Oxford Cambridge and RSA

A level Physics B

H557/02 Scientific literacy in physics

Question Set 8

1 The equation shows a fission reaction.

$$^{235}_{92}U + ^{1}_{0}n \rightarrow ^{146}_{57}La + ^{87}_{35}Br + 3\,^{1}_{0}n$$

(a) Explain how this reaction can become a chain reaction and suggest how the rate of the reaction can be controlled.

[2]

(b) The graph in **Fig. 1.1** shows the binding energies per nucleon of the nuclei involved in the reaction.

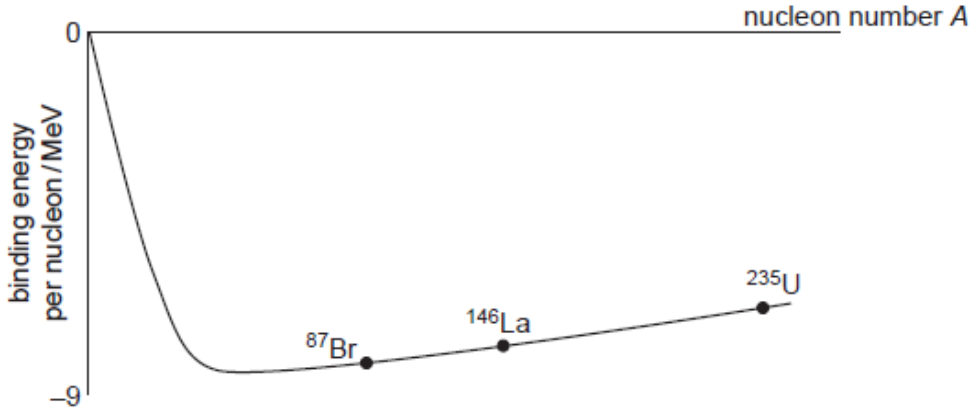

Fig. 1.1

Use the graph to explain why energy is released in the reaction.

[2]

(c) Each fission reaction releases about 16 MeV. Calculate the mass change in a single reaction.

mass change =……kg **[3]**

(d) Each year, fission reactors around the world produce about 1.4×10^{18} J of useful energy. Use the data below to calculate an estimate of the time uranium reserves will last at the **current** rate of energy production. Suggest and explain why such an estimate may be inaccurate.

estimated mass of ^{235}U available = 1.6×10^{8} kg
mass of ^{235}U atom = 3.9×10^{-25} kg.
efficiency of power stations = 30%

time uranium reserves will last ……years

[4]

Total Marks for Question Set 8: 11