FREE REVISION PACK

Nuclear Stability & Decay Equations

AQA A-level Physics · 7407 / 7408 · Specification 3.2.1.2

Easy | Medium | Multiple choice · past-paper questions

5	5	≈ 10 min
QUESTIONS	TOTAL MARKS	SUGGESTED TIME*

Contents

Q	LEVEL	FOCUS	SOURCE	MARKS
1	Easy	Which emissions give an isotope?	AQA June 2016 · AS Paper 2 · Q5	1 mark
2	Easy	Counting alpha decays in a series	AQA June 2018 · AS Paper 2 · Q6	1 mark
3	Easy	How the strong force varies with distance	AQA June 2022 · A-level Paper 1 · Q11	1 mark
4	Medium	Daughter nucleus after β^+ decay	AQA June 2025 · AS Paper 2 · Q32	1 mark
5	Medium	Neutron absorption then two decays	AQA June 2023 · AS Paper 2 · Q22	1 mark

Key ideas to have ready

- The **strong nuclear force** holds nucleons together: repulsive below about 0.5 fm, attractive up to about 3 fm, negligible beyond.
- α decay: A falls by 4, Z falls by 2. β^- decay: A unchanged, Z rises by 1 (a neutron becomes a proton).
- β^+ decay: A unchanged, Z falls by 1 (a proton becomes a neutron).
- In a decay chain, use the change in A to count α decays first, then the change in Z to count β decays.

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 1–3

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

AQA June 2016 · AS Paper 2 · Q5

1 A nucleus of a particular element decays, emitting a series of α and β^- particles.

Which of the following series of emissions would result in an isotope of the original element?

[1 mark]

A 1 α and 1 β^- ⬭

B 1 α and 2 β^- ⬭

C 2 α and 1 β^- ⬭

D 2 α and 2 β^- ⬭

AQA June 2018 · AS Paper 2 · Q6

2 $^{236}_{92}\mathrm{U}$ undergoes a series of decays to produce $^{204}_{82}\mathrm{Pb}$.

How many alpha decays are involved in this decay series?

[1 mark]

A 5 ⬭

B 6 ⬭

C 8 ⬭

D 10 ⬭

AQA June 2022 · A-level Paper 1 · Q11

3 Which row describes the variation with distance of the strong nuclear force?

[1 mark]

	Attractive	Repulsive	
A	beyond 3 fm	from 0.5 fm to 3 fm	⬭
B	from 0.5 fm to 3 fm	beyond 3 fm	⬭
C	from 0.5 fm to 3 fm	up to 0.5 fm	⬭
D	up to 0.5 fm	from 0.5 fm to 3 fm	⬭

Medium

Two or three steps. Roughly a third to a half of students get these right.

Questions 4–5

AQA June 2025 · AS Paper 2 · Q32

4 A nucleus of $^{15}_{8}O$ emits a beta-plus particle.

Which row shows the number of protons and the number of neutrons in the resulting nucleus?

[1 mark]

	Number of protons	Number of neutrons	
A	9	7	⬭
B	9	6	⬭
C	7	8	⬭
D	7	7	⬭

AQA June 2023 · AS Paper 2 · Q22

5 A nucleus of bismuth-209 $\left(^{209}_{83}Bi\right)$ absorbs a neutron. The newly formed nucleus subsequently decays in two stages to form a nucleus of nuclide **X**.
One beta-minus particle and one alpha particle are emitted during these two decays.

What are the nucleon number and the proton number of **X**?

[1 mark]

	Nucleon number	Proton number	
A	205	82	⬭
B	205	83	⬭
C	206	82	⬭
D	206	83	⬭

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