AQA GCSE Physics | 8463

SPECIFICATION POINT 4.5.6.1.2

Speed

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**140**
Available paper years	**2003–2025**

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.

4.5.6.1.2 Speed

Answer 01 · Mark scheme June 2003 | 3451F | Original Q5 | Legacy

The full source mark scheme begins on page 193. Follow original question 5 in that document.

Answer 02 · Mark scheme June 2003 | 3462F3 | Original Q5 | Legacy

The full source mark scheme begins on page 215. Follow original question 5 in that document.

Answer 03 · Mark scheme June 2004 | 3451F | Original Q3 | Legacy

The full source mark scheme begins on page 232. Follow original question 3 in that document.

Answer 04 · Mark scheme June 2004 | 3451F | Original Q8 | Legacy

The full source mark scheme begins on page 232. Follow original question 8 in that document.

Answer 05 · Mark scheme June 2004 | 3451F | Original Q12 | Legacy

The full source mark scheme begins on page 232. Follow original question 12 in that document.

4.5.6.1.2 Speed

Answer 06 · Mark scheme June 2004 | 3462F3 | Original Q3 | Legacy

The full source mark scheme begins on page 253. Follow original question 3 in that document.

Answer 07 · Mark scheme June 2004 | 3462F3 | Original Q6 | Legacy

The full source mark scheme begins on page 253. Follow original question 6 in that document.

Answer 08 · Mark scheme June 2004 | 3462F3 | Original Q10 | Legacy

The full source mark scheme begins on page 253. Follow original question 10 in that document.

Answer 09 · Mark scheme June 2005 | 3451 | Original Q3 | Legacy

The full source mark scheme begins on page 270. Follow original question 3 in that document.

Answer 10 · Mark scheme June 2005 | 3451 | Original Q12 | Legacy

The full source mark scheme begins on page 270. Follow original question 12 in that document.

4.5.6.1.2 Speed

Answer 11 · Mark scheme June 2005 | 3451 | Original Q14 | Legacy

The full source mark scheme begins on page 270. Follow original question 14 in that document.

Answer 12 · Mark scheme June 2005 | 3451 | Original Q15 | Legacy

The full source mark scheme begins on page 270. Follow original question 15 in that document.

Answer 13 · Mark scheme June 2005 | 3451 | Original Q17 | Legacy

The full source mark scheme begins on page 270. Follow original question 17 in that document.

Answer 14 · Mark scheme June 2005 | 3462 | Original Q3 | Legacy

The full source mark scheme begins on page 288. Follow original question 3 in that document.

Answer 15 · Mark scheme June 2005 | 3462 | Original Q10 | Legacy

The full source mark scheme begins on page 288. Follow original question 10 in that document.

4.5.6.1.2 Speed

Answer 16 · Mark scheme June 2005 | 3462 | Original Q12 | Legacy

The full source mark scheme begins on page 288. Follow original question 12 in that document.

Answer 17 · Mark scheme June 2005 | 3462 | Original Q13 | Legacy

The full source mark scheme begins on page 288. Follow original question 13 in that document.

Answer 18 · Mark scheme June 2006 | 3451 | Original Q7 | Legacy

The full source mark scheme begins on page 302. Follow original question 7 in that document.

Answer 19 · Mark scheme June 2006 | 3451 | Original Q11 | Legacy

The full source mark scheme begins on page 302. Follow original question 11 in that document.

Answer 20 · Mark scheme June 2006 | 3451 | Original Q15 | Legacy

The full source mark scheme begins on page 302. Follow original question 15 in that document.

4.5.6.1.2 Speed

Answer 21 · Mark scheme June 2006 | 3462 | Original Q7 | Legacy

The full source mark scheme begins on page 322. Follow original question 7 in that document.

Answer 22 · Mark scheme June 2006 | 3462 | Original Q13 | Legacy

The full source mark scheme begins on page 322. Follow original question 13 in that document.

Answer 23 · Mark scheme November 2006 | PHY1B | Original Q8 | Legacy

Eight	**3**	**2**	**3**	**3**

Answer 24 · Mark scheme March 2007 | PHY1B | Original Q4 | Legacy

Four	**A**	away from	**2**
	B	beyond	**4**
	C	furthest	**3**
	D	towards	**1**

Answer 25 · Mark scheme June 2007 | PHY1B | Original Q8 | Legacy

Eight	**1**	**4**	**3**	**1**

Answer 26 · Mark scheme June 2007 | PHY1F | Original Q4 | Legacy

The full source mark scheme begins on page 336. Follow original question 4 in that document.

Answer 27 · Mark scheme November 2007 | PHY1A | Original Q7 | Legacy

Seven	**4**	**4**	**1**	**3**

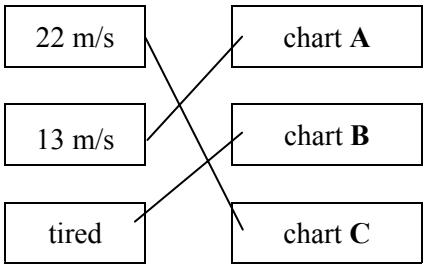
Answer 28 · Mark scheme November 2007 | PHY1B | Original Q7 | Legacy

Seven	**2**	**3**	**1**	**1**

4.5.6.1.2 Speed

Answer 29 · Mark scheme

Question 3

question	answers	extra information	mark
(a)(i)	constant		1
(ii)	heat		1
(b)(i)	3 links correct  	allow **1** mark for 1 correct link if more than one line is drawn from a condition mark all lines from that condition incorrect	2
(ii)	increased		1
total			5

4.5.6.1.2 Speed

Answer 29 · Mark scheme

January 2008 | PHY2F | Original Q3 | Legacy

PHY2F

4.5.6.1.2 Speed

Answer 30 · Mark scheme

Question 3

question	answers	extra information	mark
(a)	tension	accept any unambiguous method of indication eg it's underlined **or** ticked	1
(b)(i)	speed of the ball is increased		1
(b)(ii)	the direction of the ball		1
(c)	centripetal	accept any unambiguous method of indication eg it's underlined **or** ticked	1
total			4

4.5.6.1.2 Speed

Answer 30 · Mark scheme January 2008 | PHY3F | Original Q3 | Legacy

PHY3F

4.5.6.1.2 Speed

Answer 31 · Mark scheme

Question 5

question	answers	extra information	mark
(a)	Venus	accept Mercury	1
(b)	any negative number or range in the range –75 to –150 inclusive	do **not** credit any positive number or positive range	1
(c)	**either** … increases … increases **or** … decreases … decreases	**both** required for the mark	1
(d)	Today's …… about Mars.	accept any unambiguous method of indication for the correct answer eg it's underlined or ticked	1
total			4

4.5.6.1.2 Speed

Answer 31 · Mark scheme

January 2008 | PHY3F | Original Q5 | Legacy

PHY3F

Answer 32 · Mark scheme

March 2008 | PHY1AP | Original Q9 | Legacy

Nine	**2**	**4**	**3**	**1**

4.5.6.1.2 Speed

Answer 32 · Mark scheme

March 2008 | PHY1AP | Original Q9 | Legacy

SCIENCE A (4461)/PHYSICS (4451)

Objective Test Answer Key

PHY1AP (Energy and Electricity)

March 2008

Higher Tier

Question	Key		
One	**A**	house	**4**
	B	power station	**1**
	C	step-down transformer	**3**
	D	step-up transformer	**2**
Two	**A**	cold water is pumped into the rocks	**1**
	B	steam drives turbines	**3**
	C	turbines drive generators	**4**
	D	water is heated by radioactive decay	**2**

	A	B	C	D
Three	**2**	**4**	**4**	**1**
Four	**2**	**4**	**3**	**1**
Five	**4**	**3**	**3**	**2**
Six	**3**	**2**	**4**	**4**
Seven	**4**	**3**	**2**	**4**
Eight	**4**	**2**	**2**	**2**
Nine	**2**	**3**	**2**	**1**

