

What are different layers of atmosphere. On what basis these layers are classified. In which layers Auroras are formed and where do satellites orbit. (CSS-2023)

Atmosphere :

Atmosphere is the thin blanket of gases that surround the planet earth. These gases include

Fixed Gases	Variable Gases
Nitrogen - 78%	Carbondioxide - 0.03%
Oxygen - 21%	Ozone
Inert gases - 0.74%	Water vapours

Layers of Atmosphere :

Scientists have classified atmosphere into five distinct layers based on temperature variations. These layers are ;

- i- Troposphere
- ii- Stratosphere
- iii- Mesosphere

iv- Thermosphere

v- Exosphere

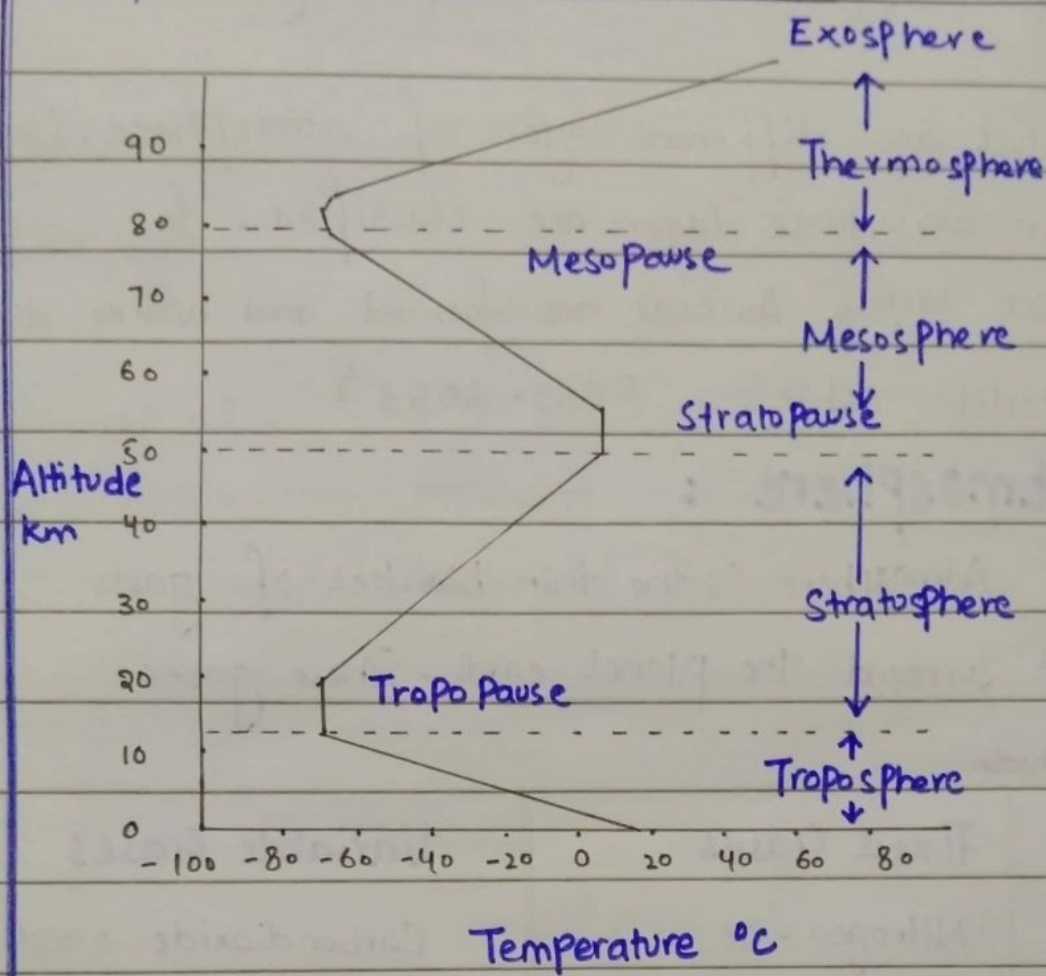


Fig 1 : Layers of Atmosphere

i- Troposphere :

The first layer of atmosphere is troposphere. It extends from the surface of earth to 12 km above surface. This is the layer of atmosphere that supports life and weather patterns. Commercial jets also fly within this layer. As we move up from troposphere

, the temperature and the air pressure decreases.

