

NCERT SOLUTIONS

CLASS - 11th



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Class : 11th

Subject : Geography

Chapter : 9

Chapter Name : Solar Radiation, Heat Balance and Temperature

Q1 Multiple choice questions.

(i) The sun is directly overhead at noon on 21st June at:

(a) The equator

(b) 23.5° S

(c) 23.5° N

(d) 66.5° N

(ii) In which one of the following cities, are the days the longest?

(a) Thiruvananthapuram

(b) Chandigarh

(c) Hyderabad

(d) Nagpur

(iii) The atmosphere is mainly heated by the:

(a) Short wave solar radiation

(b) Reflected solar radiation

(c) Long wave terrestrial radiation

(d) Scattered solar radiation

(iv) Make correct pairs from the following two columns.

(i) Insolation	(a) The difference between the mean temperature of the warmest and the coldest months
(ii) Albedo	(b) The lines joining the places of equal temperature
(iii) Isotherm	(c) The incoming solar radiation
(iv) Annual range	(d) The percentage of visible light reflected by an object

(v) The main reason that the earth experiences highest temperatures in the subtropics in the northern hemisphere rather than at the equator is :

- (a) Subtropical areas tend to have less cloud cover than equatorial areas.
- (b) Subtropical areas have longer day hours in the summer than the equatorial.
- (c) Subtropical areas have an enhanced “green house effect” compared to equatorial areas.
- (d) Subtropical areas are nearer to the oceanic areas than the equatorial locations.

Answer.

- (i) (c) 23.5° N
- (ii) (b) Chandigarh
- (iii) (c) Long wave terrestrial radiation
- (iv)

(i) Insolation	(c) The incoming solar radiation
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(ii) Albedo	(d) The percentage of visible light reflected by an object
(iii) Isotherm	(b) The lines joining the places of equal temperature
(iv) Annual range	(a) The difference between the mean temperature of the warmest and the coldest months

(v) (b) Subtropical areas have longer day hours in the summer than the equatorial

Page : 82 , Block Name : Multiple choice Question

Q2 Answer the following questions in about 30 words.

- (i) How does the unequal distribution of heat over the planet earth in space and time cause variations in weather and climate?
- (ii) What are the factors that control temperature distribution on the surface of the earth?
- (iii) In India, why is the day temperature maximum in May and why not after the summer solstice?
- (iv) Why is the annual range of temperature high in the Siberian plains?

Answer.

(i) Unequal distribution of heat over the planet results in advection, conduction and convection. Unequal distribution of heat causes different pressures at different areas since hot air causes less pressure and rises up whereas cool air is denser and creates more pressure. This further leads to movement of air resulting into wind. Variation in daily weather is a result of advection process alone. For example- loo in northern India is due to advection, monsoonal winds in India largely depend upon excessive heating of Tibetan plateau.

(ii) The factors that control temperature distribution on the surface of the earth are :-

- The latitude of the place
- The altitude of the place
- Distance from the sea, the air-mass circulation
- The presence of warm and cold ocean currents
- Local aspects

(iii) During the month of May, the sun is ascending towards Tropic of Cancer ($23\frac{1}{2}^{\circ}\text{N}$) from the equator. As a result, the sun is mostly overhead till summer solstice i.e 21st June resulting maximum day temperature in May. After summer solstice sun starts moving towards the equator, thus the overhead condition is no longer there. Further, monsoon season begins towards late June which brings down day temperature in the country.

(iv) Siberian plains are located between the Arctic Circle and the Tropic of Cancer. The mean January temperature is minus 20°C both at 80°N and 50°N latitudes and in July the temperature is 10°C . Thus, the annual range of temperature is high in Siberian Plains.

Page : 82 , Block Name : Short Answer Question

Q3 Answer the following questions in about 150 words.

- (i) How do the latitude and the tilt in the axis of rotation of the earth affect the amount of radiation received at the earth's surface?
- (ii) Discuss the processes through which the earth-atmosphere system maintains heat balance.
- (iii) Compare the global distribution of temperature in January over the northern and the southern hemisphere of the earth.

Answer.

