

Question	Answers	Extra information	Mark	AO / Specification reference
01.1	0.004 m 4×10^{-3} m		1 1	AO1 AO2 6.4.1.1
01.2	$0.004 \times 10\,000$ = 40 m		1 1	AO2 6.4.1.1
01.3	20 m from the pea		1	AO3 6.4.1.1
01.4	1×10^{-10} m		1	AO1/1 6.4.1.1
02.1	a positive mass with negatively charged electrons embedded in it		1 1	AO1
02.2	atoms are tiny spheres that cannot be divided		1	AO1
02.3	most alpha particles went straight through a gold foil but some came back		1 1	
03.1	three		1	AO2 6.4.1.2
03.2	seven		1	AO2 6.4.1.2
03.3	three		1	AO2 6.4.1.2

Question	Answers	Extra information	Mark	AO / Specification reference
03.4	loses positive		1 1	AO1 6.4.1.2
04.1	B, C, A, D	B before C C before A A before D	1 1 1	AO2 6.4.1.1 6.4.1.2 6.4.1.3
04.2	alpha gold most some most		1 1 1 1 1	AO1 6.4.1.3
04.3	a place/orbit that is a certain distance from the nucleus where you find an electron		1	AO1 6.4.1.3
04.4	lower, higher B	must be this order	1 1	AO2 6.4.1.1
04.5	tiny spheres that could not be divided		1	AO1 6.4.1.2 6.4.1.3
05.1	six eight		1 1	AO2 6.4.1.2

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05.2	isotopes		1	AO1 6.4.1.2
05.3	no charge electron		1 1	AO1 6.4.1.1 6.4.1.2
05.4	$^{14}_6\text{C}$		1	AO1 6.4.1.2
06.1	ten		1	AO2 4.4.1.2
06.2	the number of electrons is the same as the number of protons		1	AO1 4.4.1.1
06.3	A and B		1	AO1 4.4.1.2
06.4	isotopes have the same number of protons but different numbers of neutrons		1	AO1 4.4.1.2
06.5	+1		1	AO2 6.4.1.2
06.6	nucleus		1	AO1 6.4.1.1
07.1	plum pudding – negative electrons embedded within a ball of positive charge nuclear model – mass of an atom is concentrated in the central nucleus model with energy levels – electrons orbit nucleus at specific distances	all lines correct for two marks one line correct for one mark	2	AO1 6.4.1.3

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07.2	experimental electron		1 1	AO1 6.4.1.3
07.3	the models have equal number of positive and negative charges		1	AO3 6.4.1.3
07.4	Level 3: Detailed description of the results of the alpha scattering experiment, with at least two observations and the relevant conclusions of the structure of the atom given. Discovery of energy levels, protons, and neutrons also described.		5-6	AO1 6.4.1.3
	Level 2: Description of the results of the alpha scattering experiment, with at least one observation and the relevant conclusion of the structure of the atom given. Discovery of energy levels, protons, or neutrons also described.		3-4	
	Level 1: Brief description of either an observation of the alpha scattering experiment given, discovery of energy levels, discovery of protons, or discovery of neutrons.		1-2	
	No relevant content.		0	

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	Indicative content: <ul style="list-style-type: none"> • alpha scattering experiment • alpha particles fired at gold foil • most passed through – most of an atom must be empty space • some bounced back – mass of an atom must be concentrated in the centre of the atom • some were deflected – central mass must be positively charged • led to development of nuclear model • (Niels) Bohr adapted nuclear model • electrons at specific distances from nucleus/electrons arranged in energy levels • used theoretical calculations to support model • other experiments developed idea that nucleus was split into protons with positive charge • (James) Chadwick found evidence for neutrons 			
08.1	31		1	AO2 6.4.1.1
08.2	200		1	AO2 6.4.1.1
08.3	$\frac{150}{10000}$ = 0.015 pm		1 1	AO2 6.4.1.1
08.4	the atomic number = 31 the atomic mass = 70 + 2 = 72	allow 72 with no working	1 1	AO2 6.4.1.2

Question	Answers	Extra information	Mark	AO / Specification reference
09.1	shower		1	AO2 6.2.4.2
09.2	energy = 5000×900 = 4 500 000 J		1 1 1	AO1 AO2 6.2.4.2
09.3	less less less		1 1 1	AO3 6.2.4.2
09.4	earth — green and yellow stripes live — neutral neutral — blue	in any order	3	AO1 6.2.3.2
10.1		one mark for each bar plotted correctly	3	AO2/2 6.1.3
10.2	2013 – 2014		1	AO2/2 6.1.3
10.3	solar power is renewable/does not contribute to climate change		1	AO3 6.1.3