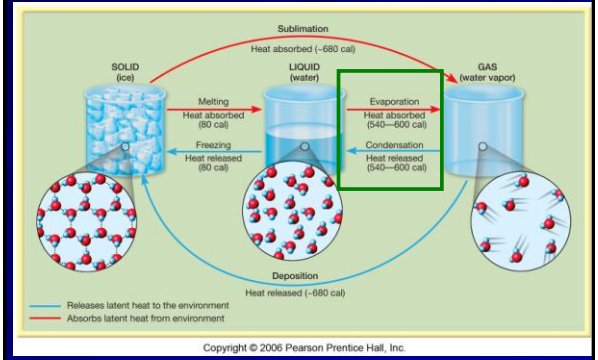
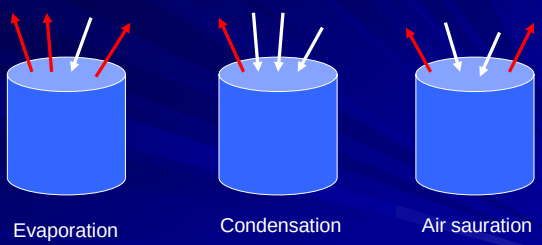
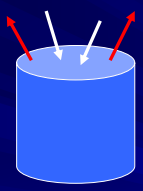
Clouds and precipitation

GS 106







Saturated air occurs when…

- Condensation = evaporation
- Temperature remains constant

WARMER AIR CAN HOLD MORE WATER VAPOR

TABLE 17.1 Amount of water vapor needed to saturate a kilogram of air at various temperatures.

Temperature °C (°F)	Water-Vapor Content at Saturation (grams)
−40 (−40)	0.1
−30 (−22)	0.3
−20 (−4)	0.75
−10 (14)	2
0 (32)	3.5
5 (41)	5
10 (50)	7
15 (59)	10
20 (68)	14
25 (77)	20
30 (86)	26.5
35 (95)	35
40 (104)	47

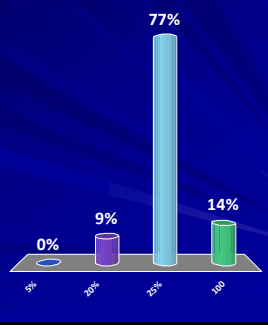
"Water vapor capacity"

How much water vapor in the air?

$$\text{Relative humidity} = \frac{\text{Actual water-vapor content}}{\text{Water-vapor capacity}} \times 100$$

What is the relative humidity of 1 kg of air at 25 degrees C that contains 5 g of water vapor?

1. 5 %
2. 20%
3. ✓ 25%
4. 100



WORK WITH YOUR NEIGHBOR TO DETERMINE THE RELATIVE HUMIDITY OF:

A. Air at 15 degrees C with 10 g of water

B. Air at 25 degrees C with 10 g of water vapor

C. Air at 25 degrees C with 20 g of water vapor

So relative humidity changes with:

1) Addition or subtraction of moisture

2) Change in temperature

Air at 25 degrees C with 20 g of water vapor has a relative humidity of 100%

When relative humidity = 100 %

CONDENSATION BEGINS

The air has reached its DEW POINT….

The temperature a parcel of air would need to be cooled to reach saturation

WORK WITH YOUR NEIGHBOR TO DETERMINE THE DEW POINT OF:

A. 1 kg of air at 20 degrees C that contains 7 g of water vapor
B. 1 kg of air at 40 degrees C that contains 14 g of water vapor
C. 1 kg of air at 5 degrees C that contains 2 g of water vapor

Wet bulb "cools" due to evaporation

Cooling proportional to dryness of air

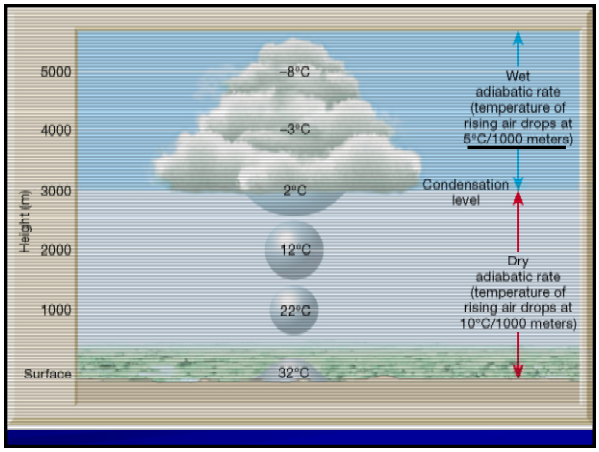
How clouds form

- Take a balloon, blow it up, and release it on your skin
- Does it feel hot or cool?

As air **expands** it **cools**

As air **compresses** it **warms**

THESE ARE KNOWN AT ADIABATIC TEMPERATURE CHANGES



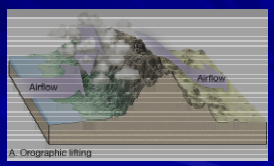
Cloud formation

- Adiabatic cooling
  1) Air rising
  2) Cools to its dew point, condensation
- How clouds form
  – Condensation occurs on *condensation nuclei*
    - Dust, smoke, salt particles

Cloud formation animation

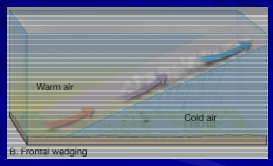
Air-lifting processes

- Orographic uplift
  – Air rises over mountains, cools
  – Often loses moisture upon reaching other side
    - Rain-shadow

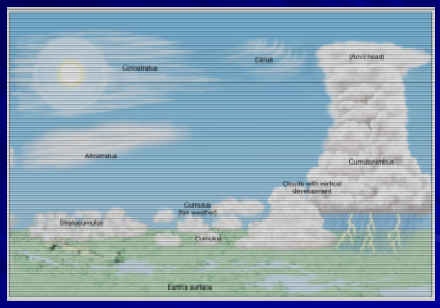


Air-lifting processes

- Frontal wedging
  - Masses of warm/cool air collide
  - Warm air rises



Cloud types



Cirrus…no precipitation, but a sign of changing weather

Stratus clouds…light to moderate precipitation

Cumulus clouds…often a sign of fair weather

Cumulonimbus…rain showers or thunderstorms