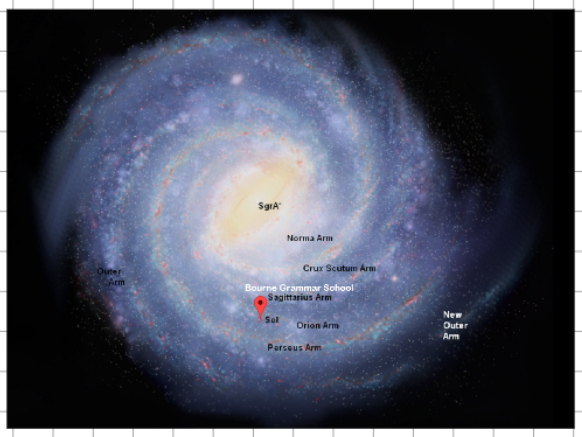
Our Cosmic Address

24th June

We are on planet EARTH, which is a part of THE SOLAR SYSTEM (a planetary system). The star our planet orbits is called the Sun (Sol).

The Sun is one star of between 100 and 400 BILLION stars which are bound together by GRAVITY. A large group of stars is called a GALAXY.

The solar system is on the ORION ARM of the MILKY WAY galaxy.



The Milky Way is part of a small group of galaxies called the LOCAL GROUP.

This group is part of a much larger group called the LANIAKEA SUPERCLUSTER.

All of the galaxies we can see form the OBSERVABLE UNIVERSE.

Gravitational force: an ATTRACTIVE force that acts between objects with mass

Orbit: a path one object takes around another

Planetary system: a group of objects that orbit a star

The Solar System

3rd July

PLANETS must:

- Orbit a star
- Be approximately spherical
- Dominate their orbits (has cleared its orbital path of other objects)

Planets with ROCKY SURFACE (Mercury, Venus, Earth and Mars) are TERRESTRIAL (Earth-like).

Planets with GASEOUS SURFACES (Jupiter, Saturn, Uranus, Neptune) are JOVIAN (Jupiter-like).

Objects that orbit planets and not stars are often referred to as SATELLITES.

Natural satellites: such as moons

Artificial satellites: objects made by humans

Earth and the Sun

4th July

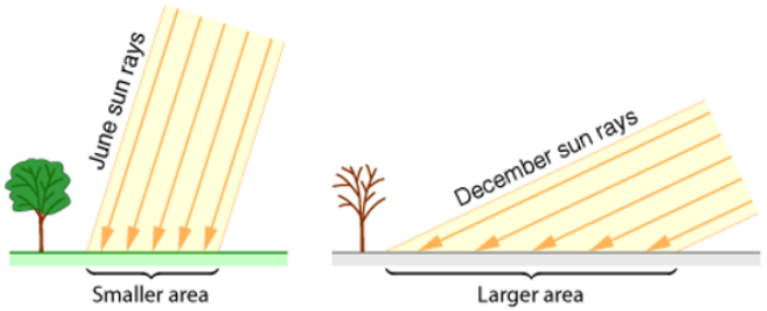
The Earth spins around an axis and follows an orbital path around the Sun.

ONE YEAR is the time taken for Earth to complete one orbit around the Sun. This takes approximately 365 1/4 days.

ONE DAY is the length of time taken for Earth to rotate once around its axis.

The rotation of the Earth is why we see the Sun move across the sky, and 'rise' and 'set'.

ONE HOUR is ONE TWENTY-FOURTH of a DAY.



