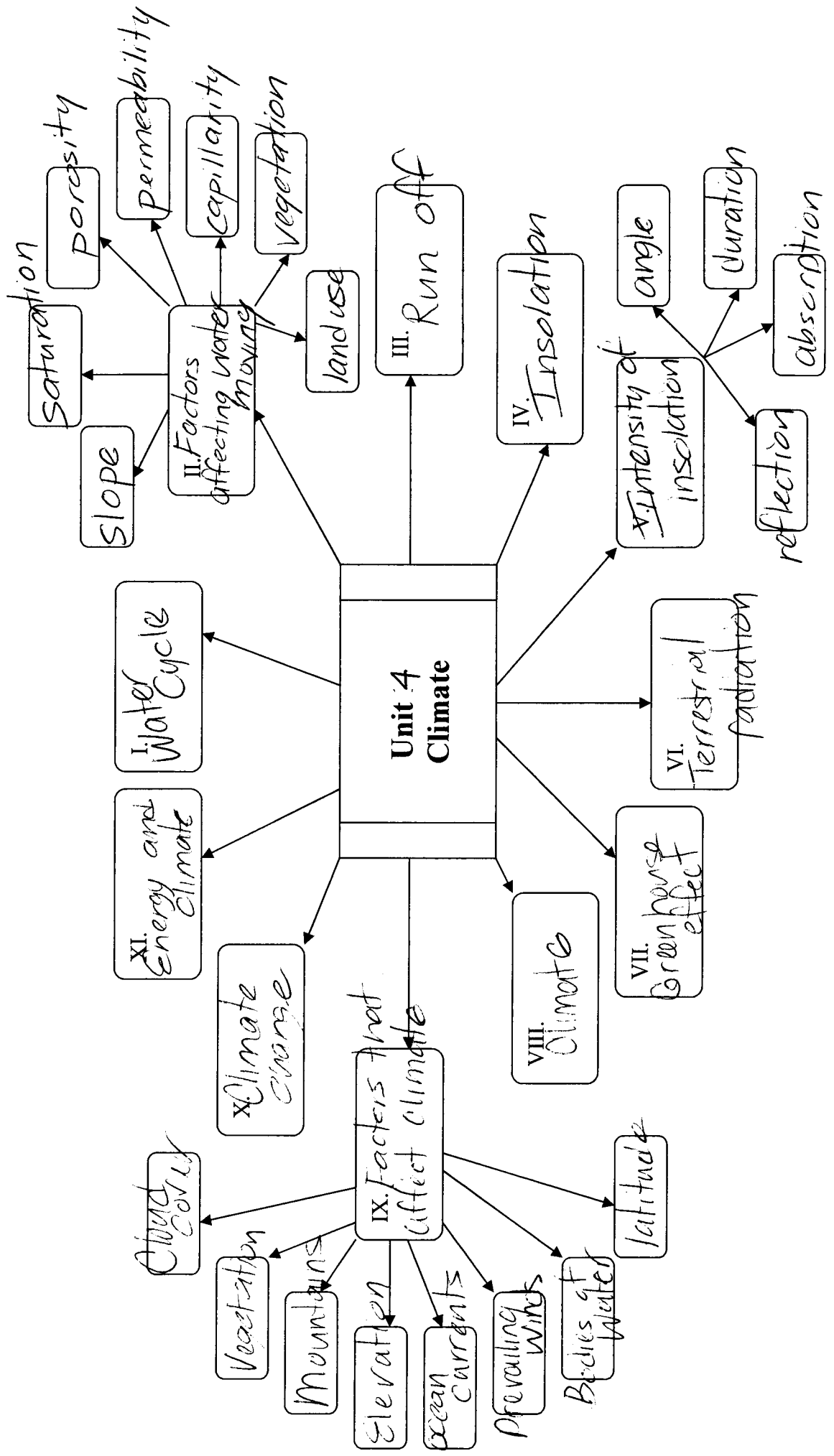
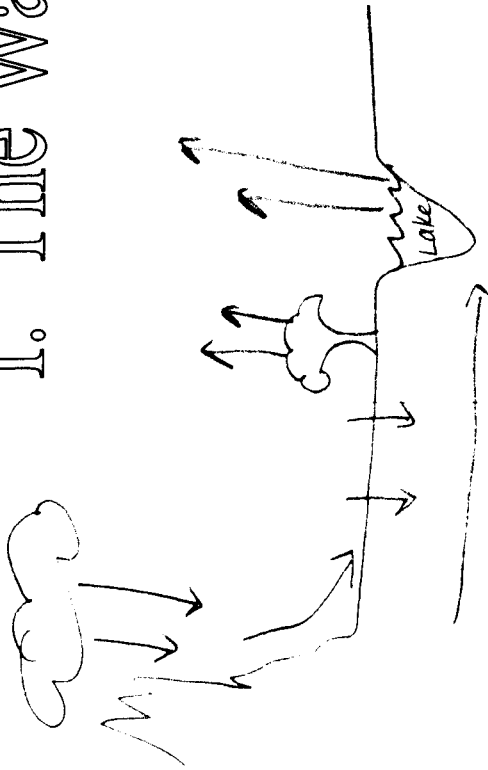


