

The Basics of Measurement

- Space
- Time
- Matter
- Energy

Angles

- Used to specify direction
- Ratio of size to distance
- Measured by dividing a full circle
- 360 degrees in a full rotation
- 60 minutes of arc in one degree
- 60 seconds of arc in one minute of arc

Distances

- Astronomical Unit = the average distance between the Earth and the sun (\sim 150 million km)
- Light Year(lt-yr) – the distance travelled by light in a vacuum in one year (10,000 Billion km or 100,000 AU)
- Parsec (ps) – The distance at which the apparent direction of an object will change by one second of arc when the Earth moves through a distance of 1 AU. (4 lt-yr, half a million AU)

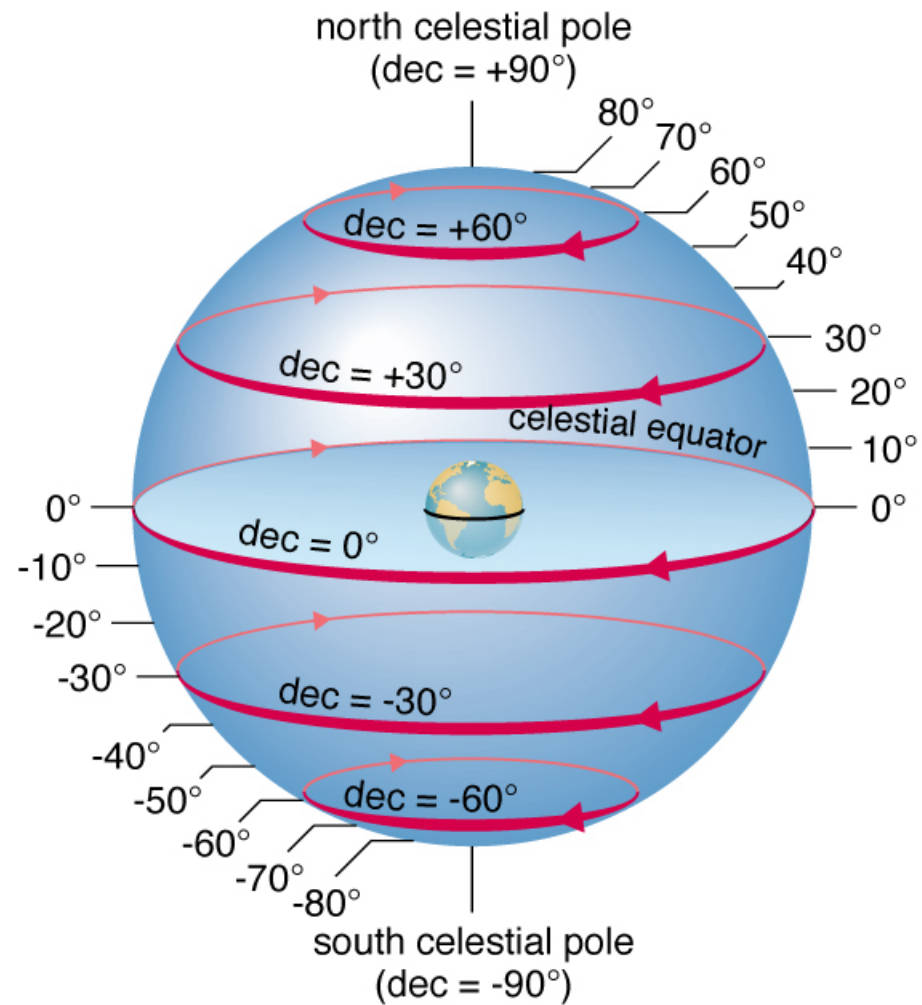
Scientific Notation

- Keep separate track of the number of digits
- Often this “power of ten” is all that is required
- E.g. $5,385,000 = 5.385 \times 10^6$
- $1,530,000,000 = 1.53 \times 10^9$
- $0.000\ 000\ 023\ 1 = 2.31 \times 10^{-8}$

