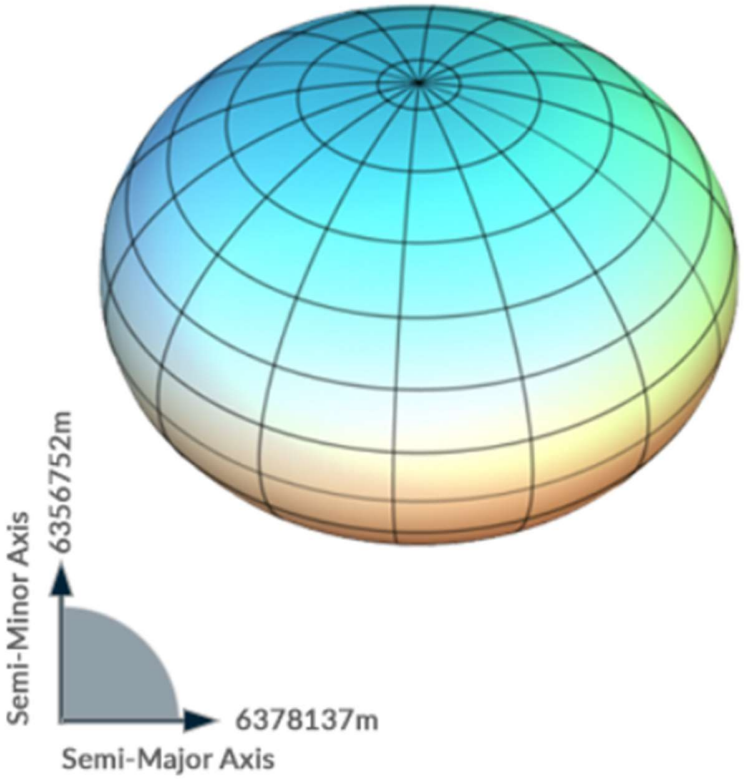
Summary Notes - Topic 1: Planet Earth

1.1 The Shape of the Earth

- The Earth is an **oblate spheroid** (a slightly flattened sphere).
- This shape is due to the Earth's **rotation**, which causes the equator to bulge slightly outward.
- The equatorial diameter (~12,756 km) is slightly **larger** than the polar diameter (~12,714 km).
- **Early astronomers knew that Earth was round for several reasons:**
    - The Moon is round.
    - The shadow of the Earth on the Moon during a lunar eclipse is round.
    - Travellers going north or south see different stars not visible from elsewhere.
    - Travellers recording shadows at different angles on the same date.
    - The existence of a horizon
    - Tall ships appearing to 'sink' as they move over the horizon



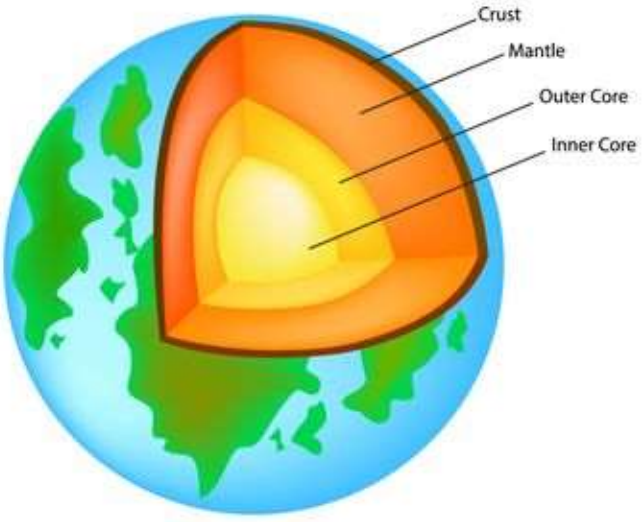
1.2 Earth’s Mean Diameter

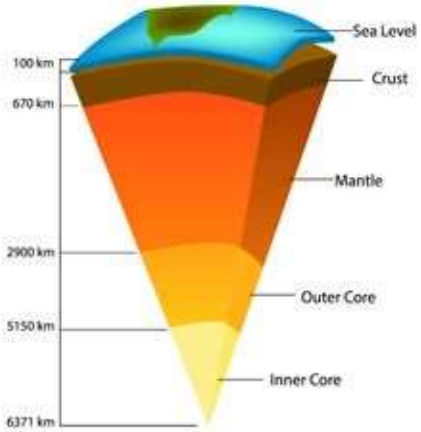
- The **mean diameter** of the Earth is approximately **13,000 km**.
- Used in calculations such as estimating the size of other planets or calculating the Earth’s circumference.

