The Nuclear Model of the Atom

Question Paper

Course	CIE IGCSE Physics
Section	5. Nuclear Physics
Topic	The Nuclear Model of the Atom
Difficulty	Easy

Time Allowed 40

Score /30

Percentage /100

Question 1a

Fig. 12.1 shows a diagram to represent a helium atom, and an incomplete key.

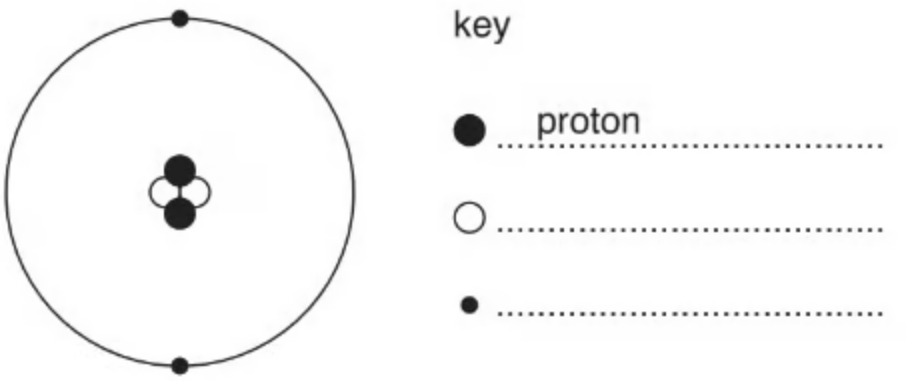

Fig. 12.1

Complete the key in Fig. 12.1. State the name of each particle.

[2 marks]

Question 1b

The table in Fig. 12.2 compares two isotopes of helium.

	$^{3}_{2}He$	$^{5}_{2}He$
number of protons		
number of neutrons		

Fig. 12.2

For each isotope, write the number of protons and the number of neutrons in the correct places in the table.

[2 marks]

Question 1c

The nucleus of the helium atom in (a) is the same as an α-particle.

(i) Describe the penetrating ability of α-particles.

[1]

(ii) Explain why it is dangerous to swallow a source that emits α-particles.

[2]

[3 marks]

Question 2a

Carbon-14 is a radioactive isotope of carbon. An atom of carbon-14 has 6 protons in its nucleus.

Another isotope of carbon is carbon-12.

(i) Determine the number of protons in a carbon-12 nucleus.

[1]

(ii) Determine the number of neutrons in a carbon-14 nucleus.

[1]

(iii) Determine the number of electrons orbiting the nucleus of a single carbon-14 atom.

[1]

[3 marks]

Question 2b

Carbon-14 decays by emitting a β-particle.

State what happens to a nucleus of carbon-14 when it emits a β-particle.

[1 mark]

Question 2c

People working with radioactive sources need to take safety precautions.

(i) A shielding material can absorb ionising radiation and reduce the damage to living tissue.

State a suitable material that will absorb all types of naturally occurring nuclear radiation.

[1]

(ii) Apart from using shielding, state how a person can reduce the amount of ionising radiation they absorb when they handle samples of radioactive substances.

[1]

[2 marks]

Question 3a

State the term used to describe nuclides which have the same number of protons but different numbers of neutrons.

[1 mark]

Question 3b

Table 1.1 describes four nuclides. The nuclide notation for lead-206 is missing.

name of nuclide	radium-222	radon-222	lead-216	lead-206
nuclide notation	$^{222}_{88}\mathrm{Ra}$	$^{222}_{86}\mathrm{Rn}$	$^{216}_{82}\mathrm{Pb}$	

Table 1.1

(i) State which **two** nuclides have the same number of protons.

[1]

(ii) Complete the table by filling in the nuclide notation for lead-206.

[1]

[2 marks]

Question 3c

Using the information from Table 1.1

(i) State which **two** nuclides have the same number of nucleons.

[1]

(ii) State which **two** nuclides have the same number of neutrons.

[1]

(iii) State which **one** of the four nuclides has the most electrons orbiting when it is in a neutral atom.

[1]

[3 marks]

Question 4a

Fig 1.1 show two different models of an atom.

