For Examiner's Use

**7** **(a)** Explain what is meant by the *binding energy* of a nucleus.

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**(b)** Fig. 7.1 shows the variation with nucleon number (mass number) *A* of the binding energy per nucleon $E_B$ of nuclei.

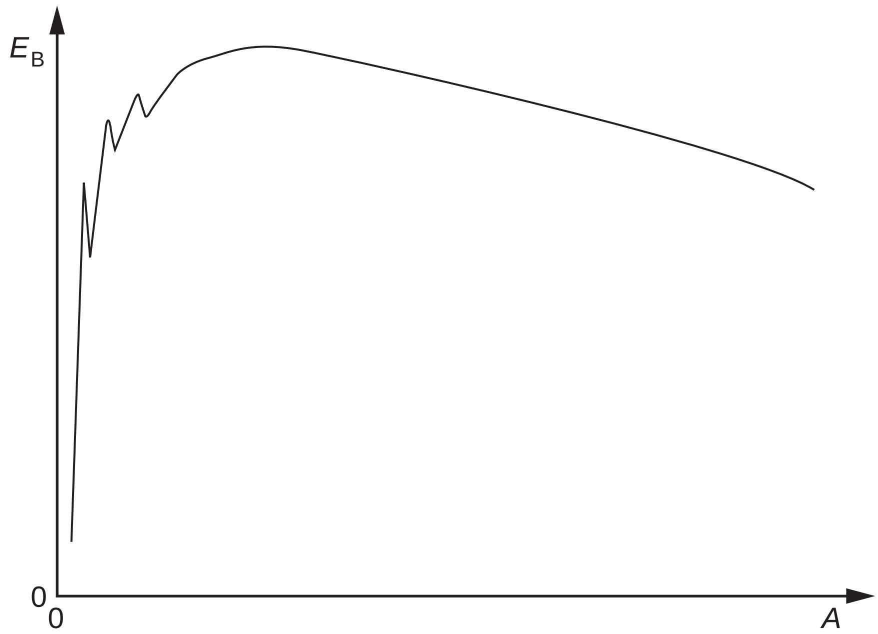


**Fig. 7.1**

One particular fission reaction may be represented by the nuclear equation

$$^{235}_{92}U + ^{1}_{0}n \rightarrow ^{141}_{56}Ba + ^{92}_{36}Kr + 3^{1}_{0}n.$$

**(i)** On Fig. 7.1, label the approximate positions of

**1.** the uranium ($^{235}_{92}U$) nucleus with the symbol U,

**2.** the barium ($^{141}_{56}Ba$) nucleus with the symbol Ba,

**3.** the krypton ($^{92}_{36}Kr$) nucleus with the symbol Kr. [2]

**(ii)** The neutron that is absorbed by the uranium nucleus has very little kinetic energy. Explain why this fission reaction is energetically possible.

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**(c)** Barium-141 has a half-life of 18 minutes. The half-life of Krypton-92 is 3.0 s.
In the fission reaction of a mass of Uranium-235, equal numbers of barium and krypton nuclei are produced.
Estimate the time taken after the fission of the sample of uranium for the ratio

$$\frac{\text{number of Barium-141 nuclei}}{\text{number of Krypton-92 nuclei}}$$

to be approximately equal to 8.

time = .............................................. s [3]