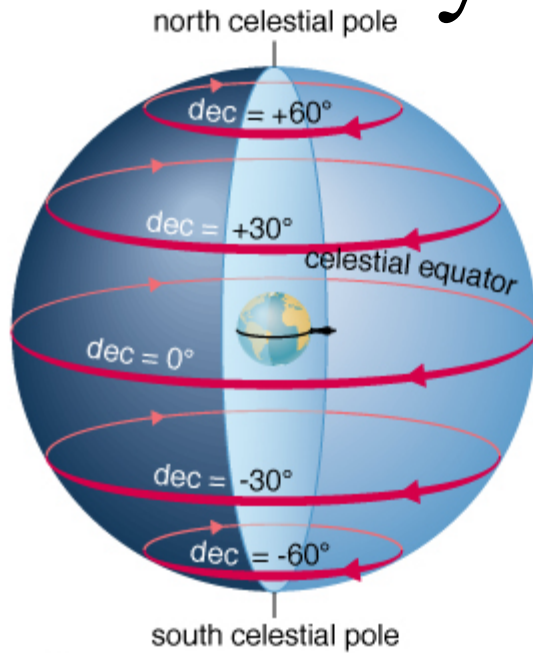
Navigation

- Orientation using the North Star is useful provided you know where you are
- Easy to fix latitude (altitude of North Star)
- Longitude very difficult without accurate timer