4.5.6.1.2 Speed

Answer 33 · Mark scheme

March 2008 | PHY1BP | Original Q6 | Legacy

Six	**A** 2	**3**	
	B 3	**2**	
	C 4	**1**	
	D 6	**4**	

	A	B	C	D

4.5.6.1.2 Speed

Answer 34 · Mark scheme June 2008 | PHY2F | Original Q1 | Legacy

Question 1

	answers	extra information	mark
(a)	53 (m)		1
(b)(i)	Similar shape curve drawn above existing line going through (0,0)	allow **1** mark for any upward smooth curve or straight upward line above existing line going through (0,0)	2
(ii)	rain on road car brakes in bad condition		1 1
(c)(i)	all three lines correctly labelled top line – C middle line – B bottom line – A	allow **1** mark for one correctly labelled accept 1.2 accept 0.9 accept 0.7	2
(ii)	any **two** from: • (table has) both variables are together • both (variables) could/ would affect the reaction time • cannot tell original contribution • need to measure one (variable) on its own • need to control one of the variables	 accept tired and music as named variables accept cannot tell which variable is affecting the drive (the most) accept need to test each separately	2
total			9

4.5.6.1.2 Speed

Answer 34 · Mark scheme

June 2008 | PHY2F | Original Q1 | Legacy

PHY2F

June 08

4.5.6.1.2 Speed

Answer 35 · Mark scheme

Question 5

question	answers	extra information	mark
(a)(i)	**P**		1
(a)(ii)	the child's grip / hold / pull (on the roundabout / bar / rail)	**or** 'the tension in the child's arms' accept 'the child's muscles' accept 'friction between the child and the roundabout' do **not** accept just 'friction'	1
(a)(iii)	increases	accept any unambiguous indication that this ending has been selected	1
(b)(i)	360 (Nm)	credit either 240 × 1 ½ **or** 240 × 1.5 with **1** mark	2
(b)(ii)	move to(wards) the left / to(wards) the / his end	**or** move away from the centre / pivot / axis (of rotation) **or** move away from the girl / the child / his daughter	1
(c)(i)	**C**		1
(c)(ii)	friction / grip of the car / tyres / wheels (on the road)	do **not** accept just 'friction / grip'	1
total			8

4.5.6.1.2 Speed

Answer 35 · Mark scheme June 2008 | PHY3F | Original Q5 | Legacy

PHY3F

4.5.6.1.2 Speed

Answer 36 · Mark scheme

Question 2

question	answers	extra information	mark
2(a)(i)	shorter than		1
2(a)(ii)	increase slightly		1
2(b)(i)	go up in the same ratio **or** (directly) proportional **or** as speed (of the tennis ball) increases so does the (difference in) frequency	accept as one goes up, so does the other accept positive correlation	1
2(b)(ii)	20 (m/s)	allow **1** mark for showing correct method on graph (ie horizontal or vertical line anywhere on graph) if indicated by a cross, must be ± half square of correct value)	2
2(b)(iii)	frequency and speed are both continuous variables		1
Total			**6**

4.5.6.1.2 Speed

Answer 36 · Mark scheme

PHY1F

4.5.6.1.2 Speed

Answer 37 · Mark scheme

Question 6

question	answers	extra information	mark
6(a)(i)	10800	allow **1** mark for correct substitution i.e. 900 × 12	2
6(a)(ii)	arrow pointing towards the left	allow anywhere on the diagram or at bottom of the page	1
6(b)	zero velocity is zero	accept 0 / none / nothing accept speed for velocity accept stopped / not moving accept a calculation i.e. 900 × 0 = 0	1 1
Total			**5**

4.5.6.1.2 Speed

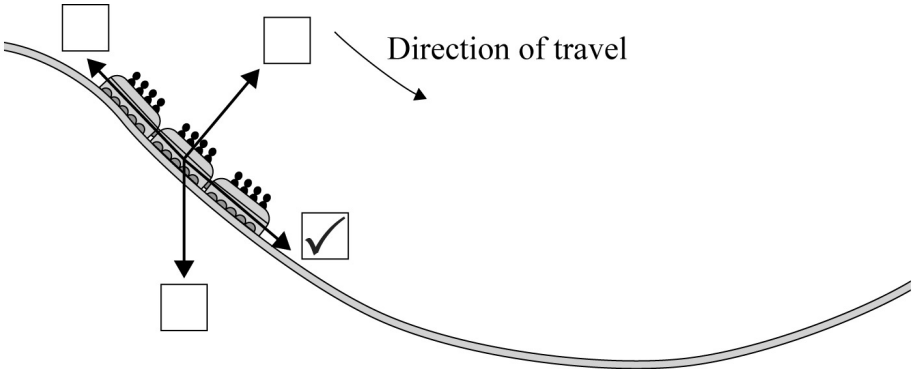
Answer 37 · Mark scheme January 2009 | PHY2F | Original Q6 | Legacy

PHY2F

4.5.6.1.2 Speed

Answer 38 · Mark scheme

Question 7

question	answers	extra information	mark
7(a)	correct box ticked 		1
7(b)	each passenger has a different mass	accept weight for mass ignore other irrelevant factors about the person e.g. mass and height do **not** accept a list with incorrect factors e.g. mass and position accept passengers started with different (gravitational) potential energy	1
7(c)(i)	30	ignore added units	1
7(c)(ii)	2400	accept their (c)(i) × 80 correctly calculated for both marks allow **1** mark for correct substitution of their (c)(i) and 80 an answer of 800 gains **1** mark only if answer to (c)(i) is not 10	2
Total			**5**

4.5.6.1.2 Speed

Answer 38 · Mark scheme January 2009 | PHY2F | Original Q7 | Legacy

PHY2F

4.5.6.1.2 Speed

Answer 39 · Mark scheme

Question 8

question	answers	extra information	mark
8(a)(i)	4.5	allow **1** mark for correct substitution i.e. 9 ÷ 2	2
8(a)(ii)	m/s^2	accept answer given in (a)(i) if not contradicted here	1
8(a)(iii)	speed		1
8(a)(iv)	straight line from the origin passing through (2s, 9 m/s)	allow **1** mark for straight line from the origin passing through to t = 2 seconds allow **1** mark for an attempt to draw a straight line from the origin passing through (2,9) allow **1** mark for a minimum of 3 points plotted with no line provided if joined up would give correct answer. Points must include(0,0) and (2,9)	2
8(b)(i)	**B** smallest (impact) force on all/ every/ any surfaces	if **A** or **C** given scores **0** marks in total these marks are awarded for comparative answers	1 1 1

Question 8 continues on the next page

4.5.6.1.2 Speed

PHY2F

Question 8 continued

8(b)(ii)	(conditions) can be repeated **or** difficult to measure forces with human athletes	accept answers in terms of variations in human athletes e.g. athletes may have different weights area / size of feet may be different difficult to measure forces athletes run at different speeds accept any answer that states or implies that with humans the conditions needed to repeat tests may not be constant e.g. athletes unable to maintain constant speed during tests (or during repeat tests) do **not** accept the robots are more accurate removes human error is insufficient fair test is insufficient	1
Total			**10**

4.5.6.1.2 Speed

Answer 40 · Mark scheme

January 2009 | PHY3F | Original Q3 | Legacy

No matching mark scheme was available in the supplied archive for this question.

4.5.6.1.2 Speed

Answer 41 · Mark scheme June 2009 | PHY2F | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)	**Y**	accept the one in the middle accept 90	1
	has the biggest mass	reason does not score if X or Z is chosen accept weight for mass accept weighs the most accept they are the heaviest accept has a larger mass do **not** accept weighs 90kg's on its own biggest/larger on its own is not sufficient	1
2(b)	increases		1
Total			**3**

4.5.6.1.2 Speed

Answer 41 · Mark scheme June 2009 | PHY2F | Original Q2 | Legacy

PHY2F

4.5.6.1.2 Speed

Answer 42 · Mark scheme

June 2009 | PHY2F | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)	shallowest slope/ gradient	accept smallest distance in biggest time accept longest time to travel the same distance accept the line is not as steep accept it is a less steep line do **not** accept the line is not steep	1
3(b)	**A – B**	If 2or 3 boxes are ticked no mark	1
3(c)(i)	200 m		1
3(c)(ii)	20 s	allow **1** mark for correctly identifying 60 s or 40 s from the graph	2
3(d)(i)	straight line starting at origin passing through t = 200 and d = 500	accept within one small square of the origin	1 1
3(d)(ii)	166	accept any value between 162 and 168 accept where their line intersects given graph line correctly read ± 3 s	1
Total			**8**

