

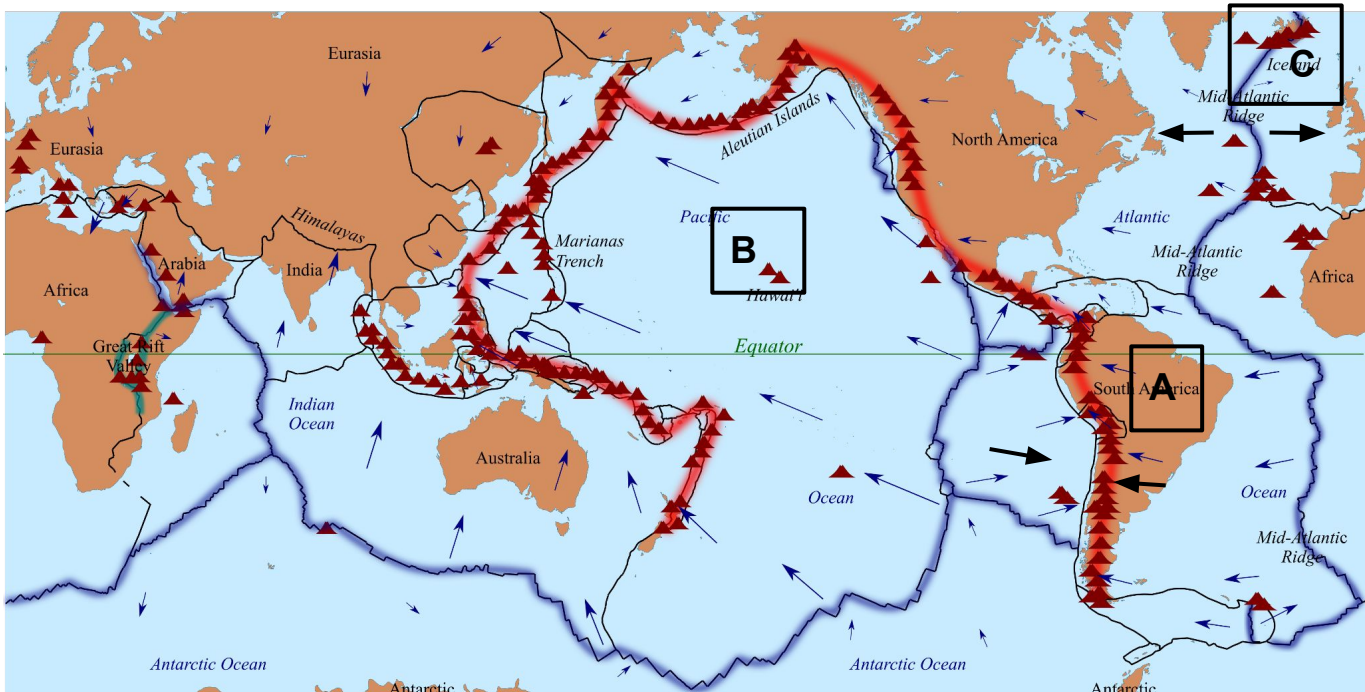
APES Unit 4 Study Guide

Ultimate Review Packet (4.1)

4.1 - Plate Tectonics

- a. **Describe** the makeup and movement of tectonic plates. **rock slabs or pieces of Earth's lithosphere, floating on top of molten magma beneath (the mantle). Movement of magma beneath the lithosphere determines tectonic plate movement**
- b. Complete the table below to review the three types of plate boundaries

Boundary	Description	Locations & Landforms
Divergent	Plates moving away from each other due to rising magma beneath, pushing them apart	Ocean floor, (mid Atlantic) leading to sea floor spreading, mid-oceanic rifts, volcanic islands
Convergent	Plates moving toward each other, colliding, with more dense plate subducting beneath	Continental-oceanic plate boundaries (W. coast of S. America); volcanoes, mountains, offshore trenches. Continental-continental (Himalayas)
Transform	Plates sliding past each other in opposite directions, edges catch on each other causing locked faults	W. coast of N. America, fault zones, earthquakes (energy released when pressure overcomes friction of locked fault)



- c. **Describe** how the Andes Mountain Range (A) was formed, using evidence from the map above. **The convergent plate boundary along the west coast of S. America lead to the subduction of the oceanic plate beneath the continental plate, forcing upfolding of continental lithosphere.**
- d. **Explain** the difference between the formation of the volcanic Islands at locations (B) and (C). **Islands at location B were formed by a hot spot, a particularly hot portion of the mantle where magma rises through the lithosphere. Islands at location C were formed by magma rising to the surface at a divergent plate boundary, rather than directly through the lithosphere.**

