AQA GCSE Physics | 8463

SPECIFICATION POINT 4.4.1.3

The development of the model of the atom (common content with chemistry)

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**8**
Available paper years	**2005–2025**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

4.4.1.3 The development of the model of the atom (common content with chemistry)

Answer 01 · Mark scheme

June 2005 | 3451 | Original Q9 | Legacy

The full source mark scheme begins on page 13. Follow original question 9 in that document.

Answer 02 · Mark scheme

June 2005 | 3462 | Original Q7 | Legacy

The full source mark scheme begins on page 31. Follow original question 7 in that document.

4.4.1.3 The development of the model of the atom (common content with chemistry)

Answer 03 · Mark scheme January 2009 | PHY2H | Original Q7 | Legacy

Question 7

question	answers	extra information	mark
7(a)	any **two** pairs from:	to gain credit it must be clear which model is being described do **not** accept simple descriptions on the diagram without comparison	4
	• nuclear model mass is concentrated at the centre / nucleus	accept the nuclear model has a nucleus/ the plum pudding model does not have a nucleus for 1 mark	(1)
	plum pudding model mass is evenly distributed		(1)
	• nuclear model positive charge occupies only a small part of the atom		(1)
	plum pudding model positive charge spread throughout the atom		(1)
	• nuclear model electrons orbit some distance from the centre / nucleus	accept electrons in shells/ orbits provided a valid comparison is made with the plum pudding model do **not** accept on its own	(1)
	plum pudding electrons embedded in the (mass) of positive (charge)	do **not** accept electrons at edge of plum pudding	(1)
	• nuclear model the atom mainly empty space		(1)
	plum pudding model is a 'solid' mass		(1)
7(b)	nucleus must be <u>positive</u> to deflect/ repel alpha particles	answers in terms of electrons/negative charge causing deflection negates mark answers in terms of reflection negates mark	1 1
	nucleus (very) small so few alpha particles deflected backwards	accept most of atom empty space so <u>most</u> pass through	

Question 7 continues on the next page

4.4.1.3 The development of the model of the atom (common content with chemistry)

PHY2H

Question 7 continued

question	answers	extra information	mark
7(c)	many/ 100 000 measurements taken	accept results for measurements accept data valid / reliable	1
	findings could not be explained by plum pudding model	accept a specific finding that could not be explained eg some alpha particles were deflected backwards	1
Total			**8**

4.4.1.3 The development of the model of the atom (common content with chemistry)

Answer 04 · Mark scheme June 2010 | PHY1BP | Original Q7 | Legacy

Seven	1	2	2	1

Answer 05 · Mark scheme June 2011 | PHY1BP | Original Q6 | Legacy

Six	**1**	**4**	**4**	**3**

Answer 06 · Mark scheme June 2015 | PH2HP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
2(a)	(an equal amount of) positive (charge)	do **not** accept charge on the atom / nucleus is positive	1	AO3 2.5.1	**E**
2(b)(i)	a (significant) number of alpha particles were scattered by more than 4° **or** alpha particles deflected backwards	accept (some) measurements / results were unexpected	1	AO1 2.5	**E**
	measurements / results could not be explained by 'plum pudding' model **or** measurements / results did not support predictions	can be explained by the nuclear model is insufficient accept measurements / results did not support hypothesis	1		
2(b)(ii)	many/(over)100 000 measurements/results taken	accept Rutherford(and Marsden) were respected scientists **or** scientists were respected accept measurements / results taken over several months the experiment was repeated many times is insufficient	1	AO3 2.5	**E**

Question 2 continues on the next page . . .

4.4.1.3 The development of the model of the atom (common content with chemistry)

Answer 06 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
2(c)			6	AO1 2.5.1a/b/c	E

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 4 and apply a 'best-fit' approach to the marking.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
no relevant content	A brief description is given with some particles correctly named	A description is given with all three particles named **and either** the polarity of charge associated with the three particles **or** the relative mass of the three particles **or** the relative mass for one particle and the relative charge for one particle given	A more detailed description is given, naming the particles and polarity of charge **and either** the relative mass is given for at least two particles **or** the relative charge is given for at least two particles

4.4.1.3 The development of the model of the atom (common content with chemistry)

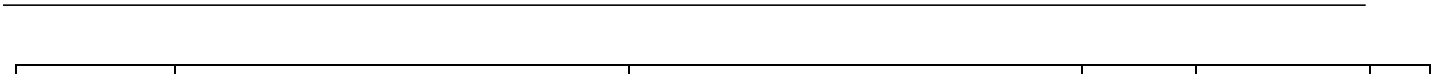
examples of the points made in the response	extra information		
brief description contains protons, neutrons and electrons protons are positive electrons are negative neutrons are uncharged has a nucleus **relative charge** proton +1 electron – 1 neutron 0 **relative mass** proton 1 neutron 1 electron (about) 1/2000 **more detailed description** protons and neutrons make up the nucleus electrons orbit the nucleus electrons are in shells most of the atom is empty space nucleus occupies a very small fraction of the volume of the atom electrons orbit at a relatively large distance from the nucleus most of the mass of the atom is contained in the nucleus the nucleus as a whole is positively charged total number of protons in the nucleus equals the total number of electrons orbitting it in an atom	accept protons and neutrons have the same mass accept electrons have tiny / negligible mass zero mass is neutral		

