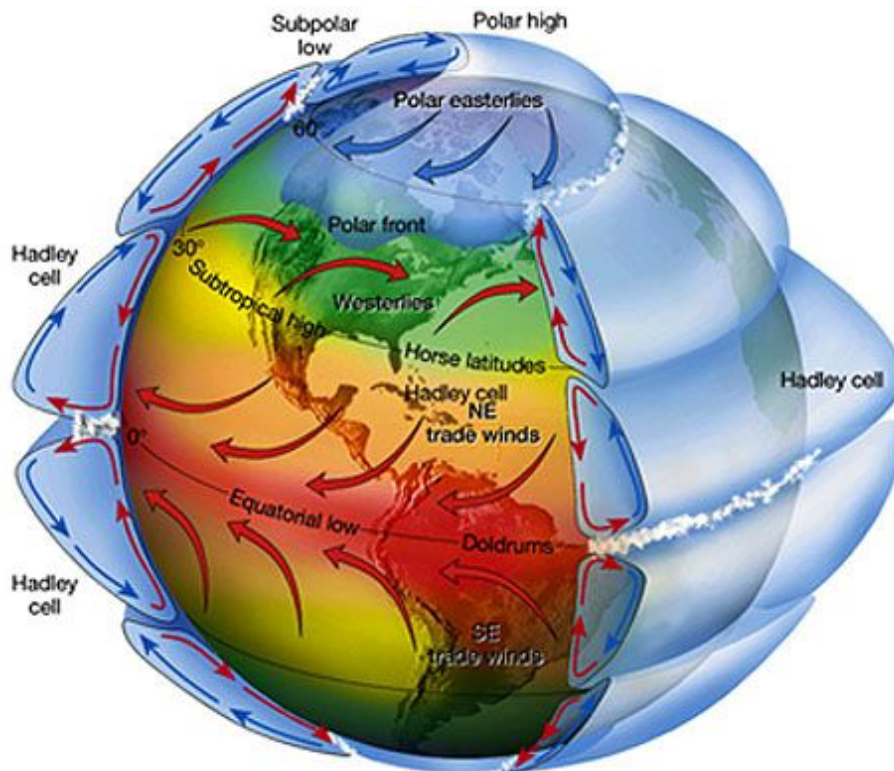
2. Watch the second part of the video series, which will introduce you to the three cells that control the earth's climate. The video is 3:35 in length.

https://www.youtube.com/watch?v=xqM83_og1Fc

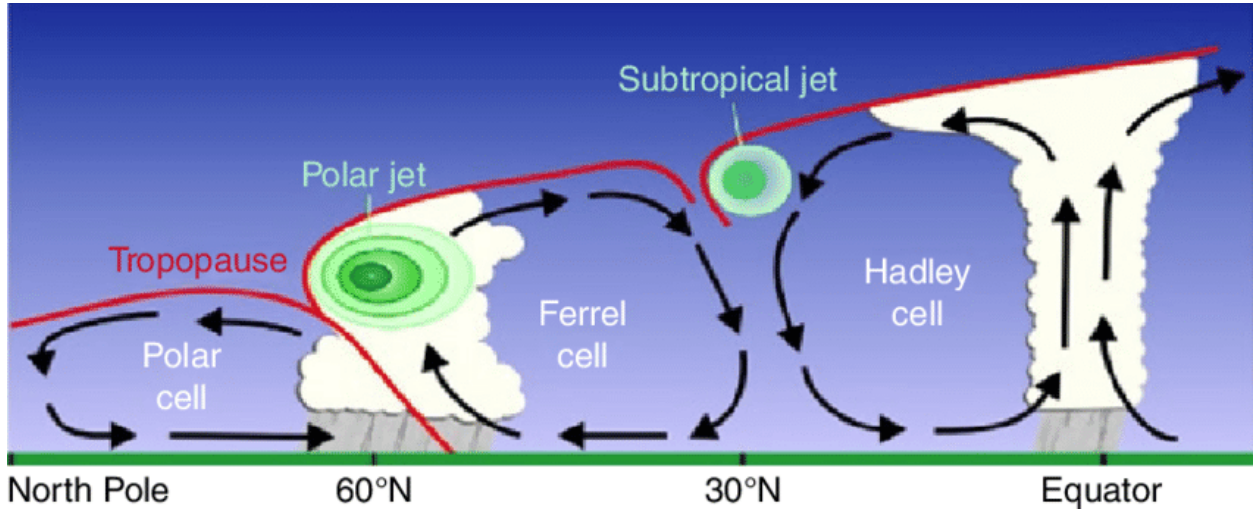
3. Watch the final part of the video series, as it describes how the Coriolis effect impacts the three global wind systems and creates jet streams, as well as different types of global wind patterns. The video is 6:18 in length.