(i) The earth's shape is a geoid resembling a sphere due to which the sun's rays fall obliquely at the top of the atmosphere and the earth intercepts a very small portion of the sun's energy. The earth's axis makes an angle of $66\frac{1}{2}^\circ$ with the plane of its orbit around the sun has a greater influence on the amount of insolation received at different latitudes.

The amount of insolation received by the earth also depends upon the angle of inclination of the rays. This depends on the latitude of a place. The higher the latitude the less is the angle they make with the surface of the earth resulting in slant sun rays. The area covered by vertical rays is always less than the slant rays.

The insolation received at the surface varies from about 320 Watt/m² in the tropics to about 70 Watt/m² in the poles. Maximum insolation is received over the subtropical deserts, where the cloudiness is the least. Equator receives comparatively less insolation than the tropics. Generally, at the same latitude the insolation is more over the continent than over the oceans. In winter, the middle and higher latitudes receive less radiation than in summer.

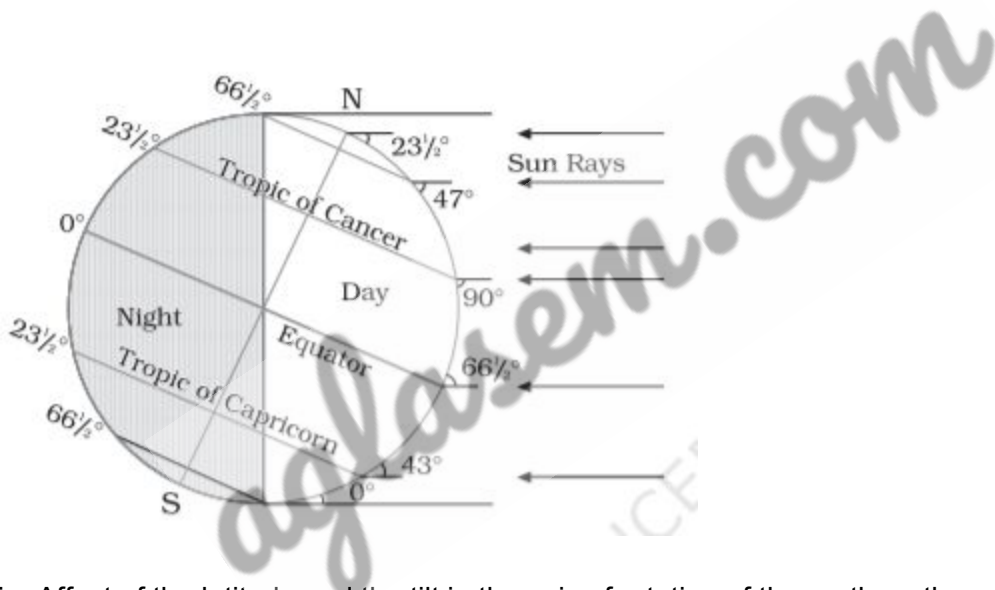


Fig. Affect of the latitude and the tilt in the axis of rotation of the earth on the amount of radiation received at the earth's surface

(ii) The earth as a whole does not accumulate or lose heat as the amount of heat received in the form of insolation equals the amount lost by the earth through terrestrial radiation.

→ Of the 100% insolation received by the earth, some amount of energy is reflected, scattered and absorbed by the atmosphere. Only the remaining part reaches the earth surface.

- Roughly 35 units are reflected back to space even before reaching the earth’s surface. Of these, 27 units are reflected back from the top of the clouds and 2 units from the snow and ice-covered areas of the earth.
- The remaining 65 units are absorbed, 14 units within the atmosphere and 51 units by the earth’s surface. The earth radiates back 51 units in the form of terrestrial radiation. Of these, 17 units are radiated to space directly and the remaining 34 units are absorbed by the atmosphere (6 units absorbed directly by the atmosphere, 9 units through convection and turbulence and 19 units through latent heat of condensation). 48 units absorbed by the atmosphere (14 units from insolation +34 units from terrestrial radiation) are also radiated back into space.

