

UPSC Civil Services Examination

UPSC Notes [GS-I]

Topic: Chemical Weathering [Geography Notes for UPSC]

Chemical Weathering

- A cluster of weathering processes namely solution, carbonation, hydration, oxidation, and reduction.
- These processes act on rocks to decompose, dissolve or moderate them to a fine clastic state through chemical reactions by oxygen, surface/ soil water, and other acids.
- Water and air along with heat must be present to speed up all chemical reactions.

Solution

- When substances are dissolved in acids or water, then the water or acid with dissolved substances is called a solution.
- This process includes the removal of solids in solution and depends upon the solubility of a mineral in weak acids or water.
- Many solids disintegrate and mix up as a suspension in water as they come in contact with water.
- Some of the soluble rock-forming minerals like sulphates, nitrates, and potassium, etc. are affected by this process.
- Hence, these minerals are simply leached out without leaving any remains in rainy climates and accumulate in dry regions.
- Minerals like calcium magnesium bicarbonate and calcium carbonate present in limestone are soluble in water containing carbonic acid and are transported away in water as a solution.
- Carbon dioxide formed by decomposing organic matter along with soil water significantly assists in this reaction.
- Sodium chloride is also a rock-forming mineral and is vulnerable to this process of solution.
- Carbonation, oxidation and Hydration go hand in hand and accelerate the weathering process.

Carbonation

- Carbonation is the reaction of bicarbonate and carbonate with minerals.
- It is a general process helping the fragmentation of feldspars and carbonate minerals.
- Carbon dioxide from the soil and atmospheric air is absorbed by water to form carbonic acid that acts like weak acid.
- Magnesium carbonates and Calcium carbonates are dissolved in carbonic acid.
- These are removed in a solution without leaving any residue resulting in cave formation.

Hydration

- Hydration is the chemical addition of water.
- Minerals take up water and enlarge.
- This enlargement causes an increase in the volume of the material itself or rock.
- This process is long and reversible, sustained recurrence of this process causes fatigue in the rocks.
- This may lead to their disintegration of rocks.

Oxidation and Reduction

- In weathering, oxidation denotes a mixture of a mineral with oxygen to form hydroxides or oxides.
- Oxidation happens where there is ready access to the oxygenated waters and atmosphere.
- The minerals commonly involved in this process are manganese, sulphur, iron, etc.
- In the process of oxidation, rock fragmentation happens due to the disturbance caused by adding of oxygen.
- Red colour of iron upon oxidation turns to yellow or brown.
- When oxidised minerals are positioned in a situation where oxygen is absent, reduction occurs.
- Such circumstances exist commonly below the water table, waterlogged ground and in areas of stagnant water.
- Red colour of iron upon reduction turns to greenish or bluish grey.
- These weathering processes are interconnected.