

TOPIC A – ASTROPHYSICS – EDEXCEL SPECIFICATION EXTRACT

A1 Observing stars

Recording star images.

Photographic emulsions and charge coupled devices (CCDs). Grain and pixel size; relative efficiencies; linearity of response.

Benefits of observing from above the Earth's atmosphere.

The importance of different wavelengths of radiation as a means of discovering information about distant objects. Use of satellites such as Hubble telescope, IRAS and COBE.

The total power emitted; luminosity L.

The Planck distribution of energy.

Stefan-Boltzmann law: $L = \sigma T^4$ x surface area, and for a sphere $L = 4\pi r^2 \sigma T^4$

Surface temperature of stars.

Wien's law: $\lambda_{\text{max}} T = 2.898 \times 10^{-3} \text{ m K}$

Appreciation that the surface temperatures of stars range from near absolute zero to 10^7 K , corresponding to peak wavelengths from radio to X-rays.

Measuring distance by trigonometric parallax.

Use of annual parallax to measure the distance of nearby stars, including the use of the small angle approximation.

The light year. (Parsecs and AU will not be required).

Simple Hertzsprung-Russell diagram.

Simplified luminosity - temperature diagram showing main sequence, white dwarfs and red giants. The use of an L/T diagram to deduce L for a distant main-sequence star.

Estimating distance of more distant stars.

Use of intensity $= L/4\pi D^2$ to find distance of stars of known luminosity.

Use of Cepheid variable stars to find distance to nearby galaxies.

A2 The lives of stars

Energy for stars.

Gravitational collapse and hydrogen 'burning'.

$c^2 \Delta m = \Delta E$. (Details of the p-p chain are not required.)

Main sequence stars.

A star spends most of its life as a main sequence star.

White dwarfs.

Hot, low volume, low mass stars. Origins and typical masses, (less than about 1.4 solar masses). Core remnants.

Red giants.

Cool, high volume, stars. Origins and typical masses, (between 0.4 and 8 solar masses). Core remnants.

Supernovae (Type II only).

Rapid implosion of stars of more than eight solar masses. Shock wave: outer layers blown away.

Neutron stars.

Core remnants greater than about 1.4 solar masses. Formation from electrons and protons. Very high density. Pulsars.

Black holes.

Core remnants greater than about 2.5 solar masses. The dense core traps radiation.