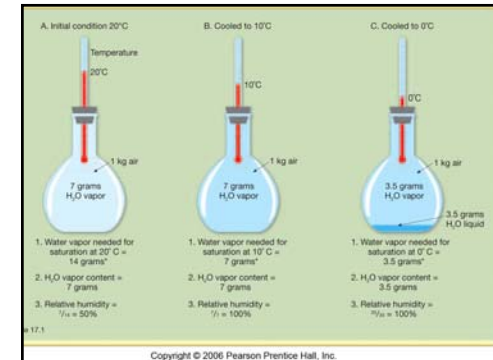


Humidity and Atmospheric Moisture

Latent Heat of Water
Atmospheric Temperature Change

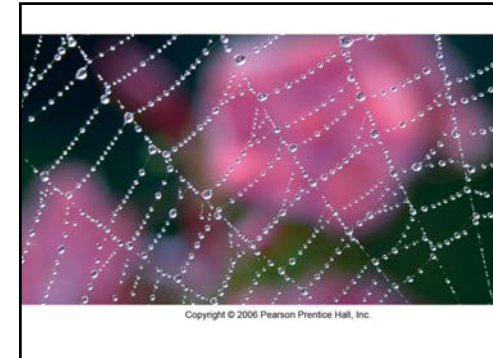
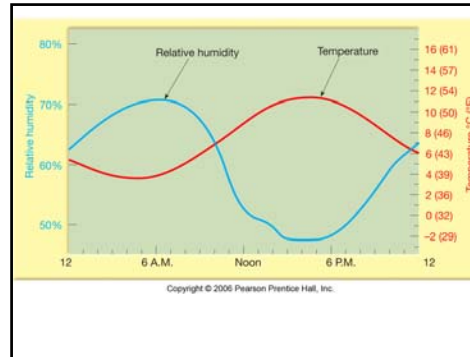
Humidity

- Description of how much water air contains
- Relative Humidity compares how much moisture is in the air, to how much moisture the air could hold
- The amount of water that air can hold is a function of temperature



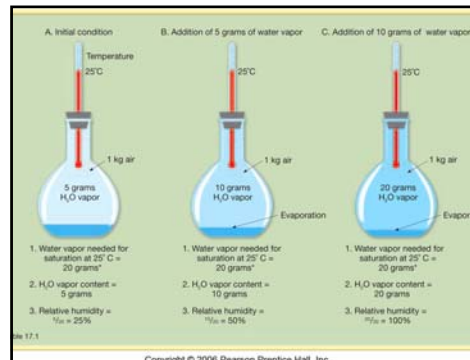
Dew Point Temperature

- The air cools to the temperature that it has 100% relative humidity
- Air is SATURATED at 100% RH
- This temperature is the DEW POINT TEMPERATURE



Changes of humidity

- Can warm or cool air, and not change water content
- Will result in different relative humidity
- Can increase or decrease water content of air without change in temperature



Relative Humidity

- Can calculate the amount of water in the air from the relative humidity, if you know the air temperature and the amount of water the air could hold at that temperature

$$\frac{RH\%}{100} \cdot \left(\begin{array}{c} \text{amount of water} \\ \text{the air could hold} \end{array} \right) = \left(\begin{array}{c} \text{amount of water} \\ \text{the air has} \end{array} \right)$$

Changes in temperature with change in elevation

- Two different mechanisms
 - Earth's atmosphere is heated from below
 - Gases cool as they expand

Environmental Lapse Rate

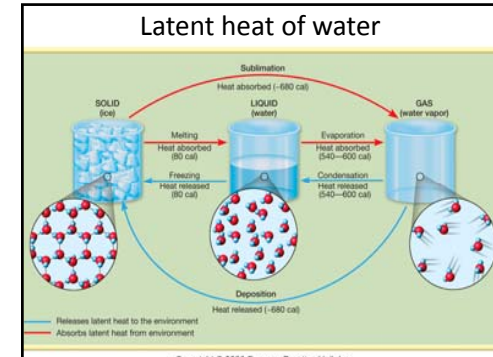
- Earth's atmosphere is heated from below
- Regularly cooler at greater distances from Earth's surface
- Varies with moisture, temperature, cloud cover, and other local conditions

Gases cool as they expand

- Still have same heat energy
- Take up larger volume
- Increase in volume at lower pressure
- Atmospheric pressure declines with altitude
- Temperature change due to change in volume called "**Adiabatic lapse rate**"

Latent Heat of Water

- Heat energy that water releases or absorbs when it changes phase
- Gains it from environment as it melts or evaporates
 - So it cools the environment
- Loses it when it freezes or condenses
 - So it warms the environment

