

Weather and Climate Review

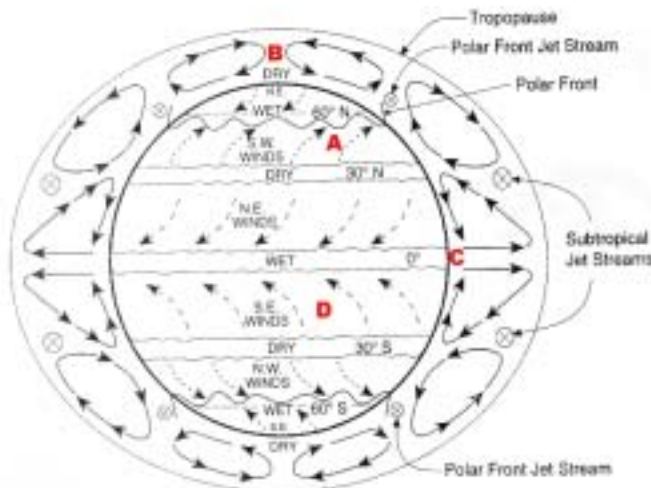
STUFF YOU NEED TO KNOW and to *UNDERSTAND!*

- 1) Because water has a higher specific heat than land, water will warm and cool more slowly than the land will. Because of this:
 - a) Locations near the coast will have milder winters and cooler summers than locations farther inland. *Large bodies of water eliminate extremes of temperature*
- 2) Most dense air is **cool/dry = high pressure (anticyclone)**
Least dense air is **warm/moist = low pressure (cyclone)**
- 3) The characteristics of an air mass are determined by the region over which it formed: (polar/arctic = cold), (tropical = warm), (continental = dry), (maritime = moist)
- 4) Winds blow from high pressure to low pressure.
Wind speed is determined by the pressure gradient: Look at the isobars on a weather map. Where the isobars are closest together the gradient is steepest and the winds are the fastest.



- 5) Winds never blow directly from high to low. They curve because of the Coriolis effect.

Winds blow: **clockwise out of a high, and counterclockwise into a low.**

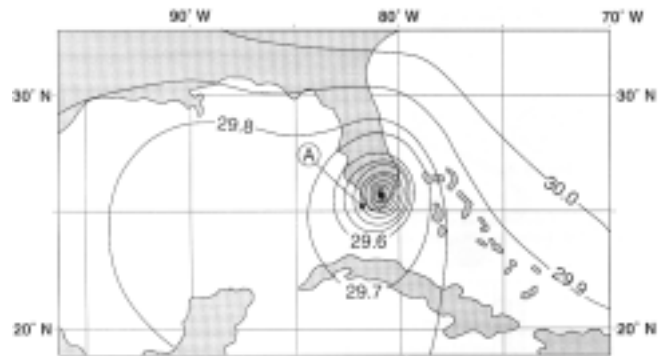
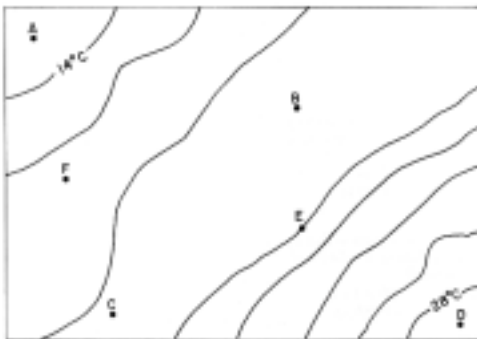


- 6) Because of the Coriolis effect wind belts exist for different regions of the earth. This chart is from page 14 of your reference tables. Note the following:
 - a) NY is about 40 deg. N and is near location A. Winds here generally blow from the SW.
 - b) If you lived at location D the winds would generally be from the SE.
 - c) At location B, the N pole, the air is cold and dry. This is high pressure air that is very dense so it sinks (descending air).

- d) At location C, the equator, the air is warm and moist. This is low pressure that has low density. Because the air here is less dense, it is rising (see arrows in the diagram).

- 7) Know your station models. Be able to use the model on page 13 of your reference tables as a guide. Be able to convert from one temperature scale to another and from pressure in inches of Hg to millibars and back. Be careful. Convert when necessary. Otherwise don't.
- 8) Be able to use the Dewpoint and Relative Humidity charts on page 12 of your reference tables. Convert to degrees Celsius only if necessary. Be sure you understand what data you are given. If you are given the dry bulb temperature and the difference between the dry and wet bulbs, **do not subtract!** You already have the difference.
- 9) To convert from a pressure abbreviation on a station model to the real pressure follow these steps:
 - a) look at the first number of the abbreviation. If it is 0 - 4, put a 10 in front. If it is 6 - 9, put a 9 in front of it.
 - b) Add a decimal point before the last number.
 ex. abbreviation: 123. The first # is 1, so add a 10 and put in the decimal: 1012.3
 abbreviation: 784. The first # is 7, so add a 9 and put in the decimal: 978.4
 - c) Check to see if the number you got is on the pressure chart on page 13 of your reference tables. If it isn't, you made a mistake. Go back. Check your work.

