



9 (a) State what is meant by

- *radioactive decay,*

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- *nuclear fission,*

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- *nuclear fusion.*

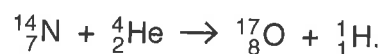
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[4]

(b) When an α -particle bombards a stationary nitrogen nucleus, a nuclear reaction that can take place is given by the equation



Data for the nuclei in the reaction are given in Fig. 9.1.

nucleus	mass/u
α -particle ${}^4_2\text{He}$	4.002604
hydrogen ${}^1_1\text{H}$	1.007825
nitrogen ${}^{14}_7\text{N}$	14.003074
oxygen ${}^{17}_8\text{O}$	16.999130

Fig. 9.1



- (i) Use data from Fig. 9.1 to determine, to three significant figures, the energy associated with the change in mass in this reaction.

energy = J [4]

- (ii) The incident α -particle has a kinetic energy of 1.76×10^{-13} J.

State and explain whether the reaction will take place.

.....

 [2]

- (c) A stationary nucleus emits a γ -ray photon of energy 1.16 MeV.

For the γ -ray photon, calculate, to three significant figures,

- (i) its wavelength,

wavelength = m [3]

- (ii) its momentum.

momentum = N s [2]





- (d) (i) The stationary nucleus in (c) has a mass of 60 u.

Use your answer in (c)(ii) to determine the recoil kinetic energy of this nucleus.
Explain your working.

energy = J [4]

- (ii) Suggest why the energy in (d)(i) is not usually thought to be an important factor when considering mass-energy for the emission of the γ -ray photon.

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..... [1]

[Total: 20]

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