FREE REVISION PACK

Mass Defect & Binding Energy

AQA A-level Physics · 7408 · Specification 3.8.1.6

Easy | Medium | Multiple choice · past-paper questions

5	5	≈ 10 min
QUESTIONS	TOTAL MARKS	SUGGESTED TIME*

Contents

Q	LEVEL	FOCUS	SOURCE	MARKS
1	Easy	Mass difference of a lithium-7 nucleus	AQA November 2020 · A-level Paper 2 · Q30	1 mark
2	Easy	Kinetic energy of an alpha particle	AQA June 2025 · A-level Paper 2 · Q28	1 mark
3	Easy	What is not true about a fission reaction	AQA June 2024 · A-level Paper 2 · Q18	1 mark
4	Easy	Mass lost when wood burns	AQA June 2024 · A-level Paper 2 · Q19	1 mark
5	Medium	Maximum power from the rate of mass loss	AQA November 2020 · A-level Paper 2 · Q31	1 mark

Key ideas to have ready

- Mass defect = (mass of separate nucleons) − (mass of nucleus). Binding energy = mass defect × c^2; 1 u ≡ 931.5 MeV.
- $E = mc^2$ applies to any energy release: power = (rate of mass loss) × c^2.
- Binding energy per nucleon peaks near iron (A ≈ 56). Products of fission or fusion move towards the peak, so they have more binding energy per nucleon.
- Free nucleons (e.g. the neutrons released in fission) have zero binding energy.

How to use this pack

1. The questions are grouped into levels (Easy and Medium). Work through them in order, and check your answers at the end of each level before moving on.
2. Every question is multiple choice with one correct answer. Write down your working anyway; that is how you find mistakes.
3. The separate mark scheme uses the same numbers and explains every answer.

Levels are based on how students did in AQA's examiner reports where that information exists, plus our own difficulty rating. *About 1.5 minutes per question.

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Easy

Definitions and one-step ideas. Most students get these right.

Questions 1–4

Only **one** answer per question is allowed. For each question, completely fill in the circle alongside the appropriate answer.

AQA November 2020 · A-level Paper 2 · Q30

1 The table shows the masses of three particles.

Particle	Mass / u
proton	1.00728
neutron	1.00867
nucleus of lithium $^{7}_{3}\mathrm{Li}$	7.01436

What is the mass difference of a $^{7}_{3}\mathrm{Li}$ nucleus?

[1 mark]

A 4.99841 u ⬭

B 0.04216 u ⬭

C 0.04147 u ⬭

D 0.04077 u ⬭

AQA June 2025 · A-level Paper 2 · Q28

2 Polonium-210 decays into lead-206 by emitting an alpha particle.

mass of nucleus of polonium-210 = 209.983 u
mass of nucleus of lead-206 = 205.975 u
mass of alpha particle = 4.003 u

Assume that the recoil speed of the lead nucleus is negligible.

What is the kinetic energy of the emitted alpha particle?

[1 mark]

A 5.0 meV ⬭

B 4.0 MeV ⬭

C 4.7 MeV ⬭

D 3.7 GeV ⬭

AQA June 2024 · A-level Paper 2 · Q18

3 The equation represents a typical fission reaction.

$$^{235}_{92}\mathrm{U} + {}^{1}_{0}\mathrm{n} \rightarrow {}^{87}_{35}\mathrm{Br} + {}^{146}_{57}\mathrm{La} + 3{}^{1}_{0}\mathrm{n}$$

Which statement about this reaction is **not** true?

[1 mark]

A $^{146}_{57}\mathrm{La}$ has the greatest binding energy per nucleon of the three nuclides. ⬭

B The mass of $^{235}_{92}\mathrm{U}$ is greater than the sum of the masses of $^{87}_{35}\mathrm{Br}$ and $^{146}_{57}\mathrm{La}$. ⬭

C The binding energy of the neutrons released in the reaction is zero. ⬭

D The binding energy of $^{235}_{92}\mathrm{U}$ is greater than the binding energy of $^{146}_{57}\mathrm{La}$. ⬭

AQA June 2024 · A-level Paper 2 · Q19

4 $5.6\ \mathrm{kW\,h}$ of heat energy is released when $1.0\ \mathrm{kg}$ of wood pellets are burnt in a power station.

What is the mass lost in burning $1.0\ \mathrm{kg}$ of wood pellets?

[1 mark]

A 0 ⬭

B $3.7 \times 10^{-12}\ \mathrm{kg}$ ⬭

C $2.2 \times 10^{-10}\ \mathrm{kg}$ ⬭

D $6.7 \times 10^{-2}\ \mathrm{kg}$ ⬭

Medium Two or three steps. Roughly a third to a half of students get these right. **Question 5**

AQA November 2020 · A-level Paper 2 · Q31

5 The mass of the fuel in a fission reactor decreases at a rate of 6.0×10^{-6} kg hour^{-1}.

What is the maximum possible power output of the reactor?

[1 mark]

A 75 MW ⬭

B 150 MW ⬭

C 300 MW ⬭

D 9000 MW ⬭

End of questions. Check your answers with the matching mark scheme. More free packs and 1-to-1 tuition:
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