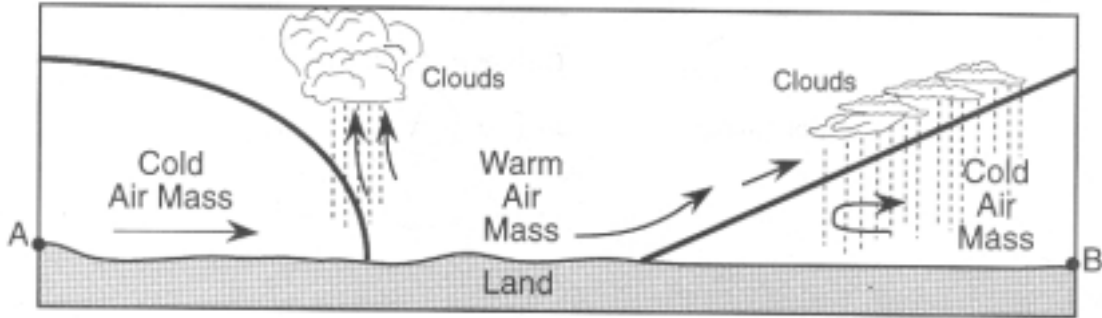
WEATHER MAPS and OTHER DIAGRAMS



- 10) Be able to distinguish **isotherms** (map on left) from **isobars** (map on right) at a glance.

Isotherms, which connect points of equal temperature are roughly parallel lines.
 Isobars, which connect points of equal pressure, tend to resemble concentric circles.

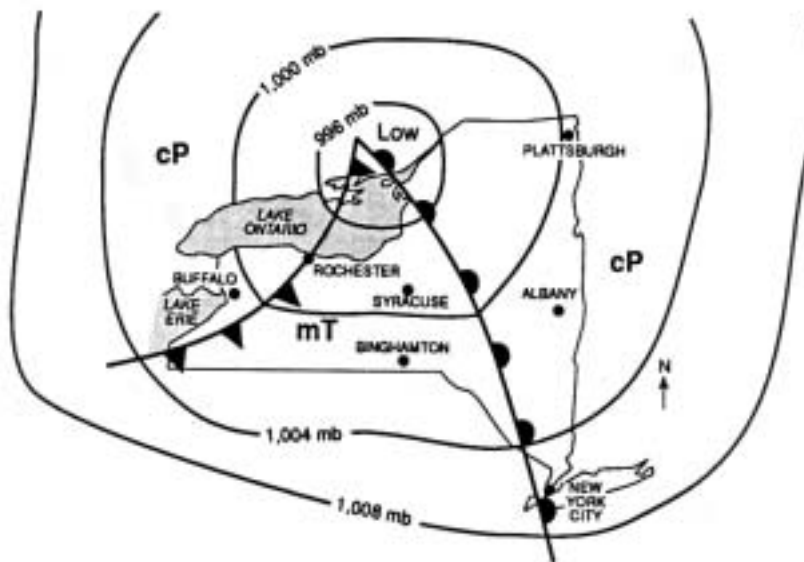
- 11) If the isobar numbers go **down** towards the center then this is a **low pressure** system.
 If the isobar numbers go **up** towards the center then this is a **high pressure** system.
- 12) Cold fronts are associated with heavy rain and often violent thunderstorms.
 Warm fronts are associated with slow, steady drizzle.



Weather Map A - Air Masses - Side View

Things to see:

- > The arrows indicate that the air masses are moving in a left to right direction.
- > Since cold air is more dense than warm air, the cold air 'slides' under the warm air masses forcing the warm air to rise.
- > As the warm air rises, it expands and cools: Adiabatic cooling.
- > When the warm air is chilled to the dew point water vapor condenses, forms clouds and it rains.
- > Note that it is raining at the **FRONTS** - just ahead of the warm front and just behind the cold front on the left. A **front** is an interface between air masses of different characteristics.



Weather Map B - Air Masses - Overhead View

Things to see:

- > These two maps show the same air masses viewed from different perspectives. Both show a cold air mass to the left, a warm air mass in the middle, and another cold air mass on the right.
- > Map B is probably the most common weather map to appear on regents exams. Take extra care to understand it.
- > A low pressure air mass is centered over Lake Ontario. Notice that the value of the isobars goes down towards the center of the low.