Total		**10**

4.4.1.3 The development of the model of the atom (common content with chemistry)

Answer 06 · Mark scheme

June 2015 | PH2HP | Original Q2 | Legacy

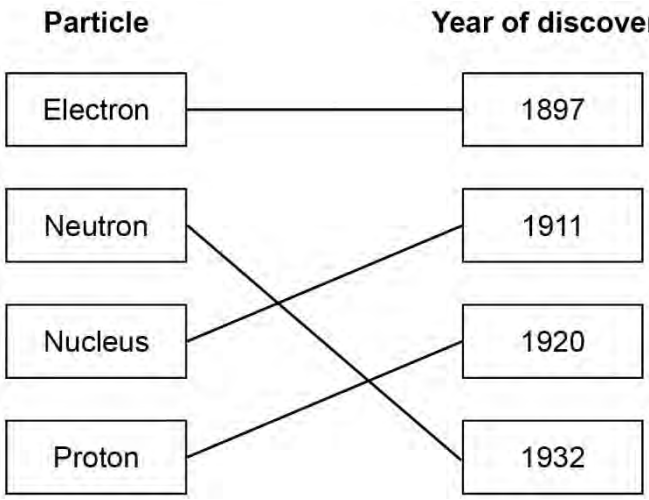


4.4.1.3 The development of the model of the atom (common content with chemistry)

Answer 07 · Mark scheme

June 2023 | 8463/1H | Original Q8

Question 8

Question	Answers	Mark	AO / Spec. Ref.
08.1	 4 correct for 2 marks 2 or 3 correct for 1 mark additional line from a box on the left negates the mark for that box	2	AO1 4.4.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	both the alpha particles and the (gold) nucleus have positive / same charge	‘it’ is alpha particle **A** allow alpha particles and protons have positive / same charge	1	AO1 AO3
	so the alpha particle and the gold nucleus repel each other	allow like charges repel ignore deflection (this refers to the path taken not the force)	1	4.4.1.1 4.2.5.1 4.2.5.2

4.4.1.3 The development of the model of the atom (common content with chemistry)

Answer 07 · Mark scheme

June 2023 | 8463/1H | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	particle **B** passes closer to the nucleus so experiences a stronger (repulsive) force **or** so experiences a stronger electric field	'it' is particle **B** any mention of particle **B** colliding with the nucleus scores zero	1 1	AO3 4.4.1.1 4.2.5.1 4.2.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	the atom is mostly empty space		1	AO3 4.4.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	in the Bohr model the electrons orbit (the nucleus) at specific distances (whereas in the nuclear model the electrons can orbit at a continuous range of distances)	allow energy levels or shells for specific distances	1	AO1 4.4.1.3

4.4.1.3 The development of the model of the atom (common content with chemistry)

Answer 07 · Mark scheme

June 2023 | 8463/1H | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.6	to move to a higher energy level an electron absorbs energy from electromagnetic radiation	allow absorbs energy by collision with another electron allow EM radiation for electromagnetic radiation	1	AO1 4.4.1.1
	to move to a lower energy level an electron emits energy in the form of electromagnetic radiation	if no other mark scored allow 1 mark for an electron changes energy level by emitting or absorbing electromagnetic radiation	1	

Total Question 8	10

4.4.1.3 The development of the model of the atom (common content with chemistry)

Answer 08 · Mark scheme

June 2025 | 8463/1H | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	new evidence is discovered that existing models cannot explain		1	AO1 4.4.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	irradiation is the exposure to radiation (radioactive) contamination is the (unwanted) presence of radioactive material on / inside a person	 allow an object for a person	1 1	AO1 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	(Po) 84 (Pb) 206		1 1	AO1 4.4.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	number of half-lives = 4 time = 4 × 138 time = 552 (days)		1 1 1	AO2 4.4.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	polonium-209 has a lower activity than polonium-210 (because polonium-209) has a longer half-life	ignore description of rate of decay MP2 dependent on MP1	1 1	AO3 4.4.2.1

Total Question 7	10

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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Physics 3451/F
Specification B

Mark Scheme

2005 examination – June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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4.4.1.3 The development of the model of the atom (common content with chemistry)

