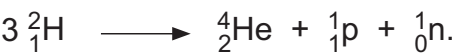


11 The deuterium nucleus (${}^2_1\text{H}$) has a mass defect of 0.002388 u. The helium-4 nucleus (${}^4_2\text{He}$) has a mass defect of 0.030377 u. Helium-4 is formed from deuterium in a nuclear reaction that can be represented by the equation



(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]
①