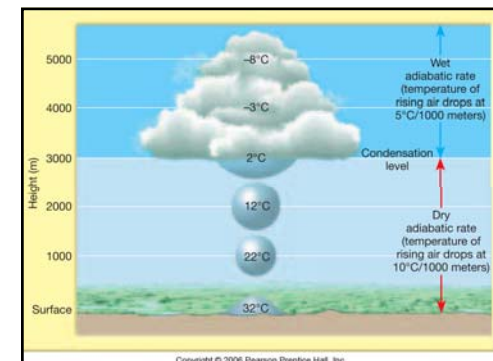


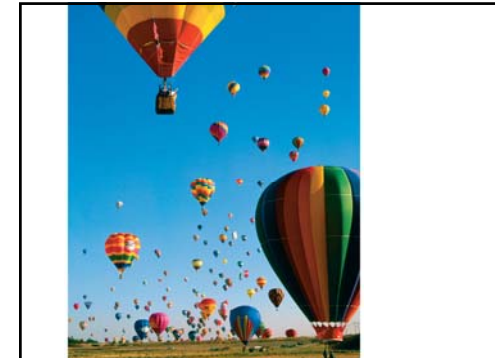
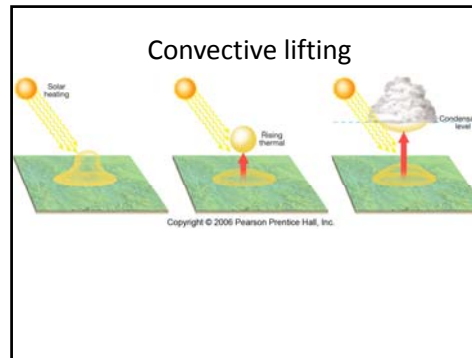
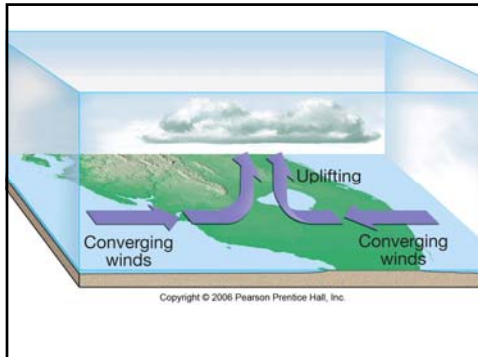
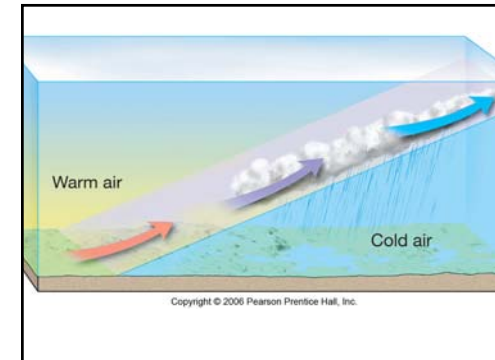
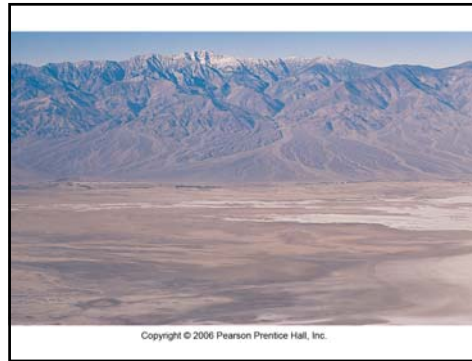
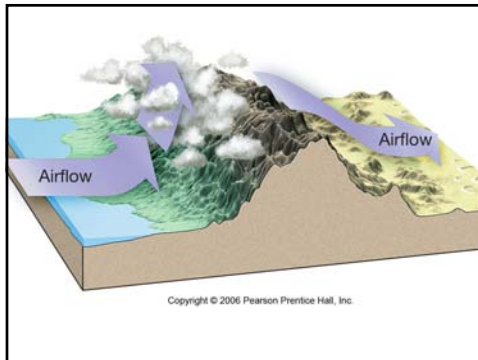
Adiabatic lapse rate

- Temperature declines with lowering pressure, as air moves to higher altitude
- Temperature increases with increasing pressure, as air moves to lower altitude

Adiabatic lapse rate

- Rate of temperature change depends on saturation
- Saturated air has condensation of water, which releases heat: warms environment
 - >10° C / 1000 m if not saturated
 - >5° C / 1000 m if condensation is occurring





Stability of Atmosphere

- Air rises due to a number of factors
- Expands as it rises: cools as it does so
 - Can calculate the new temperature with the adiabatic lapse rate:
 - Dry for unsaturated
 - Wet for saturated
 - Compare the temperature of the air that has risen to the temperature of the air at that height
 - Higher density air that has risen is stable (cooler)
 - Lower density air that has risen is unstable (warmer)

Environmental Lapse Rate

- Earth's atmosphere is heated from below
- Regularly cooler at greater distances from Earth's surface
- Varies with moisture, temperature, cloud cover, and other local conditions

Adiabatic lapse rate

- Rate of temperature change depends on saturation
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