Physics (Specification B)
Foundation Tier 3451/F

3451/F Q1

question	answers	extra information	mark
(a)(i)	less than	accept any correct indication	1
(ii)	more than	accept any correct indication	1
(b)	any **two** from: stays above the same place above the equator one orbit takes 24 hours	 do **not** accept stays in the same place do **not** accept goes around equator unless qualified do **not** accept orbit at same speed as Earth do **not** accept orbit at a constant speed accept has same angular speed / velocity as Earth	2
total			4

3451/F Q2

question	answers	extra information	mark
(a)	comet		1
(b)	large group / number / collection of stars	ignore reference to planets accept millions of stars do **not** accept thousands of stars do **not** accept loads of stars	1
(c)	giant supernova neutron		1 1 1
total			5

4.4.1.3 The development of the model of the atom (common content with chemistry)

3451/F Q3

question	answers	extra information	mark
(a)(i)	radio		1
(ii)	gamma	accept microwave accept infrared	1
(iii)	ultra violet		1
(iv)	microwaves		1
(b)	the same as		1
(c)	X-rays do not go through lead	references to gamma rays are incorrect accept lead protects them from the X-rays accept not exposed to X-rays	1
	lead stops / reduces risk of X-rays harming / damaging / killing (persons) <u>cells</u>	accept X-rays (may) cause cancer accept organs for cell do **not** accept references to electric shock do **not** accept stops bones of people showing on X-ray answers involving the horse wearing an apron are incorrect	1
	Quality of written communication	award for a sensible sequence of **two** points	1
total			8

4.4.1.3 The development of the model of the atom (common content with chemistry)

3451/F Q4

question	answers	extra information	mark
(a)	light electrical		1 1
(b)	15% **or** 0.15	correct substitution gains **1** mark only an answer of 15 with no unit **or** an incorrect unit gains **1** mark an answer of 0.15 given with a unit gains **1** mark	2
(c)	the ticket machine is a long way from other electricity supplies		1
(d)	any figure between 5 and 10 inclusive	unit not required but if given must match numerical answer	1
total			6

3451/F Q5

question	answers	extra information	mark
(a)(i)	radon (gas)	do **not** accept gas	1
(ii)	background		1
(b)	bigger	accept any word which means bigger	1
(c)	**Z** alpha will not pass through aluminium or lead	if Z is not given, the reason does not score accept alpha cannot go through metals / dense material accept there is nothing to stop the radiation accept alpha will not pass through aluminium do **not** accept alpha will not pass through lead do **not** accept alpha stopped by air	1 1
total			5

4.4.1.3 The development of the model of the atom (common content with chemistry)

3451/F Q6

question	answers	extra information	mark
(a)	loses negative charge / electrons	do **not** accept positive charge transfers to the comb do **not** accept friction	1
(b)	**A** attract		1
	B repel		1
	C attract		1
(c)	**F A D E**	allow **2** marks for 2 letters in the correct place allow **1** mark for 1 letter in the correct place	3
total			7

4.4.1.3 The development of the model of the atom (common content with chemistry)

Physics B – AQA GCSE Mark Scheme, 2005 June series

3451/F Q7

question	answers	extra information	mark
(a)	all points correctly plotted	tolerance ± $\frac{1}{2}$ square on y axis only allow **1** mark for 3 correctly plotted points	2
	attempt made to draw a smooth curve	do **not** accept dot-to-dot line	1
(b)(i)	3 days ± 0.2 **or** any value correctly obtained using their graph line	if no line drawn in (a), answer must be exactly 3	1
(ii)	3 days or their (b)(i)		1
(c)	radon-222	accept radon **or** 222 accept alpha or 3.8 correct isotope required for reason to score	1
	has the shortest half-life	accept the others have longer half-lives	1
total			7

4.4.1.3 The development of the model of the atom (common content with chemistry)

3451/F Q8

question	answers	extra information	mark
(a)	fossils of Cynognathus are found in Africa and South America		1
	the shapes ……. almost fit together	only two boxes should be ticked deduct **1** mark for each additional box to a minimum mark of **0**	1
(b)	continental		1
	crust		1
	tectonic		1
total			5

4.4.1.3 The development of the model of the atom (common content with chemistry)

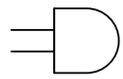
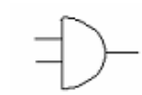
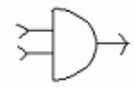
3451/F Q9

question	answers	extra information	mark
(a)	capacitor LDR relay (normally open)	accept condenser **or** light dependent resistor accept 'ldr', 'Ldr' etc. do **not** accept 'relay normally closed'	1 1 1
(b)(i)	battery	accept '(battery of) cells' do **not** accept 'battery / cell'	1
(ii)	LED	**or** light emitting diode accept 'led' or 'Led' do **not** accept just 'diode'	1
(iii)	B will light (but C will not)	accept '(only) B will work' accept 'one is on the other is off' do **not** accept 'C is on and B is off'	1
(iv)	any **one** from: B is connected the right way round (and C is not) a (light emitting) diode only allows (a significant) current to flow in one direction B's anode is connected to the positive side of the supply B's cathode is connected to the negative terminal	N.B. the candidate's answer to part (b)(iii) may include this mark but do **not** credit if the response to part (b)(iii) is incorrect or there is any other contradiction if (iv) is completely consistent with (iii) which is wrong, allow **1** mark	1
(c)(i)	first input / second input / output 0 / 0 / **0** 1 / 0 / **0** 0 / 1 / **0** 1 / 1 / **1**	**all** correct allow: OFF NO OFF NO OFF NO ON YES	1
(ii)	truth (table)		1

