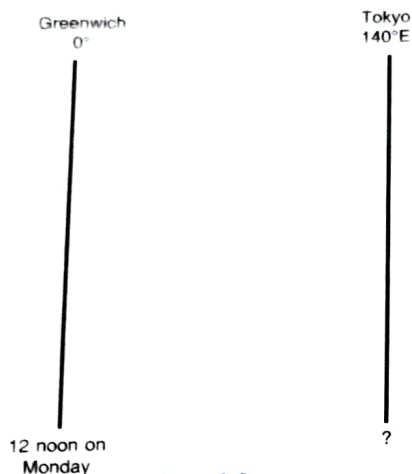


Worked Examples

1. When it is 12 noon on Monday at Greenwich, what is the local time at Tokyo (140°E)?

Time at Greenwich (0°) = 12 noon

Difference in longitude between Greenwich and Tokyo is 140° .

**Fig. 2.9**

Difference in time

$$= 140 \times 4 \text{ minutes,}$$

$$= 560 \text{ minutes or 9 hours and 20 minutes.}$$

The difference in time should be added because Tokyo is to the east of Greenwich.

The local time at Tokyo is 9 hours and 20 minutes past noon or 9.20 p.m.

2. When the local time is 6 a.m. on Monday at Alexandria (30°E) in Egypt, what will be the local time at New Orleans (90°W) in the United States?

Time at Alexandria (30°E)

$$= 6 \text{ a.m. on Monday.}$$

Difference in longitude

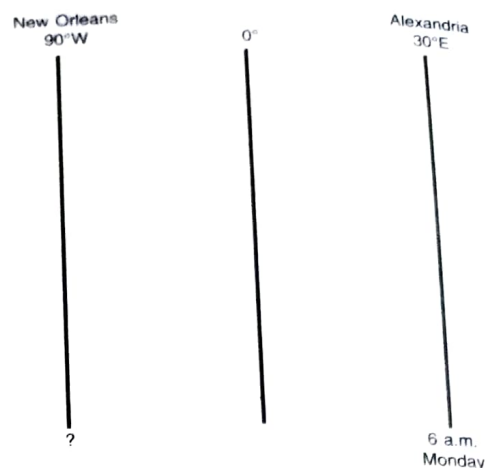
$$= 30 + 90 \text{ or } 120 \text{ degrees}$$

Difference in time

$$= 120 \times 4 \text{ or } 480 \text{ minutes}$$

$$= 8 \text{ hours.}$$

Difference in time has to be subtracted as New Orleans is to the west of Alexandria.

**Fig. 2.10**

Time at New Orleans

$$= 6 \text{ a.m.} - 8 \text{ hrs}$$

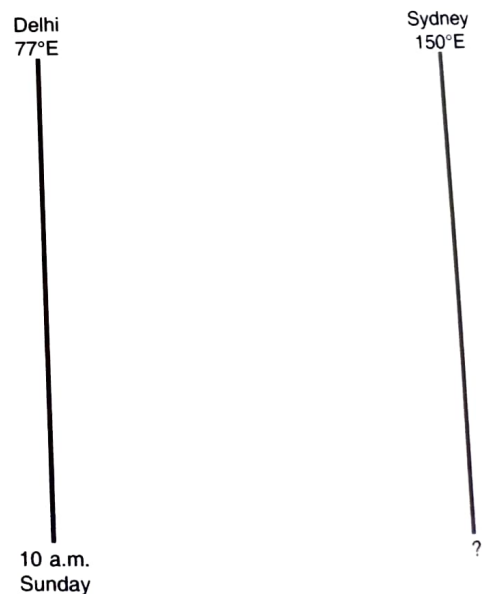
$$= 2 \text{ hours before midnight on Sunday.}$$

$$= 10 \text{ p.m. on Sunday.}$$

3. A cricket match commences at Delhi (77°) at 10 a.m. on Sunday. What will be the local times at Sydney (150°E) and New York (74°W) when the radio commentary is received? Show your working clearly.

Time at Delhi = 10 a.m. on Sunday.

(a) Longitude of Sydney = 150°E .

**Fig. 2.11**

Difference in longitude between Delhi (77°E) and Sydney (150°E)

$$= 150 - 77$$

$$= 73 \text{ degrees. (Fig. 2.11)}$$

Difference in time

$$= 73 \times 4 \text{ minutes.}$$

$$= 292 \text{ minutes or 4 hours 52 minutes.}$$

Difference in time has to be added as Sydney is in the east.

Local time at Sydney

$$= 10 + 4\text{h } 52\text{m or } 14\text{h } 52\text{m.}$$

$$= 2.52 \text{ p.m.}$$

(b) Longitude of New York = 74° p.m.