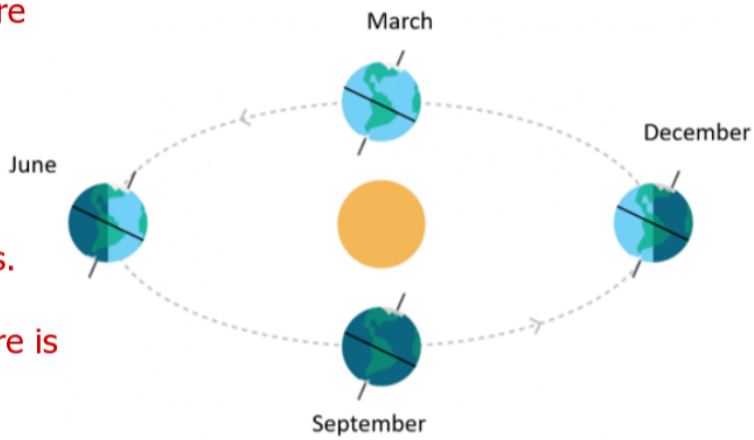
The Earth's axis is tilted at 23.5° which changes the angle at which the Sun's rays hit the surface.

Northern hemisphere is tilted TOWARDS the Sun.

Summer in the UK.

More daylight hours.

Average temperature is higher.



Northern hemisphere is tilted AWAY from the Sun.

Winter in the UK.

Daylight hours are fewer.

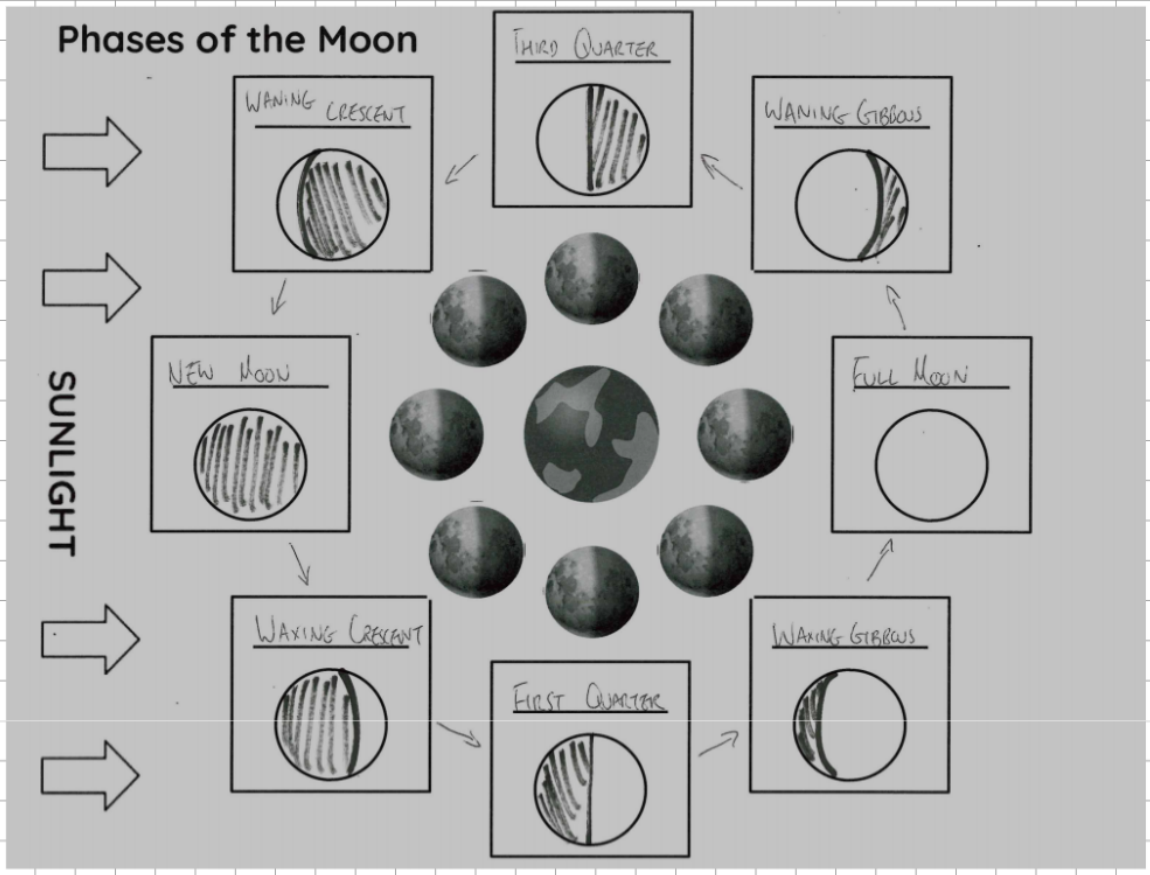
Average temperature is lower.