cont…

4.4.1.3 The development of the model of the atom (common content with chemistry)

3451/F Q9 cont…

(iii)		a Roman upper case D in any orientation without contacts is acceptable but if contacts are shown do **not** give the mark if there is any ambiguity or contradiction allow  	1
(d)	light sensor	**or** light dependent resistor **or** LDR accept 'ldr', Ldr' etc allow solar cell, photo cell	1
	NOT gate	accept 'Not gate' **or** 'not gate' if both correct but in the wrong order credit with **1** mark	1
total			12

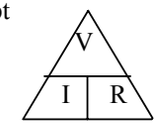
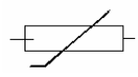
4.4.1.3 The development of the model of the atom (common content with chemistry)

3451/F Q10

question	answers	extra information	mark
(a)(i)	rays continued to meet on the right hand side of the lens and beyond	must be straight lines from the right hand side of the lens ignore details through the lens allow if no arrows	1
	meet exactly on the axis	negate mark if contradictory arrow(s) added do not need to go beyond the focus for this mark	1
(ii)	(principal) focus	**or** focal (point)	1
(iii)	converging	**or** convex	1
(b)(i)	**A**		1
(ii)	rays seem to come from this point	**or** words to this effect **or** shows this on the diagram	1
(iii)	diverging	**or** concave	1
(c)	film	accept any unambiguous method of showing the correct response	1
	smaller than		1
	further away from		1
(d)	any **three** from: • real image can be put on a screen • virtual image cannot be put on a screen / film • virtual image is imaginary • real image is formed where (real) rays cross / converge • virtual image is where virtual / imaginary rays (seem to) come from • virtual image formed where virtual rays intersect / cross	allow film allow real image has light travelling through it **or** virtual image is where rays seem to come from	3
total			13

4.4.1.3 The development of the model of the atom (common content with chemistry)

3451/F Q11

question	answers	extra information	mark
(a)(i)	$A_1 = 0.5$ $A_4 = 0.5$	ignore any units allow **1** mark for $A_1 = A_4 \neq 0.5$	1 1
(ii)	the resistance of **P** is more than 20 Ω a smaller current goes through P / A_2 (than 20 Ω)	 dependent on getting 1st mark correct accept converse	1 1
(b)(i)	potential difference = current × resistance	accept pd / voltage for potential difference accept V = I × R, correct symbols and correct case only accept volts = amps × ohms accept  provided subsequent method is correct allow combination of physical quantities and named units allow voltage = I × R	1
(ii)	6	allow **1** mark for correct substitution	2
(iii)	6	accept their (b)(ii)	1
(c)	thermistor or  resistance goes down (as temperature of thermistor goes up)	accept correct circuit symbol allow phonetic spelling do **not** accept changes for goes down do **not** accept an answer in terms of current only answers in terms of other components are incorrect	1 1
total			10

4.4.1.3 The development of the model of the atom (common content with chemistry)

Physics B – AQA GCSE Mark Scheme, 2005 June series

3451/F Q12

question	answers	extra information	mark
(a)(i)	larger the distance, greater the time	accept 'they are proportional' accept converse	1
(ii)	any value between 6 and 9 years inclusive		1
(b)(i)	carbon dioxide		1
(ii)	(Venus) has high**er** temperature (than Mercury)	accept has the high**est** temperature accept Venus is hotter / hottest do **not** accept has a high / very high temperature	1
	(Venus) further from the Sun than Mercury	accept 'Venus is not the closest planet to the Sun' answer in terms of greenhouse effect only, scores **0** marks	1
total			5

4.4.1.3 The development of the model of the atom (common content with chemistry)

3451/F Q13

question	answers	extra information	mark
(a)(i)	20		1
(ii)	convection		1
(iii)	fit draughtproof strips	accept lay carpet accept fit curtains accept close doors / windows / curtains accept any reasonable suggestion for reducing a draught 'double glazing' alone is insufficient	1
(b)	air is (a good) insulator **or** air is a poor conductor	accept air cavity / 'it' for air	1
	reducing heat transfer by <u>conduction</u>	accept stops for reduces ignore convection do **not** accept radiation do **not** accept answers in terms of heat being trapped	1
(c)(i)	most cost effective	accept it is cheaper or low<u>est</u> cost accept shortest payback time accept in terms of reducing heat loss by the largest amount do **not** accept it is easier ignore most heat is lost through the roof	1
(ii)	4		1
total			7

