Ch - 2

Geographic Grid : Latitudes and Longitudes

Geographic Grid - The intersection of horizontal lines (latitudes) and vertical lines (longitude that pinpoint any place on the earth surface is a framework of criss-crossing lines known as EARTH'S OR GEOGRAPHIC GRID.

Latitudes and Longitudes were devised by a Greek philosopher, ERATOSTHENES.

Uses of geographic grid :

→ It helps locating places on map.
→ Helps in various calculations.
→ Indicate directions.
→ Shows many other features.

Difference between :

	Latitudes	Longitudes
DEFINITION	They are imaginery lines joining places having same angular distance north or south of the equator.	They are imaginery lines having same angular distance east or west of the Prime Meridian.
NO	They are 181 in number.	They are 360 in number.

SHAPE	They are circular and run from east to west.	They are semi-circular and run from North to South.
SIZE	The size of latitudes decreases from Equator to Poles.	The size of longitudes remain the same.
DISTANCE BTW. THEM	The distance between two consecutive latitudes remains the same i.e., 111 km approx. since they are parallel to each other they are also called Parallels of latitude.	The distance between two consecutive longitude is maximum at the equator and minimum at poles.

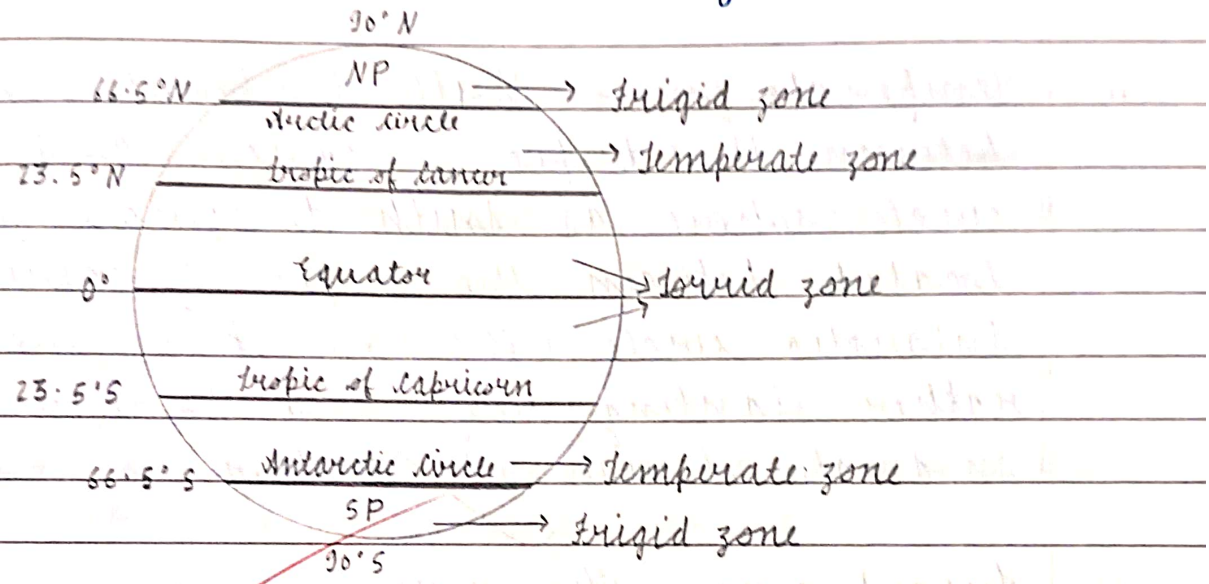
Important Parallels of Latitudes -

1. Equator - (0°) - Largest latitude that passes from the centre of the earth dividing earth into two equal parts or hemisphere namely : Northern and Southern.

2. Tropic of cancer (23 1/2° N) & Tropic of capricorn (23 1/2° S) - They mark the limit of the vertical rays to fall on the earth surface.

3. The Arctic circle (66½° N) & The Antarctic circle (66½° S) - They mark the limit of North and South Cole regions respectively.

4. The north and south pole (NP - 90° N) & (SP - 90° S) - They are the extreme ends of the sphere.



Important Parallels of latitudes

Uses of latitudes -

1. To find location of places on earth - With the help of latitudes we can find the absolute location of place north or south of equator.