The decrease in temperature is upto -53°C .

ii - Stratosphere :

Stratosphere is the second layer of atmosphere. It extends from 12-50 km above the surface of earth. It is within this layer that Ozone layer exists. This layer protects the earth from incoming ultraviolet radiations, which otherwise are harmful for life on earth. It is because of presence of this layer and absorption of UV radiations, the temperature here increases dramatically up to -3°C .

Mesosphere :

Mesosphere is the middle layer of atmosphere. It extends from 50-80 km above the surface of earth. Meteors are destroyed within this layer. This layer absorbs no heat and is the coldest layer of atmosphere. The temperature declines to -73°C .

Thermosphere :

Thermosphere is the hottest layer of atmosphere. It extends from 80-700 km. It directly absorbs incoming radiations from

the sun - It is within this layer auroras are formed that are observed in the sky of polar regions. The temperature here exceeds 2000°C

v- **Exosphere :**

The outer most layer of atmosphere is exosphere. It extends from 700 to 10,000 km and blends into outer space. The temperature here varies. It is within this layer that satellites and space crafts are found.

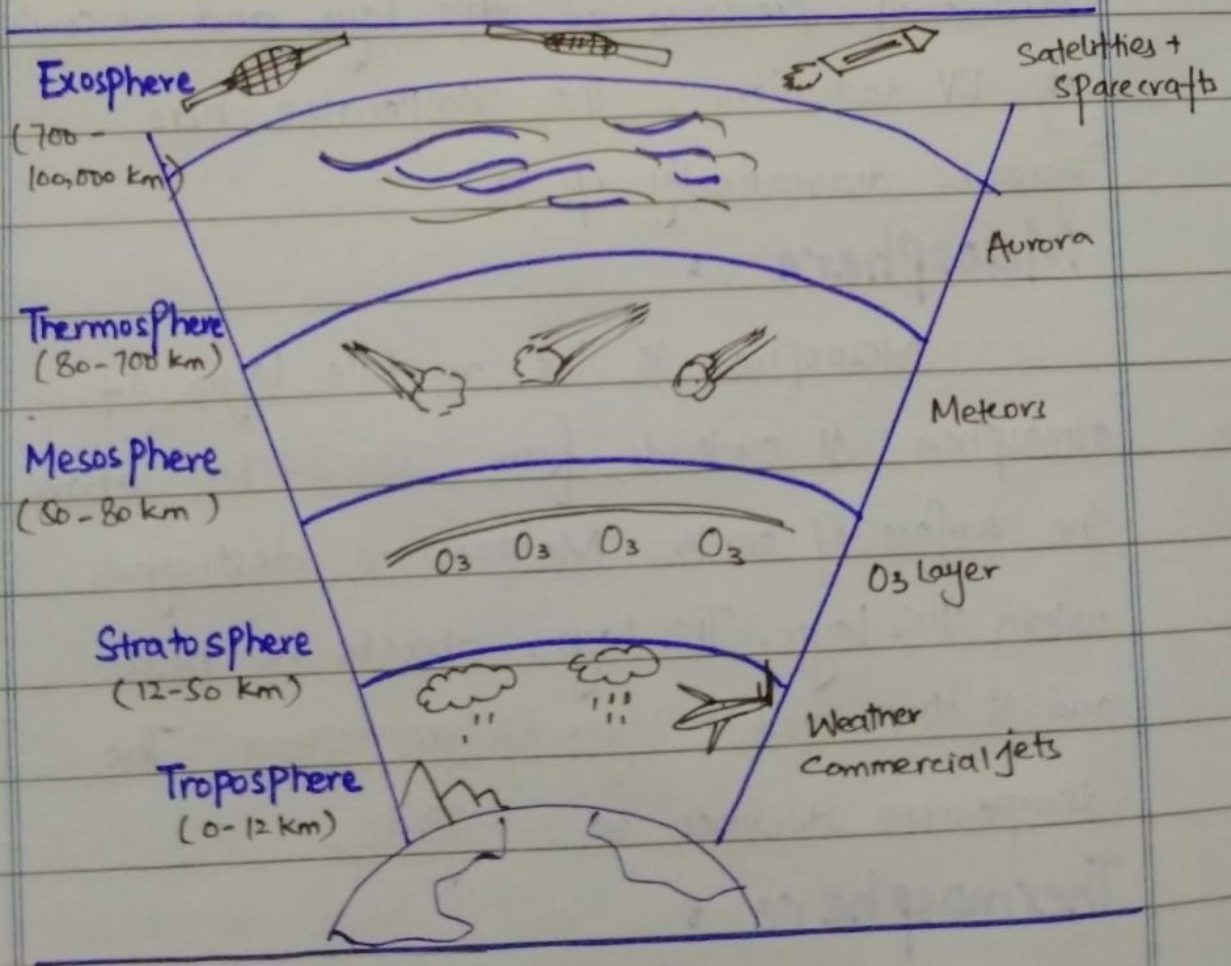


Fig : Layers of atmosphere + composition / function

Describe water cycle and briefly explain major processes involved in water cycle? (CSS-2021)

Water Cycle :

Water cycle, also known as hydrological cycle, refers to the movement of water from one reservoir to another that is from hydrosphere to atmosphere, lithosphere and back to hydrosphere. It is a cyclical process.

Major Processes Involved in Water Cycle :

The movement of water from one reservoir to another takes place through following processes:

- i- Evaporation
- ii- Transpiration
- iii- Condensation
- iv- Precipitation
- v- Surface run-off
- vi- Infiltration

