Q1.

Answer the question with a cross in the box you think is correct (☒). If you change your mind about an answer, put a line through the box (☒) and then mark your new answer with a cross (☒).

The nucleus of a different atom emits a gamma ray.

What happens to the number of particles in the nucleus?

(1)

- ☐ **A** it decreases by one
- ☐ **B** it decreases by two
- ☐ **C** it decreases by four
- ☐ **D** it does not change

(Total for question = 1 mark)

Q2.

Ionising radiations are emitted by unstable nuclei.
Complete the sentence by putting a cross (☒) in the box next to your answer.

Following the radioactive decay of a nucleus, the nucleus might undergo some rearrangement, losing energy as

(1)

- ☐ **A** gamma radiation
- ☐ **B** a proton
- ☐ **C** a neutron
- ☐ **D** an X-ray

Q3.

Describe what happens in the nucleus of an atom when a positron is emitted.

(2)

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(Total for question = 2 marks)

Q4.

The nucleus of americium-238 can absorb an electron.

When this happens, one of the protons in the nucleus becomes a neutron, as shown in Figure 8.

Figure 8

(i) Describe how absorbing an electron affects the proton number and the nucleon number of a nucleus.

(2)

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(ii) Deduce which nucleus is formed when americium-238 absorbs an electron.

(1)

☒ **A** uranium-234

☒ **B** uranium-235

☒ **C** plutonium-238

☒ **D** americium-238

(Total for question = 3 marks)

Q5.

Some isotopes are unstable.
They emit β^- particles when they decay.

Explain how a nucleus changes when a β^- particle is emitted.

(2)

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(Total for question = 2 marks)

Q6.

Carbon–14 decays into nitrogen–14.

The symbol for nitrogen–14 is $^{14}_{7}N$

Explain what happens in a carbon-14 nucleus when it decays to a nitrogen-14 nucleus.

(2)

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(Total for question = 2 marks)

Q7.

Some isotopes are unstable.
They emit β^- particles when they decay.

Explain how a nucleus changes when a β^- particle is emitted.

(2)

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(Total for question = 2 marks)

Q8.

Lead-214 is a radioactive isotope.

(i) State **one** way in which radioactive isotopes can be harmful to people.

(1)

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(ii) Lead-214 emits β^- particles.

Describe what happens to the nucleus of a lead-214 atom when it emits a β^- particle.

(2)

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(Total for question = 3 marks)

Q9.

Ionising radiations are emitted by unstable nuclei.
Some unstable nuclei decay by emitting β^- radiation.

(i) Describe the process of β^- emission.

(3)

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(ii) Explain what happens to the mass number and the atomic number of a nucleus when β^- emission occurs.

(3)

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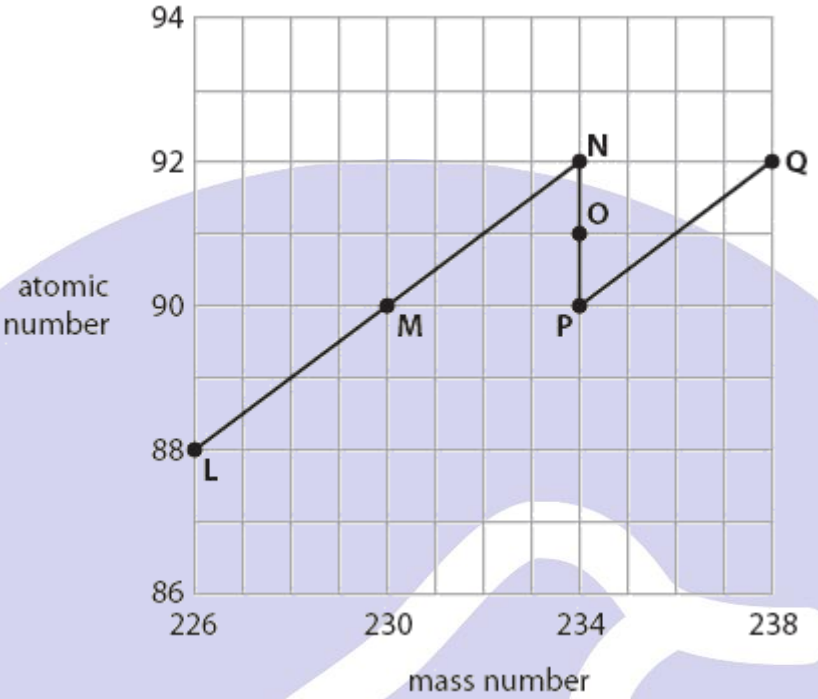
Q10.

