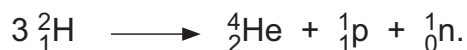


- 11 The deuterium nucleus (${}^2_1\text{H}$) has a mass defect of 0.002 388 u. The helium-4 nucleus (${}^4_2\text{He}$) has a mass defect of 0.030 377 u. Helium-4 is formed from deuterium in a nuclear reaction that can be represented by the equation



- (a) (i) State the name of this type of nuclear reaction.

..... [1]

- (ii) Show that the energy released when one nucleus of helium-4 is formed from deuterium is $3.47 \times 10^{-12} \text{ J}$.

[3]

- (b) A star has a radius of $6.96 \times 10^8 \text{ m}$. Helium-4 is produced in this star, from deuterium, at a mass rate of $7.34 \times 10^{11} \text{ kg s}^{-1}$. All the energy released from this process is radiated away from the star. All the energy that is radiated from the star is released by this process.

- (i) Calculate the luminosity of the star.

luminosity = W [3]

- (ii) Use your answer in (b)(i) to determine the surface temperature of the star.

temperature = K [2]