CHAPTER - 9
SOLAR RADIATION, HEAT BALANCE & TEMPERATURE

1. Multiple choice question

(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

Answer: (c) 23.5° N

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

(a) Tiruvanantpuram
(b) Chandigarh
(c) Hyderabad
(d) Nagpur

Answer: (b) Chandigarh

(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

Answer: (c) Long wave terrestrial 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**

Answer:

(i) Insolation	(c) The incoming solar radiation
(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) 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: (a) Subtropical areas tend to have less cloud cover than equatorial areas.

2. 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?

Answer: 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. Places near the equator are much hotter than those located near the poles. Summers are always hotter than winters. Therefore, the unequal

distribution of heat over the earth in space and time cause large-scale variations in weather and climate.

(ii) What are the factors that control temperature distribution on the surface of the earth?

Answer: The factors that control temperature distribution on the surface of the earth are latitude or distance from equator, height from sea level, distance from Ocean, ocean currents, prevailing winds, angle of slope, nature of land, rainfall, etc.

(iii) In India, why is the day temperature maximum in May and why not after the summer solstice?

Answer: In India, the maximum day temperature is recorded in the first week of May. In June, the southwest monsoons arrive at the Kerala coast and advance further inland in June and July. These southwest moisture laden monsoon winds have cooling effect therefore; summer solstice in June is cooler than May.

(iv) Why is the annual range of temperature high in the Siberian plains?

Answer: Siberian plains in Russia have continental climate because it is located far from the ocean and equalising effect of sea/ocean is least. Therefore, annual range of temperature is high in the Siberian plains.

3. 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?

Answer: The earth's axis makes an angle of 66.5° with the plane of its orbit round the sun has a greater influence on the amount of isolation received at different latitudes. In June, the Northern Hemisphere is inclined towards the sun and receives more solar radiation than the Southern Hemisphere. In December, the Southern Hemisphere is inclined towards the sun and receives more solar radiation than the Northern Hemisphere. Latitude also makes a difference in the amount of solar radiation received on the earth. The sun's rays are almost vertical near the equator for most part of the year and they are inclined at the poles. Therefore, the places near the equator receive more solar radiation than those located near the poles.

(ii) Discuss the processes through which the earth- atmosphere system maintains heat balance.

Answer: The sun's rays are almost vertical at the equator and oblique towards the poles. Therefore, the incoming solar radiation is maximum at the equator and it decreases towards the poles. There are variations in the amount of radiation received at the earth's surface. Up to 38° north and south latitudes, the incoming solar radiation are greater than the outgoing terrestrial radiation. Therefore, the tropics should have been getting progressively hotter and the poles getting progressively cooler.

However, this is not so. The atmosphere and the oceans act as giant thermal engines that transfer heat from the tropics towards the poles. Due to imbalance of heat, winds and ocean currents are produced. Thus, the transfer of surplus energy from the lower latitudes to the deficit energy zone of the higher latitudes maintains an overall balance over the earth's surface. This is termed as the heat budget or heat balance of the earth.

(iii) Compare the global distribution of temperature in January over the northern and the southern hemisphere of the earth.

Answer: Global Distribution of Temperature in January: The sun shines almost vertically over Tropic of Capricorn in the southern hemisphere in the month of January. It is summer in the southern hemisphere and winter in the northern hemisphere. There is high temperature over the land mass in the southern hemisphere. The temperature rising over 30°C in north- west Argentina, east-central Africa, Borneo and Central Australia. In the same time, the landmasses in the northern hemisphere are cooler than the oceans. The northeast Asia, northern part of North America and Europe, and Greenland received lowest temperature. Verkhoyansk in Siberian Russia experiences mean January temperature of -50°C. The air over the ocean is warmer than that over the landmasses in the northern hemisphere. The isotherms bend toward equator while crossing the landmasses and toward pole while crossing the oceans. In the southern hemisphere, the isotherms bend toward equator while crossing the oceans and toward pole while crossing the landmasses. Isotherms are irregular and closely spaced in the northern hemisphere, due to the presence of vast expanse of landmasses. However, isotherms are more widely spaced in the southern hemisphere in the month of January.