Common questions:

Q - Which city is experiencing rain? *

A - Rochester - It's right on a cold front where rain is most likely.

Q - Which cities have the highest temperature?

A - Syracuse & Binghamton - They're in the middle of the warm air mass.

Q - Which city just experienced a drop in temperature, and an increase in air pressure?

A - Buffalo - The cold front just past. It is now in cold/dry air (cP) which is high pressure air.

Q - Which city is likely to experience an increase in temperature and drizzle in the next few hours?

A - New York City - A warm front (slow, steady rain) is about to pass over NYC.

Q - In what direction is this weather system most likely to move?

A - To the EAST or NORTHEAST - Most weather systems at these latitudes follow a ***storm track***. This will carry them towards the east or northeast.

Q - What is the wind direction in Buffalo?

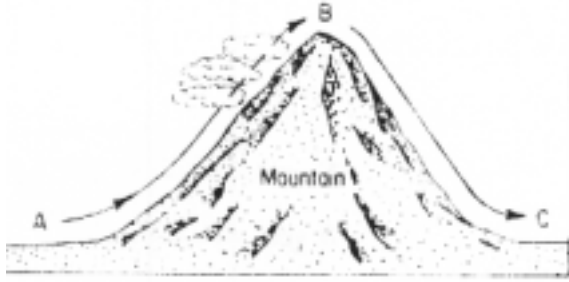
A - From the NW - Look at the direction of the cold front. The cold front symbols are pointing towards the SE so the winds are blowing from the NW.

Also remember that since this is a Low Pressure System (cyclone). Winds generally blow COUNTERCLOCKWISE and INWARD towards the center of any low pressure center in the northern hemisphere. This whole system is slowly rotating in a counterclockwise direction.

* If you are asked "in which city is it raining" you should look for the following:

- 1) Find a city on or just behind a cold front or possibly just ahead of a warm front. IF the map includes station models look for:
- 2) A city with 100% cloud cover. *It is never raining if the cloud cover is less than 100%*
- 3) A city where the air temperature and the dew point temperature are very close together. This indicates high relative humidity and a good chance of rain.

CLOUD FORMATION & PRECIPITATION



1) Air rises - expands - cools

2) When the air reaches the dewpoint, the water vapor condenses into droplets of liquid water.

NOTE: Water vapor **MUST** condense onto small particles of dust or pollen or smoke in the air. Such particles are called **condensation**

nuclei. If these are not present, then condensation may not occur even if the RH is 100%.

3) At first these water droplets are so small they remain suspended in the air. These are clouds.

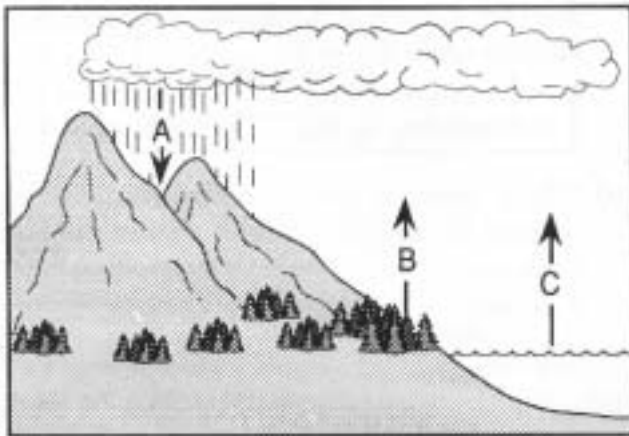
4) As droplets merge and grow heavier they may begin to fall. This is rain.

5) If the dewpoint is below freezing, then the water vapor **sublimates**. It goes directly from the gas phase to the solid phase. In this case it forms crystals called snow. Note that **snow is the only form of precipitation that does not begin as a liquid.**

6) If raindrops fall through a layer of very cold air the drops may freeze entirely or partially becoming sleet or even hail.

7) If there are very strong updrafts (usually associated with thunderstorms) then the frozen raindrops may be blown upwards where they get wet and re-freeze as they fall again. Each time this happens the hail 'stones' grow bigger and bigger. Hail may reach the size of baseballs.

THE WATER CYCLE



The water cycle:

- 1) Water **enters** the atmosphere by
 - a) Evaporation (mostly from oceans)
 - b) Transpiration (from plants)

We put these words together to form the term '**evapotranspiration**'.

- 2) Water **leaves** the atmosphere and falls to earth as precipitation.

A - precipitation

B - transpiration

C - evaporation