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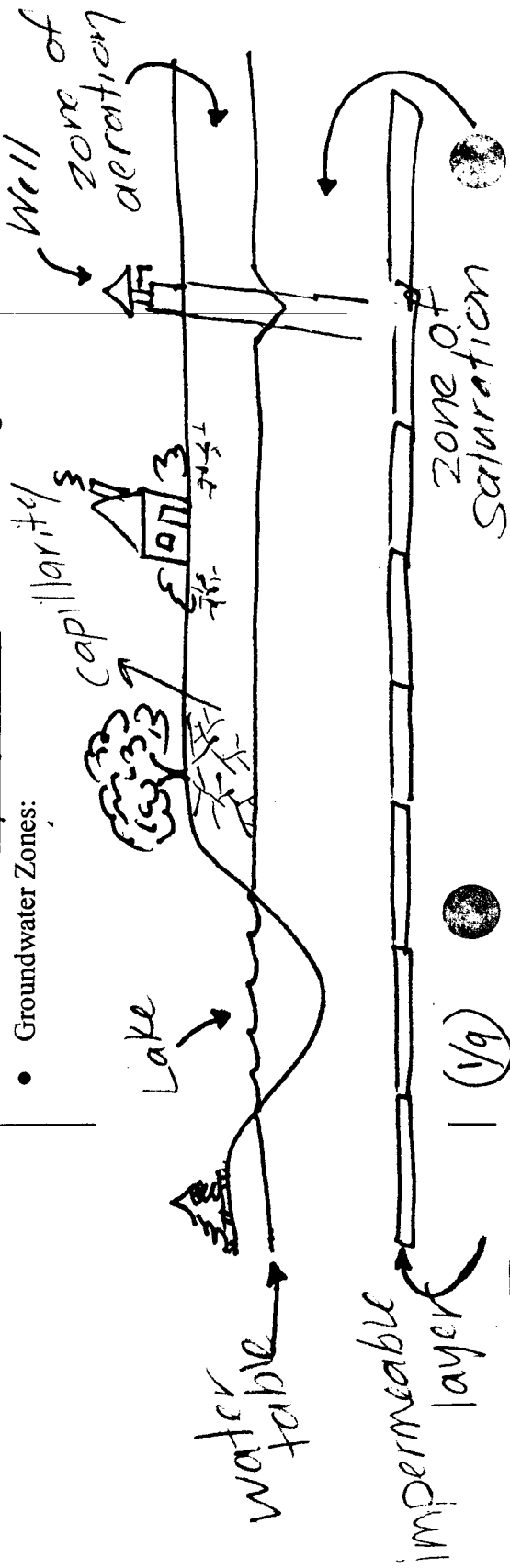
Unit 4 Notepacket
 Climate
 E. Science



