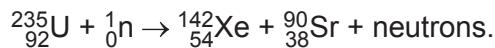


- 8 (a) State what is meant by the binding energy of a nucleus.

.....  
.....  
..... [2]

- (b) A nucleus of uranium-235 absorbs a neutron and becomes unstable. It then undergoes a fission reaction. One possible reaction is



- (i) Determine the number of neutrons produced in this fission reaction.

number = ..... [1]

- (ii) Data for the binding energies per nucleon for this fission reaction are given in Table 8.1.

**Table 8.1**

isotope	binding energy per nucleon/MeV
uranium-235	7.59
xenon-142	8.37
strontium-90	8.72

Calculate the energy released, in MeV, from the fission of one nucleus of uranium-235.

energy = ..... MeV [2]

- (iii) The isotope xenon-142 is unstable. The isotope xenon-132 is stable.

Suggest a reason why xenon-142 is unstable.

..... [1]

- (iv) Xenon-142 decays into the isotope caesium-142.

A sample initially contains only nuclei of xenon-142. After a time equal to 6.0 s, the ratio

$$\frac{\text{number of decayed nuclei of xenon-142}}{\text{number of undecayed nuclei of xenon-142}}$$

is equal to 31.

Calculate the half-life of xenon-142. Show your working.

half-life = ..... s [3]