**Water in the Atmosphere Notes:**

**Unit 3: Interactions of the Atmosphere and Hydrosphere**

**Mini-Unit:** Water in the Atmosphere

**Goal 3: The student will demonstrate the ability to explain how the transfer of energy affects the water cycle.**

Objectives – The student will be able to:

* + Analyze energy transfer systems that influence phase changes (condensation, melting, deposition, freezing, sublimation, and evaporation) and the latent heat in the atmosphere

**Textbook:** Unit 7, Chapter 23, pg. 574

**Atmospheric Moisture:**

**Condensation**

**Precipitation**

 **Transpiration Evaporation**

3 States of Water in Atmosphere:

1. Ice – solid
2. Water – liquid
3. Water Vapor – gas

Humidity – water in the atmosphere

Key Points:

* Warm air can hold more water than cold air
* Dew point and relative humidity are related

Relative Humidity – measure of how close the air is to reaching the dew point

* What we call “humidity”
* Measured as a percent
* At 75% relative humidity, the air has ¾ of the water vapor it can hold
* As relative humidity goes up, the temperature/dew point spread decreases

Dew Point – the temperature where the condensation point equals the evaporation point, under this temperature and water droplets form

* The temperature to which the present air would have to be lowered to become saturated
* The greater the temperature/dew point spread, the less amount of water in the air compared to how much it could hold
* Measured in degrees
* Dew Point: 50 degrees – comfortable
* Dew Point: 60 degrees – humid
* Dew Point: 70 degrees – very uncomfortable

Dew – when the temperature drops to the dew point and air comes in contact with the cooler ground

Frost – when the dew point falls below the freezing temperature of water, water vapor goes straight to ice, therefore it is not frozen dew

If the dew point = current temperature = 100% relative humidity = water vapor condenses forming dew

Absolute Humidity – measure of the actual amount of water vapor in the air; mass of the water vapor in the air per unit of mass of air

**Clouds and Fog:**

Clouds – a collection of small water droplets or ice crystals suspended in the air, which forms when the air is cooled and condensation occurs.

Cloud Formation:

1. Condensation Nuclei - In order for water to condense and form a cloud, a solid surface for condensation to occur on must be available
2. Evaporation rate must be in equilibrium with condensation, “saturated air” (At dew point)
3. As temperature of the saturated air drops, condensation occurs more than evaporation, and clouds form

Cooling Processes for Cloud Formation:

1. Adiabatic Cooling – The process by which the temperature of an air mass decreases as an air mass rises and expands due to a decrease in air pressure, thus a decrease in particle collisions, thus lower temperatures
2. Mixing – When a body of moist air mixes with another body of moist air that is cooler
3. Lifting – The forced upward movement of air either by a mountain range or another air mass going underneath it and lifting it (storms)
4. Advective Cooling – The process by which the temperature of an air mass decreases as the air mass moves over a cold surface such a cold ocean or land surface

Classification of Clouds:

1. Shape
2. Altitude



Stratus Clouds:

1. Flat uniform base
2. Form at low altitudes
3. Typically wide gray clouds with no precipitation

Cumulus Clouds:

1. Puffy, billowy cloud
2. Form at low altitudes
3. On hot humid days the cloud can climb up high and form storm clouds called cumulonimbus

Cirrus Clouds:

1. Feathery clouds
2. High altitudes
3. Composed of ice crystals

Fog:

1. Very low altitude
2. Forms differently from other clouds, either warm air comes in contact with the cool ground or flows over cool water

**Precipitation:**

Precipitation – any form of water that falls to Earth’s surface from the clouds; includes rain, snow, sleet, hail and freezing rain

Rain – liquid precipitation

Snow – solid ice precipitation that fall as pellets, crystals, or groups of crystals called snowflakes

Sleet – rain that freezes on the way down to Earth

Freezing Rain – rain that does not freeze until it hits the ground

Hail – solid precipitation that is a ball of ice that cycles in the clouds, the more cycling the bigger the hail