9 **(a)** State what is meant by nuclear fusion.

.....

.....

..... [2]

(b) On Fig. 9.1, sketch the variation of binding energy per nucleon with nucleon number A for values of A between 1 and 250.

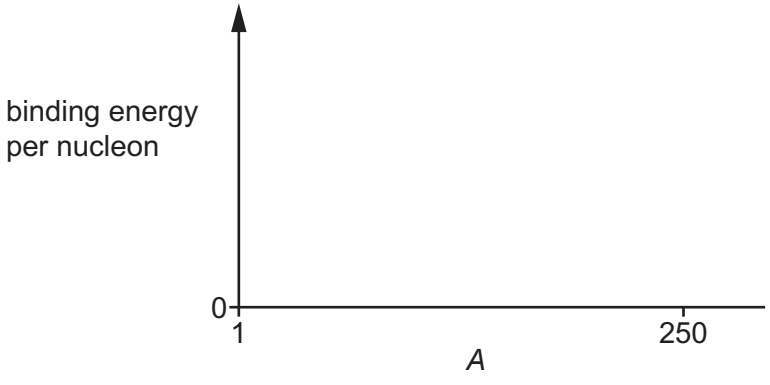

Fig. 9.1

[2]

(c) On your line in Fig. 9.1, label:

(i) a point X that could represent a nucleus that undergoes alpha-decay [1]

(ii) a point Y that could represent a nucleus that undergoes nuclear fusion. [1]

(d) A nucleus Z undergoes nuclear fission to form strontium-93 ($^{93}_{38}Sr$) and xenon-139 ($^{139}_{54}Xe$) according to

$$^{1}_{0}n + Z \longrightarrow {}^{93}_{38}Sr + {}^{139}_{54}Xe + 2{}^{1}_{0}n.$$

Table 9.1 shows the binding energies of the strontium-93 and xenon-139 nuclei.

Table 9.1

nucleus	binding energy / J
$^{93}_{38}Sr$	1.25×10^{-10}
$^{139}_{54}Xe$	1.81×10^{-10}

The fission of 1.00 mol of Z releases 1.77×10^{13} J of energy.

Determine the binding energy per nucleon, in MeV, of Z.

binding energy per nucleon = ... MeV [4]

[Total: 10]