2. To measure distance - 1° angular distance can be expressed as 111 km approx. Therefore distance of Mumbai (19° N) will be 111 x 19° = 2109 km

3. Carving heat zones - Latitudes determine the amount of heat received by the earth surface surface through vertical and slanting sunrays. There are three thermal or heat zones on this

earth.

i) Torrid zone - It lies between the tropic of cancer (23 1/2° N) and tropic of capricorn. This zone receives vertical sunrays almost throughout the year thus it is the hottest zone.

ii) Temperate zone - North temperate zone lies between the tropic of cancer and Arctic circle where as south temperate zone is located between the tropic of capricorn and Antarctic circle (66 1/2° S). This zone receives rather slanting rays and therefore has moderate climate i.e., neither hot nor too cold.

iii) Frigid zone - The north frigid zone lies between the Arctic circle and North Pole whereas south frigid zone lies between the Antarctic circle and south Pole. Since these zone receive extremely slanted sunrays thus it is the coldest zone.

Therefore the significance of important lines of latitude is that they carve out the heat zones.

Lines of latitude are not of equal length due to earth's spherical shape.

Longitude - Longitude is an angular distance of a place East or west of the Prime Meridian

Prime meridian - It is the 0° longitude which passes through Greenwhich near London. Thus it is also referred as Greenwich Meridian.

→ The Prime Meridian along with 180° longitude divides the earth into two equal hemispheres - To the east of 0° till 180° is the Eastern and to west of 0° is the Western Hemisphere (Hemi = half).

→ Note - Lines of longitude are of same length because they all converge at the poles.

→ The longitude of 180° E and W refer to the same meridian.

→ Longitudes are also called meridians -
The word meridian has been derived from a latin word 'meridianum' which means 'noon' or 'mid day'. Since all places located on the same longitude have their mid day at the same time, longitudes are called meridians.

Longitude and Time

→ The earth completes one rotation of its 360° longitudes in 24 hrs. Therefore it covers 15° degrees in 1 hour (360 ÷ 24 = 15)
Since 1 hour = 60 minutes
1° longitude will be converted in 4 minutes ($\frac{60}{15} = 4$).
Thus the time interval between 2 consecutive longitudes is 4 min.

→ Since the earth rotates from West to East, the places in the east see the rising sun first and are ahead in time than places in the west.

→ To make the time calculations easy, the formula of EGA and WLS is adapted.
EGA = East → Gain → Add : To the east you gain time so you add.
WLS = West → Lose → Subtract : To the west you lose time so you subtract.

This means that for each degree of longitude to the east, 4' are to be added and to the west, 4' are to be subtracted.

Explain -

a) Local time - Local time is the time common to all places located on a particular longitude irrespective of latitudes.
→ It is also called sun time as it is obtained by the midday sun.
→ For each degree (°) of longitude, local time varies by 4 minutes.

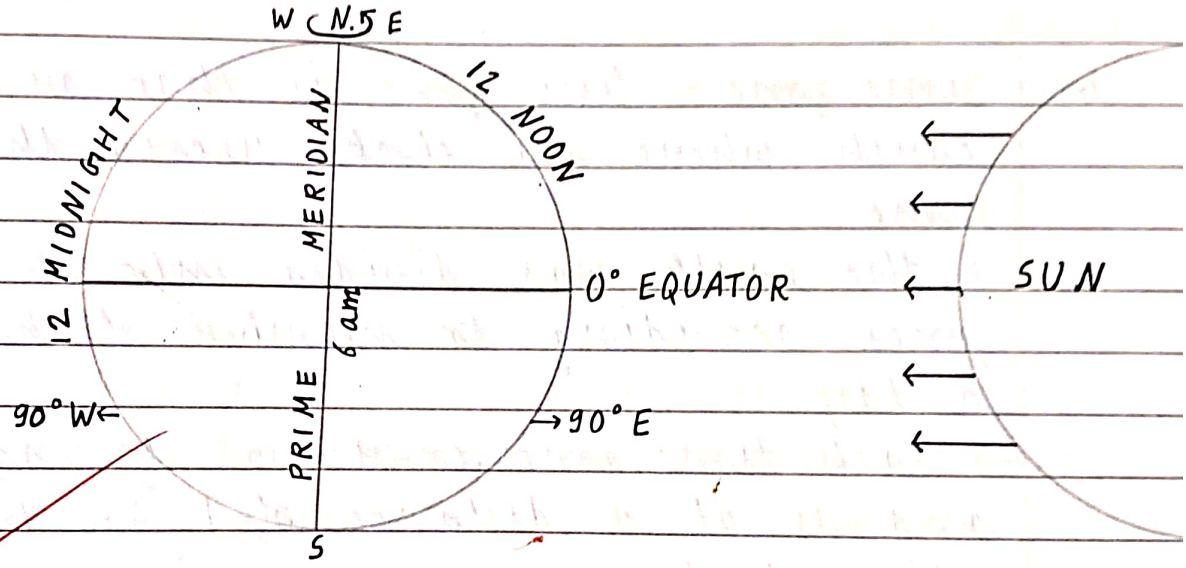


Diagram: Places on same longitude have same tim

Explanation - If Prime meridian at 0° has time 6 am then 90° E longitude (all places from North to South) will have 12 noon.