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Ultimate Review Packet (4.2 - 4.3)

4.2 - Soil Formation

- Identify** THREE abiotic components of soil sand, silt, clay, N/P/K, water, oxygen, carbon dioxide, pebbles/rocks
- Identify** TWO biotic components of soil fungi, bacteria, insects, earthworms, roots, dead organic matter, detritivores, viruses, humus
- Explain** how weathering of parent material impacts soil formation weathering of parent material is the breakdown of rock layers underlying soil by water, wind, and freeze-thaw cycle. This process contributes to soil formation. Parent material composition can also impact soil qualities, such as a limestone or calcium carbonate-containing parent material giving rise to high pH, calcium-rich soil
- Describe** the process of soil erosion soil erosion is the transportation of topsoil from one location to another by wind, rain, or biological activity such as animal burrowing or tree root growth
- Describe** the composition of the A horizon of soil the A horizon, sometimes referred to as top soil is made up of both organic matter from the O horizon and mineral matter like sand, silt, and clay
- Explain** a non-agricultural benefit that soil provides to humans soil provides ecosystem services like water filtration by trapping pollutants in runoff, enabling clean water to recharge groundwater reservoirs below. It can also sequester carbon, mitigating climate change.

4.3 - Soil Properties

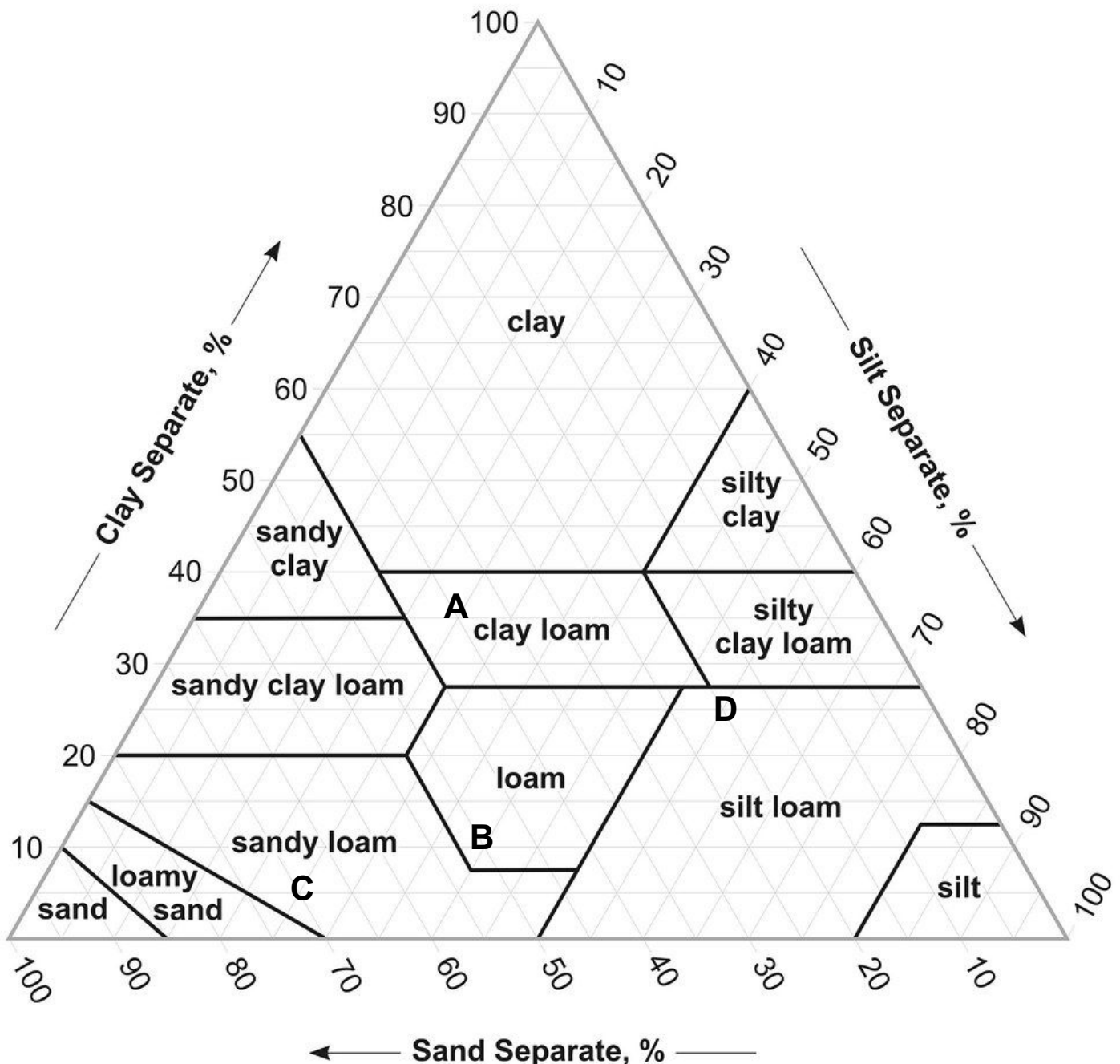
- Define soil texture the percentage of sand, silt, and clay found in a soil
- Describe** a method to measure soil texture soil samples can be placed in a jar of water, shaken up, and then allowed to settle out by particle size. The depth of each layer can be measured to determine the % of the sample that each particle type makes up
- Explain** the relationship between soil texture and water holding capacity The greater the percentage of clay in a soil sample, the greater the water holding capacity. This is because clay is the smallest particle, so it packs together more densely and is less permeable
- Identify a chemical characteristic of soil quality and **explain** how this characteristic relates to soil fertility. pH measure the acidity/alkalinity/H⁺ or OH⁻ ion concentration of a soil. Soils with a low pH will hold fewer nutrients and have lower fertility, or ability to support plant growth N/P/K/ ammonium/nitrate level of the soil determines the availability of key plant nutrients needed to support growth, so higher levels of these nutrients would lead to higher fertility
- Students conduct an experiment to measure the fertility of different soil samples. For each soil sample, they measure the depth of the O horizon and collect 500 grams of the soil in identical pots. The students then plant 10 mung bean seeds in each soil sample and water the soil with 80 mL of water each day for two weeks. At the end of the study, the students record the average height of each mung bean sprout in each pot to calculate an average.
 - Identify** a possible hypothesis for this experiment the greater the amount of organic matter in the soil sample, the higher the average height of mung bean seeds will be
 - Explain** how the results of the study might change if one soil sample was heated to 100° F for a week prior to planting mung bean seeds in it. The sample that was heated before planting would likely lead to higher average plant growth the before as decomposition of organic matter and release of nutrients occurs faster at higher temp.

