6th Grade Unit 4: Weather and Climate

*Lesson 1: What is weather and how can we describe different types of weather conditions?*

*Vocab: weather, humidity, relative humidity, dew point, precipitation, air pressure, wind, visibility*

Weather- the conditions of Earth’s atmosphere at a certain time and place

(conditions include: humidity, temperature, air pressure, wind, visibility,

precipitation)

Temperature (see Unit 3 lesson 2) is the measurement of the amount of thermal energy

in a substance. It is how fast (hot) or slow (cold) the particles/atoms are moving.

Measured with a thermometer using K (kelvin), ℃ (celsius), fahrenheit ℉. Can be electric or

filled with a liquid like alcohol or water. Liquid thermometers work using density changes

as the liquid warms or cools. (see thermal expansion)

Humidity- the amount of water vapor in the air

The more water that evaporate the more humid the air becomes. Relative humidity is the amt.

of water vapor in the air compared to the amt. of water vapor needed for saturation. Saturation is when the rate of evaporation and condensation are equal (as full as it can be w/ water, 100%). If the air cools down, the air contract and less water can fit in it. Dew point is the temp.

at which more condensation occurs then evaporation so condensation (dew & fog) can form.

Precipitation- any form of water that falls from the sky

4 main forms are: rain, snow, sleet, hail

Rain forms by condensation that collects into larger and larger droplets until they are big

enough to fall. Snow happens when water vapor freezes to a solid. Hail forms when balls or clumps of ice fall from clouds during a thunderstorm. Sleet forms when rain falls through a layer of freezing air turning to ice.

Air pressure- the force of the air molecules pushing down on an area

Air pressure depends on the amount of air that is above pressing down. We don’t feel it b/c

the air presses in all directions at onces and balances out. Related to density; as altitude

increases air pressure and density decrease. Measured with a barometer.

Wind- air that moves horizontally, or parallel, to the ground

Wind is caused by uneven heating of Earth’s surface and that pressure differences that the

hot and cold spot create. Wind moves from high pressure to low pressure spots. Measure wind

using an anemometer that measures wind speed.Wind direction is measured with a wind vane

or wind sock. Wind pushes on the tail causing the arrow to point into the wind.

Visibility- the measure of the transparency of the atmosphere

Visibility is basically how far we can see. Measured using known landmarks to judge the

distance. Affected by pollution or fog

Weather data collection

Stationary: Ground station or Weather buoy (measure in a set location)

Moving: Ships, Airplanes, Satellite (track changes as weather systems move)

*Lesson 2: How do clouds form and how are clouds classified?*

*Vocab: cloud, dew point, stratus cloud, cumulus cloud, cirrus cloud, fog*

Cloud- a collection of small water droplets or ice crystals that are suspended in the air

Precipitation that falls from clouds has a big effect on local climate (ex. Desert gets less

than 25 cm of precip. a year) Temperature is affected by clouds. They reflect sunlight back

into space (low altitude thick clouds) and cool Earth or the absorb sunlight (high altitude thin clouds) and warm Earth.

How do clouds form?

Water vapor from evaporation condenses (gas into a liquid). To do this, air must have reached

the dew point and there must be a solid surface for the water to cling to.

* Warm moist air rises b/c it’s less dense
* Gets high enough in the atmos. to cool to its dew point (temp. that evaporation and

condensation are balanced)

* Water molecules condense quickly when there is a solid surface to stick to
* *Cloud condensation nuclei* are the tiny particles that water molecules cling to
* Cloud condensation nuclei are things like dust, smoke, salt
* At very high altitudes clouds are made of ice crystals

Sun’s role

* 50% of the sun’s energy absorbs into the land and water on the surface
* When it absorbs the energy it evaporates (liquid water into water vapor)
* Solar energy doesn’t warm Earth evenly making warm and cool spots or areas of low and high pressure
* Uneven pressure causes the air to move from high to low pressure areas (wind)
* Air warmed by the sun is pushed up by cooler air so that it can reach its dew point

Processes that cool the moist air to the dew point

* Frontal lifting when a mass of cold air slides under a mass of warm air; causing the warm air to rise and then cool to the dew point (often makes thunderstorm clouds)
* Orographic lifting when an obstacle, like mountains, force the air up where it cools to the dew point; causes clouds with lots of precip. falls as rain or snow on the other side of the mt.

