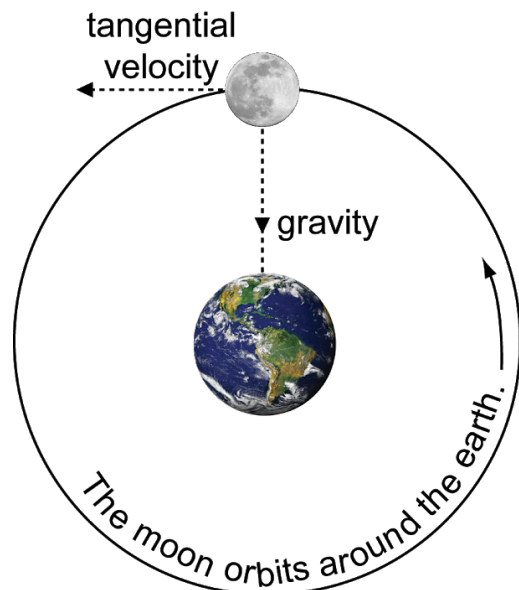


The Solar System

- Stars** are objects in the universe that produce their own light
- Planets** are in orbits around stars, are spherical in shape and have a gravitational field strong enough to clear other material out of its way
- Dwarf planets** are in orbits around stars, are spherical in shape but do not have a gravitational field strong enough to clear other material out of its way
- Moons** are bodies which orbit both a planet and a star
- The four **inner planets** (Mercury, Venus, Earth and Mars) are small and rocky
- The four **outer planets** (Jupiter, Saturn, Uranus and Neptune) are large and made of gas, these can be referred to as **gas giants**

Orbits of planets, moons and artificial satellites

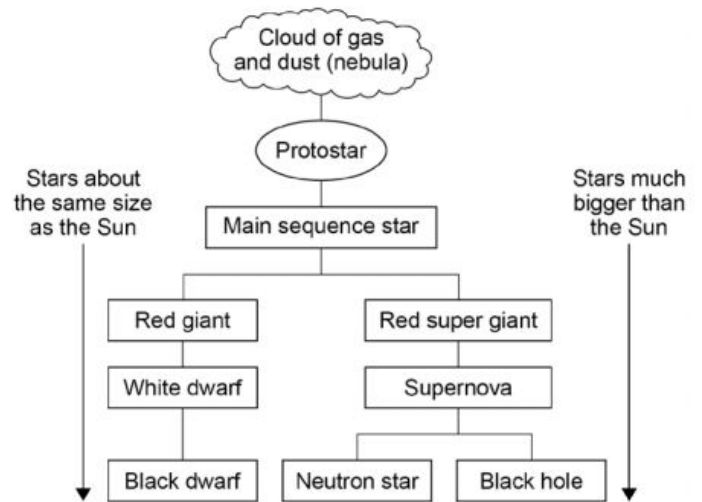
- The further away a planet is from the object that it is orbiting, the longer the time it will take to complete the orbit**
- The amount of time that it takes an object to complete one orbit is known as an orbital period
- The further away an object is from the body that it orbits, the lesser the gravitational pull, as the further away from the body, the weaker the gravitational field
- When an object is orbiting another, it has a tangential velocity (at 90° to the circle of orbit) but cannot escape as the pull of the gravitational field will be constantly changing the direction, causing it to travel in a circular shape



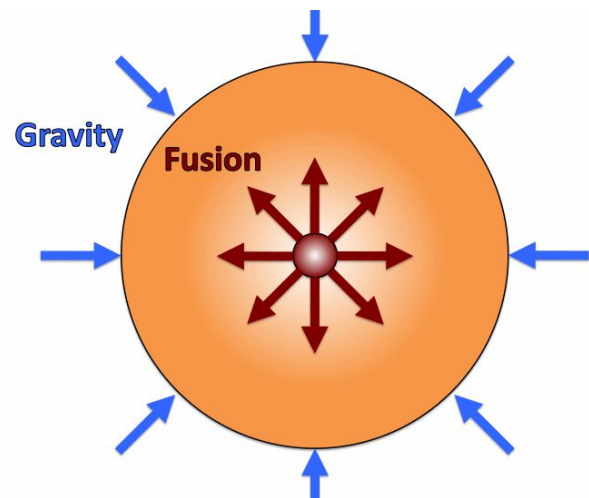
- The lower the orbit of the satellite, the greater the speed needs to be to account for the stronger gravitational pull
- When an artificial satellite is put into orbit, it is taken to a specific height and launched at a right angle

