Astronomy **Summary Knowledge Organiser** – Chapter 3 (Topic 2) **The Lunar disc (i) surface features**

The **SHAPE** of the Moon is an **OBLATE SPHEROID**
The mean **diameter** of the Moon is **3500 km**
The mean **radius** of the Moon is **1750 km**
The Moon's POLAR DIAMETER is only 4km **smaller** than its **EQUATORIAL DIAMETER**
The Moon is clearly 'less squashed' than Earth but **the Sun** is much more spherical than both – it is **almost perfectly spherical**.
Mean DISTANCE from the Moon to Earth is **380000km**
The **FULL DISC of the Moon subtends an angle of 0.5°**
ORBITAL PERIOD = 27.3 days (a sidereal month)

When you look at the Moon you see **large dark grey, smooth SEAS (**called ***maria*** if plural or ***mare*** if singular**).**
The seas originate from **volcanoes erupting**, releasing hot molten lava onto the cold lunar surface which then cooled and solidified to form **black basalt rock**. These regions are **flat** and **low lying**.
The **lighter-grey, mountainous regions** are **HIGHLANDS** (called ***terrae*** or ***terra*** if singular). They are made of a **lighter coloured** igneous rock called **anorthosite** and are **highly cratered** <u>because</u> they are **older** than seas.

The Moon's **NEARSIDE** has **many seas** compared to its **FARSIDE**. Early in its life the Moon was heavily bombarded by the left-over rocky debris from the formation of the Solar System and this carved out basins/depressions. When, about 4000 million years ago the bombardment stopped, molten **lava seeped through** the **relatively-THIN NEARSIDE CRUST** forming the lunar maria.
Mountain ranges were created when land was thrust upwards and deep valleys formed between them!

You need to able to identify the **LOCATION** of the following **lunar surface features**:

a Sea of Tranquility

b Ocean of Storms

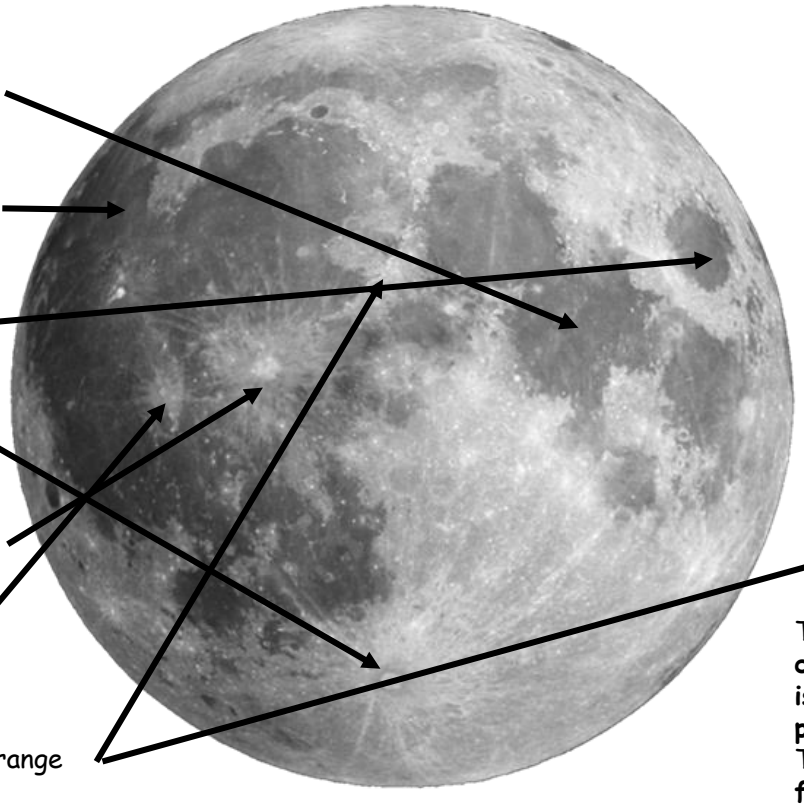
c Sea of Crises

d Tycho crater

e Copernicus crater

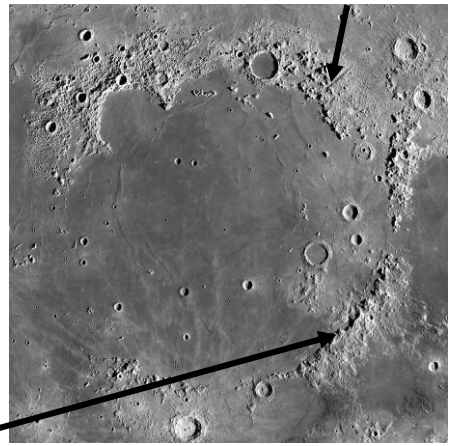
f Kepler crater

g Apennine mountain range

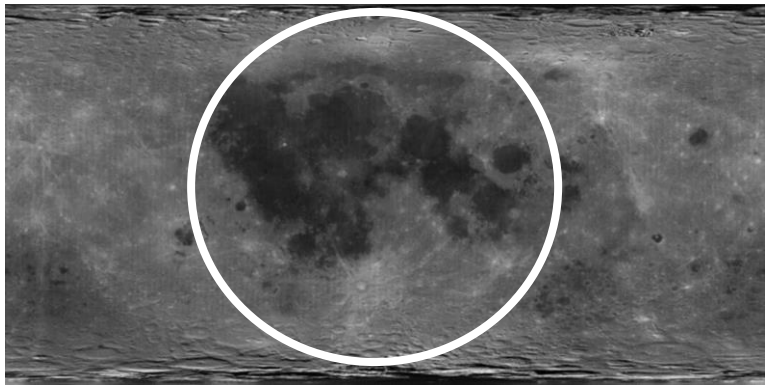


LUNAR CRATERS were formed by **METEOROIDS** from space striking the lunar surface. Each IMPACT created a SHOCKWAVE that COMPRESSED the surface creating a LARGE CAVITY. Impacts like this create a **rebound** of material and that **EJECTA** gets thrown in all directions leaving **bright-streaks on the surrounding surface** that we call **ejecta RAYS**.

