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## Insolation Solar Radiation: Objectives and Insolation (Solar Radiation)

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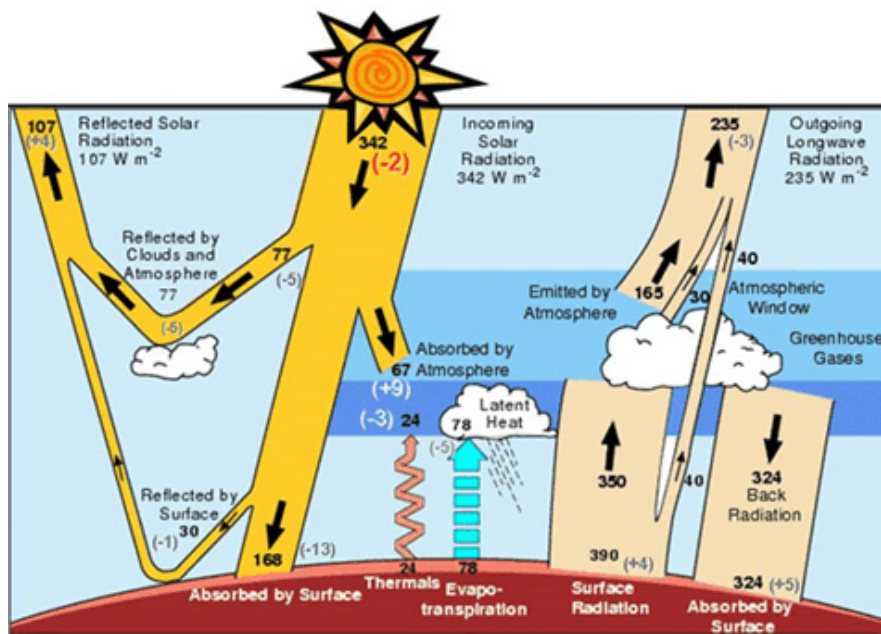
The Atmosphere Is Made Up of Different Types of Gasses, Water Vapour, And Dust Particles. Atmosphere Is Essential for Survival of Plant and Animal Life. They Also Require Optimum Temperature to Keep Themselves Warm and Grow. Let Us Now Study About the Source of Heat and Energy Received on The Surface of The Earth, How the Earth's Surface Gets Warm During the Day and Cool Down During the Night, and Other Related Phenomena.

### Objectives

The Major Objectives of This Chapter Are:

- To Explain the Importance of Insolation and Establish Relationship Between the Angle of Incidence of Sun's Rays and The Intensity of Heat Received from Them at A Place
- To Explain the Different Processes Involved in Heating and Cooling of The Atmosphere Such as Conduction, Convection, Radiation, and Advection
- To Explain the Heat Budget of the Earth
- To Differentiate Between the Solar Radiation and Terrestrial Radiation
- To Explain the Causes of Global Warming and Its Effects
- To Explain the Various Factors Affecting the Horizontal Distribution of Temperature
- To Explain the Main Characteristics of Temperature Distribution in The World in The Month of January And July With the Help of Map
- To Explain the Conditions in Which the Inversion of Temperature Occurs

### Insolation (Solar Radiation)



The Sun Is the Primary Source of Energy on The Earth. This Energy Is Radiated in All Directions into The Space Through Short Waves. This Is Called Solar Radiation. Only Two Billionths or Two Units of Energy Out of 1, 00, 00,00, 000 Units of Energy Radiated by The Sun of The Total Solar Radiation Reaches the Surface of The Earth. This Small Proportion of Solar Radiation Is of Great Importance. It Is the Only Major Source of Energy on The Earth for Most of The Physical and Biological Phenomena.

Incoming Solar Radiation Through Short Waves Is Termed as Insolation. The Amount of Insolation Received on The Earth's Surface Is Far Less Than That Is Radiated From The Sun Because of The Small Size of The Earth, And Its Distance From The Sun. Water Vapour, Dust Particles, Ozone And Other Gases Present In The Atmosphere Absorb A Small Amount of Insolation.