4.4.1.3 The development of the model of the atom (common content with chemistry)

3451/F Q14

question	answers	extra information	mark
(a)(i)	constant speed	do **not** accept normal speed do **not** accept it is stopped / stationary	1
	in a straight line	accept any appropriate reference to a direction constant velocity gains **2** marks 'not accelerating' gains **2** marks terminal velocity alone gets **1** mark	1
(ii)	goes down owtte	accept motorbike (it) slows down	1
(b)(i)	20 (m/s)	ignore incorrect units	1
(ii)	acceleration = change in velocity / time (taken)	do **not** accept velocity for change in velocity accept change in speed accept $a = \frac{v-u}{t}$ **or** $a = \frac{v_1 - v_2}{t}$ **or** $a = \frac{\Delta v}{t}$ do **not** accept $a = \frac{v}{t}$	1
(iii)	4 **or** their (b)(i) ÷ 5	allow **1** mark for correct substitution	2
	m/s^2	m/s/s **or** ms^{-2} **or** metres per second squared **or** metres per second per second	1
(c)	vehicle may skid / slide	loss of control / brakes lock / wheels lock accept greater stopping distance **or** difficult to stop	1
	due to reduced friction (between tyre(s) and road)	accept due to less grip do **not** accept no friction	1

cont…

4.4.1.3 The development of the model of the atom (common content with chemistry)

3451/F Q14 cont…

(d)	any **three** from: • <u>increased</u> speed • <u>reduced</u> braking force • <u>slower</u> (driver) reactions • <u>poor</u> vehicle maintenance • <u>increased</u> mass / weight of vehicle • <u>poor</u> road surface • <u>more</u> streamlined	do **not** accept night time / poor vision N.B. specific answers may **each** gain credit eg tiredness (1), drinking alcohol (1), using drugs (1), driver distracted (1) etc specific examples may **each** gain credit eg worn brakes or worn tyres etc accept large mass / weight of vehicle if candidates give three answers that affect stopping distance but not specific to <u>increase</u> award **1** mark only	3
total			13

4.4.1.3 The development of the model of the atom (common content with chemistry)

3451/F Q15

question	answers	extra information	mark
(a)(i)	arrow from centre of the ball **and** at right angles to the string **and** in the correct direction	arrow should point to the student's belt accept free-hand 'straight' line do **not** accept curved line	1
(ii)	increase increase increase	accept 'be stronger / bigger' accept 'be stronger / bigger' accept 'be stronger / bigger'	1 1 1
(b)	speed velocity direction	all **three** correct any two correct for **1** mark otherwise **0** marks	2
(c)(i)	centripetal	accept 'centripedal' and other minor misspellings do **not** accept anything which could be 'centrifugal'	1
(ii)	gravity	accept 'weight' accept 'force of attraction due to mass(es) (of the Moon and the Earth)'	1
(iii)	electron(s)		1
(iv)	electrostatic	accept 'electrical' do **not** accept just 'centripetal'	1
total			10

4.4.1.3 The development of the model of the atom (common content with chemistry)

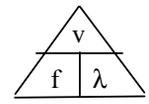
3451/F Q16

question	answers	extra information	mark
(a)(i)	**X** at the centre of the lifebelt	measuring from the centre of **X**, allow 2 mm tolerance in any direction	1
(ii)	any **two** from: below the point of suspension at the centre (of the lifebelt) (because) the lifebelt / it is symmetrical	if X is on vertical line below the hanger (but not at centre) can gain the first point only accept '(vertically) below **Y**' accept 'in the middle' **or** (because) the mass / weight is evenly distributed	2
(b)	Nm **or** newton metre(s) 750	accept Newton metre(s) do **not** accept any ambiguity in the symbol ie NM, nM or nm (moment) = force × (perpendicular) distance (between line of action and pivot) **or** (moment) = 500 × 1.5 gains **1** mark	1 2
(c)	**Quality of written communication**: any **three** connected points from: low(er) <u>centre of mass / gravity</u> (more) <u>stable</u> less likely to fall over the <u>turning effect / moment</u> (of the weight of case) is less so the pull on her arm is less	for **2** of the underlined terms used in the correct context **or** <u>centre of mass / gravity</u> will be close(r) to the wheels / axle / ground **or** less <u>unstable</u> accept 'less likely to overturn' do **not** accept 'will not fall over' **or** so less effort is needed to hold the case ignore references to pulling the case	1 3
total			10