Difference in longitude between Delhi and New York (77 + 74)

$$= 151 \text{ degrees. (Fig 2.12)}$$

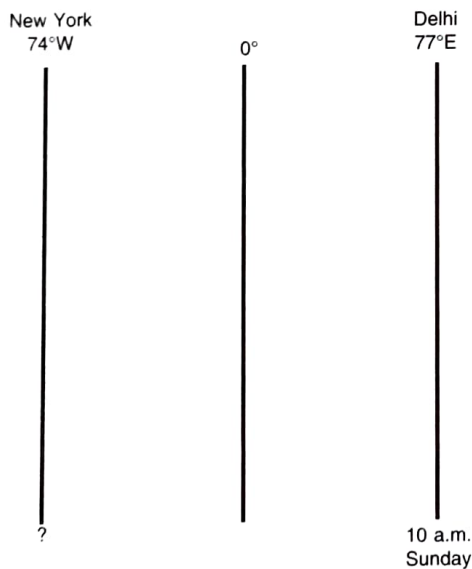


Fig. 2.12

Difference in time

$$= 151 \times 4 \text{ minutes.}$$

$$= 604 \text{ minutes or } 10\text{h } 4\text{m}$$

As New York is located to the west of Delhi, the difference in time is to be subtracted from the time at Delhi.

Local time at New York will be

$$10 \text{ a.m.} - 10\text{h } 4\text{m}$$

or 4 minutes before midnight on Sunday.

or 11.56 p.m. on Saturday.

The longitude of a station can be calculated when the difference in time between two stations is known and the longitude of the station is given. The difference in time can be converted to difference in longitudes. If the time difference is ahead, the station lies to the east. If the time difference is behind, the station lies to the west of the known station.

The following worked examples will illustrate the method of calculating the longitude of an unknown station from the difference in time from a station whose longitude is known:

1. A radio news report broadcast from Tokyo (140°E) at 5 p.m. on Friday was received by a ship at 7 p.m. the same day. Find out the longitude of the ship.

Time difference between Tokyo and the ship

$$= 2 \text{ hours. (Fig. 2.13)}$$

$$= 120 \text{ minutes.}$$

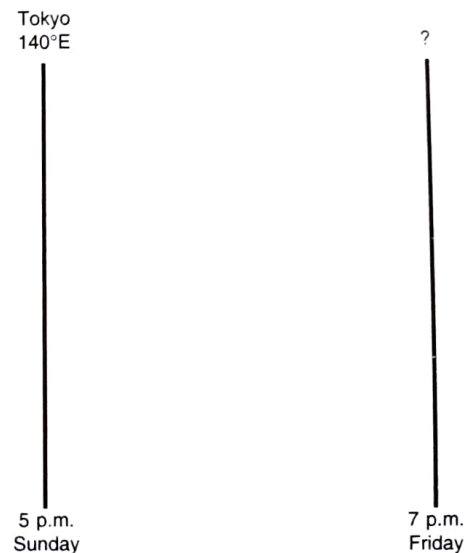


Fig. 2.13

Time difference of 4 minutes

$$= 1^\circ \text{ of longitude.}$$

Time difference of 120 minutes

$$= 120/4 \text{ or } 30^\circ \text{ longitude.}$$

As the local time of the ship is ahead of that of Tokyo, the ship must be 30° to the east of Tokyo.

The longitude of the ship

$$= 140 + 30 \text{ or } 170^\circ\text{E.}$$

2. A ship's chronometer shows Greenwich Mean Time as 14.30 hours when the local time is 12 noon at the ship. Find out the longitude of the ship.

Greenwich Mean Time is based on 0° longitude.

Time difference between the ship and Greenwich Mean Time

$$= (14.30 - 12.00) \text{ hours. (Fig. 2.14)}$$

$$= 2 \text{ hours and } 30 \text{ minutes} = 150 \text{ minutes.}$$

Time difference of 4 minutes

$$= 1^\circ \text{ of longitude.}$$

Time difference of 150 minutes

$$= 150/4 \text{ or } 37^\circ 30' \text{ of longitude.}$$

As the local time of the ship is behind that of the Greenwich, the ship lies to the west of Greenwich.

