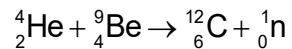


- 5 In a proposed fusion reactor, one possible reaction is



The binding energy per nucleon are given as follows

	binding energy per nucleon / MeV
${}_2^4\text{He}$	7.075175
${}_4^9\text{Be}$	6.462767
${}_6^{12}\text{C}$	7.675310

- (a) (i) Explain what is meant by *binding energy*.

.....  
.....  
.....

[1]

- (ii) Calculate the energy released during this process.

energy released = ..... MeV [3]

(b) Uranium (U) has at least fourteen isotopes. Uranium-238 ( $^{238}_{92}\text{U}$ ) is an isotope and the mean radius of its nucleus is  $8.9 \times 10^{-15} \text{ m}$ .

(i) Explain what is meant by an *isotope*.

.....  
.....  
.....

[1]

(ii) For a uranium-238 nucleus, show that

1. its mass is  $3.95 \times 10^{-25} \text{ kg}$ ,

$$\text{mass} = \dots \text{kg} [1]$$

2. its mean density is  $1.3 \times 10^{17} \text{ kg m}^{-3}$ .

$$\text{density} = \dots \text{kg m}^{-3} [2]$$

(iii) The density of a lump of uranium is  $1.9 \times 10^4 \text{ kg m}^{-3}$ .

Using your answer to (b)(ii)(2), suggest what can be inferred about the structure of the atom.

.....  
.....  
.....  
.....

[2]

[Total: 10]