4.5.6.1.2 Speed

Answer 42 · Mark scheme June 2009 | PHY2F | Original Q3 | Legacy

PHY2F

4.5.6.1.2 Speed

Answer 43 · Mark scheme

Question 5

question	answers	extra information	mark
5(a)(i)	50 (N)	ignore any units	1
5(a)(ii)	resultant force		1
5(a)(iii)	4000	accept their (a)(i) × 80 correctly calculated for **2** marks allow **1** mark for correct substitution i.e. 50 × 80 or their (a)(i) × 80 ignore any units	2
5(b)(i)	joule		1
5(b)(ii)	heat		1
Total			**6**

4.5.6.1.2 Speed

Answer 43 · Mark scheme June 2009 | PHY2F | Original Q5 | Legacy

PHY2F

4.5.6.1.2 Speed

Answer 44 · Mark scheme

June 2009 | PHY3F | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)(i)	direction	accept any unambiguous indication	1
2(a)(ii)	centripetal	accept any unambiguous indication	1
2(b)	**A**	accept any unambiguous indication	1
2(c)	mass of the passengers is greater	accept any unambiguous indication	1
Total			**4**

4.5.6.1.2 Speed

Answer 44 · Mark scheme

June 2009 | PHY3F | Original Q2 | Legacy

PHY3F

Answer 45 · Mark scheme

November 2009 | PHY1BP | Original Q3 | Legacy

Three	**A**	count rate	**1**
	B	half-life	**3**
	C	penetrating power	**4**
	D	range	**2**

4.5.6.1.2 Speed

Answer 46 · Mark scheme

Question 3

question	answers	extra information	mark
3(a)	**R** has the greatest speed / velocity	reason cannot score if **R** is not chosen accept it is going at 28 m/s answer should be comparative	1 1
3(b)(i)	3250	allow **1** mark for correct substitution of 130 and 25 ie 130 × 25 accept 2600 or 3640 for **1** mark	2
3(b)(ii)	kg m/s	accept answer given in (b)(i) if no answer given here	1
3(c)(i)	increase it	accept make it slower accept slow it down accept make it longer accept (reactions) would be slower do **not** accept if the answer clearly refers to distance comparative answers expected	1
3(c)(ii)	increase it	accept make it longer do **not** accept if the answer clearly refers to time comparative answers expected	1
Total			**7**

4.5.6.1.2 Speed

Answer 46 · Mark scheme

January 2010 | PHY2F | Original Q3 | Legacy

PHY2F

4.5.6.1.2 Speed

Answer 47 · Mark scheme

Question 6

question	answers	extra information	mark
6(a)	96	allow **1** mark for correct substitution ie 80 × 1.2	2
	newton or N	allow Newton do **not** allow n	1
6(b)(i)	direction		1
6(b)(ii)	velocity and time are continuous (variables)	answers must refer to both variables accept the variables are continuous / not categoric accept the data / 'it' is continuous accept the data / 'it' is not categoric	1
6(b)(iii)	**C**		1
	velocity is not changing	the **2** marks for reason may be scored even if **A** or **B** are chosen accept speed for velocity accept speed is constant (9 m/s) accept **not** decelerating accept **not** accelerating accept reached terminal velocity	1
	forces must be balanced **or** resultant force is zero	accept forces are equal accept arrows are the same length / size do **not** accept the arrows are equal	1
Total			**8**

4.5.6.1.2 Speed

Answer 47 · Mark scheme

January 2010 | PHY2F | Original Q6 | Legacy

PHY2F

4.5.6.1.2 Speed

Answer 48 · Mark scheme

Question 7

question	answers	extra information	mark
7(a)	distance (from the Sun in millions of km) and time taken for orbit	both required in either order **not** just 'time taken'	1
7(b)(i)	**either** distance (from the Sun in millions of km) **or** time taken for orbit (and) (average) temperature	 **not** just 'time taken' both required in either order	1
7(b)(ii)	(+) 430 / (+) 470 **or** Mercury / Venus		1
7(c)	25 (hours)	do **not** accept 24 (hours)	1
7(d)	...different positions at different times		1
7(e)	…direction…speed gravitational	both and in the correct order	1 1
Total			**7**

4.5.6.1.2 Speed

Answer 48 · Mark scheme

January 2010 | PHY3F | Original Q7 | Legacy

PHY3F

Answer 49 · Mark scheme

March 2010 | PHY1BP | Original Q9 | Legacy

Nine	**2**	**4**	**2**	**1**

Answer 50 · Mark scheme

June 2010 | PHY1BP | Original Q8 | Legacy

Eight	3	3	4	2

4.5.6.1.2 Speed

Answer 51 · Mark scheme

Question 5

question	answers	extra information	mark
5(a)	any **one** from: • above the atmosphere • no clouds in the way • no light pollution	 accept no atmospheric pollution answers in terms of being closer to space negate answers in terms of looking at the Earth negate	1
5(b)(i)	red-shift		1
5(b)(ii)	expanding		1
5(c)(i)	as one gets bigger the other gets bigger	accept (directly) proportional accept positive correlation	1
5(c)(ii)	**C** it is furthest from the Earth **or** it is furthest away **or** has the largest red-shift **or** it is moving (away) the fastest	 only scores if **C** is chosen	1 1
Total			**6**

4.5.6.1.2 Speed

Answer 51 · Mark scheme June 2010 | PHY1F | Original Q5 | Legacy

PHY1F

4.5.6.1.2 Speed

Answer 52 · Mark scheme

June 2010 | PHY2F | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)	distance travelled under the braking force	accept braking (distance)	1
3(b)	(directly) proportional **or** increase in the same ratio	accept a correct description using figures eg if speed doubles then thinking distance doubles accept for **1** mark positive correlation accept for **1** mark as speed increases so does thinking distance accept as one increases the other increases accept as thinking distance increases speed increases	2
3(c)(i)	control variable		1
3(c)(ii)	experiment done, student listens to music / ipod (etc) experiment (repeated), student not listening to music	 for both marks to be awarded there must be a comparison	1 1
3(d)	increase it	accept an answer which implies reactions are slower do **not** accept answers in terms of thinking distance only	1
3(e)	**Y**		1
Total			**8**

4.5.6.1.2 Speed

Answer 52 · Mark scheme June 2010 | PHY2F | Original Q3 | Legacy

PHY2F

4.5.6.1.2 Speed

Answer 53 · Mark scheme

June 2010 | PHY2F | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)(i)	75 000 newtons / N	accept correct substitution for **1** mark ie 7500 × 10 do **not** accept n full credit for using g = 9.8 **or** 9.81	2 1
6(a)(ii)	60 000 000	accept for both marks their (a)(i) × 800 correctly calculated accept correct substitution for **1** mark ie their (a)(i) × 800	2
6(b)(i)	arrow drawn parallel (to) **and** down (the) slope	accept arrow drawn anywhere on the diagram	1
6(b)(ii)	increases GPE transformed to KE **or** speed increasing	 accept is accelerating however 'speed increasing' only scores if correctly linked to increasing kinetic energy	1 1
6(c)	so more likely to wear one **or** they know wearing a helmet is likely to / will reduce (risk) head injury **or** so can make an (informed) choice (about wearing one)		1
Total			**9**

4.5.6.1.2 Speed

Answer 53 · Mark scheme June 2010 | PHY2F | Original Q6 | Legacy

PHY2F

4.5.6.1.2 Speed

Answer 54 · Mark scheme

Question 3

question	answers	extra information	mark
3(a)	increases		1
3(b)(i)	**B**		1
3(b)(ii)	tension in the wire		1
3(b)(iii)	**C**		1
Total			**4**

4.5.6.1.2 Speed

Answer 54 · Mark scheme June 2010 | PHY3F | Original Q3 | Legacy

PHY3F

Answer 55 · Mark scheme November 2010 | PHY1AP | Original Q8 | Legacy

Eight	**4**	**1**	**3**	**4**

Answer 56 · Mark scheme November 2010 | PHY1AP | Original Q9 | Legacy

Nine	**2**	**3**	**3**	**4**

Answer 57 · Mark scheme November 2010 | PHY1BP | Original Q5 | Legacy

Five	**A**	decreased	**3**			
	B	increased	**2**			
	C	shifted	**1**			
	D	not changed	**4**			
	A		**B**	**C**	**D**	

4.5.6.1.2 Speed

Answer 58 · Mark scheme

Question 3

question	answers	extra information	mark
3(a)(i)	12		1
3(a)(ii)	0.2	allow **1** mark for their (a)(i) ÷ 60 and correctly calculated	1
	m/s^2	accept correct unit circled in list accept ms^{-2} do **not** accept mps^2	1
3(b)	**B**		1
Total			**4**

4.5.6.1.2 Speed

Answer 58 · Mark scheme January 2011 | PHY2F | Original Q3 | Legacy

PHY2F

4.5.6.1.2 Speed

Answer 59 · Mark scheme

Question 7

question	answers	extra information	mark
7(a)(i)	120		1
7(a)(ii)	20	accept 140-their (a)(i) provided answer is not negative	1
7(a)(iii)	as speed increases drag force / water resistance / friction / **D** increases (until) **D** = 140 N or (until) **D** = **T**	 forces balance is insufficient	1 1 1
7(b)(i)	(average) speed (of swimmer)		1
7(b)(ii)	any **two** from: • more data • force may vary (a lot) / change • give more <u>reliable average</u>	 accept results for data do **not** accept more accurate data ignore references to anomalies ignore accurate / precise	2

Question 7 continues on the next page . . .