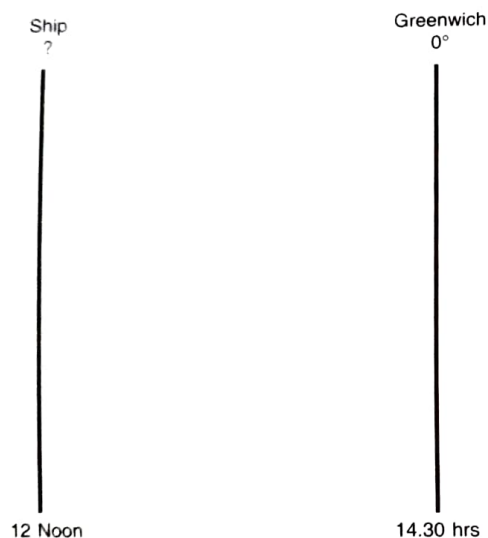


Fig. 2.14

The longitude of the ship is $37^\circ 30'\text{W}$.

3. A team of scientists exploring minerals set up a camp in Siberia. The radio broadcast at 08.00 hours from Moscow was heard at the camp site at 14.30 hours local time. The longitude of Moscow is $37^\circ 30'\text{E}$. Find out the longitude of the camp site in Siberia.

Difference in time between Moscow and the camp site

$$= (14.30 - 08.00) \text{ hours.}$$

$$= 6 \text{ hours and } 30 \text{ minutes.}$$

$$= 390 \text{ minutes.}$$

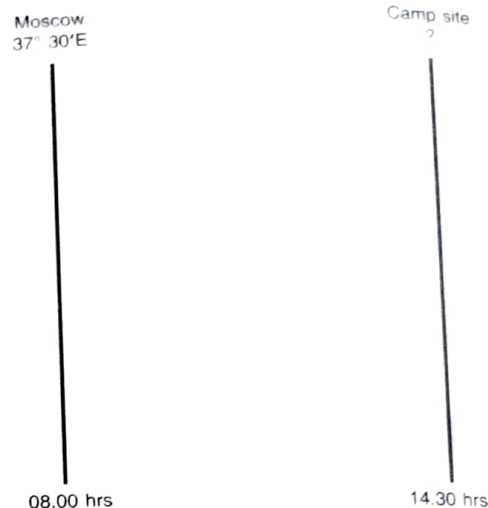


Fig. 2.15

Time difference of 4 minutes

$$= 1^\circ \text{ longitude.}$$

Time difference of 390 minutes

$$= 390/4 \text{ or } 97^\circ 30' \text{ of longitude.}$$

As the local time at the camp site is ahead of the time at Moscow, the differences in longitude should be added.

The longitude of the camp site in Siberia

$$= 37^\circ 30' + 97^\circ 30'$$

$$= 135^\circ\text{E.}$$

Local Time

Local time at a place is fixed with reference to the path of the Sun in the sky. It is 12 noon local time when the angle of inclination of the Sun is maximum.

This can be found easily by studying the length of the shadow of a flagstaff or pole fixed on the ground. When the length of the shadow is shortest, it is noon. At that time the Sun is shining vertically over the longitude at that point.

GEOGRAPHIC GRID—LATITUDES AND LONGITUDES



Map not to scale

is called the **International Date Line** because the date is changed whenever people cross this line by ships or aeroplanes.

While travelling eastwards to the American side, a date is repeated. For example, the time is 6 a.m. on Tuesday, 26 December, at 180°E on the Asian side, but on crossing the longitude, the time is 6 a.m. on Monday, 25 December on the American side. As a result of crossing the International Date Line eastwards, Christmas Day gets repeated. The person celebrates Christmas day on two successive days.