4.4.1.3 The development of the model of the atom (common content with chemistry)

Physics B – AQA GCSE Mark Scheme, 2005 June series

3451/F Q17

question	answers	extra information	mark
(a)	any **two** from: • **amplitude** decreasing • **wavelength** increasing • **frequency** decreasing **Quality of written communication**	accept siren / sound getting quieter do **not** accept sound decreases accept pitch decreasing ignore reference to transverse wave ignore reference to speed contradictory statements within each point lose the mark all emboldened terms in candidate's answer used correctly	2 1
(b)(i)	ultrasound **or** ultrasonic		1
(ii)	wave speed = frequency × wavelength	accept speed / velocity for wave speed accept $v = f \times \lambda$ do **not** accept w for λ do **not** accept s for v accept  provided subsequent calculation shows a correct method	1
(iii)	339.2 **or** 340 **or** 339	allow **1** mark for using 212 000 allow **1** mark for correct substitution an answer of 0.3392 **or** 0.34 **or** 0.339 gains **1** mark only award full credit for a correct numerical answer with the unit changed to km/s	3
total			8

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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science: Double Award 3462/3F
Specification B (Co-ordinated)

Mark Scheme

2005 examination - June series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

Double Award
Foundation Tier 3462/3F

3462/3F Q1

question	answers	extra information	mark
(a)(i)	less than	accept any correct indication	1
(ii)	more than	accept any correct indication	1
(b)	any **two** from: stays above the same place above the equator one orbit takes 24 hours	 do **not** accept stays in the same place do **not** accept goes around equator unless qualified do **not** accept orbit at same speed as Earth do **not** accept orbit at a constant speed accept has same angular speed / velocity as Earth	2
total			4

3462/ 3F Q2

question	answers	extra information	mark
(a)	comet		1
(b)	large group / number / collection of stars	ignore reference to planets accept millions of stars do **not** accept thousands of stars do **not** accept loads of stars	1
(c)	giant supernova neutron		1 1 1
total			5

4.4.1.3 The development of the model of the atom (common content with chemistry)

3462/3F Q3

question	answers	extra information	mark
(a)(i)	radio		1
(ii)	gamma	accept microwave accept infrared	1
(iii)	ultra violet		1
(iv)	microwaves		1
(b)	the same as		1
(c)	**Quality of written communication**	award for a sensible sequence of **two** points	1
	X-rays do not go through lead	accept lead protects them from the X-rays accept not exposed to X-rays	1
	lead stops / reduces risk of X-rays harming / damaging / killing (persons) <u>cells</u>	accept X-rays (may) cause cancer accept organs for cell do **not** accept references to electric shock do **not** accept stops bones of people showing on X-ray answers involving the horse wearing an apron are incorrect references to gamma rays are incorrect	1
total			8

4.4.1.3 The development of the model of the atom (common content with chemistry)

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

3462/3F Q4

question	answers	extra information	mark
(a)	light electrical		1 1
(b)	15% **or** 0.15	correct substitution gains **1** mark only an answer of 15 with no unit **or** an incorrect unit gains **1** mark an answer of 0.15 given with a unit gains **1** mark	2
(c)	the ticket machine is a long way from other electricity supplies		1
(d)	any figure between 5 and 10 inclusive	unit not required but if given must match numerical answer	1
total			6

4.4.1.3 The development of the model of the atom (common content with chemistry)

3462/3F Q5

question	answers	extra information	mark
(a)(i)	radon (gas)	do **not** accept gas	1
(ii)	background		1
(b)	bigger	accept any word which means bigger	1
(c)	**Z** alpha will not pass through aluminium or lead	if Z is not given, the reason does not score accept alpha cannot go through metals / dense material accept there is nothing to stop the radiation accept alpha will not pass through aluminium do **not** accept alpha will not pass through lead do **not** accept alpha stopped by air	1 1
total			5

4.4.1.3 The development of the model of the atom (common content with chemistry)

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

3462/3F Q6

question	answers	extra information	mark
(a)	loses negative charge / electrons	do **not** accept positive charge transfers to the comb do **not** accept friction	1
(b)	**A** attract		1
	B repel		1
	C attract		1
(c)	**F A D E**	allow **2** marks for 2 letters in the correct place allow **1** mark for 1 letter in the correct place	3
total			7

4.4.1.3 The development of the model of the atom (common content with chemistry)

3462/3F Q7

question	answers	extra information	mark
(a)	all points correctly plotted	tolerance ± $\frac{1}{2}$ square on y axis only allow **1** mark for 3 correctly plotted points	2
	attempt made to draw a smooth curve	do **not** accept dot-to-dot line	1
(b)(i)	3 days ± 0.2 **or** any value correctly obtained using their graph line	if no line drawn in (a), answer must be exactly 3	1
(ii)	3 days or their (b)(i)		1
(c)	radon-222	accept radon **or** 222 accept alpha or 3.8 correct isotope required for reason to score	1
	has the shortest <u>half-life</u>	accept the others have longer <u>half-lives</u>	1
total			7

