

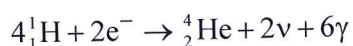
Solutions Ch4.3 and 4.4

Answer 1

Year 11

(4 marks)

A major source of energy in the Universe is a product of fusion reactions. These include many steps and are very complex. One reaction involves the combination of four protons and two electrons to form a helium nucleus, two neutrinos and six photons. Neutrinos and photons have no mass. The overall equation for this reaction can be written as



- (a) Use the information listed in the table below to calculate the energy (in MeV) released from this process due to the mass defect. (2 marks)

Particle	Proton	Helium	Electron	Neutron
Mass (u)	1.007276	4.002602	0.000549	1.008665

- (b) The major component of the Sun is ${}^1_1\text{H}$, which enables fusion reactions to take place. Explain why this is important to us on Earth. (2 marks)

Description	Marks
(a) $\Delta m = [4(1.007276) + 2(0.000549) - 4.002602] = 0.0276\text{u}$	1
$\Delta E = \Delta m \cdot c^2 \text{ (931 MeV)} = 25.696 \text{ MeV (or 25.7 MeV)}$	1
(b) The temperature inside the sun is very high and converts the hydrogen into helium.	1
This energy is radiated out and is the main source of energy for the earth	1
	Total 4