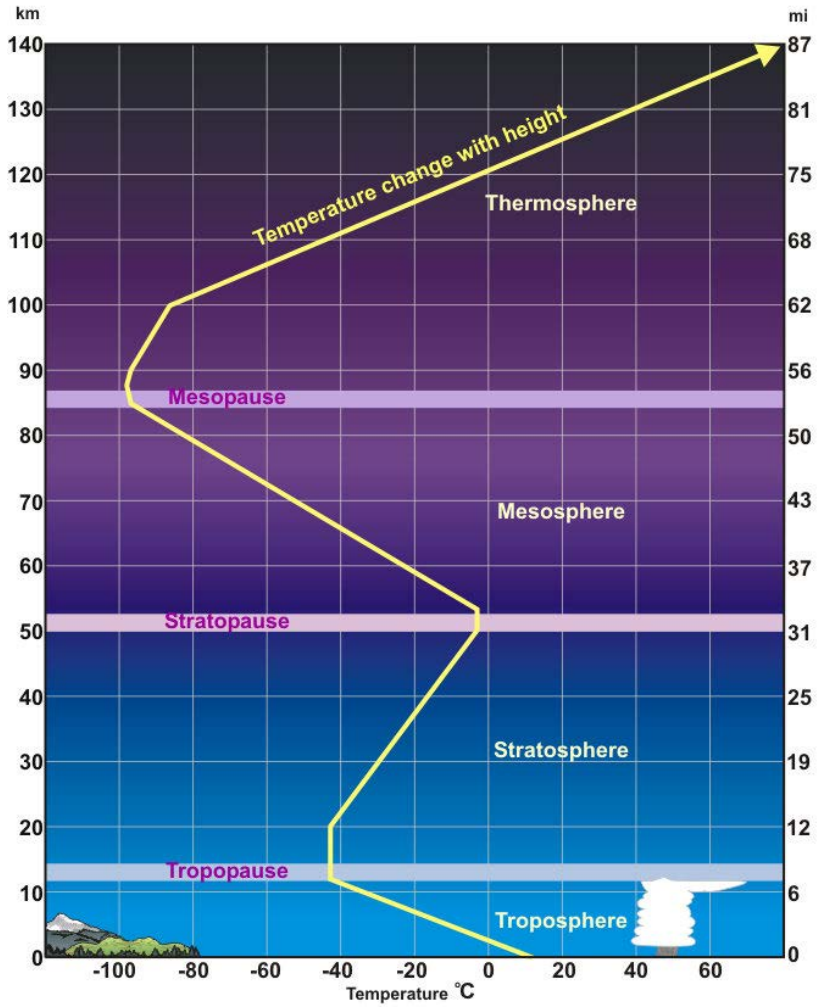
Name: _____ **Study Guide**

# Topic 3: Weather

## The Atmosphere




**Thermosphere**
- Temperature **increases**
- High temperatures
- Thin air
- Feels cold

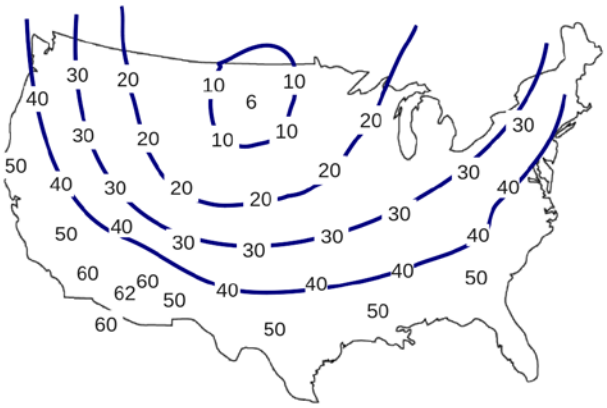
**Mesosphere**
- Temperature **decreases**

**Stratosphere**
- Temperature **increases**
- Contains **ozone**
  - Ozone absorbs ultraviolet light
  - Absorption = **heat**

**Troposphere**
- Temperature **decreases**
- All water located here
- **Weather occurs here!!!**

- **As altitude increases, air pressure decreases!**
- **As altitude increases, water vapor decreases!**
- **As temperature increases, air density decreases!! → This is why hot air rises!**
- **Use ESRT page 14.**