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Ultimate Review Packet (4.3 continued)

4.3 - Soil Properties

- Make a claim** about which soil sample below would have the highest nutrient levels. **Justify** your claim and **identify** the texture of that soil. **Sample A would have the highest nutrient levels since it has the highest proportion of clay. Clay particles have a negative charge and bind to many positively charged plant nutrients, preventing them from being leached from soil**
- If each soil sample below were placed in a plastic column and 10 mL of water poured through each column, **make a claim** about which sample would allow the water to drain through the column the fastest. **Justify** your claim and **identify** the texture of that soil. **Sample C would allow water to drain through the fastest because it has the highest percentage of sand, making it more permeable due to the large particle size of sand**



APES Unit 4 Ultimate Review Packet (4.4 - 4.6)

4.4 - Earth's Atmosphere

- List** the four most abundant gasses of Earth's atmosphere, from most to least abundant.
Nitrogen ~ 78% Oxygen ~ 21% Argon ~0.93% Water vapor ~ 0-4%
- Describe** the importance of the stratosphere to life on earth
The stratosphere contains the largest concentration of ozone molecules, which absorb UV-B and UV-C rays, preventing damage to the skin/eyes/DNA mutation of organisms on earth
- Identify** the relationship between temperature and altitude in the troposphere
Inverse relationship: as altitude increases in the troposphere, temperature decreases
- Identify** the layer of Earth's atmosphere in which charged gas molecules are heated by intense solar radiation
The thermosphere (this effect is referred to as *aurora borealis* or Northern Lights)

4.5 - Global Wind Patterns

- Explain** how the distribution of solar radiation across earth's surface is responsible for the pattern of air circulation known as a Hadley Cell. Because solar radiation is most intense at the equator, the air near the equator is warmed more than air at higher latitudes. This causes that air to rise away from earth's surface and spread poleward/away from the equator, before sinking back down to earth's surface near 30° N/S
- Explain** how the Coriolis effect is responsible for the Eastern Trade Winds in the northern and southern hemispheres. As descending air from the Hadley cell comes back down to earth at 30° N/S, it begins to flow back toward the equator toward the low pressure conditions created by warm air rising at the equator. As it flows across earth's surface, earth's rotation from west to east gives winds in this direction an east to west deflection, resulting in the Eastern Trade Winds
- Explain** why 30° N and S experience drier, higher pressure conditions than the equator. As the air near the equator rises it cools, and much of its moisture condenses and falls as precipitation. As it expands poleward, it cools further, and eventually sinks back down to earth around 30° N/S. Because this dry, dense air mass is descending down toward earth's surface, it created dry, high pressure conditions at these latitudes