Declination

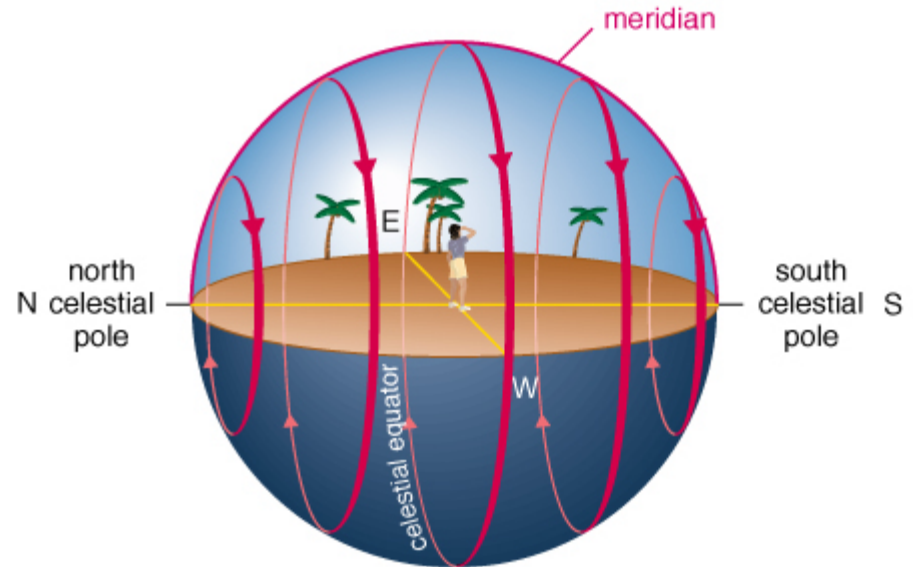


The Sky from the Equator



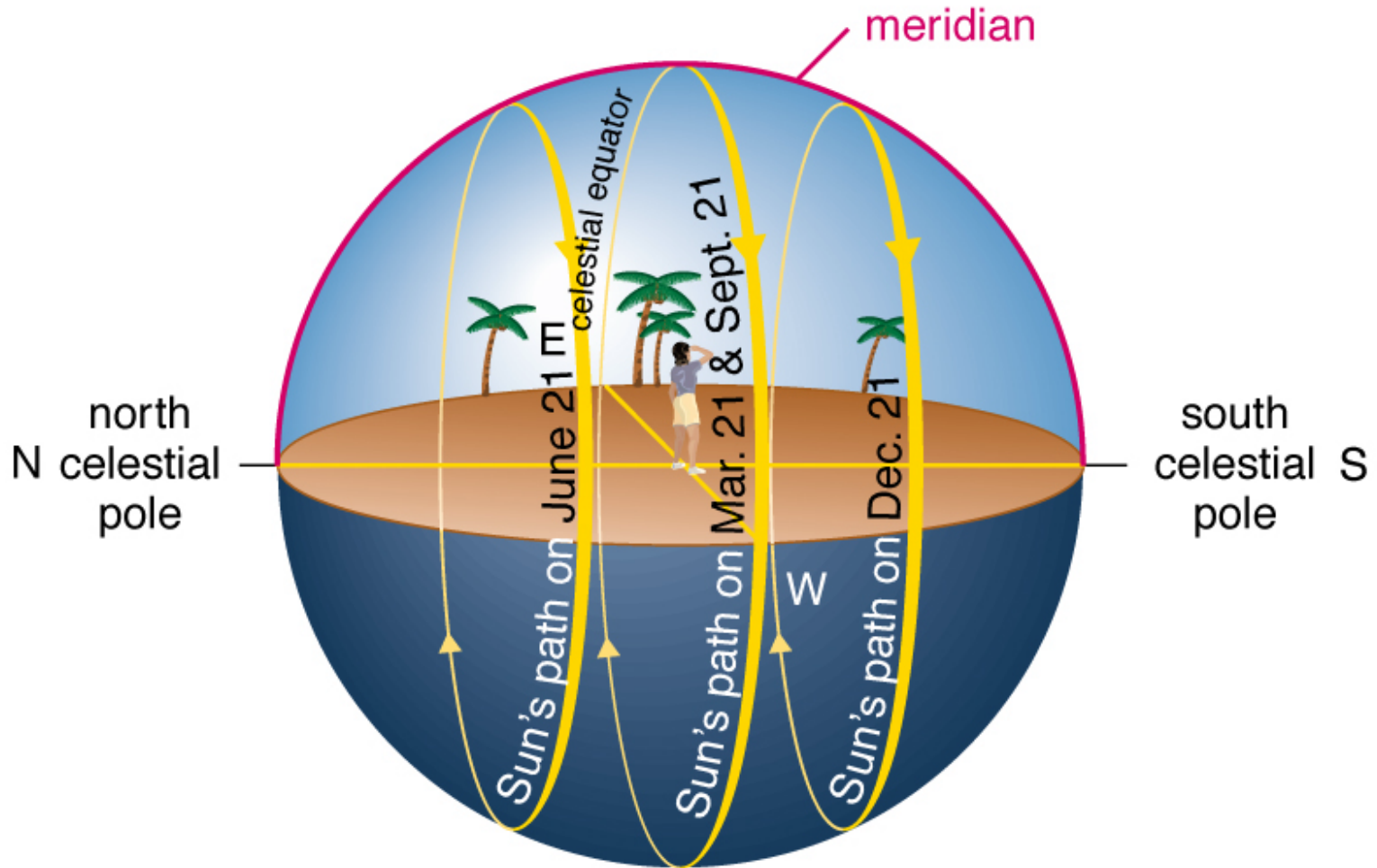
a

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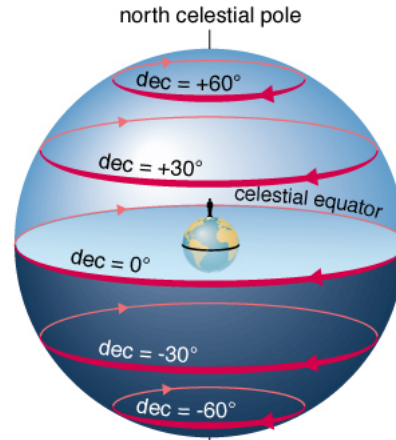


