

Atomic structure – GCSE Physics Paper 11. **No.5**

0	5
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Atoms of different elements have different properties.

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1

 Which of the following is the same for all atoms of the same element?**[1 mark]**Tick (✓) **one** box.

Atomic number

☐

Mass number

☐

Neutron number

☐

0	5
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2

 Which of the following is different for isotopes of the same element?**[1 mark]**Tick (✓) **one** box.

Number of electrons

☐

Number of neutrons

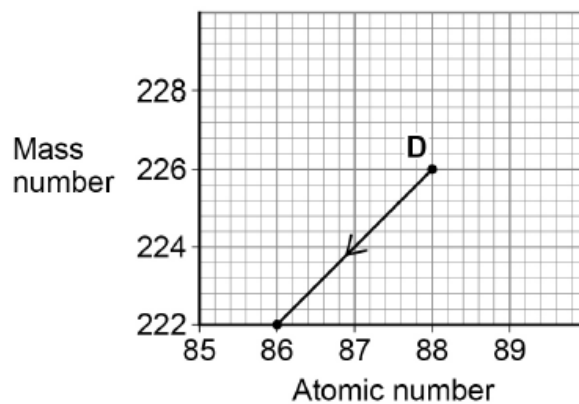
☐

Number of protons

☐

0 5 . 3

A nucleus emits radiation.

Figure 7 shows how the mass number and the atomic number change.The nucleus is labelled **D**.**Figure 7**Which type of radiation is emitted when nucleus **D** decays?**[1 mark]**Tick (✓) **one** box.

Alpha

☐

Beta

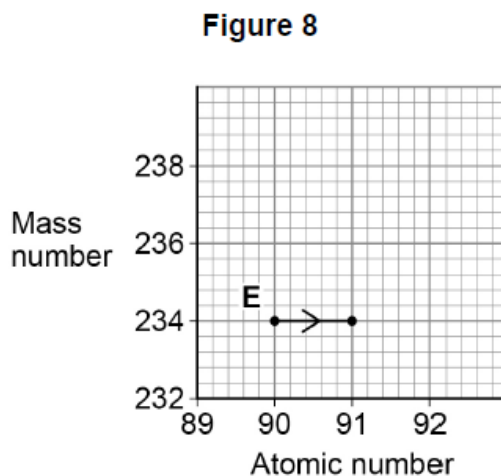
☐

Neutron

☐

0 5 . 4 Nucleus **E** also emits radiation.

Figure 8 shows how the mass number and the atomic number change for nucleus **E**.



Which type of radiation is emitted when nucleus **E** decays?

[1 mark]

Tick (✓) **one** box.

Alpha

☐

Beta

☐

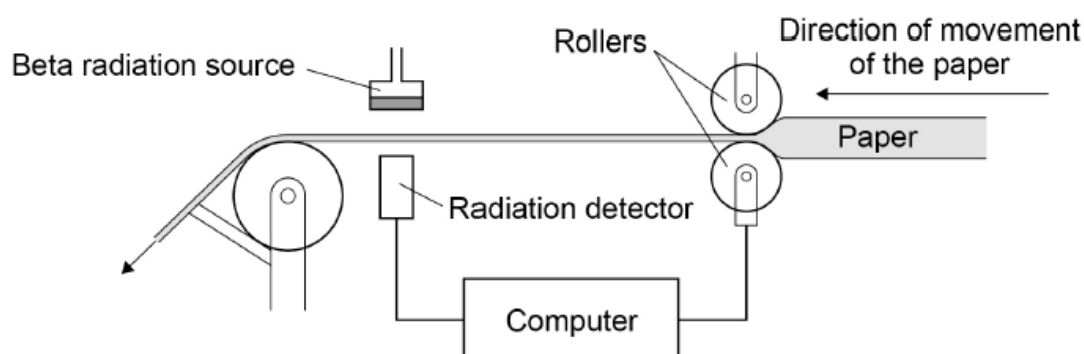
Neutron

☐

Beta radiation can be used to monitor the thickness of paper during production.

Figure 9 shows how the radiation is used.

Figure 9



The computer uses information from the radiation detector to change the size of the gap between the rollers.

0 5 . 5

Complete the sentences.

Choose answers from the box.

Each answer can be used once, more than once or not at all.

decrease	stay the same	increase
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The thickness of the paper between the beta source and the detector increases.

[2 marks]

The reading on the detector will _____.

This is because the amount of radiation absorbed by the paper

will _____.

0 5 . 6

All radioactive elements have a half-life.

What is meant by 'half-life'?

[1 mark]

Tick (✓) **one** box.

The time it takes for all the nuclei in a radioactive sample to split in half.

☐

The time it takes for the count rate of a radioactive sample to halve.

☐

The time it takes for the radiation to travel half of its range in air.

☐

0 5 . 7

Why should the radiation source used in **Figure 9** have a long half-life?

[1 mark]

Tick (✓) **one** box.

So the activity of the source is approximately constant.

☐

So the amount of radiation decreases quickly.

☐

So the radiation has a long range in air.

☐

2. No.10

1 0

Energy from the Sun is released by nuclear fusion.

1 0 . 1

Complete the sentences.

[2 marks]

Nuclear fusion is the joining together of _____.

During nuclear fusion the total mass of the particles _____.

1 0 . 2

Nuclear fusion of deuterium is difficult to achieve on Earth because of the high temperature needed.

Electricity is used to increase the temperature of 4.0 g of deuterium by 50 000 000 °C.

specific heat capacity of deuterium = 5200 J/kg °C

Calculate the energy needed to increase the temperature of the deuterium by 50 000 000 °C.