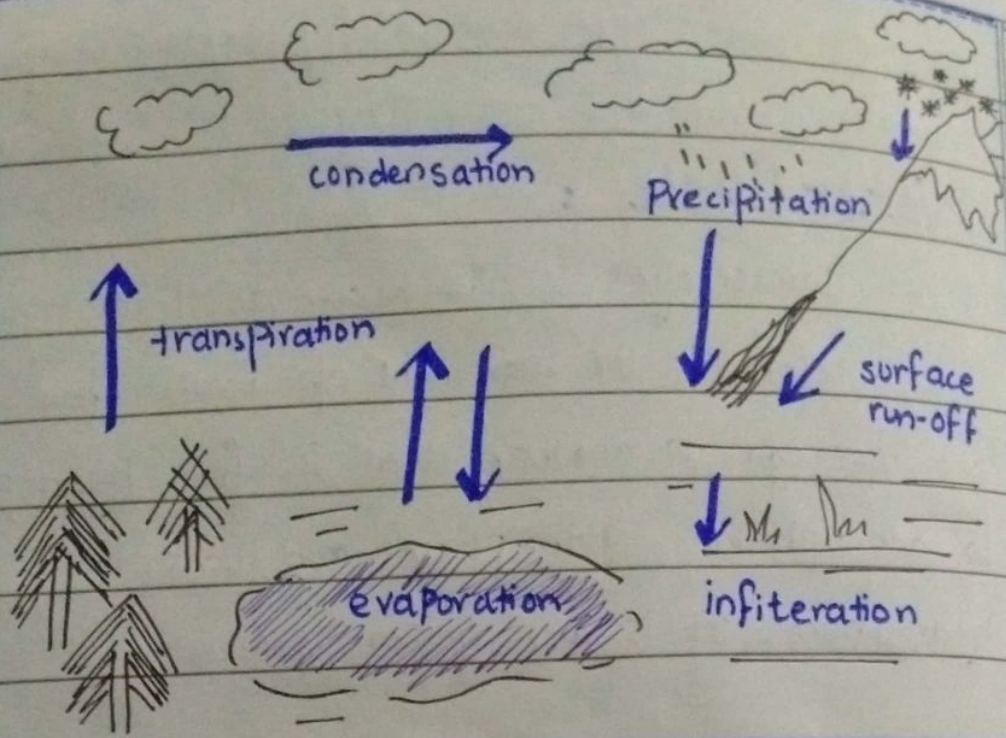


Fig 1 : Hydrological Cycle

Evaporation — Evaporation is the process by which liquid water changes into gaseous form i.e. vapours of water. When water bodies warm up, water is evaporated and moves into the atmosphere as water vapour. The rate of evaporation depends upon the temperature or heat absorbed.

Transpiration — Transpiration is the evaporation of water from plant leaves through small openings called stomata. As plant absorbs water from soil, it reaches from stems to

leaves and from there excessive water is removed via transpiration. Transpiration adds more water into the atmosphere.

Condensation — Condensation is the opposite of evaporation. It is the process in which water vapours change into liquid droplets. The small droplets are suspended into the atmosphere in the form of clouds or fog.

Precipitation — Precipitation refers to the fall of water particles from atmosphere to ground in the form of rain, snow, sleet or hailstorm.

Surface Run-off — Much of the water that falls to the ground runs-off into streams which later join rivers and finally reach to ocean, where a great deal of evaporation occurs. The run-off also carries nutrients and sediments along with it.

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Infiltration — Infiltration refers to the process whereby ground soaks the rainwater through soil and porous rocks. This helps in recharging ground water level.

Importance of Water Cycle :

Water cycle has a number of functions listed

as ;

- Purifies surface water by evaporation
- sustains life by providing fresh water
- helps in biogeochemical cycles
- recharges ground water - aquifers
- maintains temperature and climate

What is acid rain. Describe its causes and how it can be prevented? (CSS-2018)

Acid Rain :

Acid rain refers to rain or any other form of precipitation that is unusually acidic i.e it has high level of hydrogen ions. The pH of acid rain is less than 5.6.

Acid Rain Formation : Explanation

Acid rain is produced when gases such as oxides of sulfur (SO_x) and oxides of nitrogen (NO_x) are released into the atmosphere. These gases react with water vapours in the presence of sunlight and form acidic particles including sulphuric acid (H_2SO_4) and nitric acid (HNO_3). These particles fall to ground either as wet deposition (rain, snow, hail) and dry deposition (dust and smoke particles)

Acidic Gases & Their Sources :

Carbondioxide	Burning of fossil fuels , Industries , respiration
Methane	Landfills , wetlands , animals , Paddy fields
Oxides of Sulfor	Volcanoes , Ocean , burning of fossil fuels
Oxides of Nitrogen	Vehicles , fossil fuels industries