Uranium-238 is an isotope of uranium. It may undergo either radioactive decay or nuclear fission.
A nucleus of uranium-238 is shown as **Q** in the chart.



(a) State **two** letters from the chart which show isotopes of the same element.

(1)

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(b) Explain what happens when **Q** decays to **P.**

(2)

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(c) Explain what happens when **P** decays to **O**.

(2)

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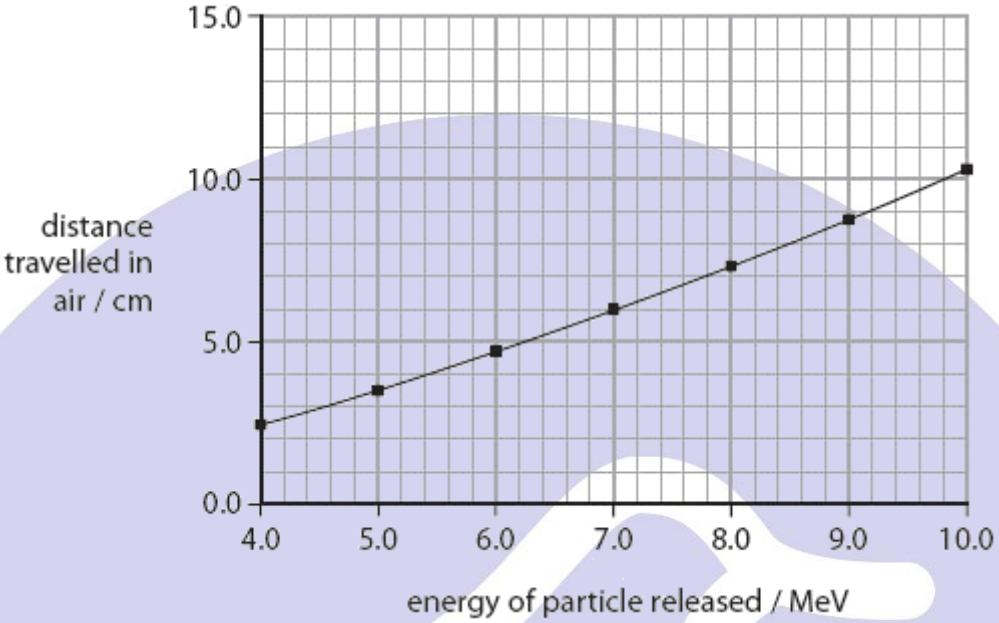
(d) Particles released during radioactive decay can have different energies.
A suitable unit for these energies is MeV.
For one type of decay, the particles released have energies between 4.0 MeV and 10.0 MeV.
The graph shows how far the particles with these energies travel in air.



(i) State the name of this type of particle.

(1)

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(ii) Use information from the graph to describe how the distance travelled in air depends on the energy of the particle.

(2)

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(e) Uranium-238 can only undergo nuclear fission by absorbing fast neutrons.
The fission emits neutrons which very quickly lose their energy.

Suggest why the fission of uranium-238 does not produce a chain reaction.

(2)

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(Total for Question = 10 marks)

Q11.

* Gamma radiation is produced by radioactive decay.

Alpha radiation and beta radiation are also produced by radioactive decay.

Compare the processes of alpha decay and beta decay.

Your answer should include what each radiation is and what effect each decay has on the original nucleus.

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(Total for question = 6 marks)