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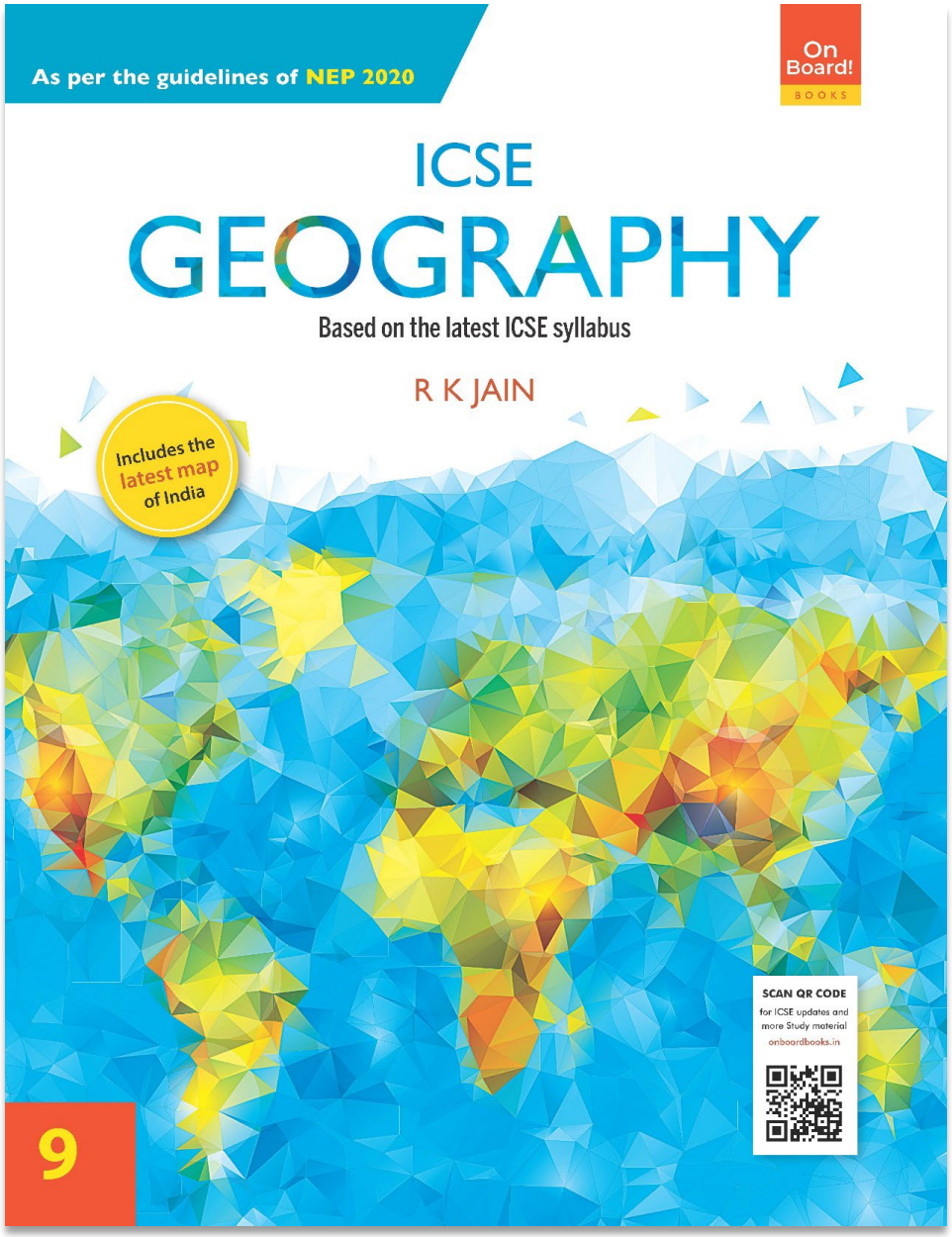
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ICSE GEOGRAPHY