Various processes through which the earth-atmosphere system maintains heat balance are :-

- Radiation - Direct and Scattered
- Turbulence and convection
- Condensation

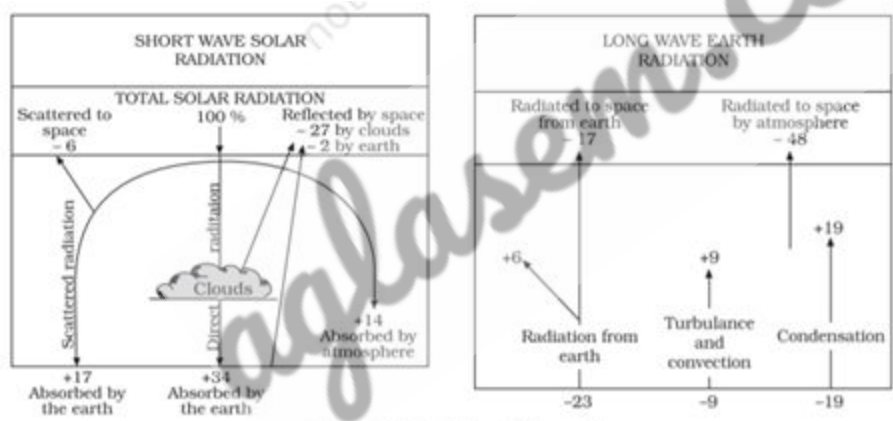


Fig. Heat Budget of the Earth

(iii) The global distribution of temperature can be understood with the help of isotherms. The Isotherms are lines joining places having equal temperature.

The effect of latitude on temperature is well pronounced, as the isotherms are generally parallel to the latitude. The deviation from this general trend is more pronounced in January, especially in the northern hemisphere. In the northern hemisphere the land surface area is much larger than in the southern hemisphere. Hence, the effects of land mass and the ocean currents are well pronounced.

In January the isotherms deviate to the north over the ocean and to the south over the continent. For eg. In the North Atlantic Ocean, the presence of warm ocean currents, Gulf Stream and North Atlantic drift, make the Northern Atlantic Ocean warmer and the isotherms bend towards the north. Over the land the temperature decreases sharply and the isotherms bend towards south in Europe. It is pronounced in the Siberian plain where the mean January temperature along 60° E longitude is minus 20° C both at 80° N and 50° N latitudes.

The mean monthly temperature for January is over 27° C, in equatorial oceans over 24° C in the tropics and 2° C - 0° C in the middle latitudes and –18° C to –48° C in the Eurasian continental interior.

The effect of the ocean is well pronounced in the southern hemisphere as the isotherms are more or less parallel to the latitudes and the variation in temperature is more gradual than in the northern hemisphere. The isotherm of 20° C, 10° C, and 0° C runs parallel to 35° S, 45° S and 60° S latitudes respectively.

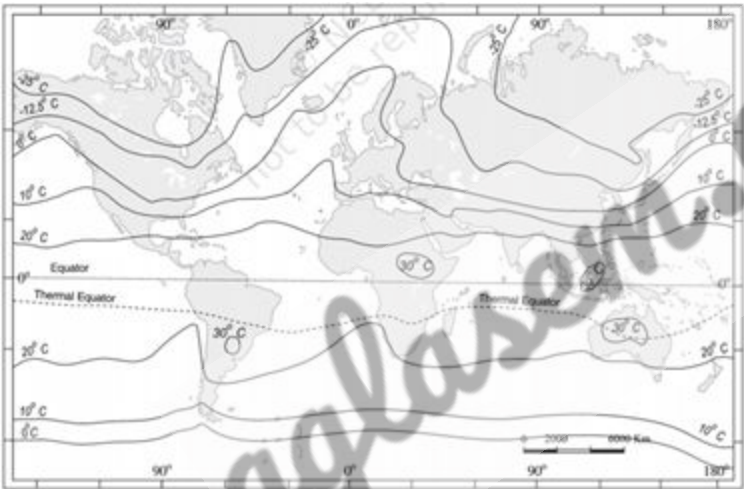


Fig. The distribution of temperature in the month of January