4.5.6.1.2 Speed

PHY2F

Question 7 continued . . .

question	answers	extra information	mark
7(b)(iii)	examples of acceptable responses: • most / some females produce smaller forces • most / some males produce larger forces • some females swim as fast as males but use a smaller force • most of the faster swimmers are male • most of the slower swimmers are female • range of the (average) speed of males is smaller than the range of the (average) speed of females • range of the (average) force of the males is greater than the range of the (average) force of the females	do **not** accept <u>all</u> females produce smaller forces do **not** accept <u>all</u> males produce larger forces do **not** accept <u>all</u> males swim faster do **not** accept <u>all</u> females swim slower	1
7(b)(iv)	exert maximum (hand) force (throughout the swim / stroke)	accept (any method to) increase (hand) force practise more is insufficient	1
Total			**10**

4.5.6.1.2 Speed

Answer 59 · Mark scheme January 2011 | PHY2F | Original Q7 | Legacy

PHY2F

4.5.6.1.2 Speed

Answer 60 · Mark scheme

Question 2

question	answers	extra information	mark
2(a)(i)	centripetal force	accept any unambiguous correct indication	1
2(a)(ii)	**B**		1
2(b)(i)	decrease	accept any unambiguous correct indication	1
2(b)(ii)	increase	accept any unambiguous correct indication	1
2(c)	Bull pit smallest (inside) radius	 accept smallest diameter / circumference	1 1
Total			**6**

4.5.6.1.2 Speed

Answer 60 · Mark scheme January 2011 | PHY3F | Original Q2 | Legacy

PHY3F

4.5.6.1.2 Speed

Answer 61 · Mark scheme

Question 4

question	answers	extra information	mark
4(a)	all correct **M** **L** **L**	allow **1** mark for 2 correct	2
4(b)	speed	accept 'velocity'	1
4(c)(i)	any **one** from: • it's natural • slowest • furthest (from the centre of the Earth)	accept 'others are artificial / made by humans'	1
4(c)(ii)	as the (average) distance decreases the speed increases	accept 'there is a negative correlation (between them)' do **not** accept 'they are inversely proportional'	1
4(c)(iii)	as the speed increases the time (taken) decreases	accept 'there is a negative correlation (between them)' do **not** accept 'they are inversely proportional'	1
Total			**6**

4.5.6.1.2 Speed

Answer 61 · Mark scheme January 2011 | PHY3F | Original Q4 | Legacy

PHY3F

Answer 62 · Mark scheme March 2011 | PHY1BP | Original Q8 | Legacy

Eight	**1**	**3**	**2**	**1**

Answer 63 · Mark scheme June 2011 | PHY1BP | Original Q5 | Legacy

Five	**A** frequency			**2**
	B red-shift			**4**
	C wavelength			**1**
	D wave speed			**3**
	A	**B**	**C**	**D**

4.5.6.1.2 Speed

Answer 64 · Mark scheme

Question 3

question	answers	extra information	mark
3(a)(i)	lorry greatest mass	reason only scores if lorry chosen accept weight for mass accept heaviest accept correct calculations for all 3 vehicles the biggest is insufficient	1 1
3(a)(ii)	2450	allow **1** mark for correct substitution ie 175 × 14	2
3(b)(i)	increases	accept any clear indication of the correct answer	1
3(b)(ii)	speed increases	accept velocity for speed accept gets faster do **not** accept it accelerates on its own moves more is insufficient	1
3(b)(iii)	straight line going to 6, 20 horizontal line from 6,20 to 8,20	allow **1** mark for a curve going to 6,20 **or** a straight line diagonally upwards but missing 6,20 allow a horizontal line from where their **diagonal** meets 20m/s to 8,20	2 1
Total			**9**

4.5.6.1.2 Speed

Answer 64 · Mark scheme June 2011 | PHY2F | Original Q3 | Legacy

PHY2F

4.5.6.1.2 Speed

Answer 65 · Mark scheme

Question 5

question	answers	extra information	mark
5(a)	The driver has been drinking alcohol.	reason only scores if this box is ticked	1
	drivers reaction time increases **or** thinking distance / stopping distance increases **or** driver less alert	accept slower reactions accept slower reaction time do not accept braking distance increases accept driver may fall asleep / be tired	1
5(b)	they are all variables that could affect outcome / results	accept specific effect of changing one of the variables accept to make the test valid ignore reliable	1
	so data / barriers can be compared	accept to see which is / works best / safest do **not** accept fair test on its own	1
5(c)	ticks in both the top and middle boxes		1
Total			**5**

4.5.6.1.2 Speed

Answer 65 · Mark scheme June 2011 | PHY2F | Original Q5 | Legacy

PHY2F

4.5.6.1.2 Speed

Answer 66 · Mark scheme

Question 7

question	answers	extra information	mark
7(a)	572	allow **1** mark for correct substitution, ie 220 × 2.6 allow **1** mark for 220 x 260 = 57 200 **or** 220 x 2600 = 572 000 but to score this mark the entire calculation must be shown	2
7(b)(i)	smooth curve drawn	accept a line that is extrapolated back to 0 degrees, but not through the origin accept a straight line of best fit (point at 40 degrees can be treated as anomalous and line may stop at 30 degrees) do **not** accept straight lines drawn 'dot to dot' or directly from first to last point or a line going through the origin	1
7(b)(ii)	increases	accept a positive correlation do **not** accept proportional	1

Question 7 continues on the next page

4.5.6.1.2 Speed

PHY2F

Question 7 continued

question	answers	extra information	mark
7(b)(iii)	long plank	no mark for this, the marks are for the explanation	
	makes the angle small(er) (than a short plank)	accept increases the distance accept small(er) slope	1
	a small(er) force is needed		1
	or		
	short plank	no mark for this, the marks are for the explanation	
	a large(r) force is used over a short(er) distance (1)		
	less work done (1)	accept less energy transfer	
Total			**6**

4.5.6.1.2 Speed

Answer 67 · Mark scheme

Question 7

question	answers	extra information	mark
7(a)	microphone		1
7(b)(i)	vertical line from any maxima or minima to axis	do **not** penalise minor errors but do **not** allow unless intention is clear	1
7(b)(ii)	loudness / volume / intensity / energy	do **not** accept noise	1
7(c)	17	this answer only	1
7(d)	the greater the distance, the smaller the amplitude **or** there is a (strong) negative correlation between distance and amplitude **or** there is an inverse square relationship between distance and amplitude	accept volume / intensity / energy / loudness for amplitude do **not** accept distance and amplitude are inversely proportional	1
7(e)	20 Hz 20,000 Hz	either order accept 20 kHz provided unit has been clearly changed	1 1
Total			**7**

