19 In 2016 the Breakthrough Starshot initiative was announced. This project intends to send a fleet of small probes to Proxima Centauri, the nearest star to the Sun. This journey would take about twenty years.

(a) The radiation intensity at Earth from Proxima Centauri is 3.25×10^{-11} W m^{-2}. The luminosity of the Sun is $L_\odot$.

(i) Show that the luminosity of Proxima Centauri is about 0.002 $L_\odot$.

(3)

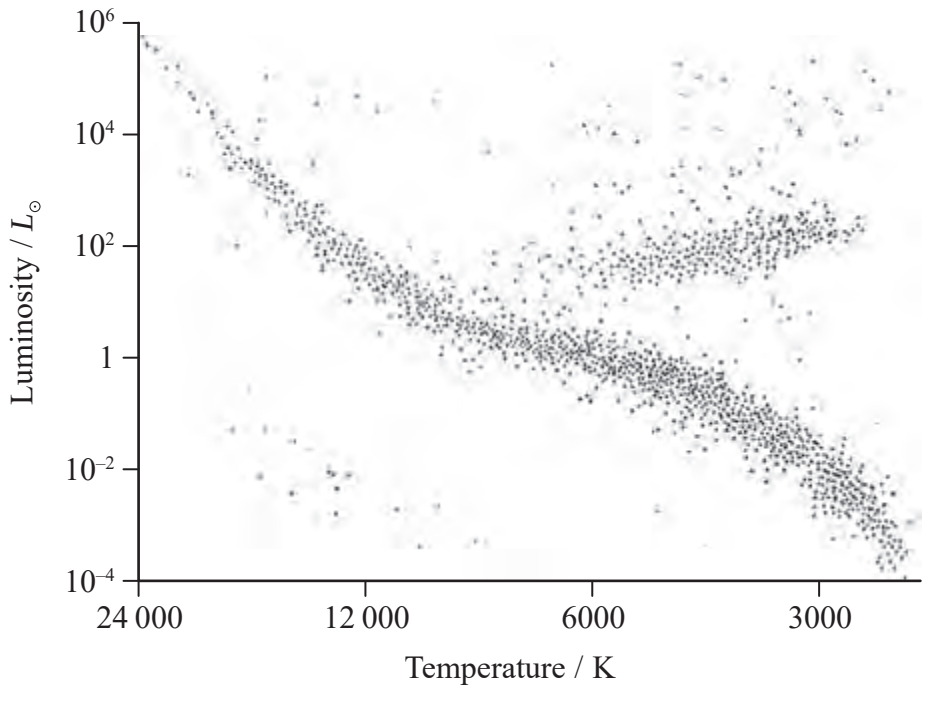
distance to Proxima Centauri = 4.00×10^{16} m
$L_\odot = 3.85 \times 10^{26}$ W

(ii) Proxima Centauri is described on a website as a main sequence star.

Determine whether the surface temperature of Proxima Centauri is consistent with a position on the main sequence of the Hertzsprung-Russell diagram.

(3)

radius of Proxima Centauri = 9.81×10^7 m



(b) The composition of a star can be determined by analysis of its absorption spectrum.

Explain why there are certain specific frequencies missing from the spectrum.

(5)

(c) Describe how the distance to nearby stars like Proxima Centauri is determined.

(3)

(Total for Question 19 = 14 marks)