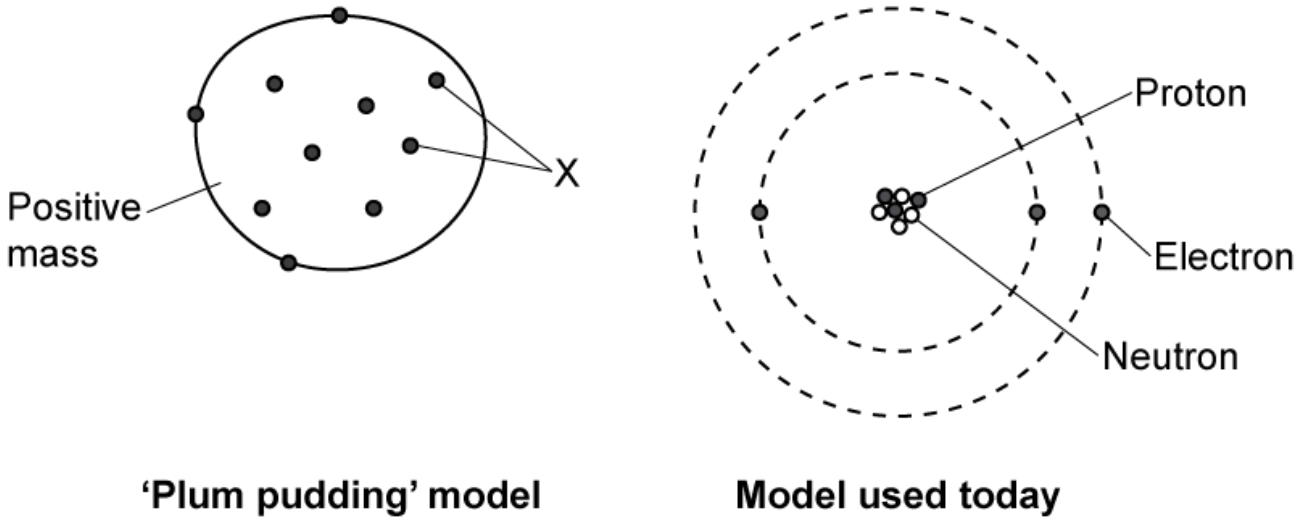

Fig 1.1

The particles labelled **X** in the plum pudding model are also included in the model of the atom used today.

State the name of the particles labelled **X**.

[1 mark]

Question 4b

Use words from the box to complete the sentences about the particles in an atom in today's model. Words can be used once, more than once or not at all.

an electron	a neutron	a proton

The particle with a positive charge is .....

The particle with the smallest mass is .....

The particle with no charge is .....

[3 marks]

Question 4c

An electron is removed from the atom, as shown in Fig. 1.2.

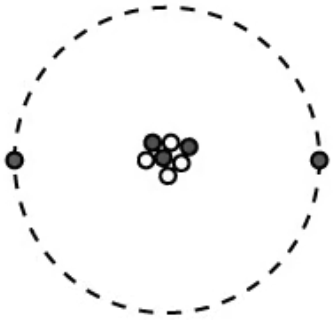

Fig. 1.2

(i) State the name given to this type of atom.

[1]

(ii) State the effect on the charge of the overall atom.

[1]

[2 marks]

Question 5a

Extended tier only

Fig. 1.1 shows the names of three different processes that take place in different locations.

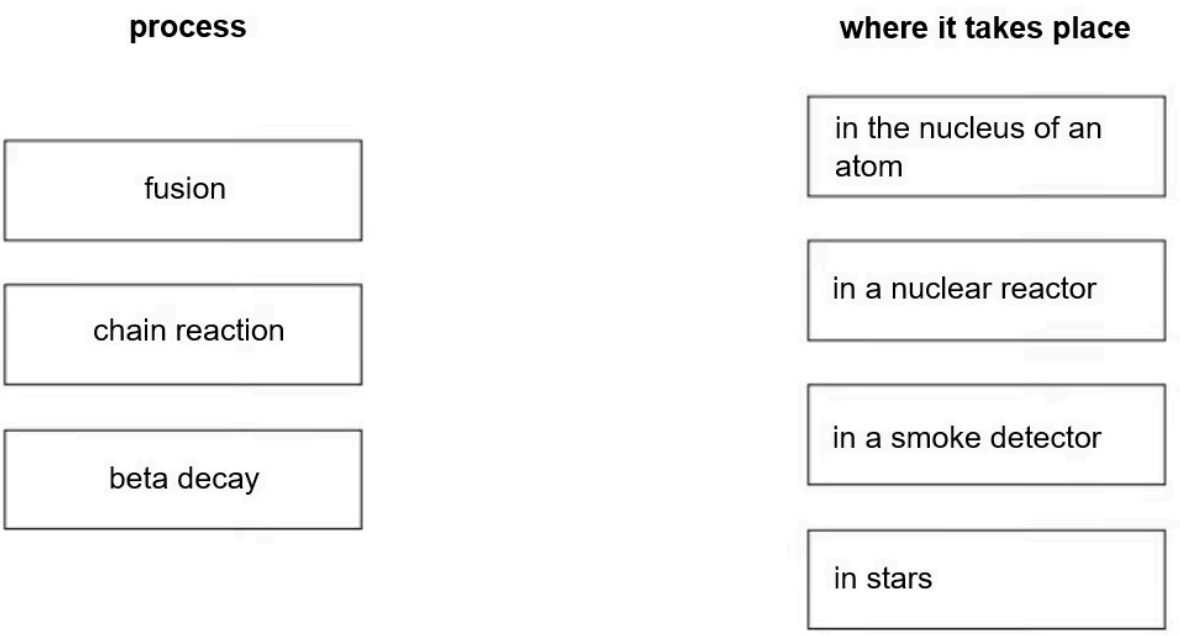

Fig 1.1

Draw one line from each process to the location it takes place.

[3 marks]

Question 5b

Extended tier only

This passage is about the differences between nuclear fission and fusion.

Tick the correct statements in the table below

Fission is the splitting of a large nucleus into daughter nuclei	
Electrons are released alongside the daughter nuclei in fission	
Fusion is the joining of two small nuclei into a heavier nucleus	
Fission releases energy, but fusion does not	

[2 marks]