## Temperature

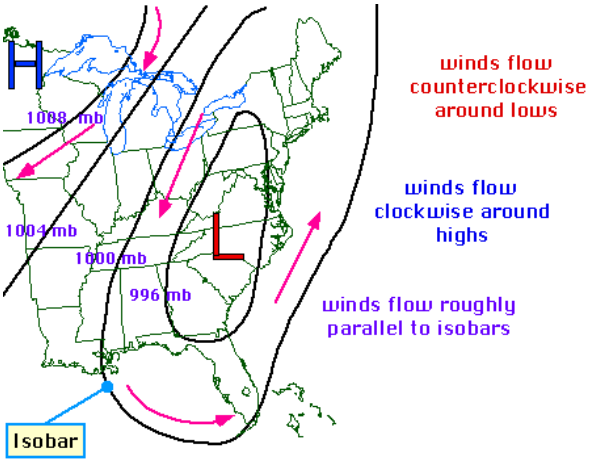


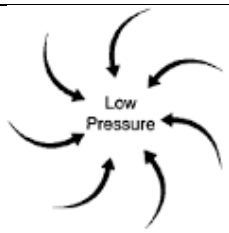
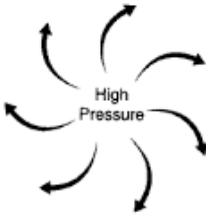

- Measured by a **thermometer**.
- **Isotherms:** lines of equal temperature on a weather map
- **Temp Conversion – ESRT Pg. 13**
- Most heat is from long-wave infrared radiation from the Earth, which is then absorbed by water vapor, carbon dioxide, & methane
- Heat is transferred by wind and air currents throughout Earth by **convection**!

| | |
|---|---|
| **Warm air rises**<br>✓ Warming air makes the molecules move faster and spread out.<br>✓ This makes the air less dense.<br>✓ Less dense air is light and will rise. | **Cold air sinks**<br>✓ Cooling air makes the molecules move slower and group together.<br>✓ This makes the air denser.<br>✓ Denser air will sink |

## Atmospheric Pressure

- Measured with a **barometer**
- **Isobars:** lines of equal air pressure on a weather map
- **Pressure Conversion – ESRT page 13.**
- Air pressure changes affect all other weather conditions.



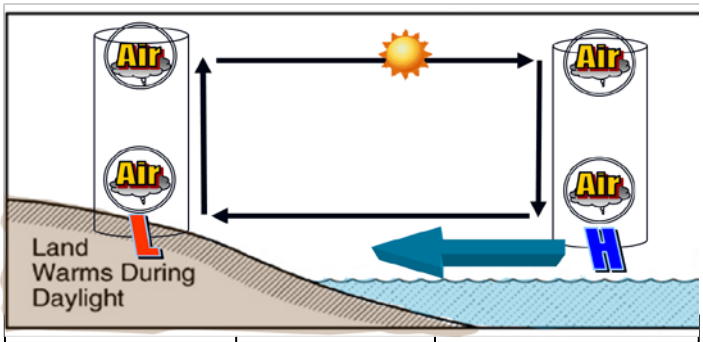

| Lows (cyclones) | Highs (anticyclones) |
|---|---|
| Rotates counter-clockwise | Rotates clockwise |
|  |  |
| Associated with **warmer, stormy weather, lots of precipitation, and clouds.** | Associated with **cooler air, clear skies, and little or no precipitation.** |

## Wind

- Caused by differences in air pressure
- Wind ALWAYS goes from HIGH pressure to the LOW pressure area.
  H ⇨ L
- Pressure gradient: the difference in air pressure
  - Shown on a weather map by how close together the isobars are (closer together means a steeper pressure gradient)
  - **The steeper the pressure gradient, the stronger the winds**!
  - Winds are always named for the direction that they come **from**!
- **Wind direction** measured with a **weather vane**.
- **Wind speed** measure with an **anemometer**.

## Local Winds

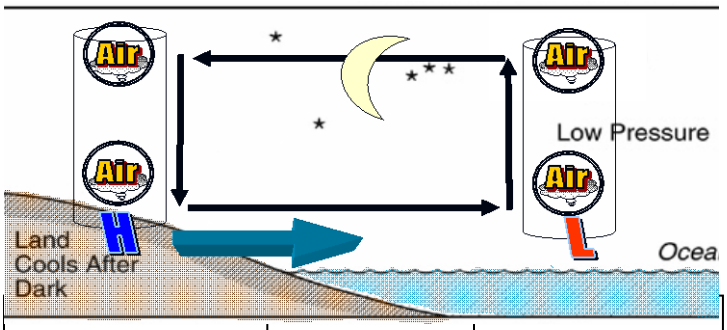
### Sea Breeze




*During the day, the land heats up and air above it becomes less dense and rises. Rising air creates low pressure.*