<https://www.youtube.com/watch?v=PDEcAxfSYaI&t=7s>

When put all together, it looks like this:

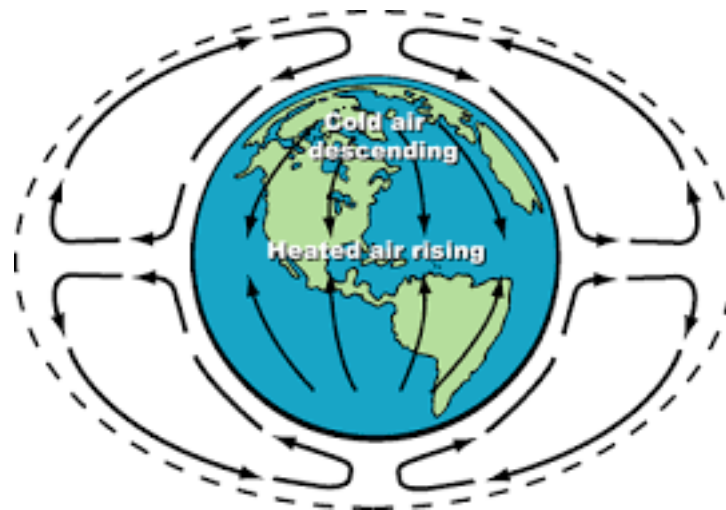


Side view:



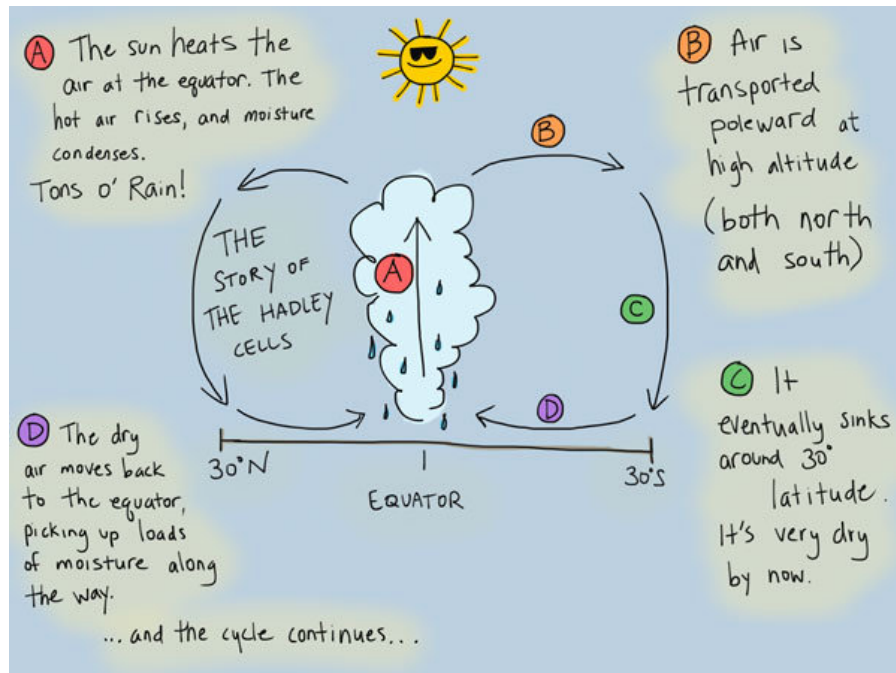
Cell Summary

If earth did not spin, there would be two main atmospheric “cells” that circulate air masses. One would operate in the northern hemisphere bringing warm air masses from the equator to the north pole, where the air mass would cool, decrease in altitude and return back to the equator to be heated again. While the other would operate in the same manner in the southern hemisphere, bringing warm air to the south pole before cooling and returning to the equator.

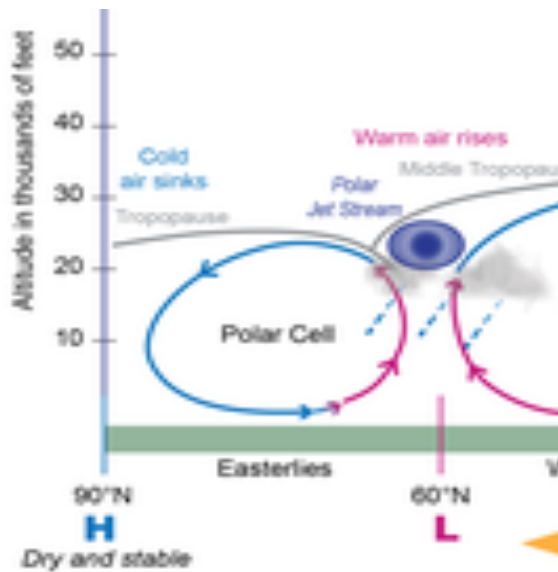


Since the earth does spin, it actually creates three different cells in the northern and southern hemisphere:

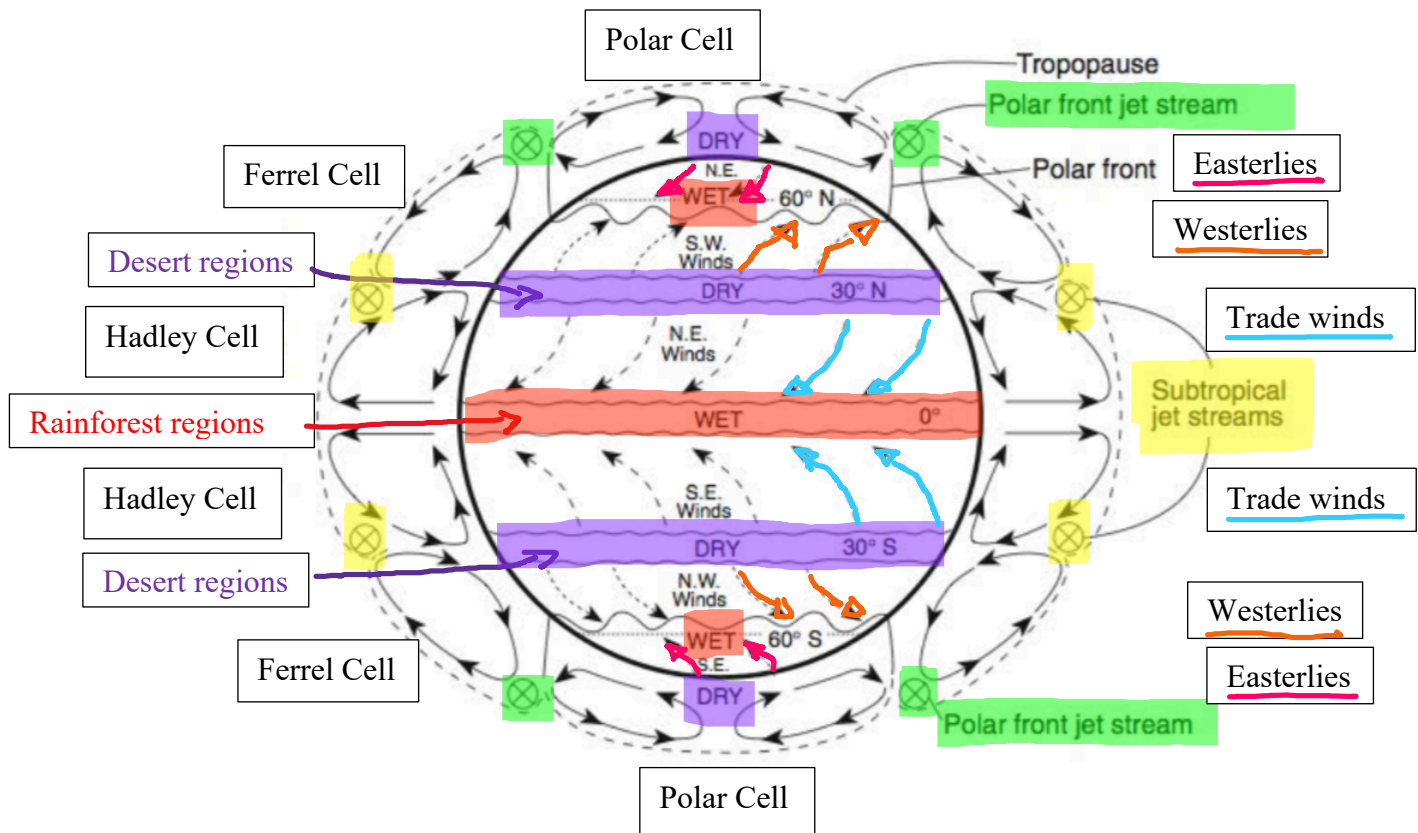
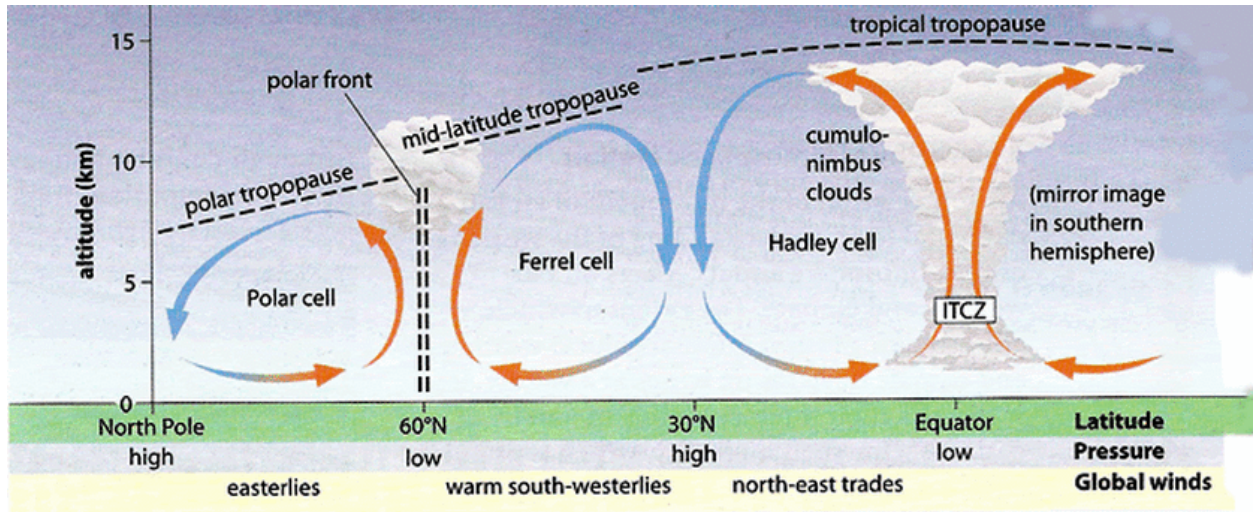
1. Hadley Cell:



- 2. Polar Cell:** Cold and dry arctic air masses travel towards lower latitudes picking up moisture along the way. When they reach a latitude of 60 degrees, they become too warm to travel further. The air mass will rise and condense as it cools, releasing its moisture as precipitation (this is why there are boreal forests found at 60 degrees of latitude) before circling back towards the arctic as a dry air mass.



