

AQA – Nuclear physics – 2022 A2 Physics P2

1. June /2022/Paper_ 7408/2/No.6

0 6

Fission and fusion are two processes that can result in the transfer of binding energy from nuclei.

0 6 . 1

State what is meant by the binding energy of a nucleus.

[2 marks]

0 6 . 2

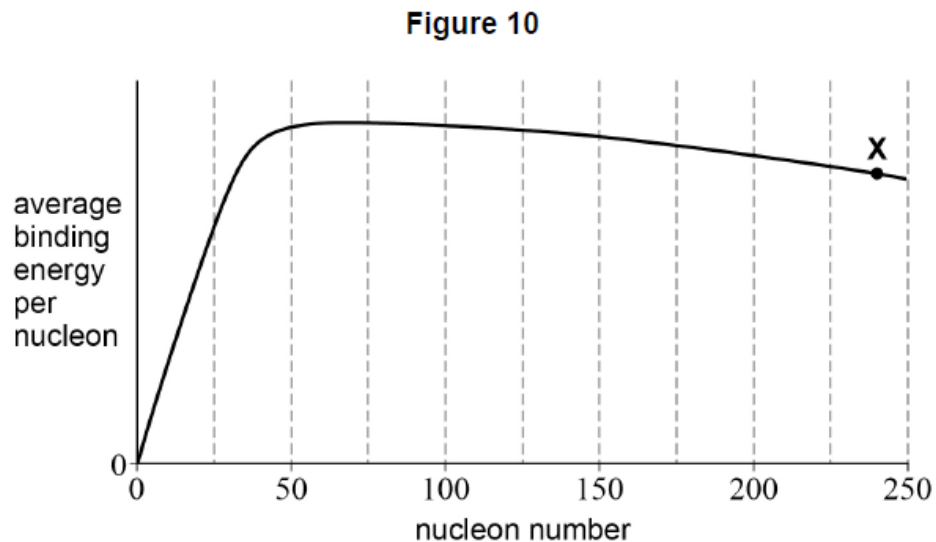
Calculate, in MeV, the binding energy for a nucleus of iron ${}_{26}^{56}\text{Fe}$.

$$\text{mass of } {}_{26}^{56}\text{Fe nucleus} = 9.288 \times 10^{-26} \text{ kg}$$

[3 marks]

binding energy = _____ MeV

Figure 10 shows a graph of average binding energy per nucleon against nucleon number for common nuclides.



0	6	3
---	---	---

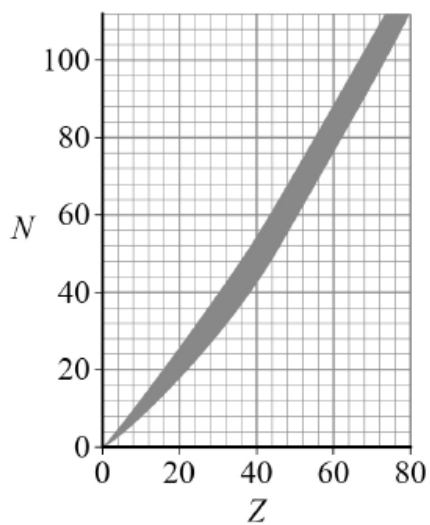
 The nuclide labelled **X** in **Figure 10** undergoes fission.

Annotate **Figure 10** with F_1 and F_2 to show **one** possible pair of nuclides resulting from the fission of **X**.

[2 marks]

0 6 . 4 Figure 11 shows a graph of N against Z for stable nuclides.

Figure 11



Deduce the likely initial mode of decay of F_1 and F_2 .
Refer to Figure 11 in your answer.

[3 marks]

2. June /2022/Paper_ 7408/2/No.25

What was deduced or observed in the Rutherford scattering experiment?

[1 mark]

- A All gold atoms are not alike.
- B Alpha particles are helium nuclei.
- C Some particles were deflected through angles greater than 90° .
- D The motion of most alpha particles was reversed.

3. June /2022/Paper_ 7408/2/No.26

Which row is correct for α , β and γ radiation?

[1 mark]

		α	β	γ	
A	Is it deflected by a magnetic field?	yes	yes	no	<input type="checkbox"/>
B	Is it deflected by an electric field?	yes	yes	yes	<input type="checkbox"/>
C	Does it have a positive charge?	yes	no	yes	<input type="checkbox"/>
D	Does it come from outside the nucleus?	no	yes	no	<input type="checkbox"/>

4. June /2022/Paper_ 7408/2/No.27

A sample of radioactive material consists of 200 g of nuclide **P** and 100 g of nuclide **Q**.

Nuclide **P** has a half-life of 2 days and nuclide **Q** has a half-life of 4 days.

What is the total mass of nuclides **P** and **Q** after 12 days?

[1 mark]

A 3.1 g

B 12.5 g

C 15.6 g

D 18.8 g

5. June /2022/Paper_ 7408/2/No.28

A nuclide has a half-life of 10 ms.

The decay constant for this nuclide lies between

[1 mark]

A 1 s^{-1} and 10 s^{-1} .

B 10 s^{-1} and 10^2 s^{-1} .

C 10^2 s^{-1} and 10^3 s^{-1} .

D 10^3 s^{-1} and 10^6 s^{-1} .

6. June /2022/Paper_ 7408/2/No.29

Which provides evidence for the existence of energy levels in nuclei?

[1 mark]

A the Rutherford alpha particle scattering experiment

B the existence of X-ray line spectra

C the existence of gamma radiation

D electron diffraction by crystals

7. June /2022/Paper_ 7408/2/No.30

Which is **not** true for gamma radiation?

[1 mark]

- A** It is more penetrating than alpha or beta radiation of the same energy through the same material.
- B** Its intensity is inversely proportional to the square of the distance from its source.
- C** It is emitted with discrete frequencies.
- D** When it is absorbed it makes the absorber radioactive.

8. June /2022/Paper_ 7408/2/No.31

In a thermal reactor, induced fission occurs when a ${}_{92}^{235}\text{U}$ nucleus captures a neutron.

Which statement is true?

[1 mark]

- A** The moderator absorbs excess neutrons.
- B** A large number of neutrons should be produced per fission to sustain the reaction.
- C** Slow neutrons are required for this induced fission.
- D** The control rods slow down neutrons.