I. The Water Cycle



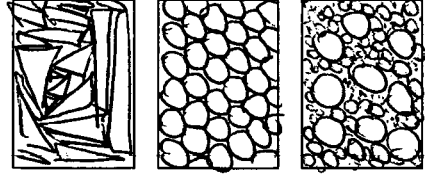
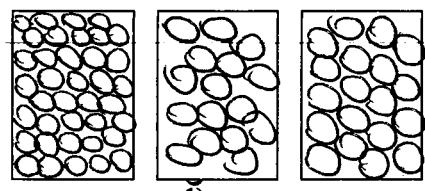
- Also called the hydrologic cycle
- It is the recycling of water between the oceans, atmosphere, and the land.
- The Earth has a limited supply of water.
- Approximately 70-75% of the Earth's surface is covered with water (salt water).
- The amount of precipitation that seeps into the ground or runs off is influenced by climate, slope, soil type, rock type, vegetation, land use, and degree of saturation.
- Precipitation returns water to the land and oceans.
- Evaporation returns water to the atmosphere.
- transpiration is the evaporation of water from vegetation, this also returns water to the atmosphere.
- infiltration is water soaking into the ground
- This water becomes stored in the soil as groundwater.
- run off is water flowing along the surface of the Earth.
 - This occurs when:
 - The ground is already soaked.
 - There is too great of a slope to allow water to soak in.
 - It is too cold outside.
 - When there is a flood.
- groundwater is water below the water table.
- Groundwater is filtered as it moves through the rock and soil
- Groundwater Zones:



III. Factors Affecting Water Movement

- A. Slope of the land. The steeper the slope, the less infiltration.
- B. Degree of Saturation. The more saturated, the less infiltration.
- C. Porosity is the percentage of open space (pores and cracks) in a material compared to its total volume.

The greater the porosity, the greater the infiltration



- These things affect porosity:
 - shape - well-rounded particles have greater porosity than angular or plate-shaped particles
 - Packing - the more closely packed the particles, the lower the porosity.
 - Sorting - If all the particles in a material are about the same size, they are said to be sorted. The more sorted the particles, the less the porosity.

D. Permeability is the ability of a material to allow fluids such as water to pass through it.

- This depends of the:
 - shape of the pores
 - how well they are connected
 - if the rock is Cemented together
 - how well the particles are sorted.
- Impermeable means that the water can not flow through.

E. Capillarity is an attractive force between water molecules and the soil or rock surrounding it.

This works against gravity and moves water upwards to the plant roots.

The smaller the soil/rock particle, the greater the capillarity.

The more vegetation, the more infiltration.

G. Land Use is how the land is used by people

Roads, parking lots, and building cover the ground and water can not infiltrate

III. Runoff and Stream Discharge

- Surface runoff can occur when:
 - The rate of precipitation exceeds the permeability rate.
 - The pore spaces of loose material or rock is saturated with water.
 - The slope of the surface is too great to allow infiltration to occur.
 - The water on the surface has not melted.
- Most runoff will eventually flow into a stream.
- The greater the runoff, the greater the amount of stream discharge there is.
- Stream discharge is the volume of water flowing past a certain spot in a stream in a specific amount of time (cubic meters per second).
- Flooding occurs when:
 - a stream overflows from its normal channel
 - when the rate of precipitation exceeds the rate of infiltration
 - there is a storm surge from a hurricane
 - coastal storms
 - rising sea level or sinking land
 - tides moving water onto the land
- Flooding safety: move to higher ground and have a citywide evacuation plan.

IV. Insolation

Means **INcoming SOLar RADiation**

- It means the same thing as Sunshine.
- It is the sun's electromagnetic energy that reaches the Earth.
- This type of energy has relatively short wavelengths (short - wave).
- Energy from insolation is transferred to the atmosphere and the Earth's surface.
 - This energy transfer is influenced by cloud cover, rotation, mountain ranges and oceans.
- See the Electromagnetic Spectrum Chart on page 14 of your reference tables