3. **Ferrel Cell:** This is the mid-latitude cell between the Hadley and Polar cell. Its motion is a direct result of the circulating atmosphere on either end of it. Unlike the polar and Hadley cells which elevate moist air masses, the Ferrel cell deposits dry air masses around 30 degrees of latitude. Since the air deposited has little moisture in it, this is where we find global desert regions like the Sahara and Mojave.



Anywhere air masses subside towards earth there will be a dry climate. Anywhere air masses rise away from earth there will be a wet climate.

These three cells, paired with the Coriolis effect, create three main wind systems:

1. **Polar easterlies** – Cold and dry winds that blow from an east direction, originating in areas of high pressure such as polar regions.
2. **Prevailing westerlies** – A prevailing wind that will blow from a west direction across midlatitude ranges of the globe. These winds have a dramatic effect on global ocean currents.
3. **Trade winds** – A powerful wind that blows in an east direction across tropical regions. Trade winds are responsible for the formation of tropical storms such as hurricanes, typhoons and cyclones.

Please watch the following summary video: <https://www.youtube.com/watch?v=umDo7Se4QsI>

Global wind system questions to be submitted

1. What wind systems move air from about 30° north or south latitude toward the equator?
2. Describe the movement of air in the huge convection current between 30° north latitude and the equator.
3. According to the diagrams, what forms as a result of rising air at the equator?
4. How might this account for the formation of tropical rain forests at the equator?
5. What wind systems move air from about 30° to 60° north or south latitude?
6. Describe the movement of air in the huge convection current between 30° and 60° south latitude.
7. Would you expect high or low pressure at the poles? Explain why.
8. What wind systems move air from 60° north or south latitude to the poles?

Section 2: Air masses and weather systems

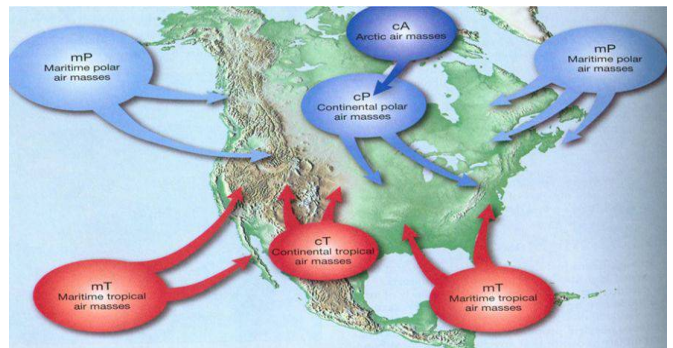
AIR MASS NOTES

What are air masses?

- Large Bodies of air
- Form when the air over a large region sits in one place for many days
- The air gradually takes on the characteristics of the land or water below it

How do air masses affect our weather?

- As an air mass moves, it brings its characteristics with it
- Changes weather



What are the two characteristics that describe air masses?

- Two words each
 - One for moisture
 - One for temperature

When describing moisture what words can we use?

- The first word of an air mass tells one where the mass was formed (over water or land)
- **Continental**
 - Air masses formed over **land**
 - **DRY**
- **Maritime**
 - Air masses formed over **water**
 - **WET**

When describing temperature what words can we use?

