

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

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.....
.....

[2]

- (b) Some masses are shown in Fig. 12.1.

	mass/u
proton (${}_1^1p$)	1.007
neutron (${}_0^1n$)	1.009
lanthanum-141 (${}_{57}^{141}\text{La}$) nucleus	140.911

Fig. 12.1

Calculate the binding energy of a nucleus of lanthanum-141.

$$\text{binding energy} = \dots \text{ J} [4]$$

- (c) The nuclide lanthanum-141 (${}_{57}^{141}\text{La}$) has a half-life of 3.9 hours.

Initially, a radioactive source contains only lanthanum-141. The initial activity of the source is A_0 .

- (i) Calculate the time for the activity of the lanthanum-141 to be reduced to $0.40A_0$.

$$\text{time} = \dots \text{ hours} [3]$$

- (ii) Suggest why the total activity of the radioactive source measured at the time calculated in (i) may be greater than $0.40A_0$.

..... [1]

[Total: 10]

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