1.3 Internal Structure of the Earth

Major Internal Divisions:

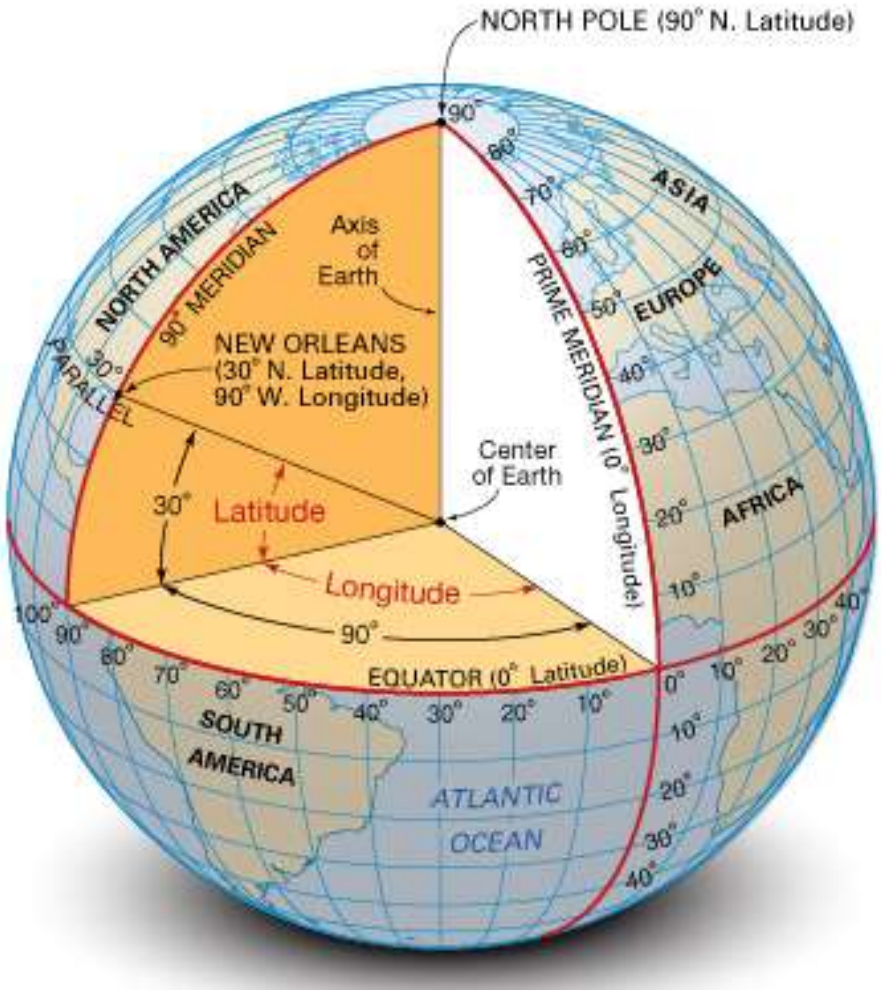
1. **Crust**:
    - Outer solid layer.
    - Thickness: ~5-70 km.
    - Tectonic plates move on the crust.
2. **Mantle**:
    - Semi-solid, **convection currents** drive plate movement.
    - ~2,900 km thick.
3. **Outer Core**:
    - **Liquid iron and nickel**, responsible for Earth’s **magnetic field**.
    - ~2,200 km thick.
4. **Inner Core**:
    - **Solid iron and nickel** due to extreme pressure.
    - ~1,220 km radius.