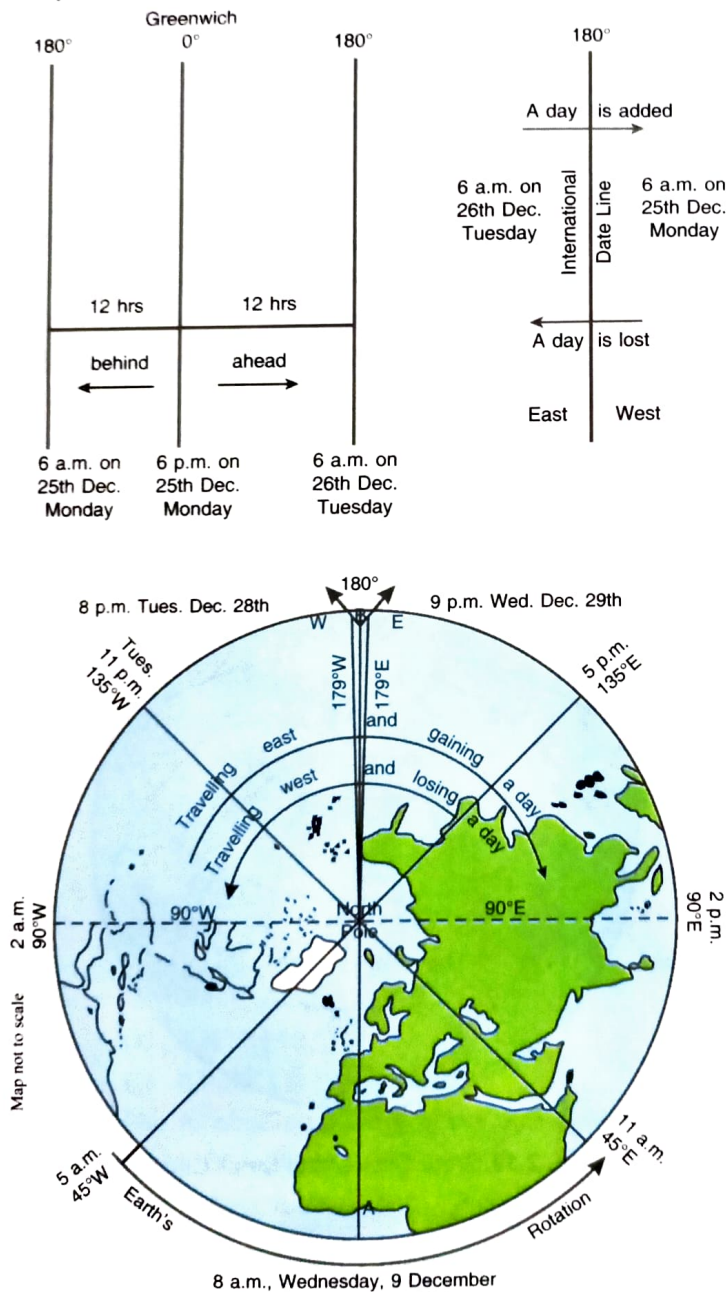


Fig. 2.17 To show why a day is lost or gained when crossing the Date Line

If a person crosses the International Date Line westwards, one day is lost. In the above example, it is 6 a.m. on 25 December at 180°W . After crossing the International Date Line, the time is 6 a.m. on 26 December. Christmas Day is lost owing to the crossing of the Date Line. One gains a date but loses a day of 24 hours.

The International Date Line passes through the Pacific Ocean (Fig 2.18). It deviates from the 180° longitude where it crosses land in order to keep all the lands under one administration on one side of the Date Line. The Date Line deviates eastwards in the Bering Straits between Alaska and Siberia.

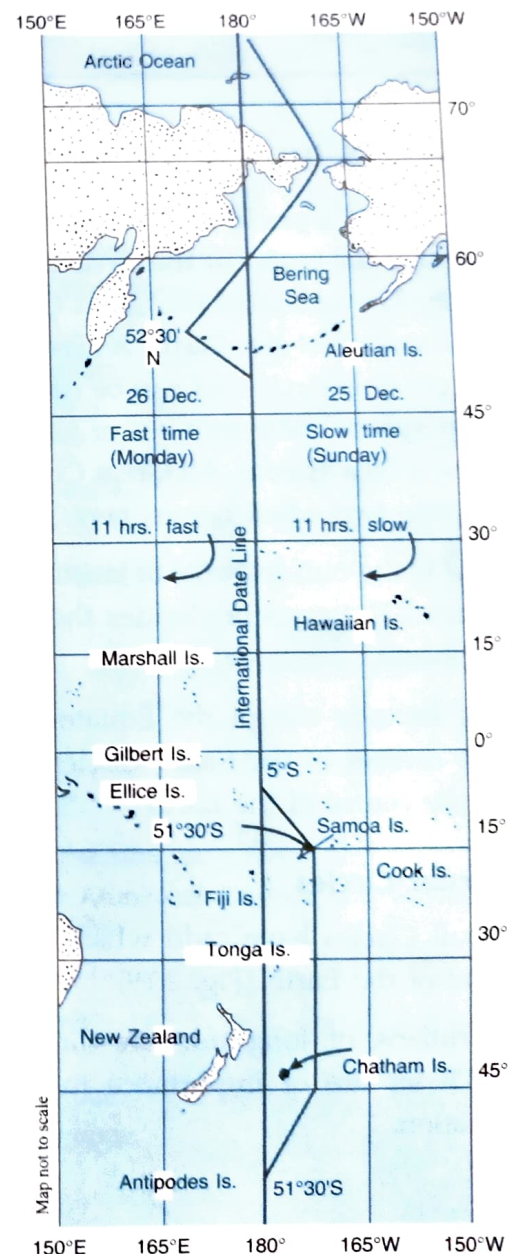


Fig. 2.18 International Date Line