1. Describe some of the factors that influence the rate of rock weathering.

- In soil sciences soil formations go through initial rock weathering than “further” weathering over time. This is important to notice in soil formation because one rock weathering factor from long term weathering will not be the only weathering in soil formation through time. The current weathering of rocks from physical, chemical, and biotic activity affects soil formation even after the soils were initially formed after historical events such as glacier meltings.

- Physical weathering: wind, water, ice, roots, glacial activity

- Rock type (parent material) influences erosion rate. For example, calcite quickly erodes when exposed to acids, while clay-based parent materials often weather more slowly.

- Chemical weathering: hydration, hydrolysis, dissolution, and acid reactions

- Temperature/climate: Rocks exposed to sun heat up and cool down daily, which expands and contracts the minerals within the rock. Similarly, hot weather (such as the tropics) and high rainfall often increases chemical weathering.

- Biotic activity: vegetation, herbivory, and microbes can increase or decrease erosion rate.

2. Describe the major processes that occur during chemical weathering of rocks.
i. Hydration: transformation of a mineral into another type of mineral due to the binding of water molecules

ii. Hydrolysis: water molecules split into hydrogen and hydroxyl, and the hydrogen replaces a cation from the mineral structure.

iii. Dissolution: water hydrates cations and anions in a mineral, disassociating them from each other and surrounding them with water molecules.

iv. Acid reactions: accelerate weathering by increasing the activity of hydrogen ions in water.

- Chemical weathering is important because it can effect the conditions of soil formation by altering Parent Material, rate of reactions dependent on the Climate, Topography, and Biota productivity from environment created to allow biological processes to occur.

3. How various kinds of parent material are formed, transported, and deposited?
-Another key point in soil formation is that parent materials came as deposits to many land masses after the Ice Age when huge ice deposits on continents began melting and releasing the different parent materials onto the soil below huge ice glaciers.

4. What are the non biological factors that control soil formation?
- **Climate**: Precipitation and Temperature: enhances chemical weathering and biological processes

- The regolith layer in a land formation will have a further depth before hitting bedrock in areas that have had more precipitation and higher temperatures due to latitude. Therefore soil horizons go much further into the Earth in areas with higher precipitation and temperatures.

- **Topography**: Topography: influences soils through its effect on hydrologic pathways and transport of soil material. Also the history of parent material formation from physical and chemical weathering can affect the geographic landscape and from that the nutrient flow through land.

- Catena: Hillslope complex. Characteristics such as soil depth, texture, and mineral content vary with hillslope position. This is from the geologic timeline of rock weathering in areas and the accumulation of minerals or soil types to specific regions in a slope.

- **Time**: Many soil-forming processes occur slowly, so the time over which soils develop influences their properties.

- Soils amount of time that physical and chemical weathering has gone through will affect how well nutrients like Nitrogen and Phosphorus will stay in soil over time due to the level of weathering that has occurred in a soil region. Having soil that is too weathered or not weathered enough can affect nutrient controls in the soil and are more prone to not sustaining nutrients over time.

5. **What are some ways that parent materials alter the characteristics of soils?**

- Influence the texture and structure from the different ways deposits form at landforms.
Material deposits come from water, wind, ice, and gravity and can decide the mineral land formation materials due to accumulation over time.

- Parent material such as limestone contains CaC0₃, reducing acidity when eroded into surrounding soils.

- Can speed or slow the rate of soil formation based on structure.

6. What roles do plants, animals, and microbes play in soil formation?

Plants can increase or decrease the rate of soil formation; they can help create more organic matter and wind/rain protection over time by covering parent materials, but roots can also break apart rocks. Herbivorous animals eat plants and can alter plant structure. Microbes provide an important chemical role in weathering minerals.

7. How is loess formed and what are its properties?

When glaciers recede, they leave behind loess, which is a mostly silty material that can be blown by the wind for great distances. Loess often covers large areas of land and is generally highly fertile but is also susceptible to erosion by wind and water.

8. How does weathering take place through a process of oxidation?

- Minerals in a rock react to oxygen and as a result the composition of the rock is changed.
-This change of oxidation is through oxidation-reduction chemical weathering reactions. This can be seen as the breakdown of carbonate rocks to create different rock types, and also create new characteristics of parent material aggregates via oxidation. Major minerals such as Ca, Mg, K, P, and Fe go through high rates of weathering and can become readily available through oxidation-reduction chemical weathering reactions.