Use the Physics Equations Sheet.

[3 marks]

Energy = _____ J

1 0 . 3 The idea of obtaining power from nuclear fusion was investigated using models.

The models were tested before starting to build the first commercial nuclear fusion power station.

Suggest **two** reasons why models were tested.

[2 marks]

1 _____

2 _____

1 0 . 4 Generating electricity using nuclear fusion will have fewer environmental effects than generating electricity using fossil fuels.

Explain **one** environmental effect of generating electricity using fossil fuels.

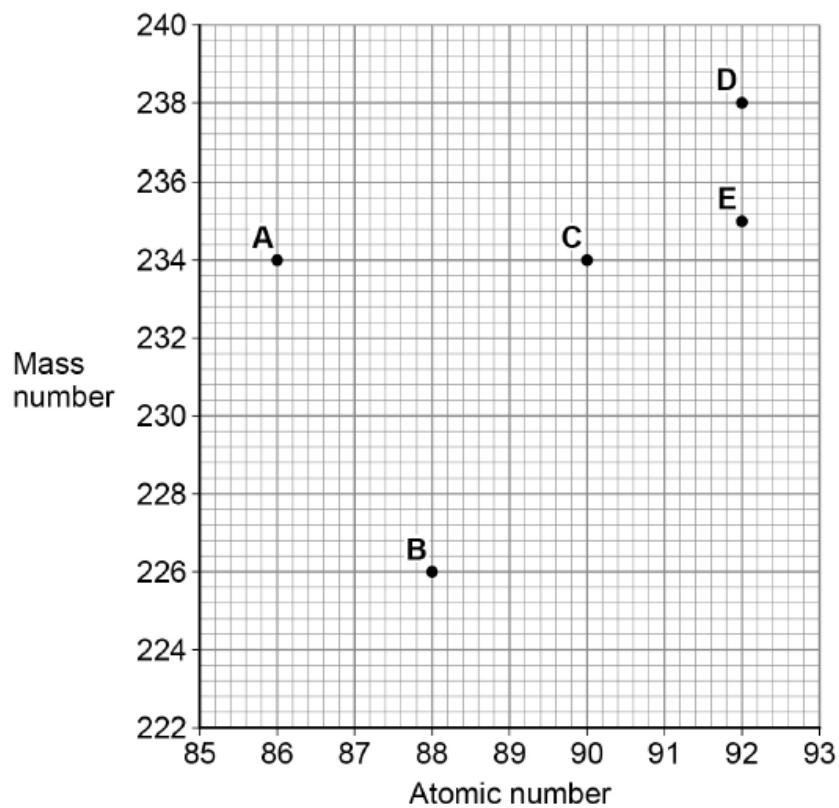
[2 marks]

3. No.6

0 6

Figure 6 shows the mass number and the atomic number for the nuclei of five different atoms.

Figure 6



0 6 . 1

How many neutrons are there in a nucleus of atom A?

[1 mark]

0 6 . 2

Which **two** atoms in **Figure 6** are the same element?

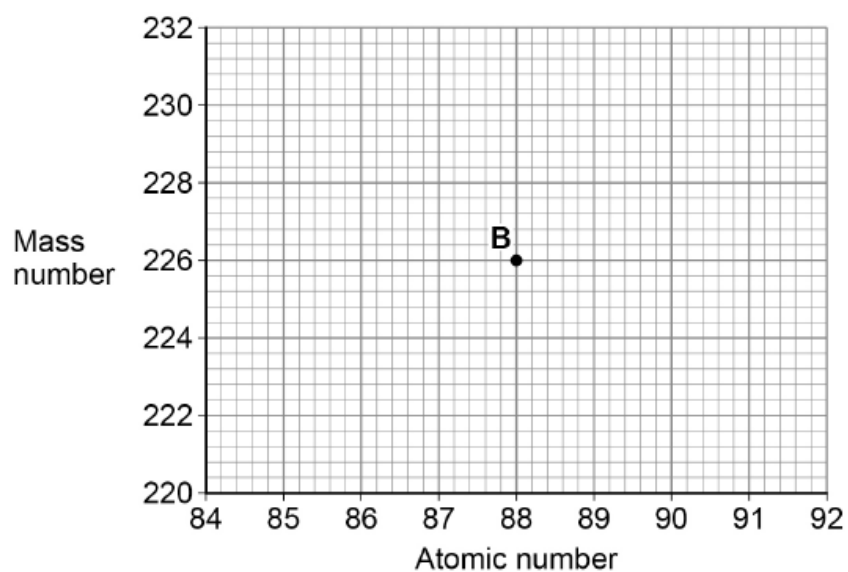
[1 mark]

Tick (✓) **one** box.**A and B**☐**A and C**☐**C and D**☐**D and E**☐

0 6 . 3

Nucleus **B** decays by emitting an alpha particle.Draw an arrow on **Figure 7** to represent the alpha decay.

[2 marks]

Figure 7

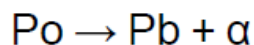
0 6 . 4

What is meant by the 'random nature of radioactive decay'?

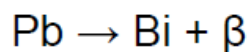
[1 mark]

0 6 . 5

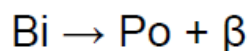
A polonium (Po) nucleus decays by emitting an alpha particle and forming a lead (Pb) nucleus.



The lead (Pb) nucleus then decays by emitting a beta particle and forms a bismuth (Bi) nucleus.



The bismuth (Bi) nucleus then decays by emitting a beta particle and forms a polonium (Po) nucleus.



Explain how these three decays result in a nucleus of the original element, polonium. **[3 marks]**