Earth and the Moon 7th July

The MOON is a NATURAL SATELLITE of the Earth. It cannot generate its own light - it is NON-LUMINOUS. Instead, it REFLECTS light from the SUN.

The apparent shape of the Moon that we see at night depends on how much of the illuminated half is visible from our position on the Earth.

These different apparent shapes of the moon are called the PHASES of the Moon.



'WAXING' before a phase name means the proportion of the illuminated side we can see is INCREASING.

'WANING' before a phase name means the opposite.

The Moon takes 28 days to complete one orbit of the Earth. It orbits the Earth at a slight inclination (angle), so it only rarely blocks the light from the Sun.

When it does block the Sun's light we call this a SOLAR ECLIPSE.

The gravitational forces of the Sun and the Moon cause the water levels in the oceans to bulge outwards. As the Earth spins we see the ocean levels rise and fall twice a day - these are the TIDES.

Origin of the Solar System

8th July

Stars form is NEBULAE (large clouds of gas).

GRAVITY can pull gas particles closer together.

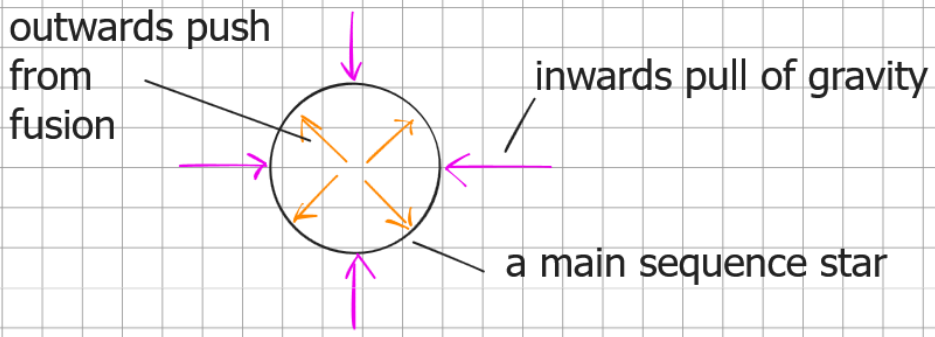
This makes parts of the nebulae become HOT and DENSE. These hot and dense areas are called PROTOSTARS.

If a protostar is hot and dense enough then gas particles start to fuse together and release energy.

This is called NUCLEAR FUSION.

If the inwards force of GRAVITY is BALANCED by the outward force from FUSION then the star is STABLE.

Stable stars are called MAIN SEQUENCE stars. The Sun is a main sequence star.



After the Sun formed there was still a spinning disk of gas and dust.

GRAVITY and MAGNETISM formed METALS, ROCKS and ICE.

The metal and rocks formed the TERRESTRIAL planets.

The ice and remaining gases formed the JOVIAN planets.

1	2	3	4	5	6	7
Gravity causes gas particles in a nebula to move closer together.	Parts of the nebula become hot and dense. This is a protostar.	Above a certain density and temperature nuclear fusion can begin and a star is formed.	The star enters the main sequence where the inwards collapse from gravity is balanced by the outwards pressure from nuclear fusion.	Gas and dust left over after the star forms moves together due to gravity and magnetism.	Close to the star metals and rocks form. Far from the star, where it is cooler, larger balls of ice can form.	The metal and rocks clump together to form rocky Terrestrial planets. The balls of ice collect gas to form Jovian planets.