$(1° = 4' \therefore 90° = \frac{90 \times 4}{60} = \frac{360}{60} = 6 \text{ hrs})$.

Thus 90° E will have 12 noon since it is to the east (EGA)

Whereas

90° W will have 12 midnight since it is to the west of Prime meridian (WLS).

Note - Since each longitude will have a different time, there will be a huge time difference in countries having great East to West longitudinal extent. This will create a lot of confusion in keeping a record of time within the same country.

To avoid this confusion the world was divided into time zones.

b) Time zone - Time zone is that area on earth where all clocks record the same time.

→ The earth was divided into 24 time zones according to number of hours in a day.

→ Each time zone covers 15° of longitudes and is at a distance of 1 hr from the adjacent time zone.

c) Standard time - It is the uniform time based on the local time of the central meridian of a time zone.

→ Since each time-zone is of 15°, standard time must always be divisible by 7.5°. This allows the time difference to be of half an hour or 30 minutes and not of smaller differences.

d) GMT or Greenwich mean time - It is the local time of 0° longitude or the Prime meridian which is used as the basis

for calculating World standard time since 1884.
→ The Greenwich time is also called Greenwich mean time as its time is taken for reference all over the world.
→ For example : India is 5:30' ahead of GMT.

e) Indian standard time {IST} - It is the local time of 82.5° E longitude which passes through almost the centre of India (Near Prayagraj) and its time is taken as Indian standard time.
→ It is 5:30' ahead of GMT
(82.5 x 4 = 330' ÷ 60 = 5:30')

f) International date line {IDL} - Fixed by international agreement the International Date line is the 180° longitude which marks the beginning of a new date on the earth.
→ When crossing this line from west to east, a day is deducted or the time is fixed backward by 1 day.
→ When crossing this 180° from east or west a day is added or the calendar is fixed one day ahead.

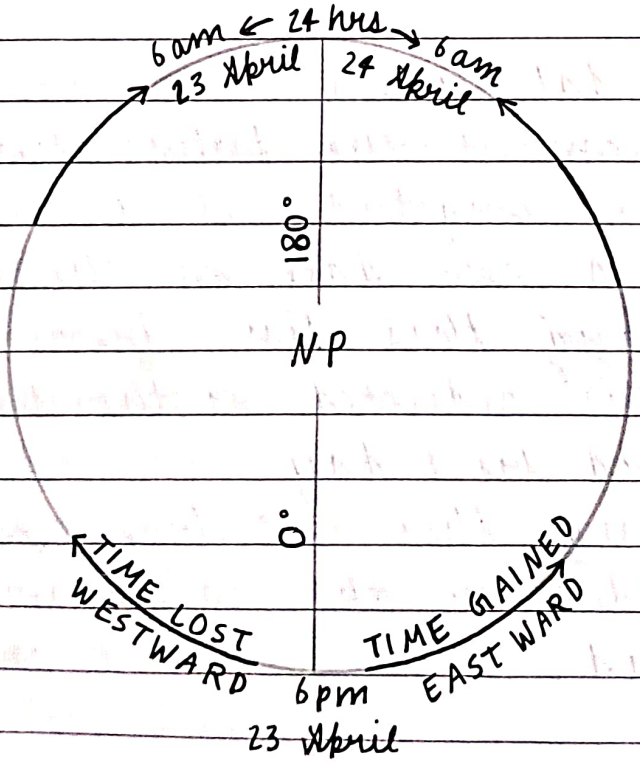
→ IDL deviates or goes zig-zag near some islands of Pacific ocean - It is to avoid the confusion of having different dates within the same country.

Answer of structured ques 3(b)

→ Moving eastward from Prime meridian till 180°, time will be 12 hrs ahead ($180 \times 4 = \frac{720}{60} = 12$ hrs) whereas westward time will be behind by 12 hrs.

→ In this way if it is 6 PM of 23rd April at Greenwich (0°), travelling eastward the time will be 6:00 am of 24th April at 180° while travelling westward the time will be 6: am but of 23rd April.

→ When the time lost and gained is computed together it will make a difference of 24 hrs between east and west of 180° meridian.

