

Moisture, Clouds, and Precipitation: Water in the Atmosphere

Dr. Michael J Passow

Water is the most important substance on Earth

Earth is the “Goldilocks Planet”

Temperatures are just right to make it possible for Earth to have vast amounts of water as liquid, solid, and gas



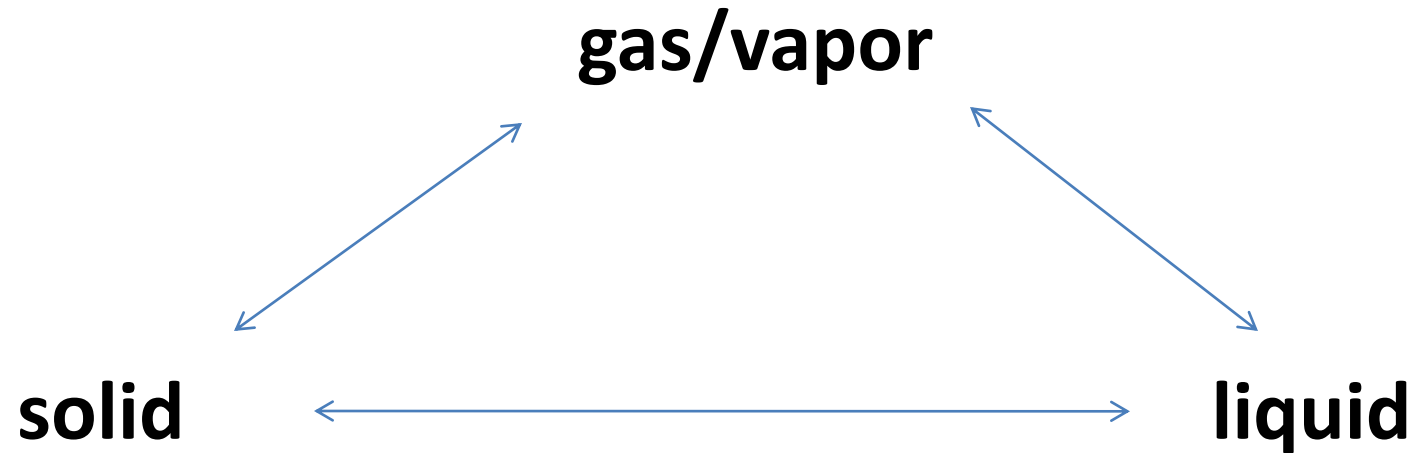
<http://www.eurocraft-industries.com/images/rain.jpg>



<http://old.farmersalmanac.com/images/snow1.jpg>

Water's Changes of State/Phase

As water gains or loses energy, it changes its **state** or **phase**



Solid \longleftrightarrow Liquid

- Melting
solid to liquid
energy absorbed

latent heat: + 334 joules/gm

- Freezing
liquid to solid
energy released

latent heat: - 334 joules/gm

Liquid ↔ Gas

- Evaporation

liquid to gas

energy absorbed

latent heat: + 2,260 joules/gm

- Condensation

gas to liquid

energy released

latent heat: - 2,260 joules/gm

Solid ↔ Gas

- Sublimation
solid to gas

best example: ice in a freezer “disappears”

- Deposition
gas to solid

best example: frost

Humidity

- Measurement of how much water vapor is in air
- “Saturated” = holds as much as it could at that temperature
- Most familiar term is “relative humidity”
how much $\text{H}_2\text{O}_{(g)}$ in a “parcel of air”
compared with how much it could hold at that temperature when saturated

Water Vapor and Changes in Temperature

If a parcel of air has a certain amount of $\text{H}_2\text{O}_{(g)}$ in it, when the

- temperature cools, the RH increases (and may reach 100%/saturation)

We see this when drops form on the outside of a glass of cold water or iced tea

- temperature warms, the RH decreases

We use this to “defog” a car windshield

Dew Point

- Temperature to which a parcel of air must be cooled to reach saturation
- Often as air cools in the evening, drops of dew form on surfaces when the temperature reaches the dew point

Measuring Humidity

- Sling psychrometer

Sling Psychrometer



- Hygrometer



Finding RH & DP

- Start by checking to see if the dry-bulb and wet-bulb temperatures are equal when they're dry
- If not, you'll have to adjust the wet-bulb to the dry-bulb
- Dip the wet-bulb in water
- CAREFULLY spin the psychrometer for about 20 – 25 seconds
- Record the dry-bulb and wet-bulb readings
- Subtract the wet-bulb from the dry-bulb to get the difference
- Use the Reference Tables to find RH and DP