Class 9

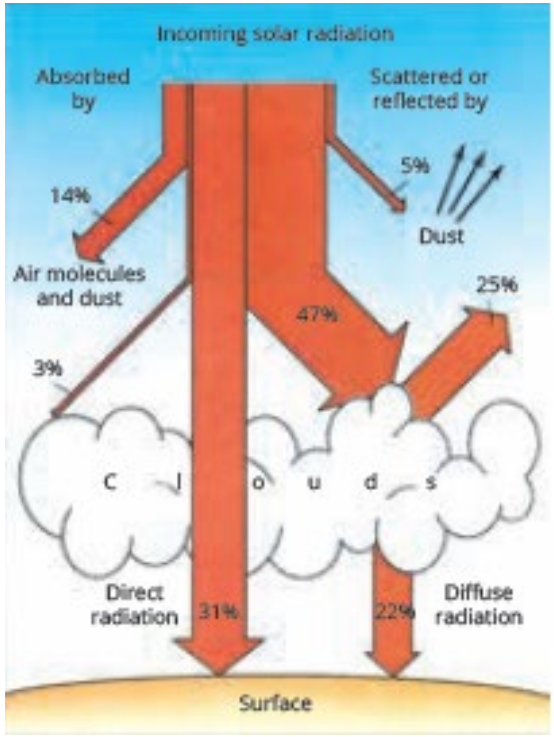
Chapter 13: Insolation

With a surface temperature of about 6000 °C, the Sun is constantly radiating heat energy into the space in the form of electromagnetic radiation. This is known as the **solar radiation**.

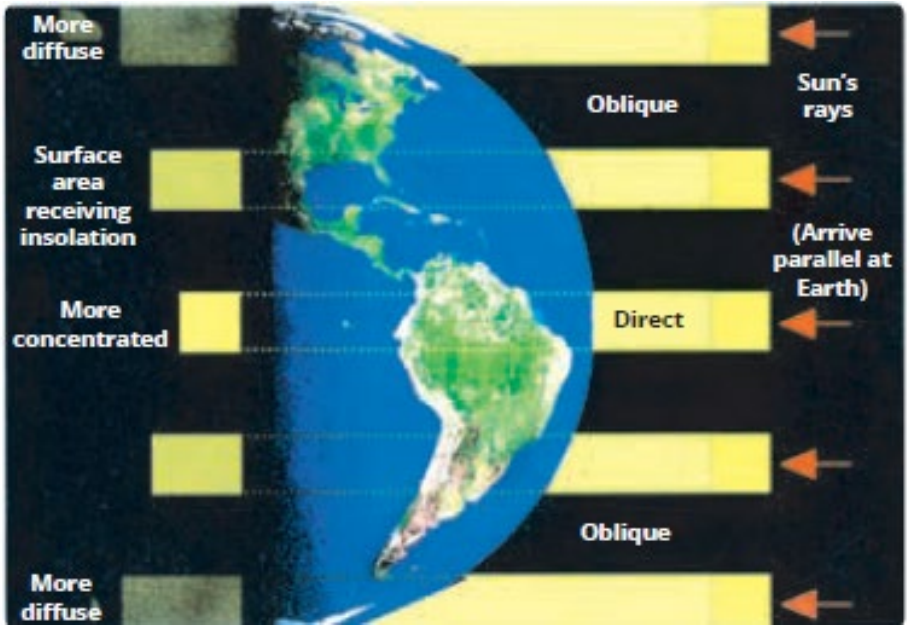
INSOLATION

The **in**coming **sola**r radia**tion**, which reaches the surface of the Earth is called **insolation**. The amount of insolation reaching the surface of the Earth and its effectiveness per unit area depends upon the following factors:

1. The inclination of the Sun's rays
2. The amount of atmosphere to be crossed
3. The duration of sunshine or the length of the day
4. The transparency of the atmosphere
5. The distance between the Sun and the Earth
6. The Sunspots



