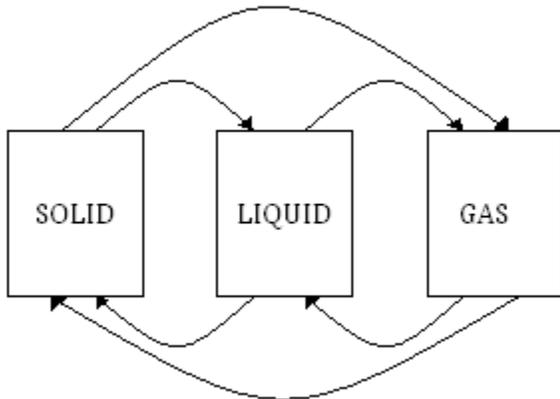


**WATER IN THE ATMOSPHERE**

\* When it comes to understanding atmospheric processes, water vapor is the most important gas in the atmosphere.

~



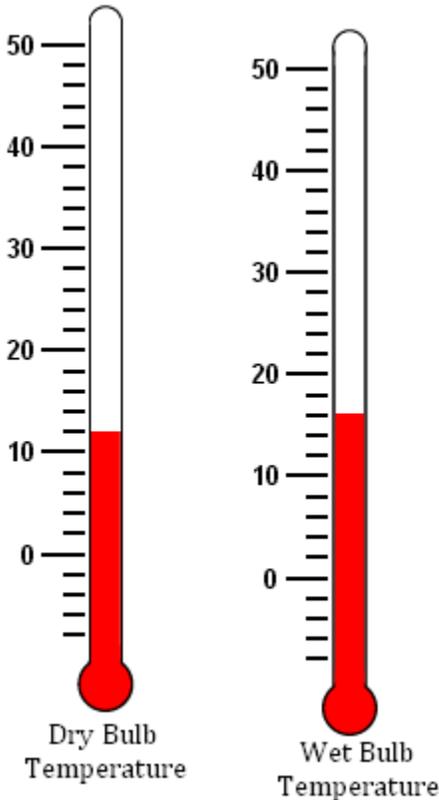
\* The process of changing state requires that energy is transferred in the form of heat.

~ latent heat: "hidden heat" – heat that doesn't produce a temperature change; used to change state of matter

~ humidity: amount of water vapor in the air

~ Be able to determine dew point and relative humidity using a wet bulb temperature, a dry bulb temperature and the charts. See below.

Solid → liquid = melting | liquid → gas = evaporation or boiling | solid → gas = sublimation (all add heat)  
 Gas → liquid = condensation | liquid → solid = freezing | gas → solid = deposition (all remove heat)



Dew Point = 4 °C

Relative Humidity = 57 %

\* When saturated, warm air contains more water vapor than saturated cold air.

\* Relative humidity is a ratio of the air's actual water vapor content compared with the amount of water vapor air can hold at that temperature.

~ Be able to use Table 1 on the back of this paper to determine relative humidity at a certain temperature.

~ A parcel of air at 20°C contains 10.5 grams of water vapor per kg of air. What is the relative humidity?  
 $\frac{10.5 \text{ g/kg} \times 100}{14 \text{ g/kg}} = 75\%$

\* When the water vapor content of air remains constant, lowering the air temperature causes an increase in relative humidity, and raising the air temperature causes a decrease in relative humidity.

~ Dew Point: reach saturation.

temperature to which a parcel of air would need to be cooled in order to

~ A parcel of air contains 20 grams of water vapor per kilogram of air. What is the dew point?

~ Clouds form when air is cooled to its dew point.

\* When air is allowed to expand, it cools, and when it is compressed, it warms.

~ The rate of cooling or heating that applies only to unsaturated air is called the dry adiabatic rate. It is equal to 10 °C per 1000 feet.

~ The slower rate of cooling caused by the addition of latent heat is called the wet adiabatic rate. It is in the range of 5 to 9 °C per 1000 feet.

**Table 1**

Temperature (°C)	Water Vapor Content at Saturation (g/kg)
-40	0.1
-30	0.3
-20	0.75
-20	2
0	3.5
5	5
10	7
15	10
20	14
25	20
30	26.5
35	35
40	47

\* What are the four processes/mechanisms that can cause air to rise?

1. orographic lifting – when elevated terrains (mountains) act as barriers to air flow
2. convergence – collision of contrasting air masses forces air to rise
3. localized convective lifting – unequal heating of Earth's surface causes pockets of air to be warmed
4. frontal wedging – cooler, more dense air acts as a barrier over which the warmer, less dense air rises

~ Briefly describe each of these processes.

\* Stable air tends to remain in its original position, while unstable air tends to rise.

\* For any type of condensation (dew, fog, clouds, etc.) to form, the air must be saturated.

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## AIR PRESSURE & WIND

\* Wind is the result of horizontal differences in air pressure. Air flows from areas of higher pressure to areas of lower pressure.

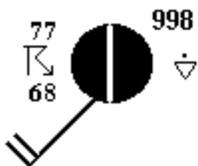
\* The unequal heating of Earth's surface generates pressure differences. Solar radiation is the ultimate source of energy for most wind.

\* Three factors combine to control wind:

- ~ pressure differences
- ~ Coriolis effect
- ~ friction

\* Closely spaced isobars indicate a rapid change in pressure and therefore, high wind speed. Widely spaced isobars indicate a slow change in pressure and therefore, light winds.

- \* **The Coriolis effect describes how Earth's rotation affects moving objects. All free-moving objects (including the wind) are deflected to the right of their path of motion in Northern Hemisphere. In the Southern Hemisphere, they are deflected to the left.**
- \* **Because of pressure differences and the Coriolis effect, winds blow counterclockwise around a low pressure center (and air flows inward towards the low pressure).**
- \* **Because of pressure differences and the Coriolis effect, winds blow clockwise around a high pressure center (and air flows outward away from the high pressure).**
- \* **Global wind patterns are a result of the atmosphere acting as a giant heat transfer system. This system moves warm air toward high latitudes (poles) and cool air toward the equator.**
- ~ Be able to draw and answer questions about the global wind patterns.
- ~ Use the diagram on page 4 to draw in the global wind patterns, their relative pressures, names, etc. [See page 4.](#)
- \* **An air mass is an immense body of air that is characterized by similar temperatures and amounts of moisture at any given altitude.**
- \* **In addition to their overall temperature, air masses are classified according to their source region.**
- \* **Much of the weather in North America, especially weather east of the Rocky Mountains, is influenced by continental polar (cP) and maritime tropical (mT) air masses.**
- ~ Describe temperature and precipitation conditions for the following air masses:
  - \* continental polar (cP): **dry & cold**
  - \* continental tropical (cT): **dry & warm**
  - \* maritime polar (mP): **wet & cold**
  - \* maritime tropical (mT): **wet & warm**
- \* **A front is a boundary that separates two air masses.**
- ~ What causes a warm front to form? **Warm air moves into an area formerly covered by cooler air**
- ~ What causes a cold front? **Cold, dense air moves into a region occupied by warmer air**
- ~ What is a stationary front? **The flow of air on either side of a front is neither toward the cold air mass or the warm air mass. Surface position of the front does not move.**
- ~ What is an occluded front? **When an active cold front overtakes a warm front.**
- ~ Be able to describe and interpret station models. Know what the symbols mean, etc.
- ~ Tell as much information about the weather at this station as you can:



**Air temperature = 77°F, dew point = 68°F, current precipitation = thunderstorms  
 Overcast skies, wind from southwest at 20 knots, atmospheric pressure = 998 mb  
 Previous precipitation = slight rain showers**

