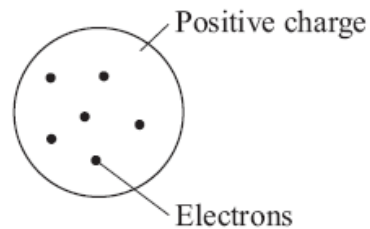
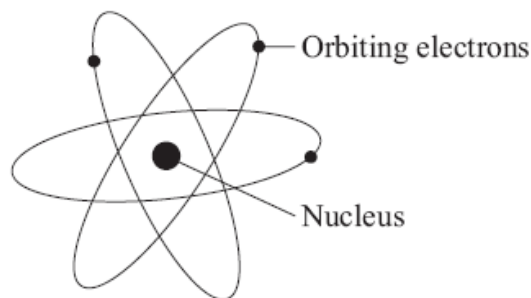


Nuclear Physics Questions

In the early part of the 20th century, scientists used the ‘plum pudding’ model to explain the structure of the atom.



Following work by Rutherford and Marsden, a new model of the atom, called the ‘nuclear’ model, was suggested.



- (a) Describe the differences between the two models of the atom.

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(4 marks)

- (b) In their investigation, Rutherford and Marsden fired positively charged alpha particles at a very thin sheet of gold. Over a period of several months, the scientists made over 100 000 measurements. These measurements showed that:
- a very small number of alpha particles were deflected backwards from the gold foil.

Use the nuclear model to explain this experimental result.

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(2 marks)

- (c) Why did the work of Rutherford and Marsden convince many scientists that the 'plum pudding' model of the atom was incorrect?

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(2 marks)

- (a) Complete the following table for an atom of uranium-238 (${}_{92}^{238}\text{U}$).

mass number	238
number of protons	92
number of neutrons	

(1 mark)

- (b) Complete the following sentence.

The name given to the number of protons in an atom is the proton number or the

.....

(1 mark)

- (c) An atom of uranium-238 (${}_{92}^{238}\text{U}$) decays to form an atom of thorium-234 (${}_{90}^{234}\text{Th}$).

- (c) (i) What type of radiation, alpha, beta or gamma, is emitted by uranium-238?

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(1 mark)

- (c) (ii) Why does an atom that decays by emitting alpha or beta radiation become an atom of a different element?

.....

.....

(1 mark)

- (a) The table gives information about the radioactive isotope, radon-222.

mass number	222
atomic number	86
radiation emitted	alpha particle

- (a) (i) Complete the following sentence.

The mass number is the total number of..... and

..... inside an atom.

(2 marks)

- (a) (ii) Radon-222 is an isotope of radon.

How many protons are there in an atom of radon-222?

.....

(1 mark)

- (a) (iii) When an atom of radon-222 emits an alpha particle, the radon-222 changes into an atom of polonium-218.

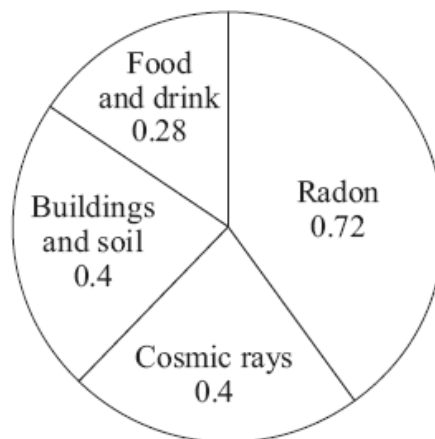
An alpha particle consists of 2 protons and 2 neutrons.

How is the structure of the nucleus of a polonium-218 atom different from the structure of the nucleus of a radon-222 atom?

.....

(1 mark)

- (b) The pie chart shows the average radiation dose that a person in the UK receives each year from natural background radiation. The doses are measured in millisieverts (mSv).



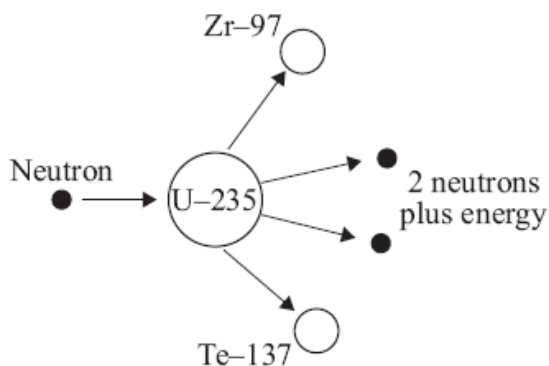
- (b) (i) Calculate the proportion of natural background radiation that comes from radon. Show clearly how you work out your answer.

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Proportion of radon =

(2 marks)

- (a) The diagram shows what can happen when the nucleus of a uranium atom absorbs a neutron.



- (i) What name is given to the process shown in the diagram?

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(1 mark)

- (ii) Explain how this process could lead to a chain reaction.

You may wish to add further detail to the diagram to help your answer.

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(2 marks)

- (iii) How does the mass number of an atom change when its nucleus absorbs a neutron?

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(1 mark)