4.5.6.1.2 Speed

Answer 67 · Mark scheme June 2011 | PHY3F | Original Q7 | Legacy

PHY3F

4.5.6.1.2 Speed

Answer 68 · Mark scheme

June 2011 | PHY3F | Original Q8 | Legacy

Question 8

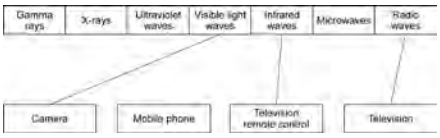
question	answers	extra information	mark
8(a)(i)	turning effect	accept turning force accept force x distance (accept symbols only if correctly defined) do **not** accept newtons x metres	1
8(a)(ii)	stop apparatus falling over	accept holds the stand in place accept make it safer / stable references to balanced / equilibrium are insufficient	1
8(a)(iii)	as x increases y increases in same proportion / ratios	 allow both marks for they are directly proportional **or** a specific example eg doubling y, doubles x allow both marks for a correct answer giving figures eg they increase in the ratio of 1 to 7 allow for **1** mark positive correlation	1 1
8(a)(iv)	the centre of mass of the ruler is at the axis of rotation		1
8(b)	108 newton metres / Nm	allow **1** mark for correct substitution ie 240 x 0.45 symbols must be correct for full credit the unit must be consistent with the numerical answer	2 1
Total			**8**

4.5.6.1.2 Speed

Answer 69 · Mark scheme

June 2012 | PH1FP | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)	3 lines drawn linking: camera to visible light television to radio waves remote control to infrared 	 if more than one line is drawn from any device all those lines are incorrect	 1 1 1
2(b)	300 000 km/s **or** 300 000 000 m/s	unit required accept the same (as light) accept the speed of light	1
2(c)	a longer wavelength than		1
2(d)(i)	refraction	do **not** allow a misspelling that might be reflection	1
2(d)(ii)	travelling along the normal	accept light is at 90° to the surface / block light is not entering at an angle is insufficient	1
Total			**7**

4.5.6.1.2 Speed

Answer 69 · Mark scheme

June 2012 | PH1FP | Original Q2 | Legacy

PH1FP

4.5.6.1.2 Speed

Answer 70 · Mark scheme

June 2012 | PH1FP | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)(i)	any suitable risk eg being injured by a car	accept a measure to reduce the risk eg stand well away from edge of pavement stay on school grounds / don't go onto the street be aware of the dangers of traffic car travelling at high speed is insufficient	1
3(a)(ii)	increased		1
3(b)(i)	S S		1 1
3(b)(ii)	big bang (theory)		1
3(b)(iii)	CMBR comes from all parts of the Universe		1
3(b)(iv)	At the moment it is the best way of explaining our scientific knowledge		1
Total			7

4.5.6.1.2 Speed

Answer 70 · Mark scheme

June 2012 | PH1FP | Original Q3 | Legacy

PH1FP

4.5.6.1.2 Speed

Answer 71 · Mark scheme

Question 6

question	answers	extra information	mark
6(a)	letter C clearly marking a compression	accept C at any point in a compression if more than one letter C marked all must be correct	1
6(b)(i)	straight continuous line drawn from loudspeaker to metal to sound sensor angle I = angle R	judge by eye judge by eye ignore any arrows on lines	1 1
6(b)(ii)	less sound reflected **or** (some) sound passes through the glass	accept energy for sound accept (some) sound absorbed by the glass	1
6(b)(iii)	makes the sound louder		1
6(b)(iv)	340	$v = f \times \lambda$ allow **1** mark for correct substitution ie 850×0.4 provided no subsequent step shown	2
6(c)	echo		1
6(d)(i)	from 250 Hz to 750 Hz		1

Question 6 continues on the next page

4.5.6.1.2 Speed

Answer 71 · Mark scheme

June 2012 | PH1FP | Original Q6 | Legacy

PH1FP

Question 6 continued

question	answers	extra information	mark
6(d)(ii)	curtains reduce (percentage of) sound reflected more(than carpet) for all frequencies (shown)	accept curtains absorb more sound (than carpet) accept for both marks an answer in terms of walls having a larger (surface) area to reflect sound and curtains reducing the amount of reflected sound more (than carpet) answers less noisy or walls / curtains have a larger area gain **1** mark only do **not** accept curtains are cheaper	1 1
Total			**11**

4.5.6.1.2 Speed

Answer 71 · Mark scheme

June 2012 | PH1FP | Original Q6 | Legacy

PH1FP

4.5.6.1.2 Speed

Answer 72 · Mark scheme

June 2012 | PH2FP | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)(i)	horizontal arrow pointing to the left	judge by eye drawn anywhere on the diagram	1
3(a)(ii)	60 (N) (at steady speed) resultant force must be zero	 accept forces must balance/are equal accept no acceleration do **not** accept constant speed	1 1
3(b)	1680 joule	 allow **1** mark for correct substitution, ie 60 x 28 provided no subsequent step shown accept J do not accept j	2 1
Total			6

4.5.6.1.2 Speed

Answer 72 · Mark scheme

PH2FP

4.5.6.1.2 Speed

Answer 73 · Mark scheme

Question 4

question	answers	extra information	mark
4(a)(i)	wavelength	accept frequency accept speed	1
4(a)(ii)	amplitude	accept energy height is insufficient	1
4(a)(iii)	sound		1
4(b)(i)	diffraction	accept diffract a description is insufficient	1
4(b)(ii)	0.12 metre per second **or** m/s **or** metre/second	allow **1** mark for correct substitution, ie 8 × 0.015 provided no subsequent step shown do **not** accept mps units must be consistent with numerical answers	2 1
Total			**7**

4.5.6.1.2 Speed

Answer 73 · Mark scheme

January 2013 | PH1FP | Original Q4 | Legacy

PH1FP

4.5.6.1.2 Speed

Answer 74 · Mark scheme

January 2013 | PH2FP | Original Q1 | Legacy

Question 1

question	answers	extra information	mark
1(a)	4 N to the right		1
1(b)(i)	bigger than equal to		1 1
1(b)(ii)	reduces it increases air resistance / drag / force C	 accept parachute has large(r) (surface) area	1 1
Total			5

4.5.6.1.2 Speed

Answer 74 · Mark scheme

January 2013 | PH2FP | Original Q1 | Legacy

PH2FP

4.5.6.1.2 Speed

Answer 75 · Mark scheme

Question 6

question	answers	extra information	mark
6(a)	any **two** from: • (make shape / body) more streamlined • increase power of engine • reduce mass / weight (of go-kart)	accept a correct description accept lower the seating position of the driver faster engine is insufficient change wheel size is insufficient	2
6(b)(i)	A–B steepest / steeper gradient / slope	reason only scores if A–B is chosen	1 1
6(b)(ii)	1820	allow **1** mark for correct substitution, ie 140 × 13 provided no subsequent step shown	2
Total			**6**

4.5.6.1.2 Speed

Answer 75 · Mark scheme

January 2013 | PH2FP | Original Q6 | Legacy

PH2FP

4.5.6.1.2 Speed

Answer 76 · Mark scheme

June 2013 | PH1FP | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)(i)	vibrate / oscillate	accept a correct description move is insufficient	1
5(a)(ii)	336	allow **1** mark for correct substitution, ie 420 × 0.8(0) provided no subsequent step shown	2
5(b)(i)	frequency		1
5(b)(ii)	longer than 0.8 m		1
5(b)(iii)	Doppler		1
Total			**6**

4.5.6.1.2 Speed

Answer 76 · Mark scheme

June 2013 | PH1FP | Original Q5 | Legacy

PH1FP

4.5.6.1.2 Speed

Answer 77 · Mark scheme

June 2013 | PH2FP | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)	time force	correct order only	1 1
6(b)	The car tyres being badly worn		1
6(c)(i)	braking distance increases with speed relevant further details, eg • but not in direct proportion • and increases more rapidly after 15 m/s • double the speed, braking distance increases × 4	accept positive correlation do **not** accept stopping distance for braking distance accept any speed between 10 and 20 accept numerical example	1 1
6(c)(ii)	line drawn above existing line starting at the origin	as speed increases braking distance must increase each speed must have a single braking distance	1
6(d)(i)	reaction time / reaction (of driver) does not depend on speed (of car)		1

Question 6 continues on the next page . . .

