

A3. This question is about nuclear reactions.

(a) State the meaning of the terms

(i) nuclide [2]

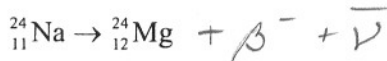
a nucleus with a specific number of protons and neutrons

(ii) isotope [1]

nuclei that have the same number of protons but different number of neutrons

(b) The isotope sodium-24 undergoes radioactive decay to the stable isotope magnesium-24.

(i) Complete the nuclear reaction equation for this decay. [2]



(ii) One of the particles emitted in the decay has zero rest-mass. Use the data below to estimate the rest mass, in atomic mass units, of the other particle emitted in the decay of $^{24}_{11}\text{Na}$. [3]

rest mass of $^{24}_{11}\text{Na} = 23.99096u$
rest mass of $^{24}_{12}\text{Mg} = 23.98504u$
energy released in decay = 5.002160 MeV

Handwritten calculation showing mass difference and energy conversion to find the rest mass of the neutrino.

(This question continues on the following page)



(Question A3 continued)

- (c) The isotope sodium-24 is radioactive but the isotope sodium-23 is stable. Suggest which of these isotopes has the greater nuclear binding energy.

[2]

Sodium-23 is stable
therefore it is held together tighter than
Sodium-24
therefore it has a greater nuclear binding
energy