

AQA GCSE Physics

Topic 8: Space (Physics only)

Notes

(Content in bold is for Higher Tier only)



Solar System (Physics only)

- Within our solar system there is one star, the Sun, plus the eight planets and the dwarf planets that orbit around the Sun. Natural satellites i.e. the moons that orbit planets, are also part of the solar system.
- The sun lies at the centre of our solar system, it is **heliocentric**.
- Dwarf planet also orbit the sun (including Pluto, Ceres)
- There are also asteroids and comets
- Our solar system is a small part of the Milky Way galaxy.
- Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune, (pluto)
 - o *My Very Early Morning Jam Sandwich Usually Nauseates (people)*
- Smaller planets are made of primarily rock, then the larger planets are primarily gas
- All planets orbit the Sun on the same plane
- All planets rotate, just at different speeds
 - o Some planets rotate in the opposite direction or on a skewed axis to the other planets, and this may be due to past collisions throwing its axis off balance
- Larger planets have rings, as their gravitational field is so strong it attracts debris

Solar System Model (Physics only)



- Initially, Earth was at the centre, the planets, our moon, and the sun, orbited the Earth
 - o “Geocentric” model
 - o Everything orbited in perfect circles
 - o With a fixed background of stars
- Then 600 years later, the heliocentric model was formed, with the sun at the centre
 - o The main evidence being Mars’ “retrograde motion”
 - Earth orbits the sun faster than mars, so we undertake it, so it appears to reverse its direction in the sky
 - o Galileo observing moons orbiting Jupiter showed not everything orbited the Earth
 - o Kepler showed that the planets orbited in ellipses, and not circles

Planetary Orbits (Physics only)

- As the planet orbits the sun,
 - o The gravitational force causes the planet to change direction constantly (it moves in a circle around the sun)
 - o **This means the velocity is always changing**
 - Hence the force causes the planet to accelerate without increasing its speed

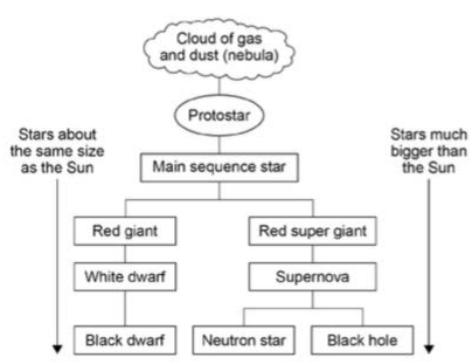
Relationships (Physics only)

- **For a stable orbit:**
 - o **If the planet moves closer to the sun, (i.e. its orbital radius decreases)**
 - o **The gravitational attraction to the sun increases**
 - **(Force increases, and so does acceleration)**
 - o **So the orbital speed of the planet increases**



Life Cycle of Star (Physics only)

- Dust and gas cloud is present in a galaxy
- The gravitational attraction between the gas/dust particles draws them together
- The cloud becomes more concentrated, as the particles get closer
- The temperature and pressure of the cloud increases as the particles get pushed so close together
- Eventually the pressure gets so great that the gas/dust particles are able to fuse together
 - o Fusion occurs as the light (mainly hydrogen gas) nuclei fuse together to form helium nuclei
 - o This creates a large amount of energy
 - o This release opposes the collapsing of the cloud due to gravity
 - o So eventually an equilibrium forms, where the energy released due to fusion balances the pressure of gravitational collapse
 - This means a star has now formed, and it will stay like this for billions of years
- Eventually the star runs out of gas to fuse
 - o This means it is not in equilibrium, so it collapses
 - o If Massive
 - The star will collapse, increasing the pressure + temperature of the core, meaning heavier elements can fuse. Once all the fusion has happened, it is too massive to be stable, so the star collapses, rebounds on its centre and produces a supernova
 - What remains is either a neutron star or black hole
 - o If Normal-sized
 - The same process happens, less fusion occurs however (less fuel to fuse)
 - The star collapses, and produces a planetary nebula
 - A lower scale supernova
 - A white dwarf remains



Red Shift (Physics only)

- Light appears red shifted from galaxies which are moving away from Earth
- The change with distance of each galaxy's speed is evidence of an expanding universe
- Imagine start of the big bang as an un-stretched balloon, with galaxies on the surface of the balloon, and as the universe expands, the balloon expands
 - o The distance from the galaxies also expands
 - o So light from a galaxy has its wavelength "red-shifted" as it appears to move away from us
 - o As wavelength appears to get larger (more in the red-end of the visible spectrum)
 - o Frequency appears to decrease, as each time a wavelength is emitted, the source (galaxy) is further away

Evidence for the Big Bang (Physics only)

- Red Shift
 - o This shows universe is expanding
 - o So initially, it must have been formed from a single point
- CMB
 - o Cosmic Microwave Background radiation



- When the universe was very young, everything, the first stars and rock, would be very hot, and should have emitted lots of short-wavelength radiation
- This radiation, as the universe expanded over time, would have been stretched to become microwaves
- This background radiation is present wherever you point a telescope in the sky
- Which proves that the hot young universe has cooled and expanded since
- As the big bang accounts for all the experimental evidence, it is the most accepted model currently

There is much about the universe that is not understood, for example dark mass and dark energy.

