(a) (i) An eclipsing binary would be observed from Earth with differing brightness. As the duller of the two stars in the system eclipses the brighter star, the binary would appear duller ~~as~~ from Earth, and then when the brighter of the two is eclipsing the other, the system would appear brighter. This can be presented in a graph of luminosity against time.

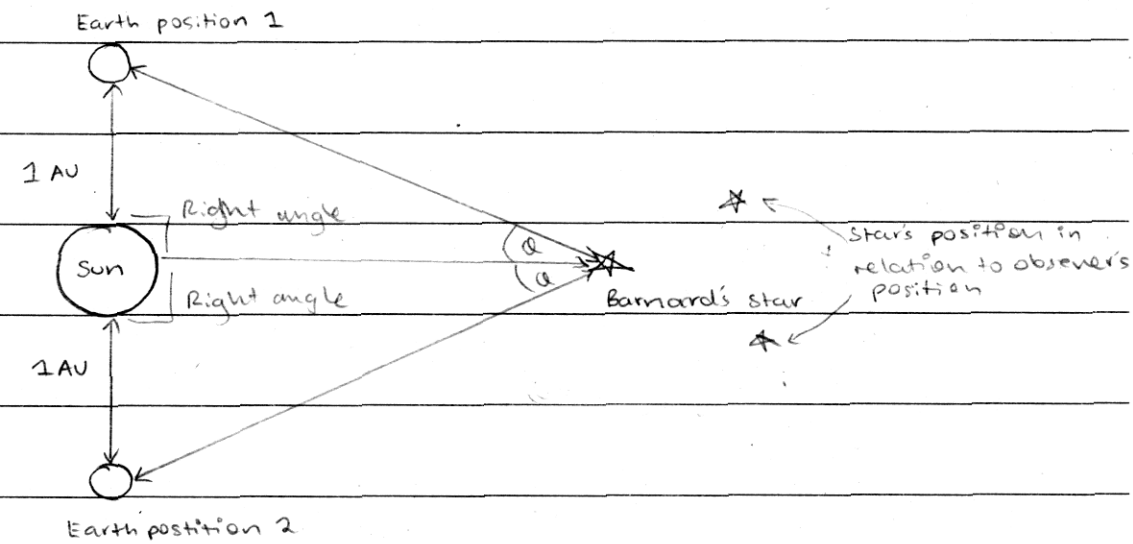
(ii) In a binary star system, there will be a centre of mass within the system, and the more massive of the two stars in a binary system will be closer to this centre. Spectroscopic binaries are the preferred systems for calculating the mass of a binary star system. ~~The wavelengths which these stars are emitting is a direct implication of the heat of the star's surface.~~ Through observing the Doppler shift of the stars, the rate of their velocity can be inferred, and this will allow for the period of the orbits of the stars to be deduced. Through this knowledge, and the radius found when observing the centre of mass, the formula $m_{1+2} = \frac{4\pi^2 r^3}{GT^2}$ can be used to find the total mass of the system.

b) (i) Proxima Centauri.

(ii) [redacted] 11.01 - 10.37

Ross 154 is 0.64 times more brighter than Proxima Centauri when viewed from Earth

(iii)



(C) (i) Position S would be where white dwarfs would be found. In relation to the sun's luminosity, a white dwarf would be duller, therefore ruling out R and Q as possibilities, and in order for the star to be white, it would still have to be a relatively hot star, and the placement of S is in the right position for this to be correct (position P would be a more likely area for red dwarfs).

(ii) A white dwarf's core no longer contains any materials with which it can fuse to emit energy, hence becoming smaller in size. Because of this, the white dwarf's considered stable and does not shrink.

(iii) The proton-proton cycle is a nuclear reaction to first take place within mainsequence stars, starting from zero age. This involves fusing the hydrogen in the core to create helium.

d) Adaptive optics is a technique used for ground based astronomy in order to correct the faults in observations due to the effects and interference of the atmosphere. It involves a wavefront sensor within the telescope, which takes large numbers of readings per second. These readings are then sent through a computer, and any faults in the readings due to the atmosphere are corrected, allowing for improved resolution and sensitivity.

Another technique used is that of interferometry. This works on the basis of the statement that the larger the diameter of the lense of a telescope, the better the sensitivity and resolution. Through the use of a device called an interferometer, a number of telescopes can be correctly connected up to act as one large telescope, hence improving resolution. It follows that the more distance your lens can cover (hence, the more telescopes you use), the better your resolution will become.

A third technique is called active optics, and works on a similar principle to adaptive optics, but not as quickly. When imperfections in a mirror can be observed, hundreds of actuators attached to the back structure of the mirror will move in order to correct imperfections. Seeing as abberations in mirrors is one

of the problems hindering telescope resolution, the correcting of these imperfections allows for better resolution.