Stars and life cycles

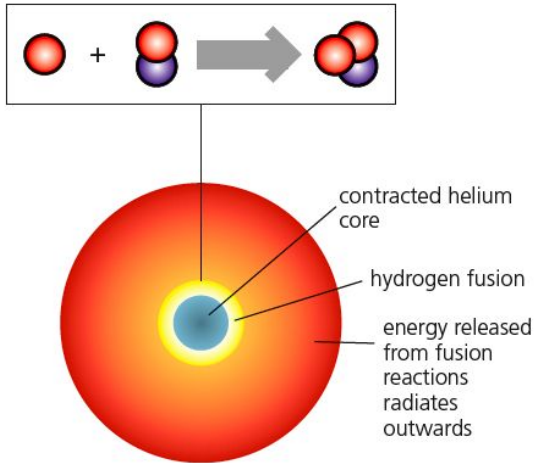
- In the early universe there was just patchy clouds of hydrogen and helium, which were pulled together by gravity, when these gases are increasingly pulled together, they form a protostar



- Nuclear fusion occurs in the protostar when the temperature becomes high enough for the atoms of hydrogen to overcome the repulsion force between like charges (15 000 000 K)
- When these forces are in equilibrium, the star is in a stable state, this means that the outwards force caused by fusion is equal and opposite to the force of gravity trying to collapse the star**



How the elements are formed



-The early universe only consisted of clouds of hydrogen and a little helium, gravity compressed these to form the first stars, where hydrogen fused to form more helium

-All elements up to iron are made through fusion in a star, the more massive the star, the greater the range of elements produced (as more energy is present)

-When hydrogen inside a star starts to run out, the fusion starts to slow down, and gravity causes the star to **contract**

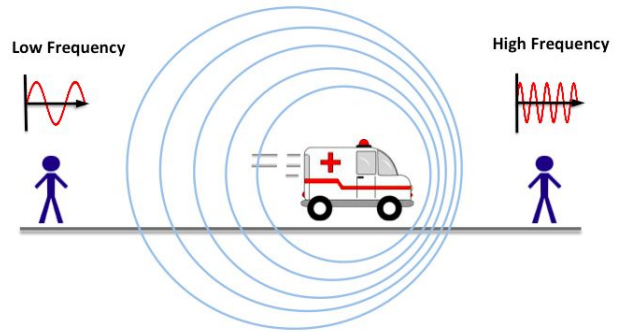
-**The contraction causes a rise in temperature until a point of where helium starts to fuse**, this starts a larger fusion reaction in which heavier elements can be formed up until iron (as after this not enough energy is present)

-After a red giant has collapsed, a supernova is formed, the temperatures are high enough here for heavier elements such as uranium and gold to be formed

-The explosion of the supernova causes elements to be scattered and join nebulae across the galaxy for new stars to be formed

Red Shift

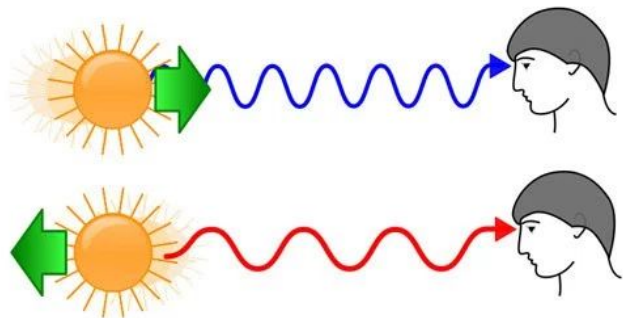
-The **doppler effect** occurs when wavelength and frequency change due to the source of the waves moving, e.g. when a racing car passes you quickly, the pitch of the noise changes



-Redshift and blueshift show whether a universe is moving away from or towards you

-Redshift shows that an object is moving away from you, the wavelengths will be stretched as the object is moving away from you, showing that the spectrum of light is shifting towards the red end of the spectrum

-Blueshift shows that an object is moving towards you, the wavelengths will be squashed as the object is moving towards you, showing that the spectrum of light is shifting towards the blue end of the spectrum



-Hubble used observations from red shift, and found that the size of red shift was directly proportional to the distance from the earth, meaning the further away the galaxy, the faster it was moving away from us

-This was further evidence for the **big bang theory**, that the universe was constantly expanding away from a set point

-Other evidence for the big bang theory include **cosmic microwave background radiation (CMBR)**