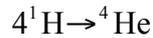


Stars and Galaxies

Coursework Sheet 1 – Feedback

1.



$$\text{so } \Delta m = 4.1.0078 - 4.0026 \quad (1 \text{ mark})$$

$$= 4.0312 - 4.0026 = 0.0286 \text{ amu} \quad (1 \text{ mark})$$

$$\text{and } \frac{\Delta m}{m} = \frac{0.0286}{4.0312} = 0.0071 = 0.71\% \quad (1 \text{ mark})$$

2.

$$L = 4\pi R^2 \sigma T_{\text{eff}}^4$$

$$T_{\text{eff}} = \left(\frac{L}{4\pi R^2 \sigma} \right)^{\frac{1}{4}} \quad (1 \text{ mark})$$

$$= \left(\frac{4.10^{26}}{4\pi(7.10^8)^2 5.7.10^{-8}} \right)^{\frac{1}{4}}$$

$$= 5800 \text{ K} \quad (1 \text{ mark})$$

3.

Use Wien's Displacement Law

$$\lambda_{\text{max}} = \frac{3.10^{-3}}{T} \quad (1 \text{ mark})$$

$$= \frac{3.10^{-3}}{3500}$$

$$= 8.6.10^{-7} \text{ m} = 860 \text{ nm} \quad (1 \text{ mark})$$

i.e. in the near infrared part of the spectrum.

4.

Flux is related to the luminosity by

$$f = \frac{L}{4\pi d^2} \quad (1 \text{ mark})$$

The luminosity of the Sun is 4×10^{26} W and the Earth - Sun distance is 1 AU = 1.5×10^{11} m. So

$$f = \frac{4 \times 10^{26}}{4\pi(1.5 \times 10^{11})^2}$$

$$= 1400 \text{ Wm}^{-2} \quad (1 \text{ mark})$$

Since Alpha Centauri is solar - like let us assume it has the same luminosity as the Sun.

Also $1 \text{ pc} = 3.1 \times 10^{16} \text{ m}$. So

$$f = \frac{4 \times 10^{26}}{4\pi(1.3 \times 3.1 \times 10^{16})^2}$$
$$= 2.0 \times 10^{-8} \text{ Wm}^{-2} \quad (1 \text{ mark})$$

Could alternatively use the inverse square law and say that

$$\frac{f_{\alpha Cen}}{f_{Sun}} = \left(\frac{d_{Sun}}{d_{\alpha Cen}} \right)^2 = \left(\frac{1.5 \times 10^{11}}{1.3 \times 3.1 \times 10^{16}} \right)^2 = 1.4 \times 10^{-11}$$
$$f_{\alpha Cen} = 1.4 \times 10^{-11} f_{Sun} = 2.0 \times 10^{-8} \text{ Wm}^{-2}$$