4.4.1.3 The development of the model of the atom (common content with chemistry)

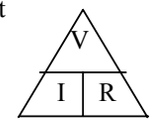
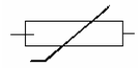
Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

3462/3F Q8

question	answers	extra information	mark
(a)	fossils of Cynognathus are found in Africa and South America		1
	the shapes ……. almost fit together	only two boxes should be ticked deduct **1** mark for each additional box to a minimum mark of **0**	1
(b)	continental		1
	crust		1
	tectonic		1
total			5

4.4.1.3 The development of the model of the atom (common content with chemistry)

3462/3F Q9

question	answers	extra information	mark
(a)(i)	$A_1 = 0.5$ $A_4 = 0.5$	ignore any units allow **1** mark for $A_1 = A_4 \neq 0.5$	1 1
(ii)	the resistance of **P** is more than 20 Ω a smaller current goes through P / A_2 (than 20 Ω)	 dependent on getting 1st mark correct accept converse	1 1
(b)(i)	potential difference = current × resistance	accept pd / voltage for potential difference accept V = I × R, correct symbols and correct case only accept volts = amps × ohms accept  provided subsequent method is correct allow combination of physical quantities and named units allow voltage = I × R	1
(ii)	6	allow **1** mark for correct substitution	2
(iii)	6	accept their (b)(ii)	1
(c)	thermistor or  resistance goes down (as temperature of thermistor goes up)	accept correct circuit symbol allow phonetic spelling do **not** accept changes for goes down do **not** accept an answer in terms of current only answers in terms of other components are incorrect	1 1
total			10

4.4.1.3 The development of the model of the atom (common content with chemistry)

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

3462/3F Q10

question	answers	extra information	mark
(a)(i)	larger the distance, greater the time	accept 'they are proportional' accept converse	1
(ii)	any value between 6 and 9 years inclusive		1
(b)(i)	carbon dioxide		1
(ii)	(Venus) has high**er** temperature (than Mercury)	accept has the high**est** temperature accept Venus is hotter / hottest do **not** accept has a high / very high temperature	1
	(Venus) further from the Sun than Mercury	accept 'Venus is not the closest planet to the Sun' answer in terms of greenhouse effect only, scores **0** marks	1
total			5

4.4.1.3 The development of the model of the atom (common content with chemistry)

3462/3F Q11

question	answers	extra information	mark
(a)(i)	20		1
(ii)	convection		1
(iii)	fit draughtproof strips	accept lay carpet accept fit curtains accept close doors / windows / curtains accept any reasonable suggestion for reducing a draught 'double glazing' alone is insufficient	1
(b)	air is (a good) insulator **or** air is a poor conductor	accept air cavity / 'it' for air	1
	reducing heat transfer by <u>conduction</u>	accept stops for reduces ignore convection do **not** accept radiation do **not** accept answers in terms of heat being trapped	1
(c)(i)	most cost effective	accept it is cheaper or low<u>est</u> cost accept shortest payback time accept in terms of reducing heat loss by the largest amount do **not** accept it is easier ignore most heat is lost through the roof	1
(ii)	4		1
total			7

4.4.1.3 The development of the model of the atom (common content with chemistry)

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

3462/3F Q12

question	answers	extra information	mark
(a)(i)	constant speed	do **not** accept normal speed do **not** accept it is stopped / stationary	1
	in a straight line	accept any appropriate reference to a direction constant velocity gains **2** marks 'not accelerating' gains **2** marks terminal velocity alone gets **1** mark	1
(ii)	goes down owtte	accept motorbike (it) slows down	1
(b)(i)	20 (m/s)	ignore incorrect units	1
(ii)	acceleration = change in velocity / time (taken)	do **not** accept velocity for change in velocity accept change in speed accept $a = \frac{v-u}{t}$ **or** $a = \frac{v_1 - v_2}{t}$ **or** $a = \frac{\Delta v}{t}$ do **not** accept $a = \frac{v}{t}$	1
(iii)	4 **or** their (b)(i) ÷ 5	allow **1** mark for correct substitution	2
	m/s^2	m/s/s **or** ms^{-2} **or** metres per second squared **or** metres per second per second	1
(c)	vehicle may skid / slide	loss of control / brakes lock / wheels lock accept greater stopping distance **or** difficult to stop	1
	due to reduced friction (between tyre(s) and road)	accept due to less grip do **not** accept no friction	1

cont…

4.4.1.3 The development of the model of the atom (common content with chemistry)

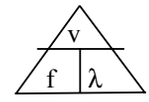
3462/3F Q12 cont…

(d)	any **three** from: • <u>increased</u> speed • <u>reduced</u> braking force • <u>slower</u> (driver) reactions • <u>poor</u> vehicle maintenance • <u>increased</u> mass / weight of vehicle • <u>poor</u> road surface • <u>more</u> streamlined	do **not** accept night time / poor vision NB specific answers may **each** gain credit eg tiredness (1), drinking alcohol (1), using drugs (1), driver distracted (1) etc specific examples may **each** gain credit eg worn brakes or worn tyres etc accept large mass / weight of vehicle if candidates give three answers that affect stopping distance but not specific to <u>increase</u> award **1** mark only	3
total			13

