PROPERTY OF:

EARTH SCIENCE – UNIT 7 – CHAPTER 16 NOTES

WEATHER

16.1 Weather
- weather = the behavior of the atmosphere at a particular place and time
- includes wind, temperature, pressure, and precipitation
- based primarily on two components: water cycle and convection currents
- The water cycle controls the amount of moisture in the air.
- The convection currents (hot air rising and cold air sinking) determine the temperature.

16.1 Humidity
- humidity = the amount of water vapor that the air can hold
- Air holds water vapor like a sponge!
- EX: Air holds more water vapor when it is warmer.
  Air holds less water vapor when it is colder.
- cold air → more dense → less space for water → lower humidity
  This causes condensation! (clouds/rain)
- hot air → less dense → more space for water → higher humidity
  This prevents condensation! (no clouds/rain)
- Air is saturated when it contains as much water vapor as possible.
- After the air is saturated, extra water vapor will turn into a solid (snow) or liquid (rain).
- dew point = the temperature at which air is saturated and condensation takes place
- The dew point changes based on the humidity.
- EX: water on the outside of a glass, early morning dew

SHOW CIRCLE & DOT DIAGRAMS TO INDICATE WARM AND COLD AIR

16.1 Clouds
- Clouds form when condensation occurs around small nuclei in the atmosphere.
- EX: Nuclei in the atmosphere include dust, smog, salt, smoke, etc.
- Clouds form any time that warm, moist air rises or is pushed up.
- What causes clouds?
  Warm air can hold more water vapor than cold air.
  As it is pushed up, the air becomes colder.
  Cold air holds less water vapor.
  As a result, some of the water vapor turns into water (rain) or ice (snow).
- EX: On a hot day, a glass of iced tea forms beads of water on the outside of the glass.

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16.1 Cloud Terminology
- Stratus = form layers or smooth, even sheets
- Cumulus = puffy, white clouds
- Cirrus = fibrous, curly, or wispy clouds
- Cirro- = high clouds
- Alto- = middle clouds
- strato- = low clouds
- Nimbus or Nimbo- = dark clouds that are usually associated with precipitation
  (There is so much water in them at sunlight cannot pass through.)

16.1 Precipitation
- Precipitation is produced after water vapor condenses into water in the air (clouds)
- EX: Rain =
  Rain falls when the air near the ground is warm (above the freezing point).
- EX: Snow =
  Snow falls when the air in the clouds is so cold that the water droplets turn into ice crystals.
  As the ice crystals freeze, they form snowflakes.
- EX: Sleet =
  Sleet begins as snow crystals.
  As the snow crystals fall, they pass through a region of warmer air.
  The crystals melt. Then they refreeze because the air near the ground is cold.
  As a result, sleet looks like little balls of ice.
- EX: Hail =
  Hail falls when the air in the clouds is so cold that it forms ice crystals.
  Convection currents in the atmosphere cause the ice crystals to go up and down in the air.
  As they move up and down, they get larger and larger.
  As a result, hail looks like large lumps of ice.

16.2 Air Masses
- a large body of air that has the same properties as the surface over which it formed
- Arctic air masses will be cold.
- Tropical air masses will be warm.
- Air masses that form over water will be moist.
- Air masses that form over land will be dry.
- EX: cool + moist
  warm + moist
  cold + dry
  hot + dry

SHOW MAP OF AIR MASSES ON PAGE 462

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16.2 High Pressure Systems
- A high pressure system is caused by air that is descending (sinking) onto the Earth.
- caused by cold air sinking
- NOTE: This does NOT mean that the weather will be cold or will be getting colder!
- Since the cold air is sinking, the warm air is not able to rise.
- Since the warm air doesn't rise, condensation is not able to take place.
- Since there is no condensation taking place, there are no clouds.
- Since there are no clouds, there is no precipitation.
- Therefore, high pressure = good weather!
- The air moves in a clockwise movement around the center of the high pressure system.
- Air is pushed down and out as it sinks.

SHOW DIAGRAM OF AN "H" WITH CLOCKWISE ARROWS AROUND IT

16.2 Low Pressure System
- A low pressure system is caused by air that is ascending (rising) into the atmosphere.
- caused by warm air rising
- NOTE: This does NOT mean that the weather will be warm or will be getting warmer!
- Since the warm air is rising into the atmosphere, the air starts to cool down.
- Since the cooler air holds less water vapor than warmer air, condensation takes place.
- Since there is condensation taking place, clouds form in the sky.
- Since there are clouds, there is precipitation.
- Therefore, low pressure = bad weather!
- The air moves in a counter-clockwise movement around the center of the low pressure system.
- Air is pulled up and in as it rises.

SHOW DIAGRAM OF AN "L" WITH COUNTER-CLOCKWISE ARROWS AROUND IT

16.2 Fronts
- Front =
  A front is a boundary between 2 different air masses.
  Air ALWAYS moves from the high pressure system to the low pressure system!
  (There are never any exceptions to this.)
- Warm Front =
  A warm air mass moves over a departing cold air mass.
  The warm air mass gently/slowly moves up and over the cold air masses.
  This produces a lot of precipitation over a wide area for a long period of time.
- Cold Front =
  A cold air mass moves in and goes underneath the warm air mass.
  The warm air mass quickly rises up over a small area.
  This produces a narrow band (thin area) of violent storms for a short period of time.
- Occluded Front =
  Cold air masses move in from both sides and go underneath the warm air mass.
  The warm air mass is pushed up between the two cold air masses.
  This produces heavy rains, strong winds, and violent storms.
- Stationary Front =
  A cold air mass and a warm air mass move toward each other, but stop moving.
  The warm air mass rises up, but does not continue moving over the cold air mass.
  The produces light wind and precipitation for a few days.

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16.2 Thunderstorms
- occur inside warm air masses and at fronts
- warm air rises rapidly to form cumulonimbus clouds
- strong winds formed when the rain creates drafts of moving air
- lightning forms due to positive and negative ions in clouds (water conducts electricity)
- thunder = sound waves produced by the rapid heating and cooling of the air due to lightning

16.2 Tornadoes
- a violent, whirling wind that moves in a narrow path over land
- usually moves from southwest to northeast
- form along a front during thunderstorms
- produced by winds moving in different directions and at different speeds
- winds are formed by differences in air pressure between the center of the tornado and the outside of the tornado
- forms a funnel cloud

16.2 Hurricanes
- a large, swirling low-pressure storm that forms over tropical oceans
- uses heat energy from the ocean to generate the winds
- warm, moist (humid) air rises and then cools and condenses
- this area of warm air rising is a low pressure system
- eye = the center of the hurricane where cool, dry air descends (sinks)
- There is no danger, precipitation, or bad weather in the eye of a hurricane.

16.3 Terms Used on Weather Maps and Weather Station Models
- isotherm = a line connecting points of equal temperatures
- isobar = a line connecting points of equal air pressures
- If isobars are close together, there will be a lot of wind. WHY?
- H = center of a high pressure system
- L = center of a low pressure system
- barometric pressure:
  + = air pressure is increasing (a high pressure system is approaching)
  — = air pressure is decreasing (a low pressure system is approaching)
- cold front, warm front, and stationary front symbols
- wind speed and direction
- temperature and dew point
- Winds are always defined based on where they ORIGINATE (come from)!
- All weather patterns move across the USA from west to east (prevailing westerlies).