3 cloud shapes

Stratus clouds- thin and flat clouds that don’t have a clear edge

* Lowest clouds in atmos.
* Strata mean layer b/c they look like a single layer that covers the sky
* Often grey
* Light mist or drizzle
* Fog is a stratus cloud

Cumulus clouds- thick and puffy on top, usually are flat on the bottom and have clear edges

* Can go very high; if high enough the top will be flat
* Fair weather if bright/dark (heavy with water) will be a storm
* Cumulus mean heap or pile

Cirrus clouds- feathery with curled up ends

* Cirrus mean curl
* Form up high where there isn’t a lot of water
* Form from very cold ice crystals
* Don’t make precipitation that reaches Earth

Clouds based on altitude

Low altitude:

* Between the surface and 2,000 m
* Stratus, stratocumulus, nimbostratus
* Nimbus means rain

Middle altitude:

* Alto is a prefix that means middle
* Altostratus and altocumulus

High Altitude:

* 6,000 m and up
* Use the prefix cirro
* Made of ice crystals
* Cirrus, cirrostratus, cirrocumulus

Clouds of vertical development

* Clouds that start low and stretch high
* Can go up to 12,000 m
* Form from very fast rising warm moist air
* Cumulus and cumulonimbus
* Cumulonimbus make storms, tornados, etc.

Fog- water that condenses near the ground (cloud on the ground)

* Ground fog/radiation fog- in low areas on calm nights when the ground cools it lowers the air to the dew point
* Sea fog/advection fog- when warm moist air moves over cold water cooling it to the dew point; happens at any time of day
* Steam fog- when evaporation happens in cold air over warm water; steam over a body of water usually on cold fall mornings
* Lowers visibility and can be dangerous

*Lesson 3: How do the water cycle and other global patterns affect local weather?*

*Vocab: air mass, front, jet stream*

Water cycle

* A continuous movement of water between the atmos., the land, the oceans, and living things
* Water is constantly changing between solid, liquid, and gaseous states
* Evaporation affects weather by moving water from the land and ocean to the air, causes humidity
* Condensation affects weather by creating clouds in the air and dew on land, creates fog
* Precipitation affects weather by returning the water to Earth that was evaporated

Air masses

* Air mass- a large volume of air in which temperature and moisture content are nearly the same throughout
* Forms when the air over a large region of Earth stays in one area for many days
* The air takes on the humidity and temp. of the land below
* Front- a boundary that form between air masses
  + The type is determined by how the air masses move, their temps. and humidity
  + Fronts cause a change in temp. and humidity (precipitation)
  + Usually happen near the middle latitudes not the poles

Types of Fronts and air masses

* Cold fronts form where cold air moves under warm air
  + Warm air is less dense and moves up quickly when the cold air pushes on it
  + The warm air, if moist, will cause clouds to form along the front
  + Can bring heavy rain as the front moves through
  + Cold air mass follow
* Warm fronts form where warm air moves over cold air
  + Warm air fills in as cold air moves out of the area
  + The warm air rises and creates clouds more slowly
  + Causes drizzly rain followed by clear warm days
* Stationary front forms where cold air and warm air stop moving
  + Where there is not enough wind for either air mass to keep moving
  + Causes many days of unchanging weather, mostly clear

Pressure systems

* High-pressure system air sinks down slowly and spreads out to areas of low pressure
  + Large and change slowly
  + Forms air masses
* Low pressure systems air rises and so causes lower pressure
  + As it rises it cools
* High pressure systems can cause low pressure systems
  + High pressure causes air to move out of the area where it sinks and warms causing it to rise making a low pressure area

High pressure systems

* Clear weather
* Cooler denser air
* Less humid
* Calm gentle breeze

Low pressure system

* Rainy weather
* Warmer less dense air
* Center where the air rises causes clouds and rain
* Often at the boundary between warm and cold air mass (front)

Global wind patterns and weather

* Overall movement of air from poles toward the equator
* Warm air at equator create a low pressure belt
* Patterns in temp. And pressure create local climate

Jet streams and weather

* Form from uneven heating creating uneven areas of pressure
* Very fast wind that is very high in the atmosphere
* In the winter, polar jet stream affects latitudes closer to the equator bringing colder air
* In the summer, the polar jet stream stays near the poles
* Storms can form near the jet stream b/c it causes temp. Changes

Ocean currents and weather

* Global winds push the water on the surface of the ocean making surface currents
* Currents carry heat energy changing local temp. And creating storms (hurricanes and monsoons)
* Summer, land becomes warmer than the ocean; lets moist air move inland and keeps the coastal areas cooler
* Cool ocean currents lower coastal air temperature
* Warm ocean currents raise coastal air temperature