*During the day, air over the sea is cool. The cool air is denser, sinks, and forms high pressure.*

### Land Breeze




*During the night, the land cools quickly and the dense air above it begins to sink creating high pressure.*

*During the night, the sea stays warm and the less dense warm air above it rises creating low pressure.*

## Coriolis Effect and Global Winds

- Earth's rotation causes wind to be deflected instead of traveling in a straight line.
- Curve to the **right** in the **northern** hemisphere.
- Curve to the **left** in the **southern** hemisphere.

## Humidity (Moisture)

- **Humidity:** measured with a **psychrometer.**
- Sources of water vapor:
  - Mostly **evaporation** from the world's oceans.
  - **Transpiration:** water vapor given off by living plants.
- Warm air holds **more** moisture than cold air.

## Relative Humidity

- A comparison (%) of how much water vapor that the air IS holding to how much water vapor the air COULD hold at a particular temperature.
- Relative Humidity can change even if water vapor amount does not change.
- Relative Humidity changes as air temperature changes.
  - Temp increases: Relative Humidity decreases (usually in the afternoon)
  - Temp decreases: Relative Humidity increases (usually in the morning)
- **100 % Relative Humidity** means air is **holding all the water vapor it can.**
- **Dew Point Temperature:** the temperature at which the relative humidity reaches 100%.
- **When Relative Humidity is 100% condensation starts and clouds form in the sky.**

The **closer** the **air temperature** is to the **dewpoint temperature**, the **higher** the **relative humidity**, and the **greater** chance of clouds and precipitation.

## Clouds

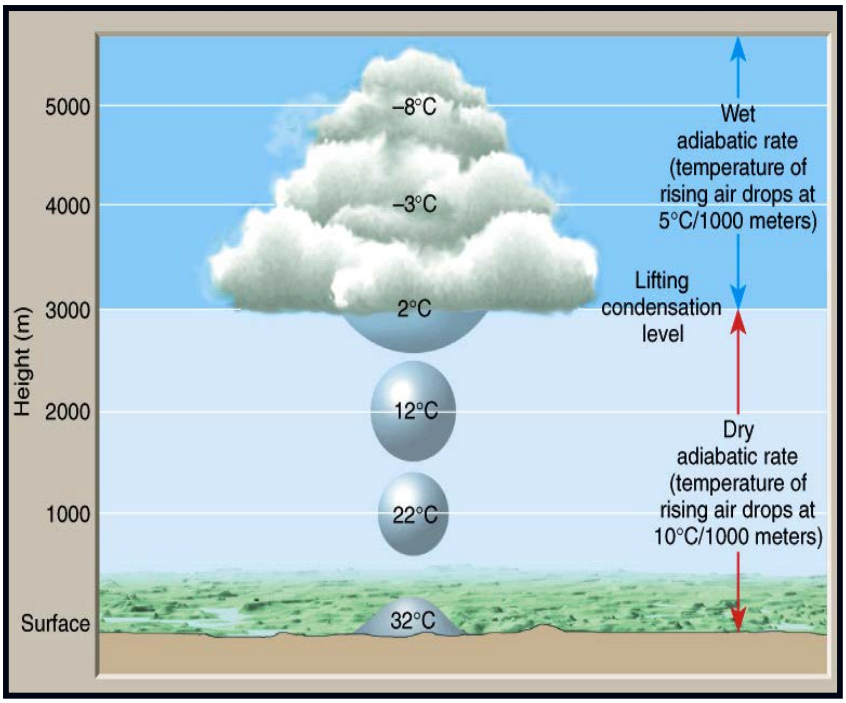
Steps to Cloud Formation:

1.) **air RISES**

**2.) air EXPANDS**

**3.) air COOLS**

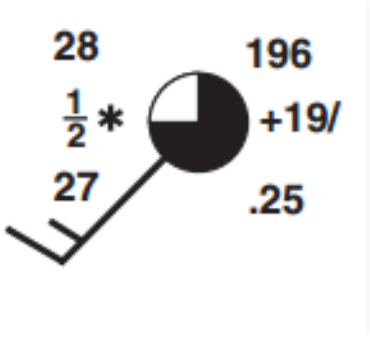
**4.) at dewpoint temp, water vapor CONDENSES**