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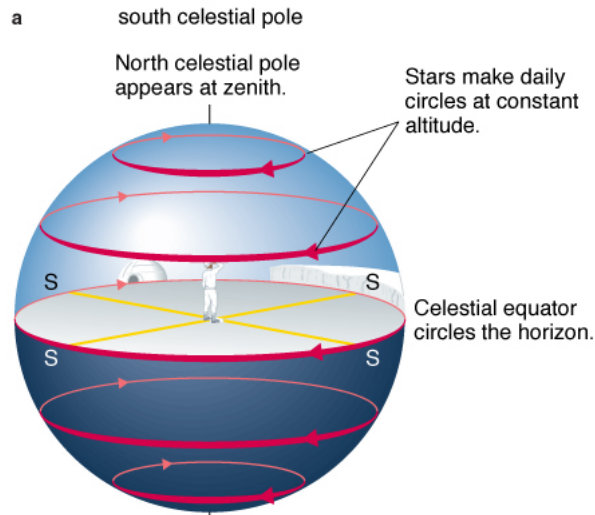
Sun's Path from the Equator



The Sky from the North Pole

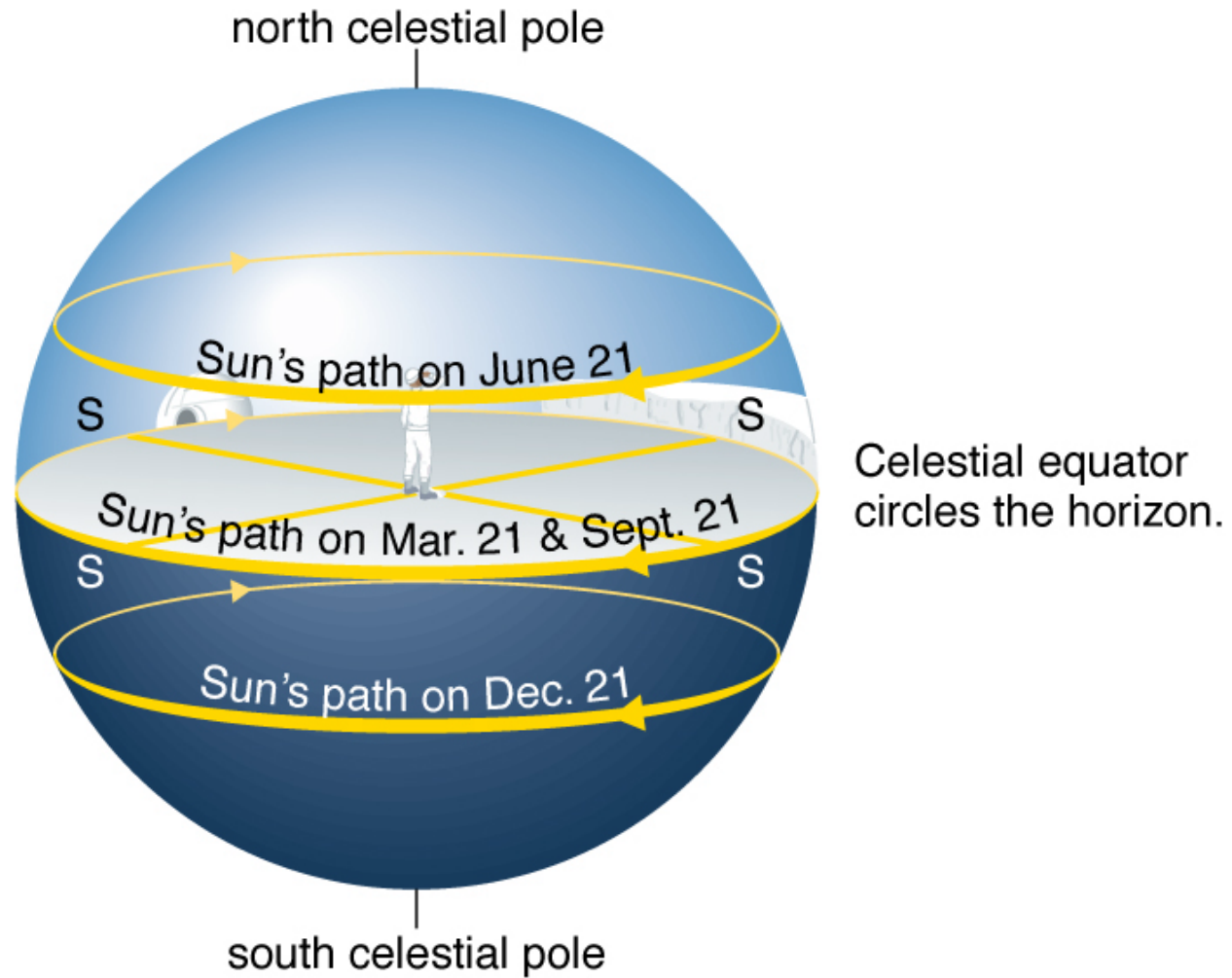


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Sun's Path from the North Pole



Solstice on the Antarctic Circle



Approximate time:

Midnight

Direction:

due south

6 A.M.

due east

Noon

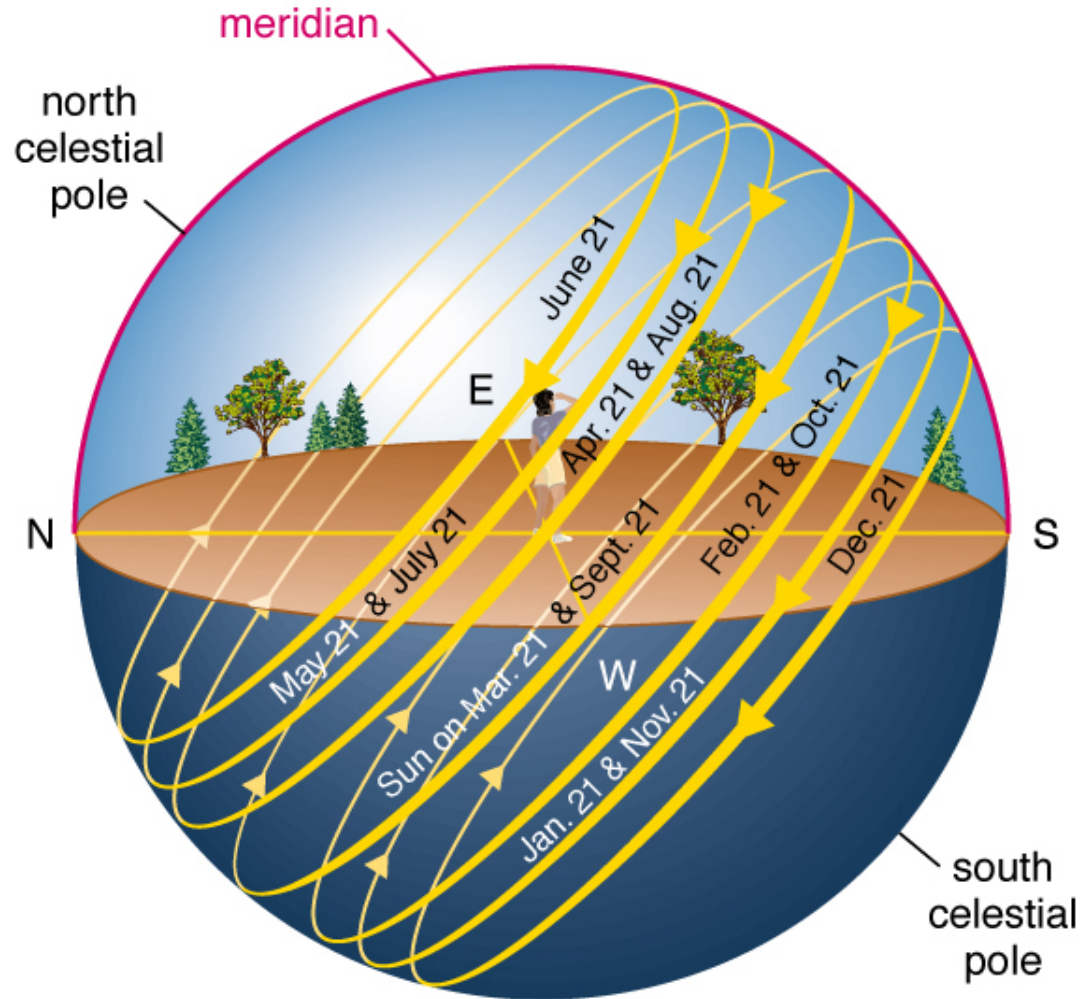
due north

6:00 P.M.

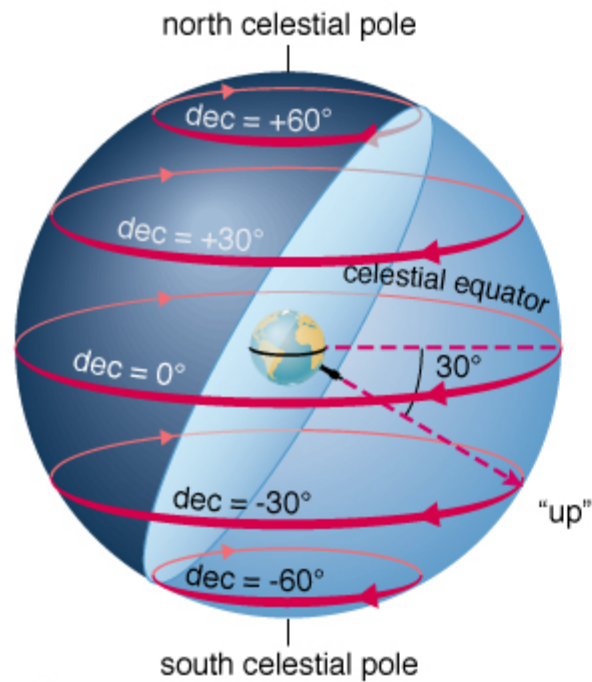
due west

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