

Mechanism of Precipitation -

◦ Precipitation Mechanism is related to how water droplets and ice crystals grow in size to fall through the atmosphere

◦ There are Two possible Mechanism

Bergeson's Process /
Ice Crystal Growth

Simpson-Langmuir's
Process / mechanism
of Collision-Coalescence/
Wake Theory

◦ ppt. in form of snowfall & snow can melt on the way down and fall as rainfall

◦ Happens in very cold conditions, winter, cold temperate latitude, high clouds which have below freezing points [cold cloud]

◦ Rainfall with large droplets

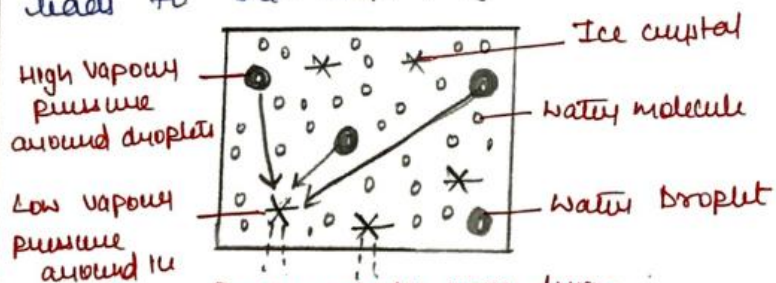
◦ Happens in Tropical areas, summer, low & middle clouds whose temp is above freezing point [warm clouds]

◦ strong convection - then this phenomenon can be associated with hail stones (Frozen droplets of water)

A] Bergeson's Method -

◦ Bergeson's Process - operates in the presence of Ice Crystal (called as Freezing Nuclei) act as condensation surface \therefore This process will only operate for cold clouds or clouds above icing height or icing layer.

◦ The ice crystals have the capacity of forcing more condensation on themselves that leads to Ice-Crystal growth.



[Water molecules move from droplets towards Ice crystal, Ice grows & falls down]

◦ Clouds which are super saturated & super cooled but if it lacks pre existing ice-crystal, Bergeron Process wont operate

◦ Here in artificial rain that involves Bergeron Process, super cooled & super saturated clouds are sprayed with artificial freezing nuclei like ice crystal, dry ice, silver Iodide that can force condensation & formation of ice crystal

② Impaction - Langmuir Mechanism / Collision - Coalescence Process / Wake Theory

◦ warm clouds (Temp. are above freezing point) such clouds don't have ice-crystals.

◦ Condensation nuclei are hygroscopic substance [attract water] such as salt crystals & dust particles & these are very very small that can resist falling.

With Turbulence, clouds are shaken and disturbed & minute water droplets collide & Coalesce to form large droplets.

Large droplets fall through the clouds. While falling they can attract more droplets because of wake process & droplets can grow even bigger & fall through atmosphere as large rain drops [Bernoulli's principle]

This process can also be used for Artificial rain instead of the natural way i.e., clouds are sprayed with salts to act as Hygroscopic Nuclei.

~~Artificial~~ Artificial rain was proposed for Delhi NCR for winter of 2023-24 because of high AQI pollution & AQI index > 700 for Delhi but project was shelved (not continue) as it was expensive, no assured results of rainfall & such pollution incident is temporary - any. The more better solution is reducing

pollution is reducing emissions \downarrow stubble
burning. India has had experimental
project for artificial rain to address
droughts but nothing significant to opt
for artificial rain as viable solution to
deal with droughts