4.4.1.3 The development of the model of the atom (common content with chemistry)

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

3462/3F Q13

question	answers	extra information	mark
(a)	**Quality of written communication**	all emboldened terms in candidate's answer used correctly	1
	any **two** from: • **amplitude** decreasing • **wavelength** increasing • **frequency** decreasing	accept siren / sound getting quieter do **not** accept sound decreases accept pitch decreasing ignore reference to transverse wave ignore reference to speed contradictory statements within each point lose the mark	2
(b)(i)	ultrasound **or** ultrasonic		1
(ii)	wave speed = frequency × wavelength	accept speed / velocity for wave speed accept $v = f \times \lambda$ do **not** accept w for λ do **not** accept s for v accept  provided subsequent calculation shows a correct method	1
(iii)	339.2 **or** 340 **or** 339	allow **1** mark for using 212 000 allow **1** mark for correct substitution an answer of 0.3392 **or** 0.34 **or** 0.339 gains **1** mark only award full credit for a correct numerical answer with the unit changed to km/s	3
total			8

Answer 07 · Examiner comments

June 2023 | 8463/1H | Original Q8

Question 8 (Standard/high Demand)

08.1 36% of students scored 2 marks, while 32% of students scored 1 mark for getting 2 or 3 particles and their year of discovery matched correctly.

08.2 43% of students scored 2 marks, while 13% scored 1 mark. Many students thought incorrectly that the alpha particle was affected by the gold atom's electrons, while some thought the alpha particles couldn't penetrate the nucleus due to the low penetrating power of alpha particles. If a student stated that either the nucleus or the alpha particle was negatively charged, this was a physics error and no marks could be scored. Any mention of the alpha particle colliding with the nucleus was ignored as the idea of proximity to the nucleus was tested in 08.3.. Particles being 'deflected' was insufficient for a description as this refers to the path followed by the alpha particle not the force experienced.

08.3 Students who stated the alpha particle collided with the nucleus scored zero. A number of students thought that the alpha particle collided with electrons as the reason for the deflection and they also scored zero. A reference to the force or the field was needed to score the second marking point. The weakest answer that would score was 'repels more'. Mention of incorrect forces causing repulsion e.g. magnetic forces, or incorrect use of technical terms like refraction / reflection, meant the student couldn't score the second marking point. 46% scored 2 marks, while 2 % scored 1 mark.

08.4 85% of students identified the correct deduction.

08.5 Only 38% of students scored this mark. Many students thought the Bohr model didn't have a nucleus, which didn't score. Some students thought the difference between the Bohr model and the nuclear model was the structure of the nucleus, which also didn't score.

08.6 It wasn't seen often, but the answer 'photons' e was creditworthy for electromagnetic radiation. Another creditworthy answer was 'lectromagnetic waves'.. If a student stated that the emission / absorption was the wrong way round this was a hysics error and scored zero. Students who hadn't learned this small part of specification content were predictably vague about how the electron gained / lost energy. 8% of students scored 2 marks, while 4% of students scored 1 mark.

4.4.1.3 The development of the model of the atom (common content with chemistry)

Answer 08 · Examiner comments June 2025 | 8463/1H | Original Q7

07.1

Nearly all of the students chose the correct reason for why scientists change the model used to describe the structure of an atom.

07.2

Many students were confused about the distinction between irradiation and radioactive contamination. Many thought that it had to do with being exposed to radiation inside or outside the body, or one causing harm the other not causing harm. Exposure to a radioactive source was insufficient to score the irradiation mark. Without using the word 'exposed' students often did not express their ideas clearly enough. 'Absorbing radiation from a source' would have been another way of gaining credit for this idea. Students were more secure explaining what radioactive contamination meant and often gave examples like 'radioactive dust' or radioactive atoms' being present on or in people / objects. Almost a quarter of the students scored 2 marks, while just over 40 % of the students scored 1 mark.

07.3

About 90 % of the students scored 2 marks for this nuclear equation, while about 5 % of the students scored 1 mark.

Answer 08 · Examiner comments June 2025 | 8463/1H | Original Q7

07.4

'4 half-lives' needed to be seen to score the first mark, the number '4' was not sufficient by itself for a mark. The most common mistake was to divide 256 000 by 16 000 to give an answer of 16, which scored no marks. Just over 70 % of the students scored 3 marks.

07.5

More / less active was insufficient as was a description of activity in terms of rate of decay.
Just over 20 % of the students scored 2 marks, while a further 12 % of the students scored 1 mark.