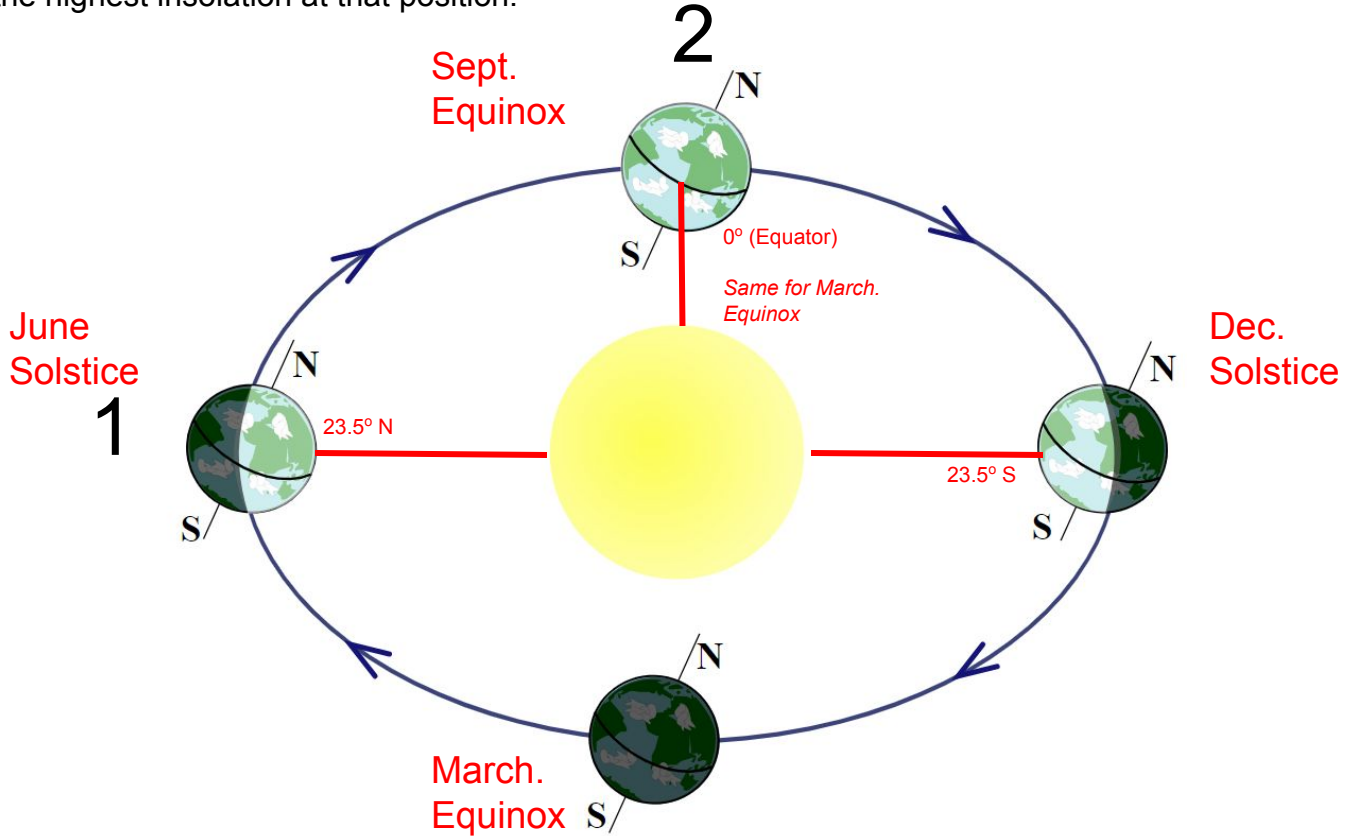
4.6 - Watersheds

- Describe** the relationship between vegetation density and water infiltration rate in a watershed. The more dense the vegetation in a watershed, the higher the rate of infiltration as the roots of plants make soil more permeable
- Describe** TWO changes in water quality that would be likely to occur in a watershed that has been clearcut. (1) Water would become more turbid/sediment polluted or filled as the loss of root structure loosens soil (2) water would be warmer due to the loss of shade provided by tree canopy/the increase in turbidity and decrease in albedo (3) nutrient levels may increase due to sediment influx/agricultural or urban runoff increase with loss of vegetation to absorb/filter runoff
- Describe** how the slope of a watershed could impact the turbidity of its surface waters. The steeper the slope of a watershed, the lower the rate of water infiltration into the soil and the greater the percentage of precipitation that becomes runoff and carries sediments into surface waters
- Identify** an urban pollutant and **describe** how that pollutant could be carried into the central body of water in a watershed. Motor oil/antifreeze/sediment/sand/salt/garbage or physical waste can be carried from impervious urban surfaces by stormwater runoff entering storm drains and emptying into the central body of water or tributaries of that central body