- Factors Influencing Insolation:** The Amount of Insolation Received on The Earth's Surface Is Not Uniform. It Varies from Place to Place and Time to Time. The Tropical Zone Receives the Maximum Amount of Annual Insolation. It Gradually Decreases Towards the Poles. Insolation Is More in Summers Than in Winters. The Following Factors Influence the Amount of Insolation Received:

- **The Angle of Incidence:** Since the Earth Is Round, The Sun's Rays Strike the Surface at Different Angles at Different Places. The Angle Formed by The Sun's Ray with The Tangent of The Earth's Circle at A Point Is Called Angle of Incidence. When the Sun Is Almost Overhead, The Rays of The Sun Are Vertical. The Angle of Incidence Is Large Hence, They Are Concentrated in A Smaller Area, Giving More Amount of Insolation at That Place. If the Sun's Rays Are Oblique, The Angle of Incidence Is Small and Sun's Rays Have to Heat Up A Greater Area, Resulting in Less Amount of Insolation Received There.
- **Duration of The Day:** Duration of The Day Decides the Amount of Insolation Received on Earth's Surface. The Longer the Duration, The Greater Is the Amount of Insolation Received. Conversely Shorter the Duration of The Day Leads to Receipt of Less Insolation.
- **Transparency of The Atmosphere:** The Transparency of The Atmosphere Depends Upon Cloud Cover, Its Thickness, Dust Particles, And Water Vapour, As They Reflect, Absorb or Transmit Insolation. Thick Clouds Hinder the Insolation to Reach the Earth While Clear Sky Helps It to Reach the Surface. Water Vapour Absorb Insolation, Resulting in Less Amount of Insolation Reaching the Surface.
- **Heating and Cooling of The Atmosphere:** Sun Is the Ultimate Source of Atmospheric Heat and Energy, But Its Effect Is Not Direct. There Are Four Heating Processes Directly Responsible for Heating the Atmosphere. They Are:
  - **Radiation:** Radiation Is the Process by Which Solar Energy Reaches the Earth and The Earth Loses Energy to The Outer Space. When the Source of Heat Transmits Heat Directly to An Object Through Heat Waves, It Is Called Radiation Process. The Vast Amount of Heat Energy Coming to And Leaving the Earth Is in The Form of Radiation. All Objects Whether Hot or Cold Emit Radiant Energy Continuously. Hotter Objects Radiate More Energy Per Unit Area Than Colder Objects. Temperature and Wavelength Are Inversely Related. Hotter the Object Shorter Is the Length of The Wave. Insolation Reaches the Earth's Surface in Short Waves and Heat Is Radiated from The Earth in Long Waves.
  - **Conduction:** When Two Objects of Unequal Temperature Come in Contact With Each Other, Heat Energy Flow from The Warmer Object to The Cooler Object. This Process of Heat Transfer Is Termed Conduction. The Flow Continues till Temperature of Both the Objects Becomes Equal or The Contact Is Broken. the Conduction in The Atmosphere Occurs at Zone of Contact Between the Atmosphere and The Earth's Surface.
  - **Convection:** The Air of The Lower Layers of The Atmosphere Gets Heated Either by The Earth's Radiation or by Conduction. The Heating of The Air Leads to Its Expansion. Its Density Decreases and It Moves Upwards. Continuous Ascent of Heated Air Creates Vacuum in The Lower Layers of The Atmosphere. As A Consequence, Cooler Air Comes Down to Fill the Vacuum, Leading to Convection. The Cyclic Movement Associated with The Convective Process in The Atmosphere Transfer Heat from The Lower Layer to The Upper Layer and Heats Up the Atmosphere.
  - **Advection:** The Temperature of a Place Will Rise If It Lies on The Path of Winds Coming from Warmer Regions. The Temperature Will Fall If the Place Lies on The Path of The Winds Blowing from Cold Regions. This Process of Horizontal Transport of Heat by Winds Is Termed Advection.