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CAMBRIDGE LOWER SECONDARY CHECKPOINT
PRACTISE QUESTIONS -MARKSCHEMS

Subject: Chemistry- Stage -8

Topic:The Structure of an Atom-Set-1

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1 Fig. 11.1 shows the paths of three α-particles moving towards a thin gold foil.

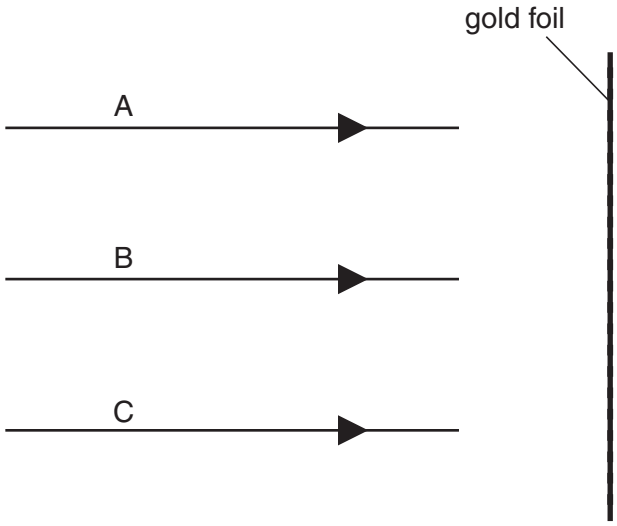

Fig. 11.1

Particle A is moving directly towards a gold nucleus.
Particle B is moving along a line which passes close to a gold nucleus.
Particle C is moving along a line which does not pass close to a gold nucleus.

(a) On Fig. 11.1, complete the paths of the α-particles A, B and C. [3]

(b) State how the results of such an experiment, using large numbers of α-particles, provides evidence for the existence of nuclei in gold atoms.

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..... [3]

(a)	A doubles back, either side	B1	
	B carries on, slightly deflected	B1	
	C carries straight on	B1	[3]
(b)	only (very) few scattered through large angles	B1	
	most pass undeviated so most of atom space	B1	
	scattering/deflection/repulsion due to concentrated mass/charge/charge/nucleus	B1	[3]
			[Total: 6]

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2 In a famous experiment, a beam consisting of a very large number of α-particles was projected, in a vacuum, at a very thin gold foil.

Fig. 11.1 shows the paths of three of the α-particles A, B and C travelling towards the foil.

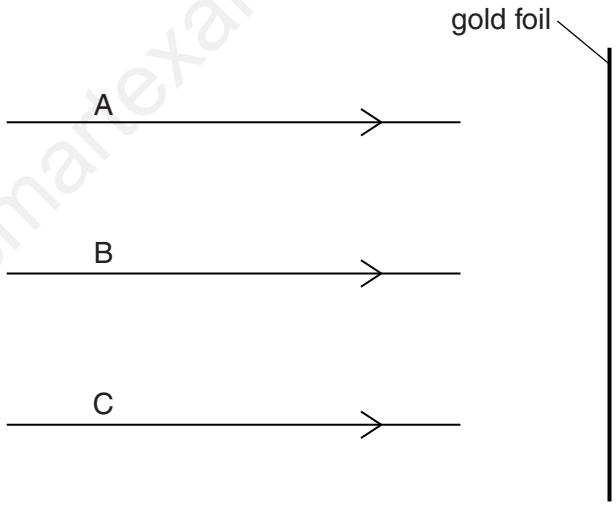

Fig. 11.1

α-particle A is travelling along a line which does not pass very close to a gold nucleus.
α-particle B is travelling along a line which passes close to a gold nucleus.
α-particle C is travelling directly towards a gold nucleus.

(a) Explain why an α-particle and a gold nucleus repel each other.

..... [1]

(b) On Fig. 11.1, draw lines with arrows to show the continuation of the paths of α-particles A, B and C. [3]

(c) State two conclusions, about gold atoms, which resulted from the experiment.

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.....

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..... [2]

[Total: 6]

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MARKING SCHEME:

(a) Both have positive/same charge B1

(b) A continues along original line B1
B deflected by any angle up to 135° (by eye) B1
C returns along same line OR deflected more than 135° (by eye) B1

(c) Any two from: B2

Atom is mostly empty space OR Nucleus is (very) much smaller than the atom OR Nucleus is very small

Charge of nucleus is (very) concentrated / (very) dense
OR Nucleus contains all the positive charge of the atom
OR Nucleus has positive charge

Nucleus contains most of the mass of the atom
OR Nucleus is (very) massive OR Nucleus is (very) dense

[Total: 6]

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3 In Geiger and Marsden's α-particle scattering experiment, α-particles were directed at a very thin gold foil.

