1. Measurements in Space

Astronomers call the distance from the Sun to the Earth one astronomical unit, which is 150,000,000km.

So,
1au = 150,000,000km
3au = 3 x 150,000,000 = 450,000,000km

The astronomical unit is useful when dealing with distances in our Solar System but another unit is needed when measuring distances throughout the rest of the Universe.

A light year is a distance unit. A light year is the distance light travels in one year and can be calculated as shown…

distance = speed x time
distance = (speed of light) x (number of seconds in a year)
distance = (3 x 10^{8}) x (365 x 24 x 60 x 60)
distance = 9.46 x 10^{15}m

One light year = 9.46 x 10^{15}m

Example
The star Proxima Centauri is 4.3light years from planet Earth. Calculate the distance to Proxima Centauri in metres.

One light year = 9.46 x 10^{15}m
4.3 light years = 4.3 x 9.46 x 10^{15} = 4.1 x 10^{16}m

The distance to Proxima Centauri is 4.1 x 1x0^{16}m

2. Big Bang Theory – Origin of the Universe

- The Universe began from a singularity (single point)
- There is evidence to show that all matter in the observable universe is moving away from us. If this is the case then the universe must be expanding.
- The universe is estimated to be 13.8 billion years old.

3. Observing the Universe

Astronomers use all 7 parts of the electromagnetic spectrum to observe the universe.

Optical telescopes observe visible light from space. Small ones allow amateurs to view the night sky relatively cheaply but there are very large optical telescopes sited around the world for professional astronomers to use however they can only be used at night and they cannot be used if the weather is poor or cloudy.
Radio telescopes detect radio waves coming from space. Although they are usually very large and expensive, these telescopes have an advantage over optical telescopes. They can be used in bad weather because clouds do not block the radio waves as they pass through the atmosphere. Radio telescopes can be used in daytime as well as at night.
X-rays are partly blocked by the Earth's atmosphere and so X-ray telescopes need to be at high altitude, flown in balloons or carried in satellites above the Earth's atmosphere.
Space telescopes
Objects in the universe emit other electromagnetic radiation such as infrared, X-rays and gamma rays. These are all blocked by the Earth's atmosphere, but can be detected by telescopes placed in orbit round the Earth.
Telescopes in space can observe the whole sky and they can operate both night and day. However, they are difficult and expensive to launch and maintain.

8. COSMOLOGY

N5 Past Paper HW
2015 – MC Q20
2016 – MC Q20

4. Spectra

White light consists of a combination of all of the wavelengths in the visible spectrum and is knows as the **continuous spectrum**.

Emission and Absorption Line Spectra
The light emitted by stars (which are hot) can tell us a great deal about their composition. Hydrogen gas, for example only produces specific emission lines at specific wavelengths of light. These wavelengths relate to specific colours.

The emission lines for helium, lithium and beryllium etc. are all different and unique to that element, like a fingerprint. By observing the emission lines of stars we can determine their composition. The spectrum produced by a star can be observed using a spectroscope, which, like a prism, separates the colours of visible light.
When white light passes through a cold gas, the elements in the gas absorb light of specific wavelengths (and therefore colours). These lines are identical in wavelength to the emission lines and again identify the elements present.

These diagrams all show the emission and absorption lines for Hydrogen.