PH2FP

Question 6 continued . . .

question	answers	extra information	mark
6(d)(ii)	(on the reduced speed limit roads) over the same period of time monitor number of accidents before and after (speed limit reduced)	accept a specific time, eg 1 year allow **1** mark only for record number of vehicles / cars using the (20 mph) roads **or** collect data on accidents on the (20 mph) roads to score both marks the answer must refer to the roads with the reduced speed limit	1 1
Total			**9**

4.5.6.1.2 Speed

Answer 77 · Mark scheme

June 2013 | PH2FP | Original Q6 | Legacy

PH2FP

4.5.6.1.2 Speed

Answer 78 · Mark scheme

June 2013 | PH3FP | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)	A		1
5(b)(i)	9000	an answer of 9 k(N) gains **1** mark	1
5(b)(ii)	increase	accept other comparative terms, eg give a bigger affect / change is insufficient	1
5(b)(iii)	smaller	accept other comparative terms, eg less	1
5(c)	Q N M	all three in correct boxes one statement in correct box gains **1** mark	2
5(d)	any **two** from: • increase the current / p.d. (supplied to the coil) • increase number of turns (on the coil) • increase the area (of the coil) • increase the (strength of the permanent) magnetic field	accept reduce the resistance of the coil **or** increase cross sectional area of wire accept more cells / batteries **or** turn up the power supply increase power is insufficient accept increase the width of the coil increase width / size is insufficient accept move the magnets closer to the coil accept use stronger magnets do **not** accept use larger magnets	2
5(e)	an economic		1
Total			**9**

4.5.6.1.2 Speed

Answer 78 · Mark scheme

June 2013 | PH3FP | Original Q5 | Legacy

PH3FP

4.5.6.1.2 Speed

Answer 79 · Mark scheme

June 2014 | PH1FP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO spec ref
2(a)(i)	A		1	AO2 1.5.3b
2(a)(ii)	B		1	AO2 1.5.3b
2(b)	340 metres/second	 allow **1** mark for correct substitution ie 850 × 0.4 provided no subsequent step shown accept m/s	2 1	AO1 AO2 1.5.1j
2(c)	higher than shorter than		1 1	AO1 1.5.4a
Total			7	

4.5.6.1.2 Speed

Answer 80 · Mark scheme

June 2014 | PH1FP | Original Q8 | Legacy

Question	Answers	Extra information	Mark	AO spec ref
8(a)	infrared / IR	correct answer only	1	AO1 1.1.1a
8(b)	any **two** from: • increase the power / watts • decrease the speed • put biscuits through again	 allow increase the temperature of the oven or make the oven hotter allow leave the biscuits in for longer increase radiation is insufficient ignore changes to the design of the oven	2	AO2 1.3.1c
8(c)	(inside) surface is a (good) reflector or poor absorber (of IR) (and) <u>outside</u> surface is poor emitter (of IR) (so) increases the energy reaching the biscuits	Ignore bounce for reflect surface is a (good) reflector of light does not score surface is a (good) reflector of light and infrared / heat does score allow reduces energy loss or makes oven more efficient do **not** accept no energy losses keeps oven hotter is insufficient	1 1 1	AO1 1.1.1c, d
Total			**6**	

4.5.6.1.2 Speed

Answer 81 · Mark scheme

June 2014 | PH2FP | Original Q2 | Legacy

2(a)(i)	not moving		1	AO2 2.1.2b
2(a)(ii)	straight line from origin to (200,500)	ignore a horizontal line after (200,500)	1	AO2 2.1.2b
2(b)	35 000	allow **1** mark for correct substitution, ie 14 000 × 2.5 provided no subsequent step an answer of 87 500 indicates acceleration (2.5) has been squared and so scores zero	2	AO2 2.1.2a
Total			**4**	

4.5.6.1.2 Speed

Answer 81 · Mark scheme June 2014 | PH2FP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO spec ref

Answer 82 · Mark scheme June 2014 | PH3FP | Original Q7 | Legacy

The full source mark scheme begins on page 348. Follow original question 7 in that document.

Answer 83 · Mark scheme June 2014 | PH3FP | Original Q8 | Legacy

The full source mark scheme begins on page 348. Follow original question 8 in that document.

Answer 84 · Mark scheme June 2015 | PH1FP | Original Q6 | Legacy

The full source mark scheme begins on page 365. Follow original question 6 in that document.

Answer 85 · Mark scheme June 2015 | PH2FP | Original Q3 | Legacy

The full source mark scheme begins on page 381. Follow original question 3 in that document.

4.5.6.1.2 Speed

Answer 86 · Mark scheme

June 2015 | PH2FP | Original Q5 | Legacy

The full source mark scheme begins on page 381. Follow original question 5 in that document.

4.5.6.1.2 Speed

Answer 87 · Mark scheme

June 2015 | PH3FP | Original Q8 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. ref.
8(a)(i)	D		1	AO2 P3.2.4b
8(a)(ii)	friction		1	AO1 P3.2.4b
8(a)(iii)	any **two** from: • the speed / velocity • the radius of the bend • the mass (of the car)	 the radius is insufficient accept curvature of the road size of the bend is insufficient accept distance of car from centre (of bend) accept weight for mass	2	AO1 P3.2.4c
8(b)	the car has a wide base the car has a low centre of mass / gravity	accept any description of a wide base e.g. the wheels are far apart accept wide wheel base do **not** accept long wheel base a large surface area is insufficient wide tyre(s) is insufficient accept any description of low centre of mass e.g. mass is close to the ground a down force is insufficient	1 1	AO2 P3.2
Total			6	

4.5.6.1.2 Speed

Answer 87 · Mark scheme

June 2015 | PH3FP | Original Q8 | Legacy



Answer 88 · Mark scheme

June 2016 | PH1FP | Original Q3 | Legacy

The full source mark scheme begins on page 396. Follow original question 3 in that document.

Answer 89 · Mark scheme

June 2016 | PH1FP | Original Q6 | Legacy

The full source mark scheme begins on page 396. Follow original question 6 in that document.

4.5.6.1.2 Speed

Answer 90 · Mark scheme

June 2016 | PH2FP | Original Q3 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)(i)	0.15 × 0.08 = 0.012		1	AO2 2.2.2a
3(a)(ii)	kg m/s		1	AO1 2.2.2a
3(a)(iii)	equal to		1	AO1 2.2.2b
3(b)	momentum of the air increases **or** force backwards increases so momentum of the toy must increase **or** the force forwards (on the toy) increases	it = toy accept air moves faster accept momentum backwards increases accept pushes more air back(wards) accept momentum forwards must increase	1 1	AO2 2.2.2b
Total			**5**	

4.5.6.1.2 Speed

Answer 90 · Mark scheme

June 2016 | PH2FP | Original Q3 | Legacy



4.5.6.1.2 Speed

Answer 91 · Mark scheme

June 2016 | PH2FP | Original Q8 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8(a)	starting / stopping the stopwatch **or** timing over the smaller distances	human error is insufficient reaction time is insufficient accept not timing accurately do not accept references to measuring distance incorrectly	1	AO3 2.1
8(b)(i)	before		1	AO3 2.1
8(b)(ii)	increasing	accept accelerating it is not constant is insufficient it is less than after four seconds is insufficient it reaches a constant speed negates	1	AO3 2.1.2b
8(b)(iii)	calculate the gradient of the straight/steepest/constant section	accept gradient of any section after 5.5 seconds/30 cm	1	AO1 2.1.2b
8(b)(iv)	drag (force) increases (as the ball bearing gets faster) (until) drag (force) = weight **or** (until) resultant force is zero	accept frictional/upward force for drag accept upward force = downward force accept till forces are balanced	1 1	AO1 2.1.4b

4.5.6.1.2 Speed

Answer 91 · Mark scheme

June 2016 | PH2FP | Original Q8 | Legacy

8(c)	less than ball bearing increases speed at a greater rate **or** ball bearing has a greater acceleration **or** terminal velocity has not been reached so resultant force must be greater **or** as weight is the same (the drag must be less)	 accept it travels the same distance in less time accept the ball bearing is going faster accept warmer oil has a lower density/viscosity for 1 mark if neither of the two reason marks score	1 1 1	AO3 2.1.4a/b
Total			**9**	

