12 One nuclear reaction that can take place in a nuclear reactor may be represented, in part, by the equation

$$^{235}_{92}\text{U} + {}^{1}_{0}\text{n} \rightarrow {}^{95}_{42}\text{Mo} + {}^{139}_{57}\text{La} + 2{}^{1}_{0}\text{n} + \ldots\ldots\ldots\ldots + \text{energy}$$

Data for a nucleus and some particles are given in Fig. 12.1.

nucleus or particle	mass / u
$^{139}_{57}$La	138.955
$^{1}_{0}$n	1.00863
$^{1}_{1}$p	1.00728
$^{0}_{-1}$e	5.49×10^{-4}

Fig. 12.1

(a) Complete the nuclear reaction shown above. [1]

(b) **(i)** Show that the energy equivalent to 1.00 u is 934 MeV.

[3]

(ii) Calculate the binding energy per nucleon, in MeV, of lanthanum-139 ($^{139}_{57}$La).

binding energy per nucleon = ... MeV [3]

Question 12 continues on the next page.

(c) State and explain whether the binding energy per nucleon of uranium-235 ($^{235}_{92}U$) will be greater, equal to or less than your answer in **(b)(ii)**.

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.....[3]

[Total: 10]