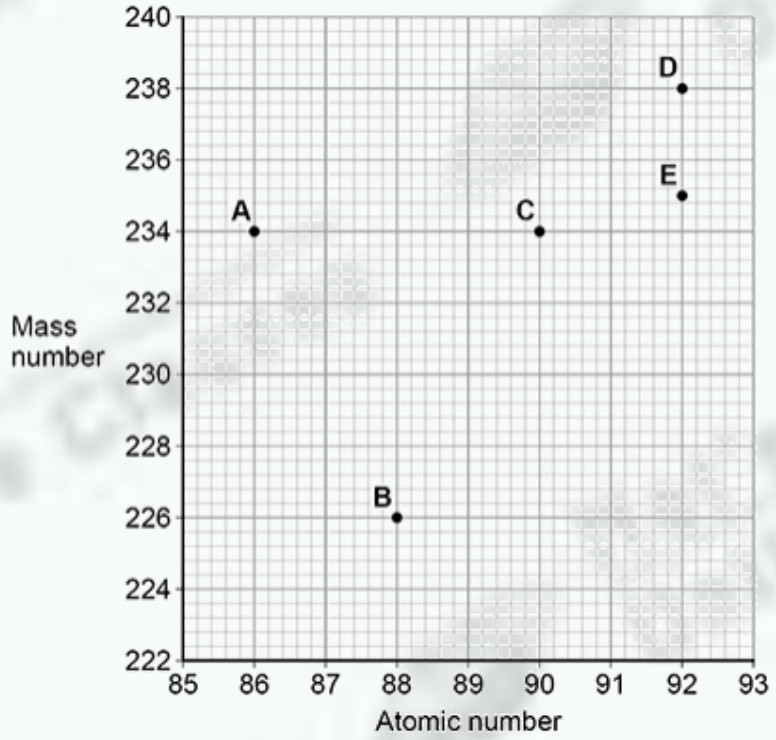
4- Atomic Structure

Total mark – 18

Question: 1

Figure 1 shows the mass number and the atomic number for the nuclei of five different atoms.

Figure 1



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

(1)

(b) Which **two** atoms in **Figure 1** are the same element?

Tick (✓) **one** box.

A and **B** ☐

A and **C** ☐

C and **D** ☐

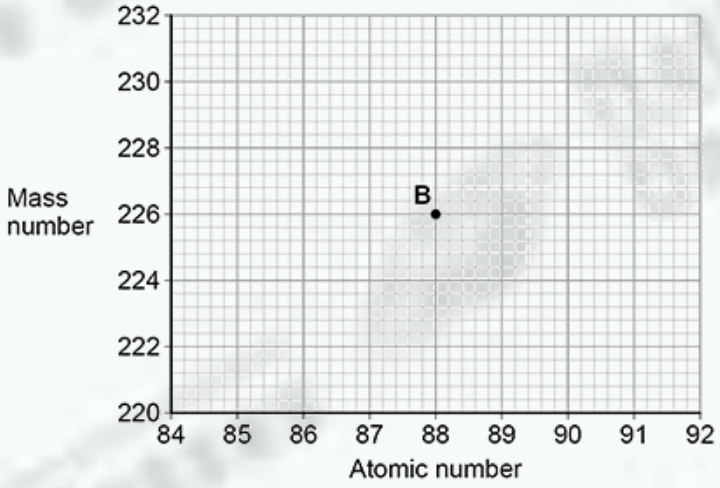
D and **E** ☐

(1)

(c) Nucleus **B** decays by emitting an alpha particle.

Draw an arrow on **Figure 2** to represent the alpha decay.

Figure 2



(2)

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

_____

_____

_____

(1)

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

$$Po \rightarrow Pb + \alpha$$

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

$$Pb \rightarrow Bi + \beta$$

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

$$Bi \rightarrow Po + \beta$$

Explain how these three decays result in a nucleus of the original element, polonium.

(3)

Question: 2

Radioactive waste from nuclear power stations is a man-made source of background radiation.

(a) Give **one** other man-made source of background radiation.

_____

(1)

Nuclear power stations use the energy released by nuclear fission to generate electricity.

(b) Give the name of **one** nuclear fuel.

_____

(1)

(c) Nuclear fission releases energy.

Describe the process of nuclear fission inside a nuclear reactor.

(4)

(d) A new type of power station is being developed that will generate electricity using nuclear fusion.

Explain how the process of nuclear fusion leads to the release of energy.

(2)

(e) Nuclear fusion power stations will produce radioactive waste. This waste will have a much shorter half-life than the radioactive waste from a nuclear fission power station.

Explain the advantage of the radioactive waste having a shorter half-life.

(2)