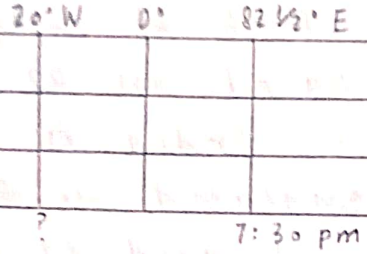


NP - North pole
0° - Prime Meridian
180° - International date line

III. Time related questions -

Mumbai - 82 ½° E

Q1. An important programme was to be broadcast from Mumbai at 7:30 pm. This was heard by some Indian sailors near Ivory Coast in West Africa at 20° W longitude. What was the local time there?



Longitudinal difference
$82.5 + 20 = 102.5$

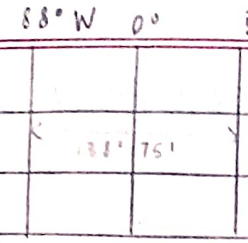
Each long. time difference is 4 min.
$102.5 \times 4 = 410$ min
$= \frac{410}{60} = 6$ hr 50 min

Change 7:30 pm in 24 hr format = 19:30

$$\begin{array}{r} 19:30 \\ -\ 6:50 \\ \hline 12:40 \end{array}$$

Ans - 12:40 pm.

Q2. What is the longitude of a place where the local time is 1:15 pm, when it is 4 am at Chicago (88° W)?



Time difference between these two places

13 : 15
- 4 : 00
09 : 15 hours

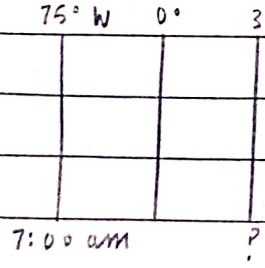
9:15 change in minutes = 540 + 15 = 555 min

$\frac{554}{4}$ = 138° 75'

138° 75'
- 88° 00'
50° 75'

Ans - 50° 75' east

Q3. Calculate the time at Durban (longitude 30° E) when the time is 7:00 a.m. at New York (75° W



Longitudinal value

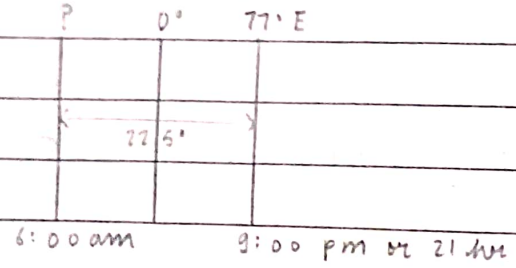
75 + 30 = 105°

105 x 4 = 420 min

= $\frac{420}{60}$ = 7 hr

7 + 7 = 14 (convert in 12 hr format)
= 2:00 p.m.

Q4. Calculate the longitude of a place where the local time is 6:00 am, when the time is 9:00 pm at New Delhi on longitude 77° E.



Time difference between these two places

21 : 00
-6 : 00
15 : 00 hours

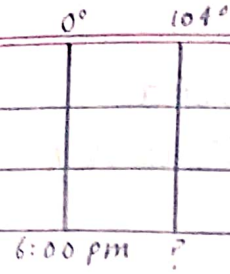
Change 15 hr in minutes = 15 x 60 = 900 min

$\frac{900}{4}$ = 225° longitude

225
-77
148

Ans - 148° West

Q5. Calculate the local time at Singapore (104° E) when it is 6:00 p.m. at Greenwich.



Longitudinal difference between Greenwich and Singapore is → $104 \times 4 = 416$ min

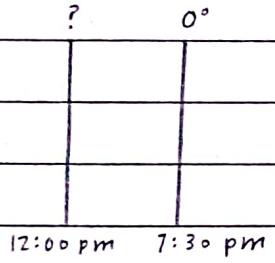
$= \frac{416}{60} = 60$ hr 56 min

According to formula - EGA

$6 + 6.56 = 12:56$ a.m.

Ans - 12:56 am

Q6. Calculate the location of a place where the local time is noon when it is 7:30 p.m. at Greenwich.



According to WLS formula -

Time difference between Greenwich and unknown place -

(24 hr format)

7:30 ⟹ 19:30

$-$ 12:00

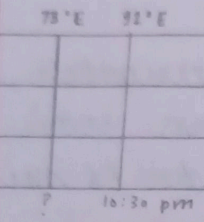
7:30 hr

7:30 hr = 450 min

Longitudinal difference = $\frac{450}{4} = 112.5$

Ans - 112 1/2° West

Q7. What is the time and day at Mumbai (73°E) when it is Sunday 10:30 p.m. at Shillong (92°E) ?



According to WLS -
Longitudinal difference ⇒ 92 - 73 = 19
So the time difference -
19 x 4 = 76 min
76 min = 1 hr 16 min

10 : 30
- 1 : 16
9 : 14

Ans - Time - 9:14 pm
Day - Sunday