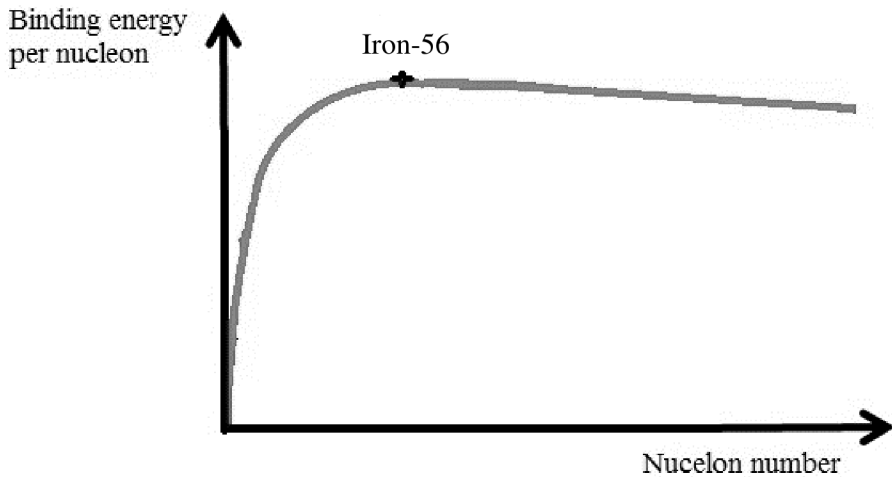


Question Number	Answer	Mark
18(a)	A massive/large nucleus splits into smaller fragments (1)	1
18(b) (i)	Steeply rising curve near to origin (1) Slowly decreasing curve after peak (1)	2
18(b) (ii)	Iron-56 marked at peak of curve (1)	1
	<p>Example of graph for (i) and (ii)</p> 	
18(c)	<p>Top line correct (1)</p> <p>Bottom line correct (1)</p> ${}^{236}_{92}\text{U} \rightarrow {}^{93}_{38}\text{Sr} + {}^{141}_{54}\text{Xe} + 2 \times {}^1_0\text{n}$	2
18(d)	<p>Calculation of mass defect (1)</p> <p>Binding energy per nucleon = 7.38 (MeV) (1)</p> <p><u>Example of calculation</u></p> <p>Mass defect = $(92 \times 0.93827 + 144 \times 0.93956 - 219.8750) \text{ GeV}/c^2$</p> <p>Mass defect = $1.74248 \text{ GeV}/c^2$</p> <p>Binding energy/nucleon = $1.74248 \text{ GeV}/236 = 7.383 \text{ MeV}$</p>	2

*18(e)

This question assesses a student’s ability to show a coherent and logically structured answer with linkages and fully-sustained reasoning.

Marks are awarded for indicative content and for how the answer is structured and shows lines of reasoning.

	Number of marks awarded for structure of answer and sustained line of reasoning
Answer shows a coherent and logical structure with linkages and fully sustained lines of reasoning demonstrated throughout	2
Answer is partially structured with some linkages and lines of reasoning	1
Answer has no linkages between points and is unstructured	0

The following table shows how the marks should be awarded for structure and lines of reasoning.

Total marks awarded is the sum of marks for indicative content and the marks for structure and lines of reasoning

IC points	IC mark	Max linkage mark	Max final mark
6	4	2	6
5	3	2	5
4	3	1	4
3	2	1	3
2	2	0	2
1	1	0	1
0	0	0	0

Indicative content

IC1 Energy from the α particles is transferred to atoms/molecules in the air

IC2 An electron in the atom/molecule is promoted to a higher energy state
Or the atom/molecule/electron is excited

IC3 When the electron return to a lower energy state a photon (of uv-radiation) is emitted
Or when the atom/molecule/electron de-excites, a photon (of uv-radiation) is emitted

IC4 α radiation is strongly ionising and so has a short range in air

IC5 Ultraviolet radiation is weakly ionising (and has long range in air)

IC6 UV-radiation can be detected much further from the source so is safer

Total for question 18

6

14