

Q1.

	Answer	Additional guidance	Mark
(i)	A description including: roll / release / drop a marble (down the slope) (1) and one from record where the marbles go (1) OR measure the angle of path (1)	allow alpha particle for marble allow any method of recording	(2) AO3

	Answer	Additional guidance	Mark
(ii)	any one from marble / weight has no charge (1) the edge of the paper is not far enough away from the weight (1) the marble / weight is too big / small (1) there is only one marble / weight (1) it is 2 dimensional / not 3D (1) all marbles have the same speed / alpha particles different speed to marbles (1) marbles (only deflect on) hitting / contact with weight (1)	not to scale allow marble cannot pass through the weight (1)	(1) AO3

	Answer	Additional guidance	Mark
(ii)	<p>an explanation including any four from:</p> <p>Observations</p> <p>most (alpha particles) pass (straight) through the foil (with little deflection) (1)</p> <p>some (alpha particles) are {scattered / deflected} through {small angles / less than 90 degrees} (1)</p> <p>(very) few (alpha particles) are {scattered / deflected} through {large angles / greater than 90 degrees} (1)</p> <p>Conclusions</p> <p>atoms are mainly empty space (1)</p> <p>there must be a nucleus / something inside the atom (1)</p> <p>(nucleus / something) must be {small / heavy / dense / concentrated / charged / positive} (1)</p>	<p>ignore electrons</p> <p>ignore refracted allow repelled</p> <p>allow rebound / reflect / back scattering / bounce back</p> <p>ignore electrons</p>	(4) A01,A03

Q3.

Question number	Indicative content	Mark
	<p>An explanation that combines identification via a judgment (2 marks) to reach a conclusion via justification/reasoning (1 mark):</p> <ul style="list-style-type: none">• some alpha particles go straight through (1)• some alpha particles scattered (1)• idea of all mass / (positive) charge concentrated in centre /nucleus (1)• mainly empty space (in rest of atom) (1)	(3)



Q4.

Question Number	Answer	Mark
	<p>Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme.</p> <p>The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.</p> <p style="text-align: center;">A03 and A02 (6 marks)</p> <p>A03</p> <ul style="list-style-type: none">• most go straight through to P• some are deflected through small angles to Q• few have deflections greater than 90° to R• or are even reflected (bounce back off the foil) to R <p>A02</p> <ul style="list-style-type: none">• alpha positive is repelled by positive nucleus• atom being mostly empty space• atoms have a small nucleus• nucleus has a big mass / density• +ve charge concentrated into a very small space	(6)

Level	Mark	Descriptor
	0	<ul style="list-style-type: none"> No awardable content
Level 1	1–2	<ul style="list-style-type: none"> Interpretation and evaluation of the information attempted but will be limited with a focus on mainly just one variable. Demonstrates limited synthesis of understanding. (AO3) The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. (AO2)
Level 2	3–4	<ul style="list-style-type: none"> Interpretation and evaluation of the information on both variables, synthesising mostly relevant understanding. (AO3) The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. (AO2)
Level 3	5–6	<ul style="list-style-type: none"> Interpretation and evaluation of the information, demonstrating throughout the skills of synthesising relevant understanding. (AO3) The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. (AO2)

Summary for guidance

Level	Mark	Additional Guidance	General additional guidance – the decision within levels
	0	No rewardable material.	Eg - At each level, as well as content, the scientific coherency of what is stated will help place the answer at the top, or the bottom, of that level.
Level 1	1–2	<u>Additional guidance</u> unlinked statement from the diagram or table or knowledge of the atom	<u>Possible candidate responses</u> most particles go to P (<i>from table</i>) OR particles refract/bend to Q (<i>from diagram</i>)
Level 2	3–4	<u>Additional guidance</u> One link between any TWO of diagram, table, knowledge about atoms.	<u>Possible candidate responses</u> Most particles go straight through (the gold) to P (<i>from table and diagram</i>) OR Most particles go to P which means an atom is mainly space (<i>from table and knowledge</i>) OR particles are reflected because there is a nucleus (<i>diagram and knowledge</i>)
Level 3	5–6	<u>Additional guidance</u> One link between diagram AND table AND knowledge about atoms	<u>Possible candidate responses</u> Most particles go straight through (the gold) to P which means an atom is mainly space OR A few particles reflected back to R which means an atom has a nucleus