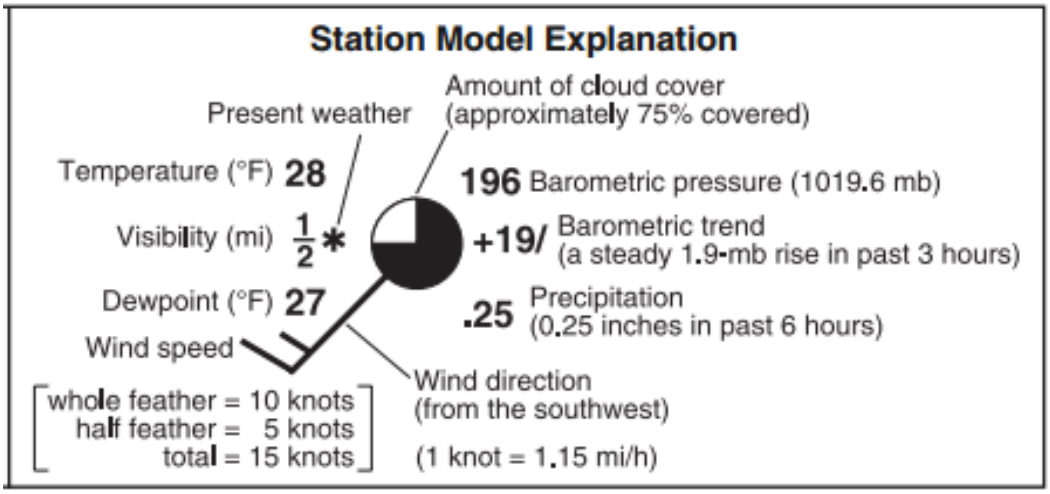

## Weather Variables and Station Models

- Temperature
- Dew point
- Air Pressure
- Barometric Trend
- Precipitation
- Cloud Cover
- Wind Speed
- Wind Direction
- Visibility

**This is a Station Model**




**Station Models tell us the current weather conditions (ESRT page 13)!**



## Air Masses

- Body of air with similar temperature and moisture conditions throughout.
- Gets its characteristics from the area it comes from (Source Region).

*Classified by:*

1. **Temperature:** Warm (Tropical) Cold (Polar)
2. **Humidity:** Moist (Maritime) Dry (Continental)

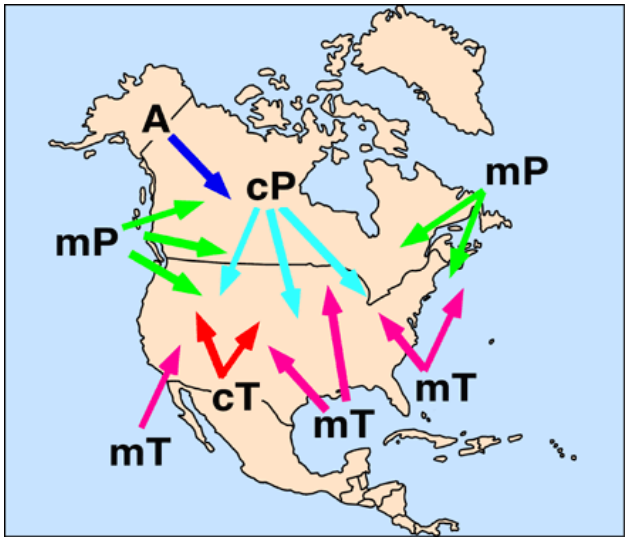
| DESCRIPTION | CONDITION | LOCATION FORMED |
|---|---|---|
| **Maritime Tropical** | Moist and Warm | Over Water and Lower Latitudes |
| **Continental Tropical** | Dry and Warm | Over Land and Lower Latitudes |
| **Maritime Polar** | Moist and Cold | Over Water and Higher Latitudes |
| **Continental Polar** | Dry and Cold | Over Land and Higher Latitudes |

**There are 4 major types of air masses:**

1. Maritime Tropical (**mT**)
2. Continental Tropical (**cT**)
3. Maritime Polar (**mP**)
4. Continental Polar (**cP**)

* Air Mass symbols on ESRT page 13

* Air Masses are moved by Prevailing Winds (pg 14 in ESRT)