Solar radiation and atmosphere



Insolation and the inclination of Sun's rays

DISTRIBUTION OF INSOLATION

- A large portion of the incoming solar radiation is lost while passing through the atmosphere due to cloudiness, atmospheric scattering, reflection and absorption (through ozone).
- The maximum surface insolation is received in the tropical zone, which extends from the Tropic of Cancer in the north to the Tropic of Capricorn in the south.
- There is little variation in the amount of insolation received during the winter and summer seasons, as every place lying in the tropics experiences the overhead Sun twice every year.
- Thus the total amount of insolation received at the surface of the Earth decreases from the equator towards the poles.
- Along 45° latitude, the insolation is about 25 per cent less than that at the equator. It is reduced to about 50 per cent along the Arctic and the Antarctic circles and is further reduced at the poles

HEATING OF THE ATMOSPHERE

- The Sun is the most important source of heat for the atmosphere, but the atmosphere is not directly heated by the rays of the Sun.
- The Earth's surface being solid, absorbs the incoming solar radiations. Thus the surface of the Earth is directly heated by the solar radiations.
- The absorbed heat energy is re-radiated by the Earth's surface in the form of **terrestrial radiation** which heats up the atmosphere.

CONDUCTION

- When two bodies having unequal temperature come in contact with one another, the heat energy flows from the hotter body to the cooler body. This transfer of heat is called **conduction**.
- Conduction is important in the lower layer of the atmosphere where the air is in direct contact with the surface of the Earth.

CONVECTION

- When the air is heated, it rises upwards. It leaves behind a partial vacuum near the surface of the Earth.
- As a result the pushed air mass moves horizontally towards cooler areas and descends gradually due to the increased density.
- The cooler air mass moves horizontally near the Earth's surface to fill the partial vacuum. This cooler air mass is also heated and rises upwards.
- This is how the convection current develops above the surface of the Earth. This process of heating the atmosphere is known as **convection**.
- It helps in the transfer of heat to various layers of the atmosphere.

RADIATION

- Radiation is the transmission of energy in the form of **electromagnetic waves**.
- The Sun radiates heat energy in the form of short waves, whereas the radiation from the Earth is in the form of long waves.

The process of transferring heat

- The radiation of heat energy from the surface of the Earth is in the form of long waves, known as **terrestrial radiation**. After sunset, insolation ceases but the Earth's surface continues to radiate heat energy even during the night.

ADVECTION

Sometimes the air masses move from one region to another along with the winds. These winds carry the temperature of one place to another. The air temperature of a place thus rises or falls depending upon whether the wind is coming from a warm or a cool area. This process of horizontal transfer of heat by the wind is known as **advection**.

COMPRESSION

When the air current descends, it presses the lower layer of the atmosphere. Due to this pressure and the increasing weight of the upper layers, the lower layer of the atmosphere gets heated.

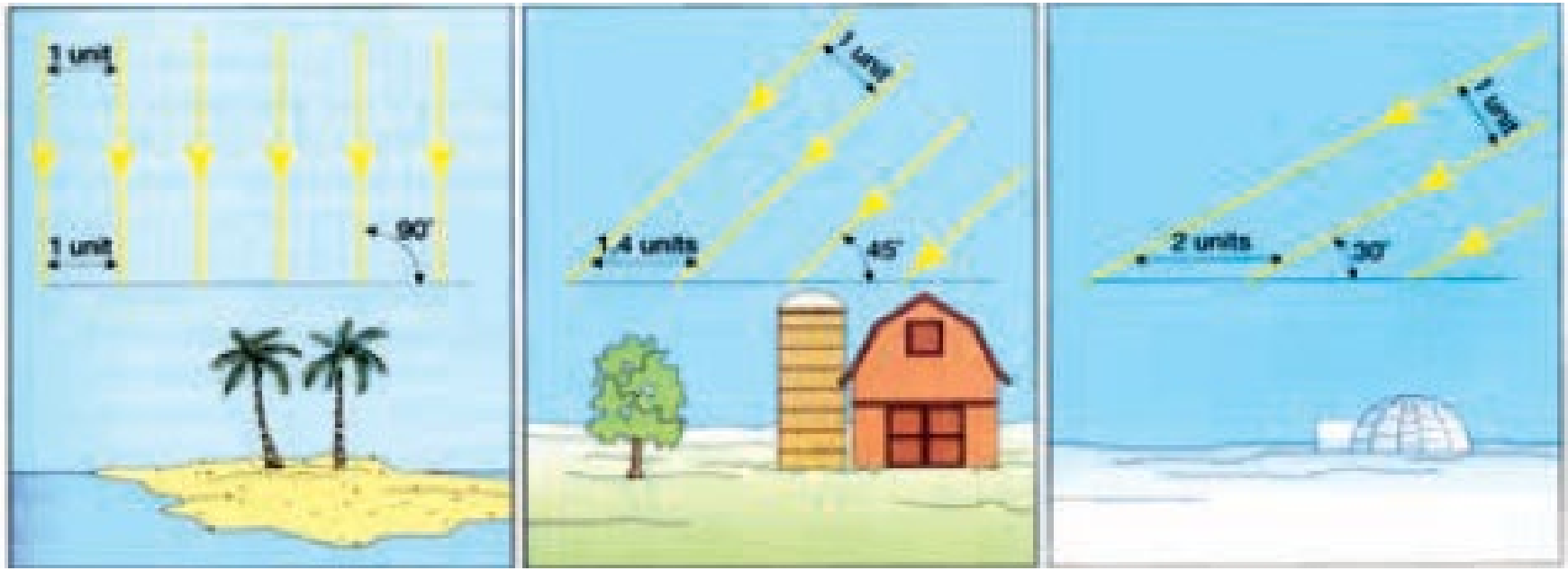
FACTORS AFFECTING THE TEMPERATURE OF A PLACE