Alps



Below is an image of the **Moon's total surface**.
The circled central part is the Moon's familiar nearside.



The Moon is now **tidally locked** into a **SYNCHRONOUS ORBIT** in which its **rotational period (27.3 days) is <u>equal</u> to its orbital period around the Earth (27.3 days).** This means the Moon's **near side is permanently facing Earth** and the **Moon's far side** (often incorrectly called its dark side) **is permanently facing away** from us.
The present **SYNCHRONOUS ROTATION** of the Moon was caused by **internal tidal gravitational forces** slowing the Moon's spin until it matched it orbital period.

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Although the Moon is **locked into a synchronous orbit with Earth**, far from being able to see 50% of the Moon's surface, **up to 59% of the lunar surface is visible from Earth over a period of time**. This is **due to LUNAR LIBRATION**.
We can see more than 50% of the Moon's surface over a period of time because;
it **physically 'wobbles'** about its equilibrium position a little,
we can **observe it from high or low latitudes** on Earth allowing us to see over or under the Moon's polar regions,
and due to the Earth's rotation we **view the Moon from slightly different angles at moonrise and moonset** so we 'peek' around the edges of the Moon's eastern & western limbs. When the **Moon rises in the east**, **more of its eastern limb can be seen** and when the Moon is **setting in the west**, a little **more of its western limb is visible**.
This is called **DIURNAL (DAILY) LIBRATION**.

All libration effects occur close to the Moon's limbs and so in reality are difficult for us to actually see in detail because we are seeing the extra surface 'side-on'.

However, most libration is due to **WHERE THE MOON IS** in its orbit of Earth.

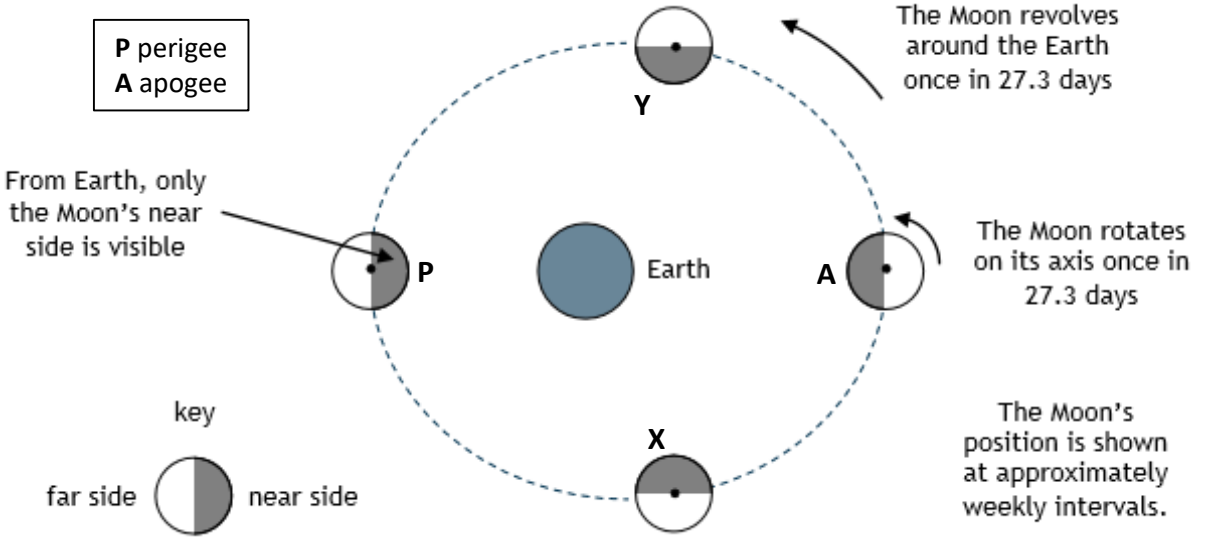
LIBRATION in LATITUDE

The **plane of the Moon's orbit is inclined at 5.1° to the ecliptic** (plane of the Earth's orbit around the Sun) as shown in the diagram below. Due to this, we can see 'under the Moon's south polar region' and 'over the north polar region' except for twice a month when the Moon crosses the plane of Earth's orbit.

The **Moon's axis** of rotation is also **inclined to its own orbital plane by 1.5°**. This further increases the effects of libration in latitude.

LIBRATION IN LONGITUDE

Whilst completing its elliptical orbit of the Earth, the **Moon's SPEED VARIES** and this **causes libration in longitude**. The diagram below shows the Moon's position at weekly intervals and the elliptical shape of the orbit has been exaggerated.



The Moon's orbital speed is **quickest at perigee** and **slowest at apogee** - but its **rotation period remains constant**. When the Moon is half way between apogee and perigee (position X & Y), the libration in longitude will be at its maximum, allowing observers on Earth to glimpse around either side of the Moon's eastern and western limbs.

At X, the Moon has **rotated by ¼ of a turn** since when it was at P, but it has **moved by *more* than ¼ of its orbital path** from perigee to apogee.

An observer on Earth is able to see slightly round the Moon's eastern limb