- The second word of an air mass tells whether an air mass was formed close to the equator or pole
- **Tropical**
 - Air masses formed near the **equator**
 - **WARM AIR**
- **Polar**
 - Air masses formed closer to the **poles**
 - **COLD AIR**



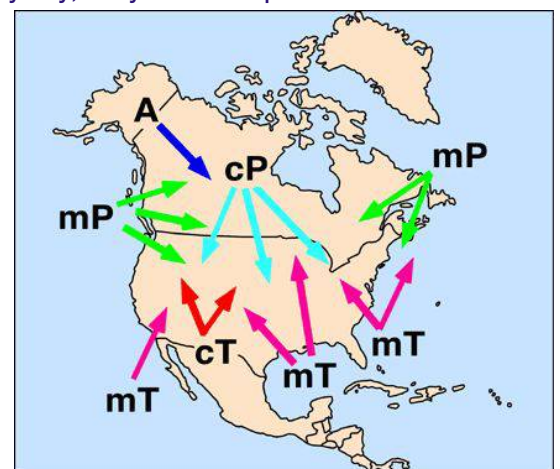
Notice the “A” here? It represents an arctic air mass. This is a smaller sub-classification of air masses characterized by dry, very cold temperatures

What are the 4 Major Air Masses?

- The four major air masses are:
 - Maritime Tropical (moist warm air)
 - Continental Tropical (dry warm air)
 - Maritime Polar (moist cold air)
 - Continental Polar (dry cold air)

What moves air masses?

- Winds
- Air masses can travel away from the regions where they form
 - Can move with global winds and jet streams
- As the air mass moves it changes