The variation in the temperature of the atmosphere is due to the combined effect of a number of factors. Some of them are as under:

1. The latitude of the place
2. The altitude of the place
3. The distance from the sea
4. The slope of the land
5. The prevailing winds
6. The ocean currents

The Latitude of the Place

The temperature of the air at a particular place depends on the amount of insolation received at that place. The amount of insolation depends upon the inclination of Sun rays, which further depends upon the latitude of that place. The inclined rays of the Sun spread over a larger area than the vertical rays of the Sun.



Changes in the Sun's angle cause variation in the amount of solar energy reaching the Earth's surface

The Altitude of the Place

The lower layers of the atmosphere are comparatively warmer than the upper layers, even in the same latitudes. The temperature of the air decreases with increase in height from the Earth's surface at an average rate of 1 °C for every 165 m of height. The decrease in temperature with increase in height from sea level is due to two reasons– (i) the density of air decreases with increase in height above the sea level. Thus, the amount of heat absorbed by the air decreases with increase in height, (ii) we also know, that the air is heated by terrestrial radiations.

The Distance from the Sea

The land surface is heated at a faster rate than the water surface. Thus the temperature of the air over land and water surfaces is not the same at a given time. The coastal areas experience the sea breezes during the daytime and the land breezes during the night time. This has a moderating influence on the temperature of the coastal areas.

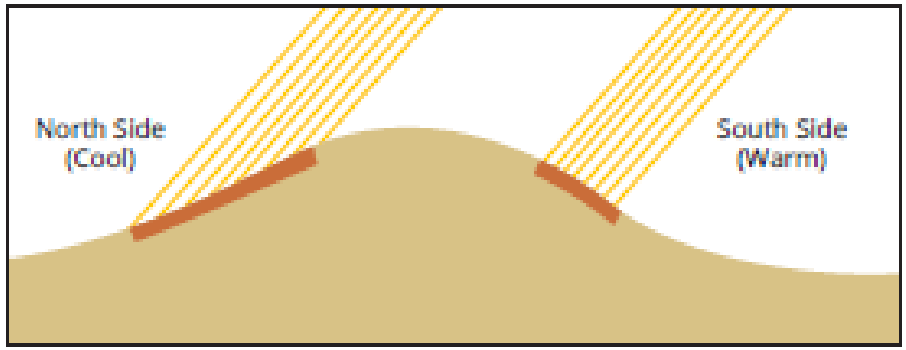
The Slope of the Land

The slope of a mountain or any other relief feature facing the Sun receive more insolation than the slope on the leeward side. This is due to the inclination of Sun rays on such slopes. Thus the Sun facing slopes record higher temperatures than the leeward slopes where the Sun's rays reach more slanting.