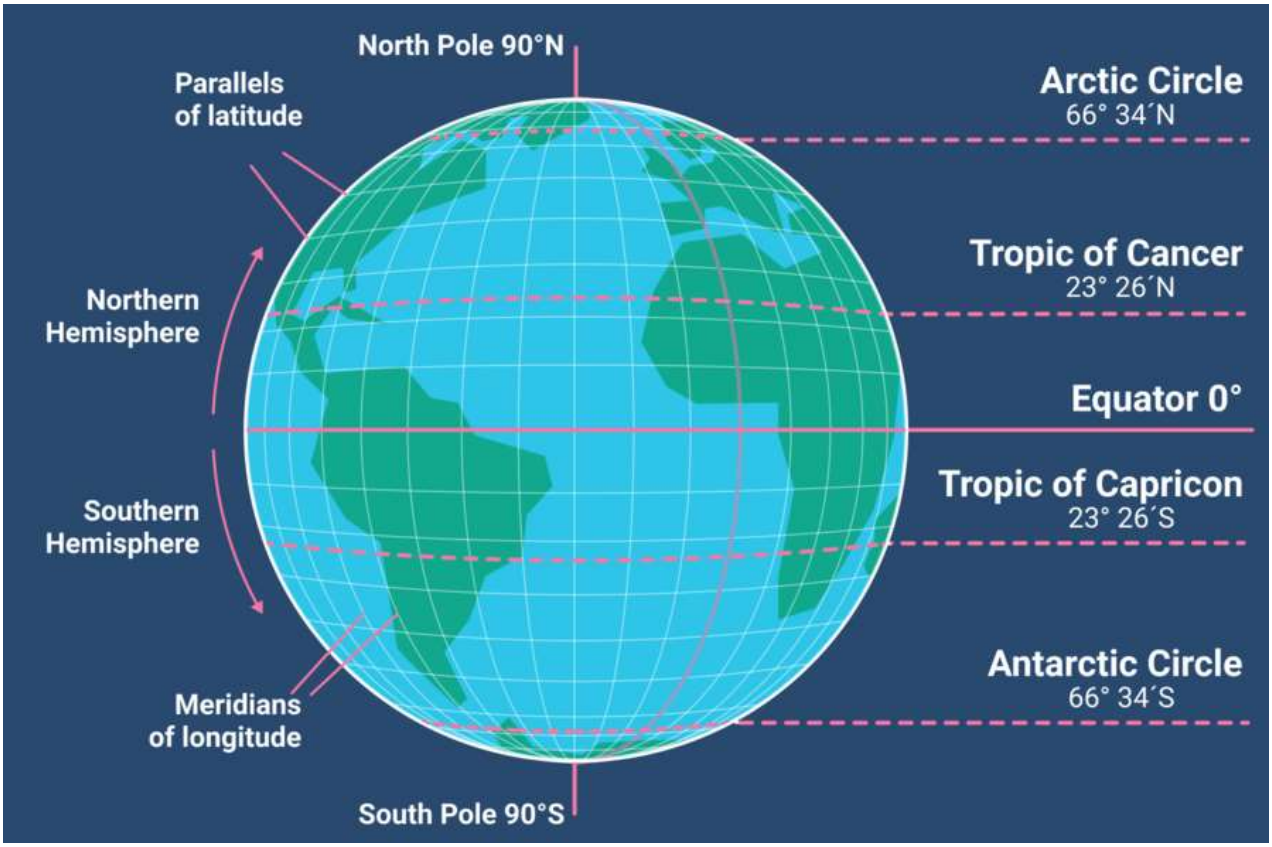
1.4 Latitude and Longitude

- **Latitude** measures position **north or south** of the Equator (0° to ±90°). It is given as an angle between your position and the equator, as measured from the centre of the Earth.
- **Longitude** measures position **east or west** of the Prime Meridian (0° to ±180°).
- Used for navigation and locating astronomical objects.



1.5 Major Divisions of Earth's Surface as Astronomical Reference Points

- **Equator (0° latitude):** Divides Earth into northern and southern hemispheres.
- **Tropic of Cancer (23.5°N):** Northernmost point where the Sun is directly overhead at least once a year (during Summer in the Northern Hemisphere)
- **Tropic of Capricorn (23.5°S):** Southernmost point where the Sun is directly overhead at least once a year (during Winter in the Northern Hemisphere
- **Arctic Circle (66.5°N):** Above this latitude, the Sun does not set in summer or rise in winter.
- **Antarctic Circle (66.5°S):** Opposite of the Arctic Circle.
- **Prime Meridian (0° longitude):** Reference line for time zones. It passes through Greenwich, UK.
- **North Pole (90°N)** and **South Pole (90°S):** Points where Earth's axis meets the surface.



Angles as decimals or degrees, minutes and seconds

We can write angles in degrees, minutes, and seconds (DMS), where 1 degree = 60 minutes and 1 minute = 60 seconds. For example, 35°20′15”.

Angles can also be written in decimal degrees, where minutes and seconds are converted into fractions of a degree. For example, 35°20′15” = 35.3375°.

To convert from decimal degrees to DMS: take the whole number as the degrees. Multiply the decimal part by 60 to get the minutes and then multiply any remaining decimal by 60 to get the seconds.

To convert from DMS to decimal degrees: take the degrees, add the minutes ÷ 60, and the seconds ÷ 3600.

Example:

Decimal to DMS: 45.762°	DMS to Decimal: 30°15′30″
0.762×60=45.72 → 45 minutes. 0.72×60=43.2 → 43 seconds. So, 45.762° = 45°45′43″	Convert the minutes: 15÷60 = 0.25° Convert the seconds: 30÷3600=0.0083° Total = 30° + 0.25° + 0.0083° = 30.2583°

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1.6 The Effects of Earth's Atmosphere on Astronomy

- **Sky Colour:**
  - The atmosphere **scatters blue light** more than other wavelengths, making the sky appear blue. This is called Rayleigh scattering. Rayleigh scattering in the atmosphere is mainly caused by nitrogen, as it is the most abundant gas, though oxygen also makes a significant contribution. It can distort colours of observed objects.

- **Skyglow (Light Pollution):**
  - Artificial light brightens the night sky, making it harder to see stars. It reduces contrast between the sky and the stars we are trying to observe.
  - Observatories are often built in **remote areas** to avoid this.

- **Twinkling (Seeing Conditions):**
  - Caused by **turbulence** in the atmosphere, distorting starlight.
  - Stars appear to 'twinkle' more when lower on the horizon.

If we make observations from high altitudes and/or equatorial positions, then the light has less atmosphere to travel through and this can help minimise distortions.