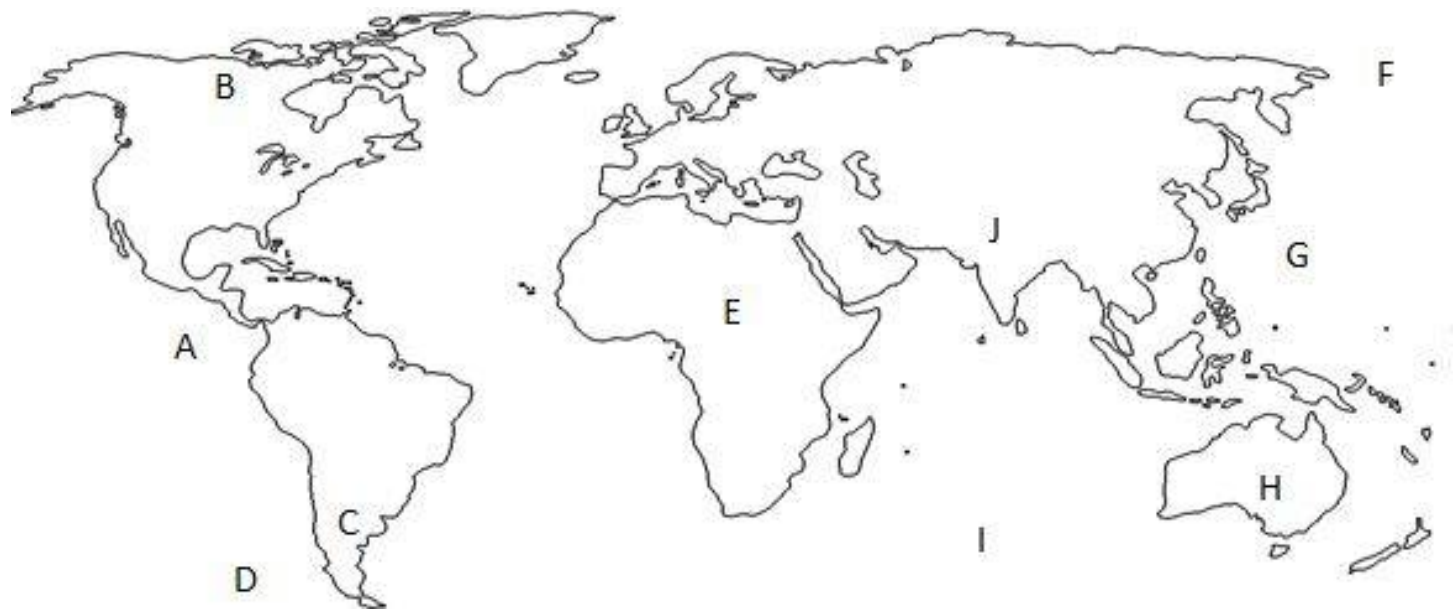


CODE WORD: _____

**You MUST watch and listen to the entire video to get the code word

Practice activity - not for marks

Air Mass Worksheet



Letter	Temperature (Hot or Cold)	Moisture (Dry or Moist)	<i>Air Mass Name</i> (Maritime Tropical, Maritime Polar, Continental Tropical, Continental Polar)
A			
B			
C			
D			
E			
F			
G			
H			
I			
J			

Air Front Computer Interactive

Procedure: Go to http://www.phschool.com/atschool/phsciexp/active_art/weather_fronts/ (also found on the website) and complete the following chart. **You will need to run flash for the interactive**

★ **MAKE SURE YOU READ THE TEXT AT THE TOP OF THE PAGE AND WATCH THE MOVEMENT ON THE INTERACTIVE**

Introduction

1. What is an air front?

2. What does an air front often cause? (2 things)
 -
 -

Front	What Type of Air Mass Is Moving In?	Which Air Mass Goes On Top and Why	Type of Cloud	Weather Caused	Picture At the End (Include labels, clouds, and precipitation)
Cold Front					
Warm Front					
Stationary Front					

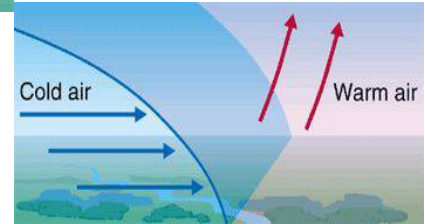
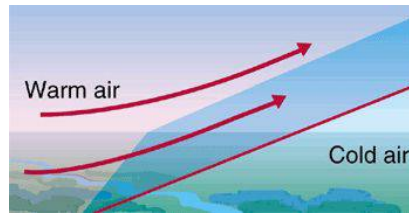
AIR FRONT NOTES

What is it called when 2 air masses meet?

- Front

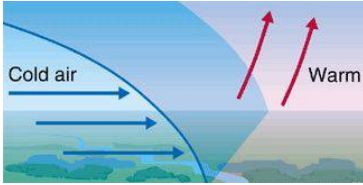
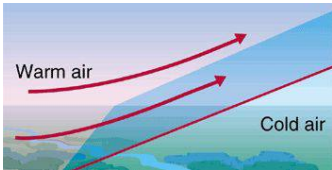
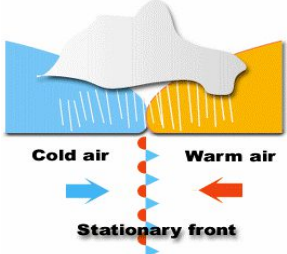
What happens at a front?

- Weather Changes
- Clouds and precipitation are often formed



What are the three different types of fronts?

- Cold Front
- Warm Front
- Stationary Front

	Cold Front	Warm Front	Stationary Front
Description <small>(State what type of air mass meets the other type of air mass)</small>	<ul style="list-style-type: none"> • Mass of cold, dense air moves in • Warmer air ahead of it is pushed upward (its less dense) and condenses forming precipitation 	<ul style="list-style-type: none"> • Mass of warm air moves in • Warm air moves above/on top the cold air (it's less dense) • Moisture in the warm air condenses, producing cloud-covered skies. 	<ul style="list-style-type: none"> • Occurs when air masses meet and stop moving. • The air can still move sideways • Whatever front advances first decides which it will be
Weather that occurs at the boundary	Heavy Storms	Hours of rain or snow	X
What type of cloud do you find at the front?	Cumulonimbus	Cirrus and Stratus	Cirrus and Stratus
Weather you will find after	Cool and Clear Skies	Warmer Weather	Either the weather of a warm front or a cold front
Ways to identify that the front is occurring	<ul style="list-style-type: none"> • Heavy Storms Occur • Temperature Drops • Barometric Pressure Drops 	<ul style="list-style-type: none"> • Steady Rain Occurs • Temperature Increases • Barometric Pressure Drops 	X
Picture			