Fig. 10.1 shows five of the nuclei of the atoms in one layer in the gold foil. Also shown are the paths of three α-particles directed at the foil.

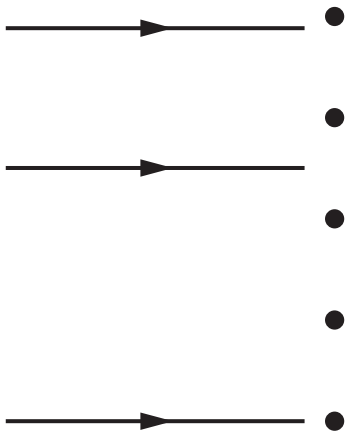

Fig. 10.1

(a) On Fig.10.1, complete the paths of the three α-particles. [3]

(b) **(i)** What result of the experiment confirmed that an atom consisted of a very tiny charged core, containing almost all the mass of the atom?

.....

..... [1]

(ii) What is the sign of the charge on this core? ..... [1]

(iii) What occupies the space between these charged cores?

..... [1]

[Total: 6]

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MARKING SCHEME:

(a)	**top**	bent down to R of layer	B1
	middle	straight on	B1
	bottom	deflected back to left	B1
	for all 3 ignore subsequent curving away from layer of nuclei		

(b)	**(i)**	deflection > 90°/the bottom one	B1
	(ii)	positive ignore numbers	B1
	(iii)	nothing/vacuum/space/electrons	B1

[Total: 6]

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4 In a laboratory experiment, the isotope uranium-238 is used as a source of α-particles.

Fig. 9.1 shows the α-particles from the uranium source being directed at a very thin gold foil, in a vacuum.

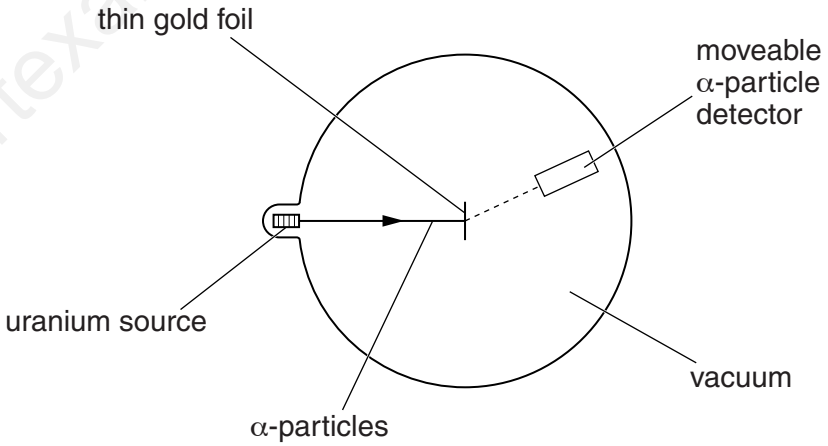

Fig. 9.1

To investigate the scattering of α-particles, a detector is moved to different positions around the very thin gold foil and measurements are recorded.

Describe the results from this scattering experiment and explain what they show about the structure of atoms.

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..... [4]

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MARKING SCHEME:

most α-particles travel straight (through the foil)	M1	
nucleus small / atom mostly empty space	A1	
small number deflected (through large angles)	M1	
most of mass in nucleus ACCEPT nucleus positive/charged	A1	[6]

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5 The arrows in Fig. 11.1 show the paths of three α-particles moving towards gold nuclei in a thin foil.

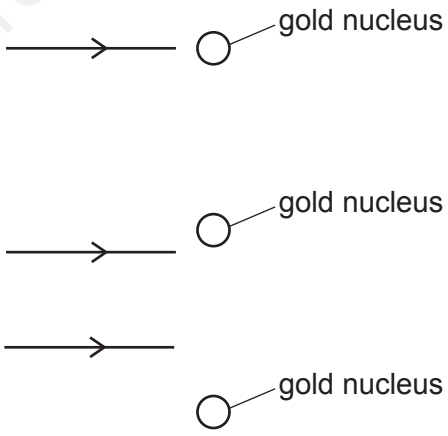

Fig. 11.1

On Fig. 11.1, complete the paths of the three α-particles. [3]

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MARKING SCHEME:

	Top: any path to the left within 45° horizontal	**B1**
	Middle: path to the right and deflected down (ending in a straight line)	**B1**
	Bottom: path not deflected OR path to the right and deflected up much less than middle path	**B1**

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6 **(a)** The arrows in Fig. 11.1 represent the paths of three α-particles moving towards gold nuclei in a thin foil. The gold nuclei are shown as shaded circles.