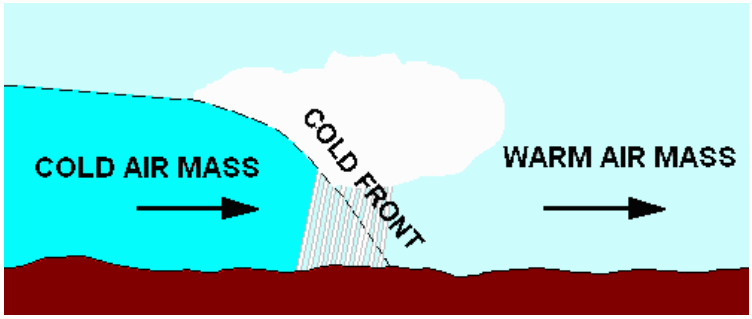


## Fronts

- boundaries between air masses (symbols on ESRT page 13)

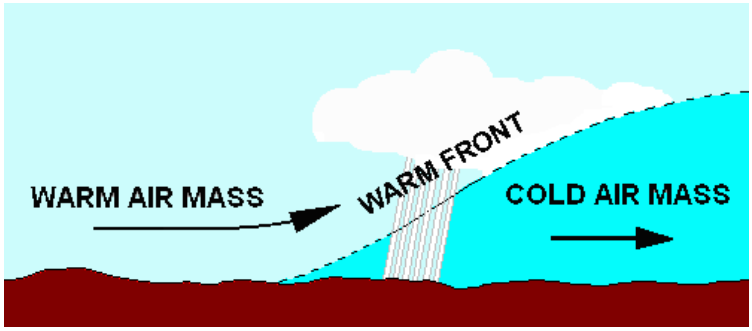
**COLD FRONT**

- Cold air moving in
- Moves faster
- Precip and thunderstorms along the front
- Once it passes, air pressure ↑, humidity ↓, air temperature ↓



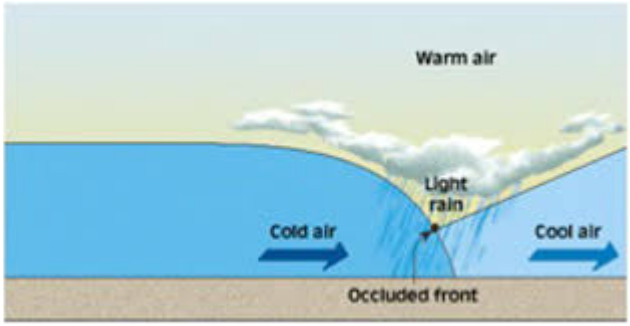

**WARM FRONT**

- Warm air moving in
- Moves slower
- Long, steady rain ahead of front
- Once it passes, air pressure ↓, humidity ↑, air temperature ↑

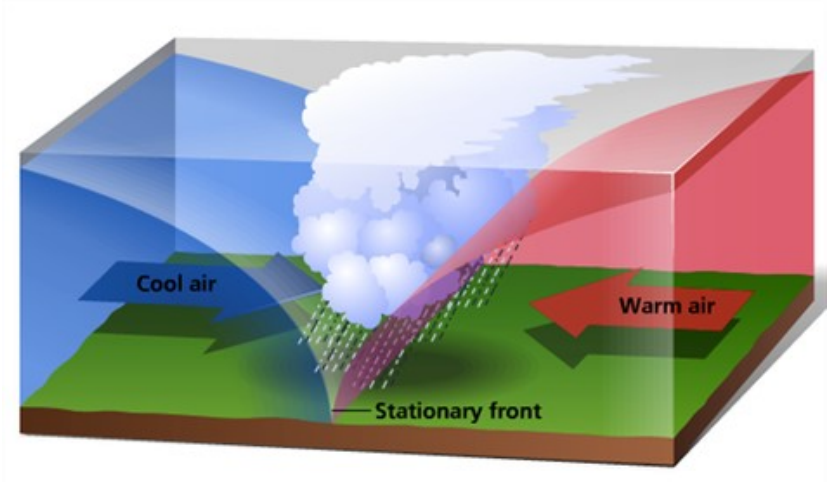



**OCCLUDED FRONT**

- A cold front catching up to and passes a warm front
- warm air is squeezed up
- combination of cold front and warm front weather




**STATIONARY FRONT**- no motion of the air masses, some steady precip possible



## Weather Maps

- A map showing the current surface distribution of atmospheric pressure, precipitation, fronts, and weather variable conditions: temperature, dew point, cloud cover, wind speed and direction, etc…