Air Fronts Worksheet

CODE WORD: _____
****You MUST watch and listen to the entire video to get the code word**

1. Examine the following diagram and answer the following questions.



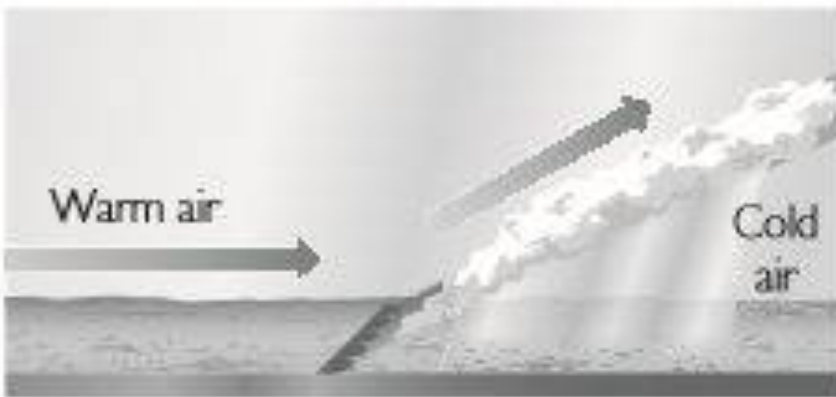
What type of front is illustrated?

How did you identify this front?

2. Explain why warm air is pushed up by the cold front.

3. Where are clouds formed when there is a cold front?

4. Examine the following diagram and answer the following questions.



What type of front is illustrated?

How did you identify this front?

5. What happens to the warm air when it overtakes the cold air?

6. Where do clouds form when there is a warm front?

AIR MASSES AND FRONT REVIEW WORKSHEET

Circle the correct answer in the table below

Type	Where it Forms (Circle over ocean or land)		Temperature (Circle warm or cold)		Humidity (Circle moist or dry)	
Continental Polar (CP)	over ocean	over land	warm	cold	moist	dry
Continental Tropical (CT)	over ocean	over land	warm	cold	moist	dry
Maritime Polar (MP)	over ocean	over land	warm	cold	moist	dry
Maritime Tropical (MT)	over ocean	over land	warm	cold	moist	dry

Complete the table below with image on the right

Letter	Temperature (Cold, Warm)	Humidity (Dry, Moist)	Name of Air Mass (CT, CP, MT, MP)
A			
B			
C			
D			
E			



Select C, W, or S to identify the type of front the statement describes.

C = Cold Front

W = Warm Front

S = Stationary

- _____ 1. Barometric pressure drops significantly.
- _____ 2. Cool air mass is in place - warm air mass moves in.
- _____ 3. Warm air mass is in place - cool air mass moves in.
- _____ 4. Brings gentle rain that may last for hours or days.
- _____ 5. Neither air mass moves.
- _____ 6. Strong winds are formed followed by heavy rain, crashing thunder, and flashing lightning.
- _____ 7. When the front passes, the temperature warms up and it becomes humid.
- _____ 8. When the front passes, the weather turns cooler.

Name: _____ Period: _____

_____ 9. Air masses move sideways.

GUIDING QUESTIONS

1. How are air masses formed?

2. What are the differences between each of the four air masses? (Mention name, characteristics, and location)

Air Mass	Location Formed	Characteristics

3. What are the three air fronts and what are characteristics of each?

Air Front	Air Mass Movement	Ways to Identify Front is Occurring	New Weather Characteristics
Cold Front			
Warm Front			
Stationary Front		X	

4. What data can be used to identify when a front occurred?

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