APES Unit 4 Ultimate Review Packet (4.7)

4.7 - Solar Radiation and Seasons

- a. **Define** insolation and **identify** the units used to measure it: **the amount of incoming solar radiation reaching a specific area measured in watts/m²**
- b. **Describe** the two factors that determine why the equator receives more insolation than higher latitudes (1) **the equator experiences a higher angle of incidence/more perpendicular direction for incoming solar rays, resulting in higher concentration of energy/m² than at higher latitudes** (2) **the sun's rays pass through less atmosphere at the equator than they do at higher latitudes, resulting in less absorption/deflection of solar radiation by atmospheric gasses**
- c. **Explain** how the angle of Earth's axis is responsible for seasonal changes **As Earth orbits the sun, it remains tilted ~ 23.5° on its axis, causing the northern/southern hemispheres to experience periods of being tilted closer or further away from the sun, receiving more/less insolation**
- d. Label the June Solstice, December Solstice, March Equinox, and September Equinox on the diagram below.
- e. Draw a line from the sun to each of the 4 positions of Earth to indicated the latitude that receives the highest insolation at that position.



- f. **Make a claim** about the whether the length of day at 60° N latitude is longer in position 1 or position 2 in the diagram above. **Justify** your claim. **Day length at 60° N would be longer in position 1 as the northern hemisphere is maximally tilted toward the sun, receiving the most direct insolation and the longest day of the year for northern latitudes.**

APES Unit 4 Ultimate Review Packet (4.8 - 4.9)

4.8 - Earth's Climate and Geography

- a. **Describe** the difference between the windward and leeward side of a mountain **the windward side of a mountain is the side facing into the wind, while the leeward side of a mountain is the side facing away from the wind**
- b. **Explain** the rainshadow effect **as air is blown toward the windward side of a mountain, it rises up over the mountain and cools as it rises in elevation. This causes its moisture to condense and fall as rain, leading to heavy precipitation on the windward side of a mountain, especially close to large bodies of water where wind is carrying excess moisture. As the air descends down the leeward side of the mountain, it's much drier, creating arid, high pressure systems on this side**

4.9 - El Nino and La Nina

- a. **Identify** the region of Earth where ENSO or the El Nino Southern Oscillation occurs **Equatorial/tropical pacific ocean**
- b. Fill out the chart below to review the normal conditions in the region where ENSO occurs

Normal Conditions	Trade Wind Direction: East to west	Pressure & Weather Conditions of Americas: Cooler, drier, higher pressure systems	Pressure & Weather Conditions of Australia & SE Asia: Warmer, rainier, lower pressure systems
		Upwelling brings cold, deep ocean waters up to the surface along the west coast Surface sea temp: colder	Eastern trade winds blow warmer surface waters to the west Surface sea temp: warmer

- c. Fill out the chart below to review the El Nino conditions in the region where ENSO occurs.

El Nino Conditions	Trade Wind Direction: Weakened or reversed (W → E)	Pressure & Weather Conditions of Americas: Warmer, rainier, lower pressure systems Eastern trade winds blow warmer surface waters to the west, suppressing upwelling Surface sea temp: warmer	Pressure & Weather Conditions of Australia & SE Asia: Warmer, drier, higher pressure systems Drought conditions, loss of cloud cover & more evaporative loss Surface sea temp: warm

- d. **Describe** the process of upwelling and **explain** why El Nino conditions suppress upwelling off the west coast of South America. **Upwelling occurs along the coast of a body of land as winds move warm ocean surface waters away from the body of land and cold water from deeper in the ocean rises to the surface. Because El Nino events feature weakened eastern trade winds or reversal of these winds, warm ocean surface water pools up along the west coast of South America, preventing colder, more dense water from rising up to the surface from below.**
- e. Pick TWO of the conditions from the charts above and **describe** how a La Nina event impacts those conditions. **Strengthening of the eastern trade winds, stronger upwelling along S. America, cooler surface water temperature (especially in eastern Pacific), higher precipitation in SE Asia/Australia, drier/drought-like conditions in western South America**