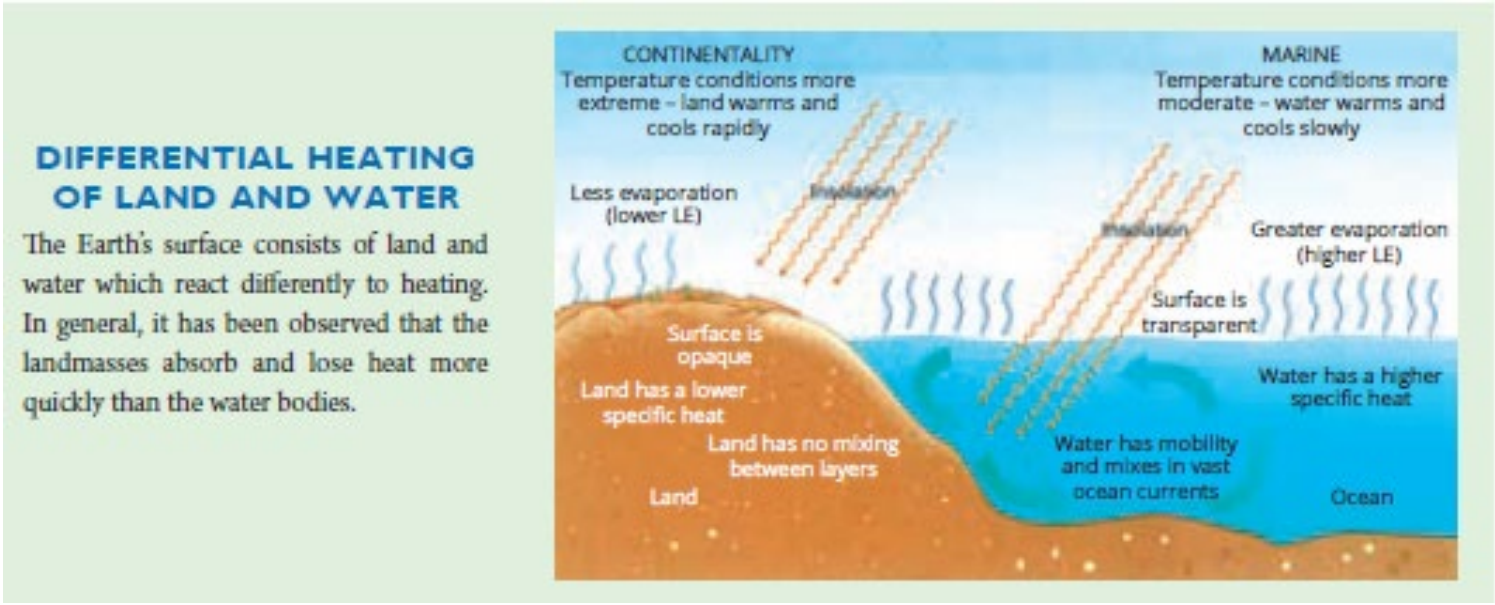
The Prevailing Winds

The prevailing winds help in the redistribution of temperature. The winds coming from the warmer areas, i.e. the low latitudes, increase the temperature of the region over which they are blowing, while the winds coming from the cooler areas, i.e. the higher latitudes, decrease the temperature over which they are blowing. The effect of these winds is, however, limited to the period during which they blow.

The winds blowing from ocean to coastal lands bring in marine influence and thus lower the temperature.



Effect of sloping land on temperature



Differential heating of land and water

The Ocean Currents

The effect of warm water currents and the cold water currents is limited to the adjoining coastal areas. The warm water currents flowing from tropical areas to temperate or cold zones raise the temperature in the effective areas. The Gulf Stream raises the average temperature of the coastal areas of northwestern Europe and the Kuroshio warm water current raises the temperature of Japanese coasts.

The effect largely depends on the winds that blow over the ocean current. The winds blowing from sea to land and passing over the warm water current tend to increase the air temperature in the coastal areas, while the winds passing over a cold water current tend to decrease the air temperature in the coastal areas.

THANK YOU