Life Cycle of Stars

9th July

When the Sun RUNS OUT OF HYDROGEN (fuel for fusion) it will EXPAND and turn into a RED GIANT star.

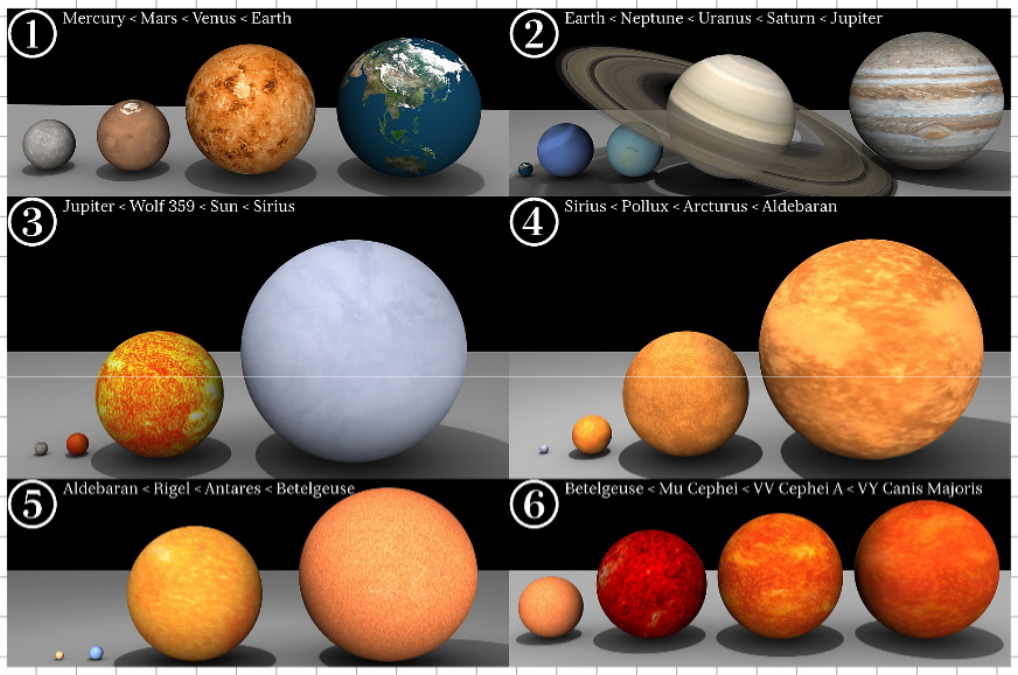
Eventually the outer layers of the star drift away to form a PLANETARY NEBULA.

The hot core of the star is left behind - we call this a WHITE DWARF

Eventually the white dwarf cools down to form a BLACK DWARF.

Sun-like stars:

Nebula → Protostar → Main Sequence → Red Giant → Planetary Nebula → White Dwarf → Black Dwarf



Stars that are MUCH MORE MASSIVE than the Sun expand into RED SUPERGIANT STARS when they run out of fuel.

Eventually these unstable stars explode as a SUPERNOVA.

The core of the star may be left behind as a very dense NEUTRON STAR, or if the star is massive enough the core may collapse further and become a BLACK HOLE.

Massive Star:

Nebula → Protostars → Main Sequence → Red Supergiant → Supernova → Neutron Star / Black Hole

Exploring Space

11th July

Type of spacecraft	Summary	Main Use	Notable examples
Observatory	A telescope in space.	Investigating objects outside of the solar system	Hubble, Webb
Flyby	Flies quickly past objects. Fitted with cameras and other detectors.	Investigating multiple solar system objects in one trip.	Stardust, Voyager 2.
Orbiter	Stays in orbit around the object we wish to investigate.	Very detailed measurements/images of one object	Galileo, Cassini.
Landers & Rovers	Landers land in one location on a planet/moon/asteroid. Rovers can move around on the surface.	Taking detailed scientific measurements from the surface of an object. Collecting samples.	Curiosity, Perseverance