Sunshine
Electromagnetic energy
Solar radiation
Short-wave radiation

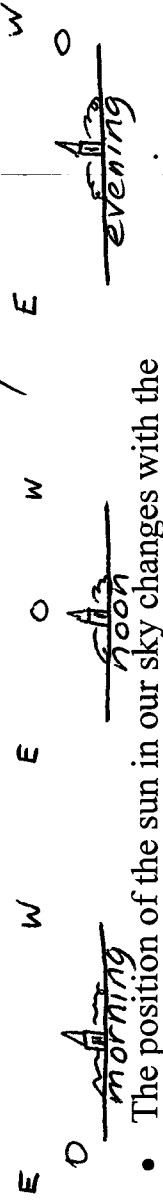


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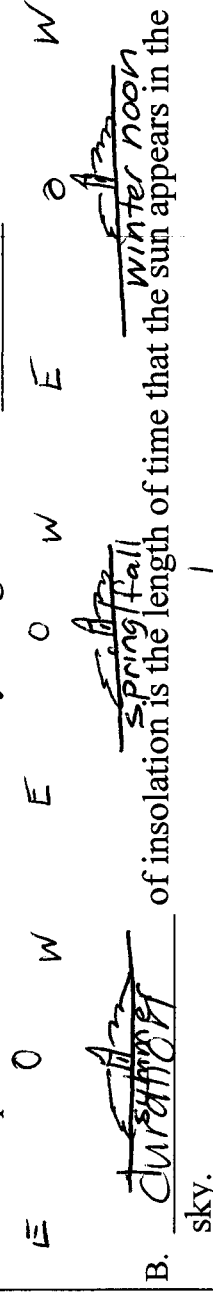
V. Intensity of Insolation

Depends upon the following:

- A. The angle of the sun in the sky has an effect the intensity of insolation.
- The more perpendicular the sun is to the earth (the higher in the sky, 90° angle above the horizon), the greater the intensity.
 - The angle of the sun in the sky changes day.



- The position of the sun in our sky changes with the day.



- B. Duration of insolation is the length of time that the sun appears in the sky.

- The longer the sun shines, the greater the temperature.
- We (in the Northern Hemisphere) have the greatest duration of insolation on June 21.
- We have the least duration of insolation on Dec 21.

C. Absorption of insolation

- Higher energy radiations (γ , x) are absorbed by ozone, carbon dioxide, and water vapor in the atmosphere.
- Visible light readily penetrates the Earth's surface.
- At the surface, visible light is scattered, refracted, and reflected.
- Water heats up (and cools down) slower than land does because:
 - Water has a higher specific heat.
 - Specific heat is the amount of energy it takes to raise one cubic centimeter on degree Celsius.
 - Water reflects light more than land does.
 - Since light can penetrate into a depth of water, it is heating a greater Volume of water than it is of land.

D. Reflection of Insolation

- Clouds reflect 20-25 % of insolation.
- Clouds can also absorb 15-30 % of insolation
- The lower the angle of insolation, the greater the reflection.
- More reflection occurs when the land is light in color or covered by snow or ice.

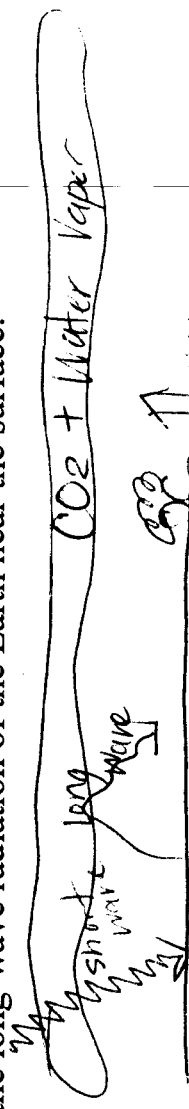
VI. Terrestrial Radiation

Energy given off by Earth
Terrestrial radiation
long-wave radiation
Infrared

- It is the energy that the Earth gives off.
- The part of the Earth that has SUNSHINE receives more energy than it gives off.
- The part of the Earth that has night time gives off more energy than it receives.
- This type of energy given off from the Earth has relatively long wavelengths.
- It is called long-wave radiation. (Infrared)

VII. The Greenhouse Effect.

- The gases in the atmosphere (Carbon Dioxide and Water Vapor) let the short-wave radiation of the sun pass through but trap the long-wave radiation of the Earth near the surface.