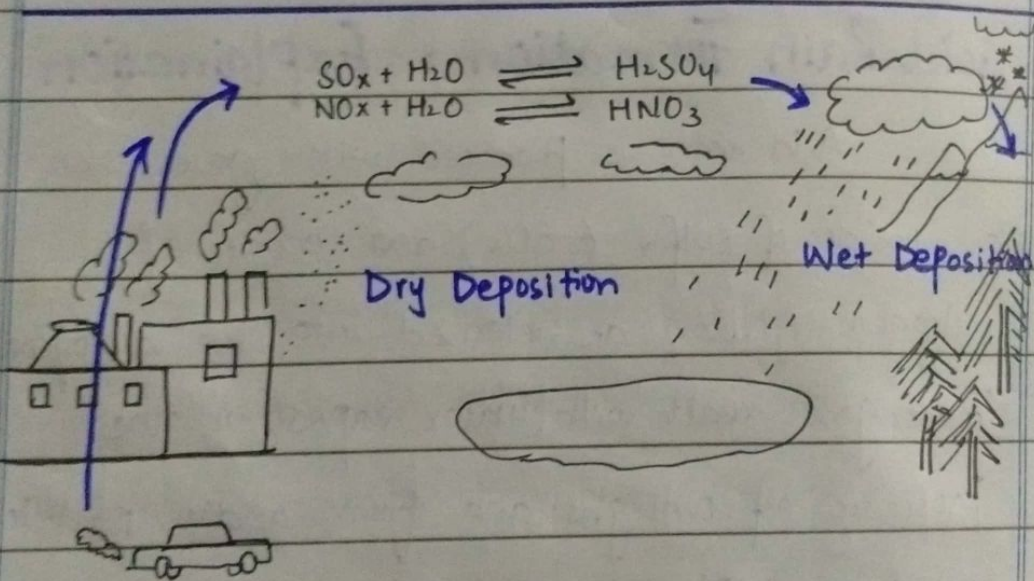


Fig 1 : Acid Rain

Effects of Acid Rain :

Acid rain can have damaging effect both on human health as well as environment.

Environment

- 1- Water Bodies and Aquatic Life — Acid rain turns water bodies (lakes, streams) acidic. At low pH most fish eggs do not hatch and many adult fish (trout) cannot survive in acidic water. Acid rain thus reduces aquatic biodiversity.
- 2- Soil — Acid rain damages soil structure and composition. It also affects soil nutrient holding capacity. Many soil microorganisms cannot survive in low pH.
- 3- Damages Vegetation — Acid rain damages forests by causing leaves to fall, stunted growth and damaged bark. The pollutants also damage stomatal opening thus plants cannot take oxygen properly.

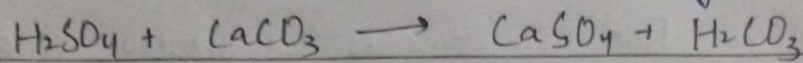
Human Health

Acid rain water is diluted and thus cause no direct harm to human health. However; the causative agents of acid rain such as SO_x , NO_x can have significant impact on human causing cardiac and respiratory problems such as asthma.

bronchitis, and damage to skin.

Historical Buildings & Monuments :

Acid rain can also damage historical buildings and monuments. The acidic components react with marble and lime and form powder like substance called gypsum that flakes away.



Many historical monuments such as Taj Mahal in India and Statue of Liberty have been damaged owing to acid rain.

Prevention of Acid Rain :

Acid rain can be prevented by taking significant measures to reduce emissions of SO_x and NO_x into atmosphere. The preventive measures can range from source control, use of pollution control technologies (PCTs) to shifting to alternate energy sources. A few preventive measures are listed as follows :

- 1- **Use of Alternate Energy** — Alternate energy resources such as renewables (solar, hydal, wind)

and biofuels can help a great deal in cutting emission of harmful gases responsible for acid rain in atmosphere.

2- **Better Quality of fuel** — Instead of using low quality fuel with high sulfur content, shifting to better quality fuel with low sulfur content is advisable. Similarly other measures such as coal washing, wet scrubber electrostatic precipitators can also reduce emissions. Natural gas is a better solution compared to fossil fuels since it produces less emissions.

3- **Catalytic Converters** — Use of catalytic converters in automobiles is another feasible method of reducing emissions. The use of metal coated beads converts harmful gases into less harmful gases.

4- **Liming** — Liming of soil also helps in reducing the damaging effect of acid rain on soil. However; this method is feasible only for a small scale use.

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5- **Policy Guidelines** — The formation of appropriate policies to control air pollution and emissions within a certain level also helps in curtailing the harmful effects of pollutants and their aftermaths.

6- **Public Awareness** — Educating the masses and creating awareness among general public regarding the harmful consequences of their careless actions can also help a great deal. Common eco-friendly practices include;

- Use of public transport
- Carpooling
- Reliance on renewables (solar/wind)
- Plantation