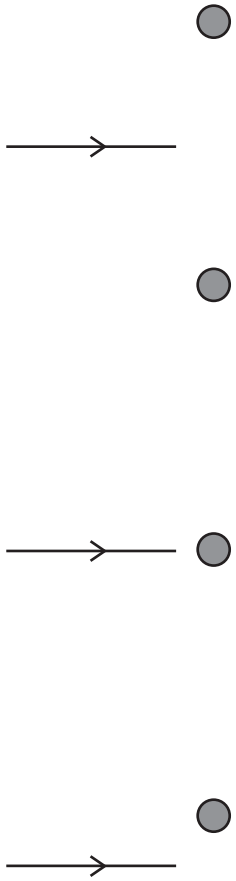

Fig. 11.1

On Fig. 11.1, complete the paths of the three α-particles. [3]

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MARKING SCHEME:

I(a)	(some) β/beta/radiation would penetrate gloves/reach other body parts (so insufficient protection)	**B1**
	middle: any path to the left within 45° of horizontal	**B1**
	bottom: path to the right and deflected down ending in a straight line	**B1**

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7 **(a)** Fig. 9.1 shows a beam of α-particles moving towards a thin sheet of gold in a vacuum.

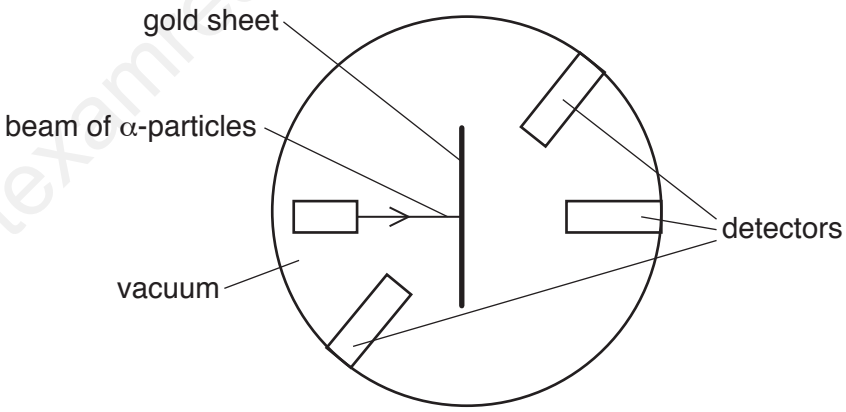

Fig. 9.1

Detectors in the region surrounding the thin gold sheet detect the α-particles and determine the number of particles that travel in various directions.

State and explain what can be deduced from the following observations.

(i) The majority of the α-particles pass through the gold sheet undeflected and are detected on the far side.

deduction .....

explanation .....

..... [2]

(ii) A small number of α-particles are deflected as they pass through the gold sheet.

deduction .....

explanation .....

..... [2]

(iii) A very small number of α-particles are deflected through very large angles or return back the way they came.

deduction .....

explanation .....

..... [2]

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MARKING SCHEME:

(a)(i)	**mark both explanation and deduction together**	
	nucleus is very small	**B1**
	very few α-particles hit or pass near to a nucleus	**B1**
(a)(ii)	**mark both explanation and deduction together**	
	nucleus is charged	**B1**
	(charged) α-particles experience a force	**B1**
(a)(iii)	**mark both explanation and deduction together**	
	centre / (small) part of atom **OR** nucleus includes most of the mass of the atom / is (very) dense	**B1**
	(α-particles move and) nucleus stays still	**B1**

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8 **(a)** The circles shown in Fig. 11.1 represent three gold nuclei. Three α-particles are approaching the gold nuclei.

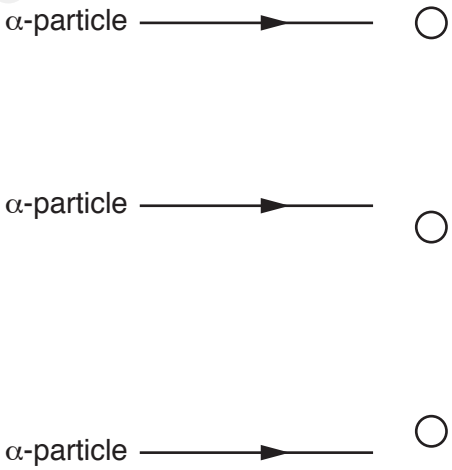

Fig. 11.1

On Fig. 11.1, complete the path of each α-particle. [3]

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MARKING SCHEME:

(a)	top: any path to the left within 45 degrees to the horizontal	**B1**
	middle: path to the right and deflected up (ending in a straight line)	**B1**
	bottom: path to the right and deflected down (ending in a straight line)	**B1**

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