

- 7 (a) The masses of some nuclei are shown in Fig. 7.1.

	mass / u
proton (${}^1_1\text{p}$)	1.007
neutron (${}^1_0\text{n}$)	1.009
lanthanum-141 (${}^{141}_{57}\text{La}$) nucleus	140.911

Fig. 7.1

- (i) Determine the number of neutrons in the lanthanum-141 nucleus.

number of neutrons = [1]

- (ii) Use data from Fig. 7.1 to show that the binding energy of a nucleus of lanthanum-141 is 1162 MeV.

[3]

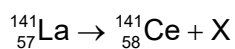
- (iii) A plutonium-239 (${}^{239}_{94}\text{Pu}$) nucleus has binding energy of 1807 MeV.
By comparing the binding energy per nucleon of lanthanum-141 and plutonium-239, state and explain whether lanthanum-141 or plutonium-239 is more likely to undergo nuclear fission.

.....

 [3]

- (b) Lanthanum-141 ($^{141}_{57}\text{La}$) undergoes radioactive decay to form cerium-141 ($^{141}_{58}\text{Ce}$) and a particle X. Particle X deflects as it moves through a magnetic field.

The decay can be represented by the equation



- (i) State what particle X is.

..... [1]

- (ii) According to conservation laws of energy and momentum, when lanthanum-141 nuclide of fixed initial energy undergoes decay, the emitted particle X should have a specific energy value. However, experimental observations show that particle X are emitted with a range of energies from different lanthanum-141 nuclides.

Explain the experimental observations.

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 [2]