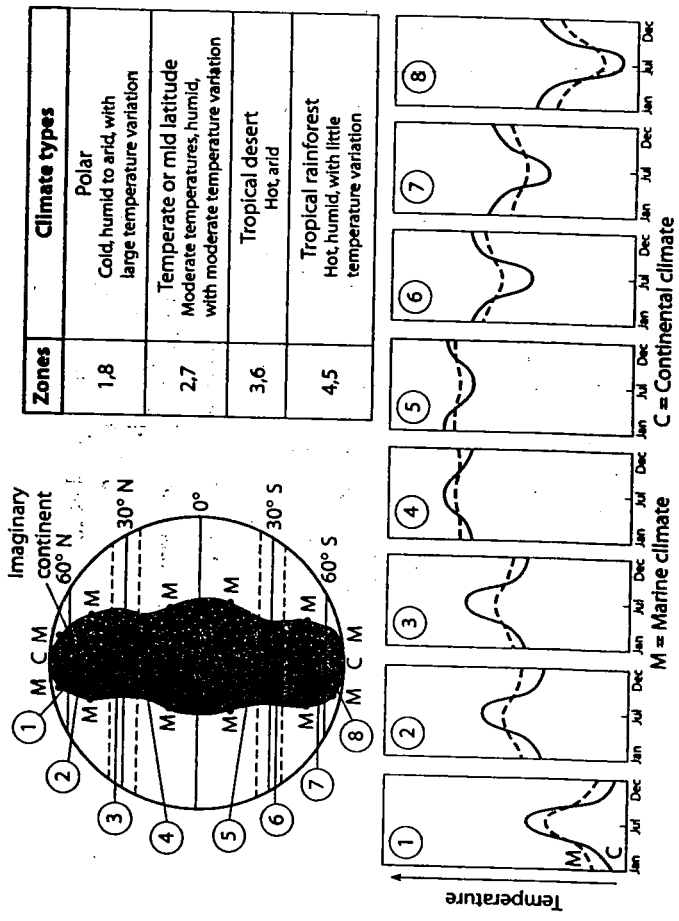
- The greenhouse effect happens all over the Earth and makes the Earth a comfortable place to live.
- Some scientists think that there may become too much CO₂ in the atmosphere and that the temperatures on Earth will become higher. Burning fossil fuels
- Why would there be too much Carbon Dioxide? + deforestation

VIII. Climate

- Climate is the atmosphere conditions for a large area over a large period of time.
- Can be classified by looking at the temperature and amount of precipitation
 - How much water coming down to the Earth compared to the amount of water going back up into the atmosphere.
- The average temperature on Earth is the result of the total amount insolation absorbed and the amount of long-wave radiation radiating back out into space.
- Global climate is affected by the interaction of solar energy with the Earth's surface and atmosphere.

Notice 2 things
 ① Seasons are opposite in the Northern + Southern hemispheres.

② Oceans have a moderating effect -
 - Not too hot in Summer
 - Not too cold in winter



IX. Factors Affecting Climate

A. Latitude and Climate

- The lower the latitude, the higher the temperature.
- The lower the latitude, the lower the yearly range in temperature.
- The lower the latitude, the lower the daily range in temperature.

Kept from extreme

B. Large Bodies of Water

- Large bodies of water influence the climate.
- If a landmass is near a body of water its temperature will be moderated by the slow heating and cooling of water.
 - Water stays cooler longer (in the spring) so the land near it will be cooler.
 - Water stays warmer longer (in the fall) so the land near it will be warmer.

C. Prevailing Winds (also called planetary or global winds)

- Prevailing are movements of air over the Earth's surface that blow in the same direction most of the time.
- Make weather systems move from West to East across the U.S.
- The West Coast has a more marine climate because they get winds coming from the ocean.
- These winds make us get lake effect snow coming from Lake Ontario and Lake Erie.
- Also causes warm southern air to come our way in the summer.

- monsoons are the weather changes caused by the seasonal shifts as the prevailing winds shift with the seasons. The are usually associated with the wet summers in Asia.

