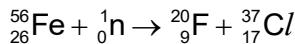


- 7 (a) Explain, with reference to the variation of binding energy per nucleon with nucleon number, why the following nuclear fission reaction of iron-56 ($^{56}_{26}\text{Fe}$) to fluorine-20 ($^{20}_9\text{F}$) and chlorine-37 ($^{37}_{17}\text{Cl}$) would **not** result in an overall release of energy.



.....

 [2]

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

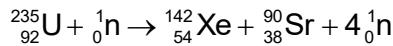


Table 7.1 shows the mass defects of the nuclei for this fission reaction.

Table 7.1

nuclei	mass defect / u
uranium-235 ($^{235}_{92}\text{U}$)	1.910
xenon-142 ($^{142}_{54}\text{Xe}$)	1.273
strontium-90 ($^{90}_{38}\text{Sr}$)	0.8405

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

energy = J [2]

- (c) Strontium-90 is unstable and decays into the isotope yttrium-90.

A sample initially contains only nuclei of strontium-90. The half-life of strontium-90 is 28.8 years. The ratio

$$\frac{\text{number of decayed nuclei of strontium-90}}{\text{number of undecayed nuclei of strontium-90}}$$

is equal to R .

Determine the value of R after 144 years.

$$R = \dots [3]$$

- (d) A power source contains 0.13 kg of strontium-90. Each nucleus of strontium-90 that decays emits 0.546 MeV of energy.

- (i) Calculate the initial number N_0 of nuclei of strontium-90 in the power source.

$$N_0 = \dots [1]$$

- (ii) Determine the initial activity of the source.

$$\text{activity} = \dots \text{Bq} [1]$$

[Turn over]

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- (iii) Hence, determine the initial power output from the source due to the decay of strontium-90.

power output = W [2]

[Total: 11]