4.5.6.1.2 Speed

Answer 91 · Mark scheme

June 2016 | PH2FP | Original Q8 | Legacy



4.5.6.1.2 Speed

Answer 92 · Mark scheme

June 2016 | PH3FP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	20 000 Hz		1	AO1 3.1.2a
5(b)	400 (m)	allow **1** mark for correct substitution ie 1600 × 0.25 provided no subsequent steps shown an answer of 200 (m) gains **1** mark	2	AO2 3.1.2c
5(c)	twice		1	AO1 3.1.2b
5(d)	From pulse 1 to pulse 3 the distance (to the sea floor) decreased then (after pulse 3) the distance (to the sea floor) increased	accept the sea got shallower **or** the submarine went deeper for the distance decreased accept the sea got deeper **or** the submarine rose for the distance increased An answer of the distance decreased then increased gains **1** mark	1 1	AO3 3.1.2b
Total			6	

4.5.6.1.2 Speed

Answer 92 · Mark scheme

June 2016 | PH3FP | Original Q5 | Legacy



4.5.6.1.2 Speed

Answer 93 · Mark scheme

June 2017 | PH1FP | Original Q6 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)	(the speed of sound is) lower	accept converse	1	AO2 1.5
6(b)	336 m/s	accept 340 allow **1** mark for correct substitution ie 800 x 0.42 provided no subsequent step	2 1	AO1 AO2 1.5.1j
6(c)	less than same as same as		1 1 1	AO1 1.5.3b
6(d)	echo		1	AO1 1.5.3c
6(e)	Sound waves are longitudinal waves. Sound waves transfer energy.		1 1	AO1 1.5 1.1.3c
Total			**10**	

4.5.6.1.2 Speed

Answer 93 · Mark scheme

June 2017 | PH1FP | Original Q6 | Legacy



4.5.6.1.2 Speed

Answer 94 · Mark scheme

June 2017 | PH1FP | Original Q8 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8(a)	Doppler		1	AO1 1.5.4a
8(b)(i)	A frequency has increased	 accept frequency is higher (compared to the emitted frequency) accept wavelength has decreased reason only scores if A is chosen	1 1	AO2 AO3 1.5.4a
8(b)(ii)	C greater change in frequency	 accept greater change in wavelength reason only scores if C chosen	1 1	AO2 AO3 1.5.4a
Total			5	

4.5.6.1.2 Speed

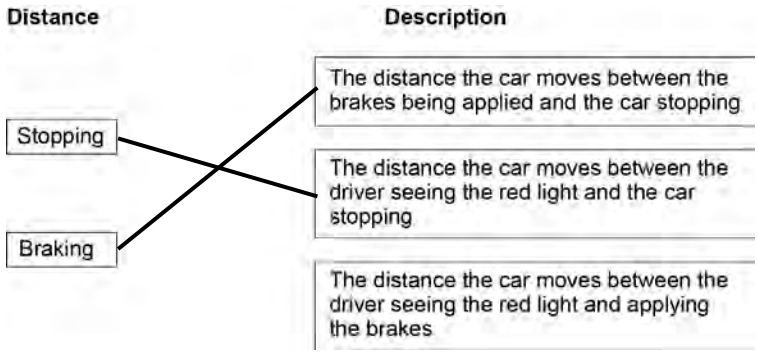
Answer 94 · Mark scheme

June 2017 | PH1FP | Original Q8 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.

4.5.6.1.2 Speed

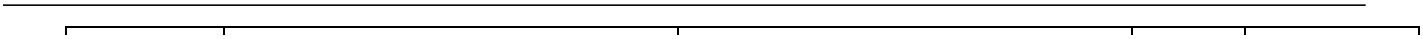
Answer 95 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	 If more than one line goes from a 'distance' box, all those lines are incorrect		2	AO1 2.1.3c
2(b)(i)	0.8s		1	AO2 2.1.3c
2(b)(ii)	increases thinking distance so increases (overall) stopping distance	 takes longer to stop more likely to have an accident is insufficient	1 1	AO1 2.1.3c, d
2(b)(iii)	$\frac{1}{2} \times 750 \times 8^2$		1	AO2 2.2.1g
2(b)(iv)	decrease(s) increase(s)	correct order only	1 1	AO1 2.1.3e
Total			8	

4.5.6.1.2 Speed

Answer 95 · Mark scheme

June 2017 | PH2FP | Original Q2 | Legacy



4.5.6.1.2 Speed

Answer 96 · Mark scheme

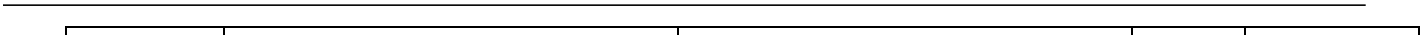
June 2017 | PH2FP | Original Q4 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	gravity	accept weight accept gravitational attraction / pull do not accept gravitational potential	1	AO1 2.2.1f
4(b)(i)	The height of the ramp.		1	AO2 HSW
4(b)(ii)	the mass of the wooden block		1	AO2 HSW
4(c)(i)	all points fit the pattern	accept all points are on the line	1	AO3 HSW
4(c)(ii)	1(.0) (N)	accept 0.9 to 1.0 inclusive	1	AO2 HSW
4(c)(iii)	the greater the height (of the ramp) the greater the force (required) but not in direct proportion	accept steeper ramp for height accept positive correlation accept line does not go through the origin allow it is a linear (pattern) accept a numerical example of increase in force and height	1 1	AO3 HSW
4(c)(iv)	B		1	AO3 HSW
4(d)	312	allow **1** mark for correct substitution ie W = 260 x 1.2 provided no subsequent step	2	AO2 2.2.1a/b
Total			**10**	

4.5.6.1.2 Speed

Answer 96 · Mark scheme

June 2017 | PH2FP | Original Q4 | Legacy



4.5.6.1.2 Speed

Answer 97 · Mark scheme

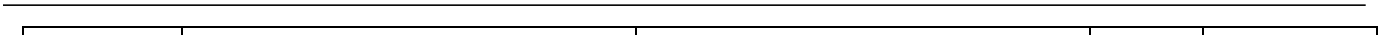
June 2017 | PH3FP | Original Q4 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)(i)	Sound with a higher frequency than humans can hear	accept sound with frequencies higher than 20 000 Hz	1	AO1 3.1.2a
4(a)(ii)	Some is reflected and some is transmitted.		1	AO1 3.1.2b
4(a)(iii)	Breaking up kidney stones		1	AO1 3.1.2d
4(b)	less	accept shorter	1	AO2 3.1.2b
4(c)	0.99	allow **2** marks for 1.98 allow **2** marks for (330×0.006)/2 **or** for 330×0.003 If no other marks allow **1** mark for substitution of 330×0.006 **or** for halving the time	3	AO2 3.1.2c
4(d)	any **one** from: • It is more reliable • They can detect smaller objects • They can detect objects over a wider range • They can detect the position of objects	accept if one breaks the others will still work accept it is more accurate reference to (surface) area is insufficient	1	AO3 3.12b
Total			**8**	

4.5.6.1.2 Speed

Answer 97 · Mark scheme

June 2017 | PH3FP | Original Q4 | Legacy



4.5.6.1.2 Speed

Answer 98 · Mark scheme

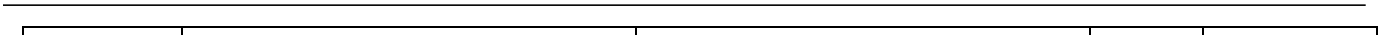
June 2017 | PH3FP | Original Q6 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)(i)	**B**		1	AO1 3.2.4a
6(a)(ii)	Accelerates him towards the centre of the circle	accept it makes him change direction accept causes him to turn do not accept pulls him towards the centre of the curve	1	AO1 3.2.4b
6(b)(i)	The centripetal force is smaller.		1	AO1 3.2.4c
6(b)(ii)	The centripetal force is bigger.		1	AO1 3.2.4c
6(c)	high narrow		1 1	AO2 3.2
Total			**6**	

4.5.6.1.2 Speed

Answer 98 · Mark scheme

June 2017 | PH3FP | Original Q6 | Legacy



4.5.6.1.2 Speed

Answer 99 · Mark scheme

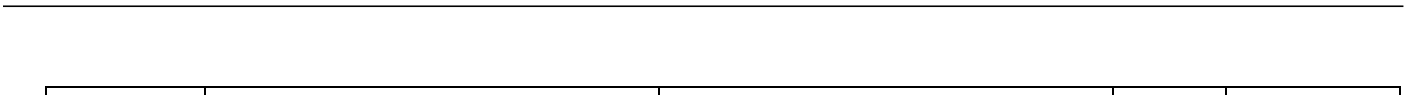
June 2018 | 8463/1F | Original Q1

Question	Answers	Extra information	Mark	AO/ Spec. Ref
01.1	chemical kinetic	in this order only	1 1	AO1 4.1.1.1
01.2	$E_k = 0.5 \times 80 \times 12^2$ $E_k = 5760$ (J)	an answer of 5760 (J) scores **2** marks	1 1	AO2 4.1.1.2
01.3	E = 0.040 × 480 × 50 E = 960 (J)	an answer of 960 (J) scores **2** marks	1 1	AO2 4.1.1.3
01.4	increased		1	AO1 4.3.2.1
Total			**7**	