D. Surface Ocean Currents

- See the ocean current map in your reference table page 4.
- Currents flowing away from the equator carry warm water (and air) to the higher latitudes.

E. Elevation is the distance above sea level

- Higher elevations have lower temperatures.
- Higher elevations have a greater chance of precipitation.



F. Mountains

- Can change the climate by affecting the wind patterns.

Orographic Effect

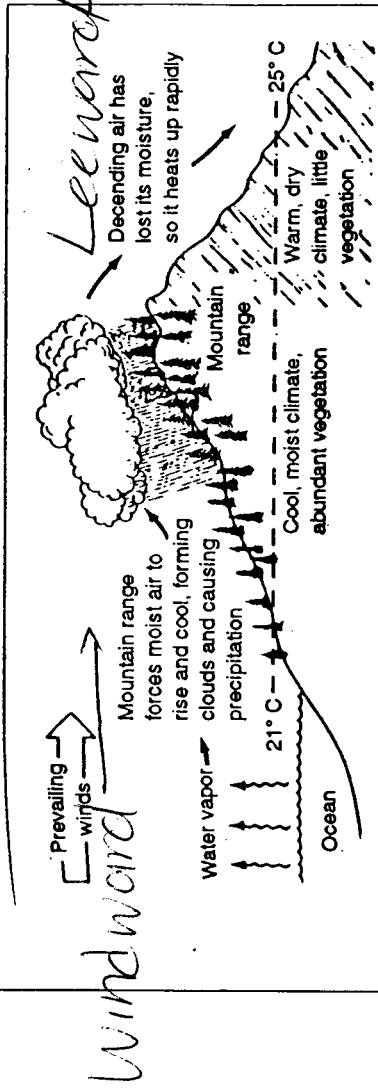


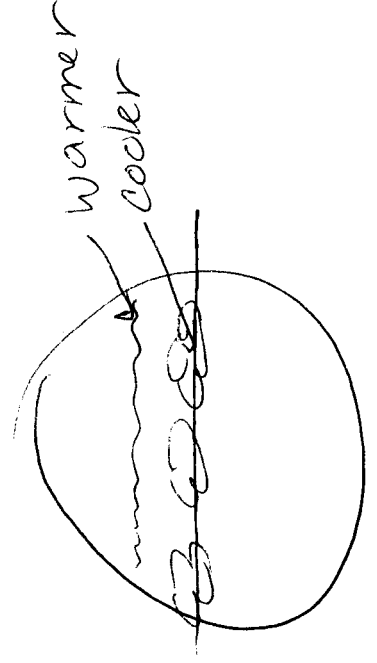
Figure 7-21. Climate differences on opposite sides of a mountain range. As air rises up the windward side of a mountain, condensation slows the adiabatic cooling of the air. But, on the leeward side, the dry air warms very quickly, making a hot desert climate.

G. Vegetation

- When rainforests are cut down, there is less water transpiring into the atmosphere and the area becomes hotter and drier.

H. Cloud Cover

- Areas with a lot of clouds (like the Equator) are cooler than areas without a lot of clouds (like the deserts at about 30° latitude).



X. Climate and Change

- Periods of warmer and cooler temperatures suggest that the Earth had climate changes that were probably caused by long period of heating imbalances.
- Average temperatures may have been significantly warmer at times in the distant past.
- Throughout geologic time, ice ages occurred in the mid ~~high~~ latitudes.
- Human influences including deforestation, urbanization, and the production of greenhouse gases have changed our climate.

XI. Energy and Climate

- The Earth may be considered to be a huge machine that is driven by two engines.
 - An internal heat engine: radioactivity, friction, heat left over from formation
 - An external heat engine: SUN
- Both heat engines convert heat energy into radiant energy.
- Energy is transferred between the Earth's surface and atmosphere by:
 - Radiation — movement of energy through the air
 - Conduction — movement of energy through solids
 - Convection — movement of energy through fluids
 - Evaporation — liquid → gas, needs heat energy to break bonds, absorbs heat, cools you
 - Condensation — gas → liquid, gives off heat



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