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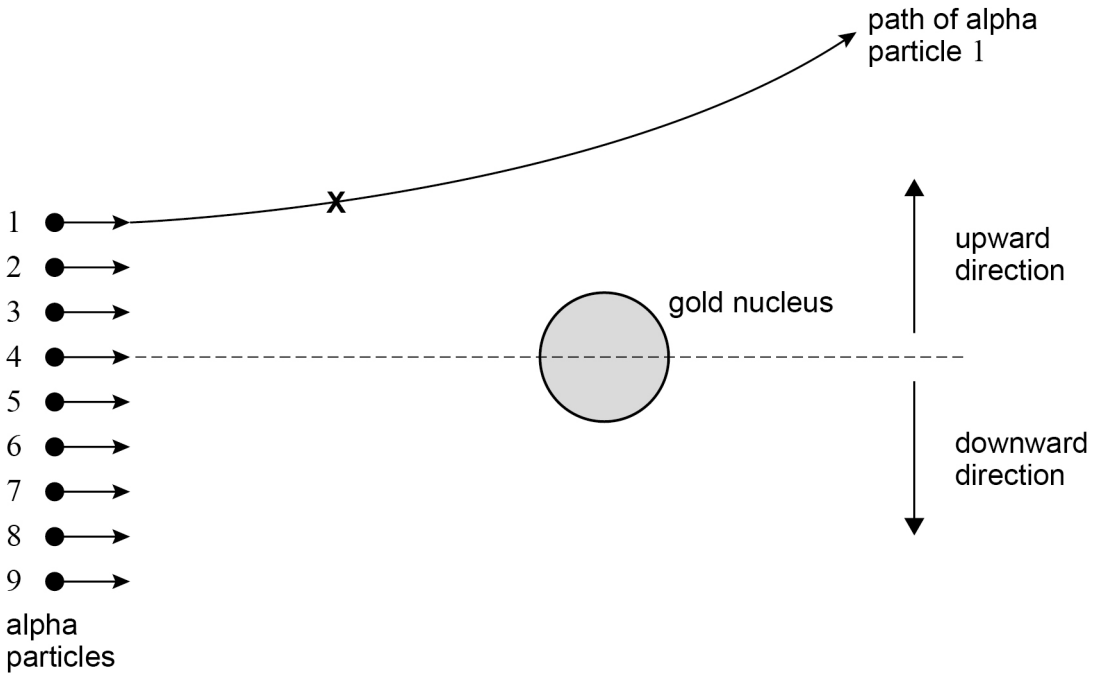
0 5 **Figure 11** shows alpha particles all travelling in the same direction at the same speed.
The alpha particles are scattered by a gold ($^{197}_{79}Au$) nucleus.
The path of alpha particle **1** is shown.

Figure 11



0 5 . 1 State the fundamental force involved when alpha particle **1** is scattered by the nucleus in **Figure 11**.

[1 mark]

0 5 . 2 Draw an arrow at position **X** on **Figure 11** to show the direction of the rate of change in momentum of alpha particle **1**

[1 mark]

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0 5 . 3 Suggest **one** of the alpha particles in **Figure 11** which may be deflected downwards with a scattering angle of $90°$

Justify your answer.

[2 marks]

alpha particle number = _____

0 5 . 4 Alpha particle **4** comes to rest at a distance of 5.5×10^{-14} m from the centre of the $^{197}_{79}\text{Au}$ nucleus.

Calculate the speed of alpha particle **4** when it is at a large distance from the nucleus. Ignore relativistic effects.

mass of alpha particle = 6.8×10^{-27} kg

[3 marks]

speed = _____ m s^{-1}

Question 5 continues on the next page

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0 5 . 5 The nuclear radius of $^{197}_{79}\mathrm{Au}$ is 6.98×10^{-15} m.

Calculate the nuclear radius of $^{107}_{47}\mathrm{Ag}$.

[2 marks]

radius = _____ m

0 5 . 6 All nuclei have approximately the same density.

State **one** conclusion about the nucleons in a nucleus that can be deduced from this fact.

[1 mark]

_____

_____

_____

_____

10

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1 3 What is the angular speed of a satellite in a geostationary orbit around the Earth?

[1 mark]

A 1.2×10^{-5} rad s^{-1} ⬭

B 7.3×10^{-5} rad s^{-1} ⬭

C 4.4×10^{-3} rad s^{-1} ⬭

D 2.6×10^{-1} rad s^{-1} ⬭

1 4 Two fixed charges of magnitude $+Q$ and $+3Q$ repel each other with a force F.
An additional charge of $-2Q$ is given to each charge.

What are the magnitude and the direction of the force between the charges?

[1 mark]

	Magnitude of force	Direction of force	
A	$\frac{F}{3}$	repulsive	⬭
B	$5F$	attractive	⬭
C	$5F$	repulsive	⬭
D	$\frac{F}{3}$	attractive	⬭

Turn over for the next question

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1 5 At a distance L from a fixed point charge, the electric field strength is E and the electric potential is V.

What are the electric field strength and the electric potential at a distance $3L$ from the charge?

[1 mark]

	Electric field strength	Electric potential	
A	$\frac{E}{3}$	$\frac{V}{9}$	⬭
B	$\frac{E}{3}$	$\frac{V}{3}$	⬭
C	$\frac{E}{9}$	$\frac{V}{3}$	⬭
D	$\frac{E}{9}$	$\frac{V}{9}$	⬭