

# WEATHER REVIEW SHEET

## THE ATMOSPHERE

- The atmosphere is divided into layers based on changes in temperature.
- “Pause” = the interface between two layers in the atmosphere
- Air pressure decreases with altitude
- There is no water vapor in the air above the tropopause, so there is no weather above the tropopause
- The ozone layer absorbs harmful UV energy from the sun. It is found in the stratosphere.

## ENERGY

- Energy from the sun is called insolation (**IN**coming **SOL**ar **radiATION**)
- Insolation is absorbed as short-wave energy (visible light) and reradiated as long-wave energy (infrared)
- Energy is transferred by
  - Convection due to density differences
  - Conduction due to contact between atoms within a substance
  - Radiation as waves through space
- Specific heat is the amount of energy required to change to temperature of a substance. Liquid water has the highest specific heat of all substances on Earth.
- High specific heat = needs a lot of energy to heat up, a long time to cool off
- Low specific heat = needs a little energy to heat up, cools quickly
- Ice absorbs 334 J/g of energy when melting, water absorbs 2260 J/g of energy when evaporating
- Water vapor radiates 2260 J/g of energy when condensing, water radiates 334 J/g of energy when freezing

## WEATHER

- Weather = local, short-term changes in atmospheric conditions.
- Climate = long-term weather patterns of a region
- Atmospheric pressure = force exerted by atmosphere
- Warm air holds more moisture than colder air.
- Warm, moist, humid air has less air pressure than cold, dry air.
- Warm air is less dense than cold air.
- Higher elevation (altitude) = less air pressure

## WINDS

- Wind is caused by uneven heating of earth's atmosphere, therefore the density differences in air masses.
- Wind moves from areas of high pressure to areas of low pressure.
- Pressure gradient = rate of change in air pressure between 2 points on a map.
- Wind direction controlled by
  - Coriolis Effect (right in the northern hemisphere, left in the southern hemisphere)
  - Atmospheric pressure gradient
- Wind direction:
  - High pressure system: clockwise outward from center
  - Low pressure system: counterclockwise towards center
- Winds are named for the direction from which they come.
- Wind Zones = Planetary Wind Belts (pattern caused by movement of air from high to low pressure areas and by the Coriolis Effect).
- Sea and Land breezes are caused by convection formed as a result of the ocean having a higher specific heat than the sand.

## HUMIDITY

- Humidity = amount of moisture (water vapor) in air.
- Dew point = temperature to which air must be cooled to reach saturation. When air is cooled below this point condensation occurs. Precipitation normally occurs.

To find DEW POINT temperature:

- 1) Find Dry-bulb temperature minus wet-bulb temperature (difference).
- 2) Find dry-bulb temperature on left of chart.
- 3) Find wet-bulb and dry-bulb difference on top of chart.
- 4) Follow IN from side and DOWN from top to find the Dew Point.

- Warmer air can hold more water vapor than colder air can.
- Air is most saturated (contains the most water) just above a body of water.
- **Cloud formation:** condensation nuclei are required and moist air must be cooled below its dew point.

## **OROGRAPHIC LIFTING**

- Occurs when there is a change in temperature of a gas caused by expansion or contraction of the gas WITHOUT the application or removal of heat.
- **Warming:** cold air descends and is compressed by surrounding air. Compression causes warming (less space between molecules, more collisions between molecules).
- **Cooling:** warm air ascends and expands. Expansion causes cooling (more space between molecules, less collisions between molecules).
- Precipitation cleans the atmosphere of dust and other pollutants.
- Orographic lifting occurs when air is forced up by mountains, causing cooling, condensation, and precipitation on the windward side and warming and evaporation on the leeward side.

## **AIR MASSES**

- **Air Masses** = large bodies of air with same characteristics (temperature, pressure, humidity). They are named for their place of **origin**.
  - cA = continental/arctic (dry/very cold)
  - cP = continental/polar (dry/cold) \*CANADA
  - cT = continental/tropical (dry/warm)
  - mT = maritime/tropical (humid/warm) \*GULF OF MEXICO
  - mP = maritime/polar (humid/cold)

## **FRONTS**

- **Cyclone** = low pressure system (warmer air mass)
- **Anticyclone** = high pressure system (colder air mass)
- **Weather front** = boundary between air masses.
  - Named for the LEADING air mass.
- An approaching cold front means that a cold air mass is moving into an area.
- Occluded front = 2 cold fronts move in and lift a warm front aloft.
- Stationary front = winds blowing in opposite directions, so boundary between air masses does not move. No weather change.
- When a cold front meets a warm front, warm air rises over cold front.
- Precipitation occurs due to adiabatic cooling of warm front and resulting condensation of moist, warm air.

## **STATION MODELS**

Station Model Barometric pressure conversions:

- To convert millibar reading for use on a station model:
  - Remove 9 or 10 and decimal point.
  - Example: 966.3 = 663, 1041.0 = 410
- To convert station model back to millibar reading:
  - If above 500, place a 9 before it and add a decimal point.
    - Example: 668 = 966.8
  - If below 500, place a 10 before it and add a decimal point.
    - Example: 125 = 1012.5
- Barometer rising = increasing air pressure = colder, denser air.
- Barometer falling = decreasing air pressure = warmer, moist air.

## **CLIMATE**

The average weather conditions (temperature and moisture) for a large region over a long period of time.

Factors affecting climate include:

- **Latitude-** The higher your latitude, the colder your climate.
- **Altitude-** The higher your altitude, the colder your climate.
- **Mountain ranges-** On the windward side of a mountain, your climate will be wet, on the leeward side of a mountain, your climate will be dry.
- **Oceans/Large Bodies of Water-** The closer you are to water, the less extreme your climate (warmer winters and cooler summers).
- **Ocean Currents-** Locations near warm water currents will have warmer climates, locations near cold water currents will have colder climates.
- **Planetary Wind Belts-** On-shore winds will cause wet climates, off-shore winds will cause dry climates (monsoon winds).