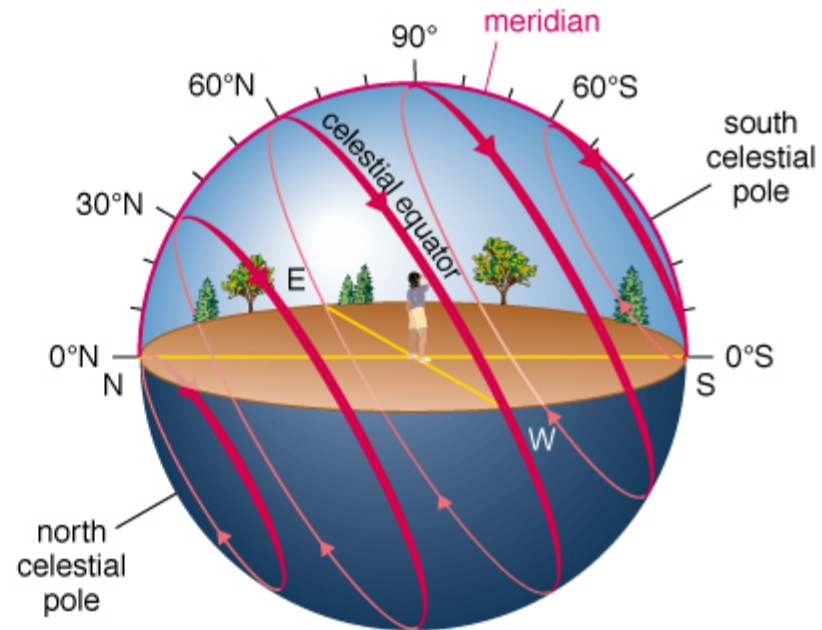
Sun's Path from Thunder Bay



The Sky from 30 degrees South



a
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b