FREE REVISION PACK

# Binding Energy

Pearson Edexcel International Advanced Level Physics · Unit 5 (WPH15) · Specification points 133–134

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–energy of a muon | Edexcel IAL January 2024 · Unit 5 · Q3 | 1 mark |
| 2 | Easy | Shape of the binding energy per nucleon curve | Edexcel IAL October 2023 · Unit 5 · Q3 | 1 mark |
| 3 | Easy | Stability from the binding energy curve | Edexcel IAL January 2025 · Unit 5 · Q4 | 1 mark |
| 4 | Easy | Binding energy per nucleon in fusion and fission | Edexcel IAL June 2025 · Unit 5 · Q3 | 1 mark |
| 5 | Medium | Energy to split helium-4 into nucleons | Edexcel IAL October 2021 · Unit 5 · Q7 | 1 mark |


**Key ideas to have ready**

- Binding energy = energy needed to separate a nucleus into its nucleons (= mass defect × $c^2$).
- Higher binding energy per nucleon → more stable; the curve peaks near iron-56.
- Fusion of light nuclei and fission of heavy nuclei both increase B.E. per nucleon and release energy.
- Total binding energy = B.E. per nucleon × number of nucleons.

**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 Pearson'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

Choose **one** answer for each question and put a cross in the box next to it.

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**1** The mass of a muon is 0.113 u.

Which of the following is equal to the equivalent mass-energy, in joules, of the muon?

☒ **A** $0.113 \times (3.0 \times 10^8)^2$

☒ **B** $\dfrac{0.113}{(3.0 \times 10^8)^2}$

☒ **C** $0.113 \times (3.0 \times 10^8)^2 \times 1.66 \times 10^{-27}$

☒ **D** $0.113 \times (3.0 \times 10^8)^2 \times 1.67 \times 10^{-27}$

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**2** Which of the following statements about nuclear binding energy (B.E.) is correct?

☒ **A** B.E. per nucleon increases steadily as proton number increases.

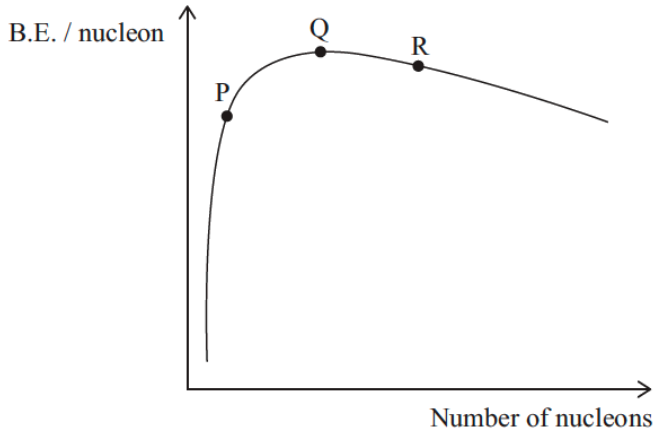
☒ **B** B.E. per nucleon decreases steadily as proton number increases.

☒ **C** B.E. per nucleon is approximately constant for all elements.

☒ **D** B.E. per nucleon increases to a maximum and then decreases as proton number increases.

Edexcel IAL January 2025 · Unit 5 · Q4

**3** The graph shows how the binding energy (B.E.) per nucleon varies with the number of nucleons. The positions of three isotopes, P, Q and R, are marked on the curve.




Which row of the table lists the isotopes from least stable to most stable?

| | Least stable ⟶ | | Most stable |
|---|---|---|---|
| ☒ **A** | P | Q | R |
| ☒ **B** | P | R | Q |
| ☒ **C** | Q | R | P |
| ☒ **D** | R | P | Q |

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**4** Energy is released when the fusion of low mass nuclei takes place.
Energy is also released when the fission of high mass nuclei takes place.

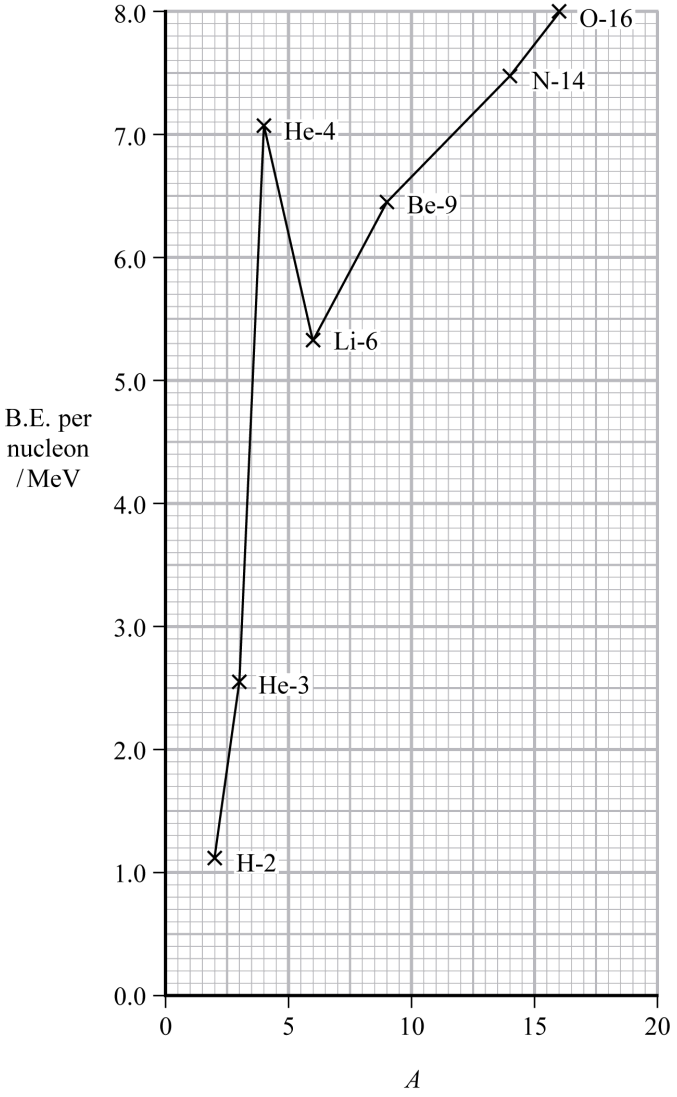
Which row of the table shows the change in binding energy per nucleon (B.E. / nucleon) for fusion and fission?

| | Nuclear fusion | Nuclear fission |
|---|---|---|
| ☒ **A** | B.E. / nucleon decreases | B.E. / nucleon decreases |
| ☒ **B** | B.E. / nucleon decreases | B.E. / nucleon increases |
| ☒ **C** | B.E. / nucleon increases | B.E. / nucleon decreases |
| ☒ **D** | B.E. / nucleon increases | B.E. / nucleon increases |

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

Edexcel IAL October 2021 · Unit 5 · Q7

**5** The graph shows how the binding energy (B.E.) per nucleon varies with nucleon number $A$ for low mass nuclei.




Which of the following is the energy required to split a He-4 nucleus into 2 protons and 2 neutrons?

- ☒ **A** 2.6 MeV
- ☒ **B** 7.1 MeV
- ☒ **C** 14.2 MeV
- ☒ **D** 28.4 MeV

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