4.5.6.1.2 Speed

Answer 99 · Mark scheme

June 2018 | 8463/1F | Original Q1



4.5.6.1.2 Speed

Answer 100 · Mark scheme

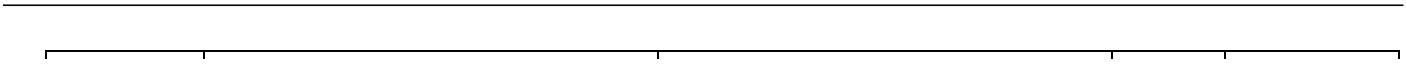
June 2018 | 8463/2F | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	Milky Way		1	AO1 4.8.1.1
01.2	distance = 300 000 × 500 d = 150 000 000 (km)	an answer of 150 000 000 scores **2** marks	1 1	AO2 4.5.6.1.2
01.3	3		1	AO1 4.8.1.1
01.4	accept any number greater than 1.0 and less than 12.0		1	AO3 4.8.1.1
01.5	$\frac{9}{0.6}$ 15	an answer of 15 scores **2** marks	1 1	AO2 4.8.1.3
Total			**7**	

4.5.6.1.2 Speed

Answer 100 · Mark scheme

June 2018 | 8463/2F | Original Q1



4.5.6.1.2 Speed

Answer 101 · Mark scheme

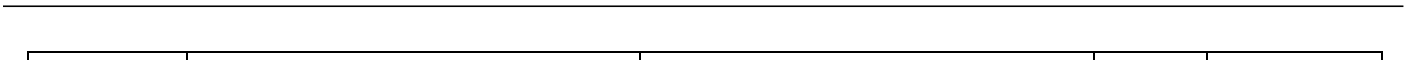
June 2018 | 8463/2F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	increased		1	AO1 4.6.1.2
03.2	(count) how many waves pass a point		1	AO1 4.6.1.2
	in one second	this is dependent on the first mark point being awarded	1	
	or			
	(count) number of waves that pass a point in a given time **or** (count) number of waves that are produced in a given time (1)	allow a specific time for a given time		
	and divide by that time in seconds (1)	this is dependent on the first mark point being awarded allow an answer in terms of measuring the frequency of the vibrating bar		
03.3		an answer of 0.2 scores **2** marks		
	period = $\frac{1}{5}$		1	AO2 4.6.1.2
	period = 0.2		1	AO2 4.6.1.2
	seconds / s		1	AO1 4.6.1.2
Total			**6**	

4.5.6.1.2 Speed

Answer 101 · Mark scheme

June 2018 | 8463/2F | Original Q3



4.5.6.1.2 Speed

Answer 102 · Mark scheme

June 2018 | 8463/2F | Original Q12

Question	Answers	Extra information	Mark	AO / Spec. Ref.
12.1	Regrettably, this part of the question assessed content that we had stipulated would only be assessed on the Higher tier. All students were awarded full marks for this part of the question.		1	
12.2	0.4		1	AO2 4.6.1.2
12.3	wave speed = frequency × wavelength	allow v = f λ	1	AO1 4.6.1.2
12.4	7200 = 0.4 × wavelength wavelength = $\frac{7200}{0.4}$ wavelength = 18 000 (m)	an answer 18 000 scores **3** marks allow up to full marks for ecf using their answer to question **12.2** a method shown as 7200 × 2.5 = 18 000 scores **0** marks	1 1 1	AO2 4.6.1.2
12.5	Regrettably, this part of the question assessed content that we had stipulated would only be assessed on the Higher tier. All students were awarded full marks for this part of the question.		2	
Total			**8**	

4.5.6.1.2 Speed

Answer 103 · Mark scheme

June 2019 | 8463/1F | Original Q11

Question 11

Question	Answers	Extra information	Mark	AO / Spec. Ref.
11.1	$41 = \frac{9.8 \times h}{0.12}$ $h = \frac{41 \times 0.12}{9.8}$ h = 0.50 (m)	an answer of 0.50 scores **3** marks allow a correct answer that rounds to 0.50 for **3** marks	1 1 1	4.1.1.2 AO2
11.2	kinetic energy = 0.5 × mass × (speed)^2 ***or*** $E_k = ½ mv^2$		1	4.1.1.2 AO1
11.3	$270 = ½ \times m \times 3^2$ $m = \frac{270}{(½ \times 3^2)}$ **or** $m = \frac{270}{4.5}$ m = 60 (kg)	an answer of 60 (kg) scores **3** marks	1 1 1	4.1.1.2 AO2

4.5.6.1.2 Speed

Answer 103 · Mark scheme

June 2019 | 8463/1F | Original Q11

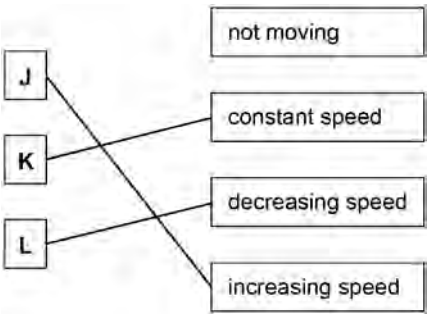
11.4	**Level 2:** Scientifically relevant features are identified; the way(s) in which they are similar / different is made clear.		3–4	WS3.5 4.1.1.2 AO3
	Level 1: Relevant features are identified and differences noted.		1–2	
	No relevant content		0	
	Indicative content • males have a greater muscle power than females for most of their lives • males have a greater muscle power than females above 9/10 years old • males have a lower muscle power than females below 9/10 years old • there is a similar pattern for males and females as age increases • males have a peak muscle power at 25 years old whereas females have a peak muscle power at 20/21 years old • at 9/10 years old males have the same muscle power as females • peak muscle power for males (47 W/kg) is greater than peak muscle power for females (37 W/kg) • the rate of increase of muscle power is greater for males than females (between 5 and 25 years old) • the rate of decrease of muscle power is greater for males than females. Ignore comments relating to strength			
11.5	any **1** from: • maximum height reached is a better indicator of maximum muscle power • maximum / peak muscle power was being investigated, not mean / average muscle power • volunteer may not use maximum effort on the first try • performance may improve with practise • performance may get worse with tiredness	allow maximum time in the air for maximum height reached / jumped	1	WS3.7 4.1.1.4 AO3
Total			**12**	

4.5.6.1.2 Speed

Answer 104 · Mark scheme

June 2019 | 8463/2F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1.1	equal to	allow the symbol = allow a correct answer indicated in the box provided the answer space is blank	1	AO1/1 4.5.6.2.3 WS 1.2
1.2	J -------- increasing speed K--------- constant speed L --------- decreasing speed	all three lines correct allow **1** mark for **1** line correct more than three lines are drawn scores **0** 	2	AO1/1 4.5.6.1.4
1.3	25 (m)		1	AO2/2 4.5.6.1.4
1.4	av speed = $\frac{100}{12.5}$ av speed = 8(.0) (m/s) OR av speed = $\frac{100}{12.6}$ av speed = 7.93… (m/s)	an answer of 8(.0) (m/s) scores **2** marks allow 7.9 or 7.94	1 1	AO2/1 4.5.6.1.2
1.5	3.0		1	AO1/1 4.5.6.1.2
Total			**7**	

4.5.6.1.2 Speed

Answer 105 · Mark scheme

June 2019 | 8463/2F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2.1	wavelength	allow a correct answer indicated in the box provided the answer space is blank	1	AO1/1 4.8.2 iso
2.2	C		1	AO3/1a 4.8.2
2.3	C		1	AO3/1a 4.8.2
2.4	Very dense and extremely hot		1	AO1/1 4.8.2 iso
2.5	Scientific evidence supports the theory		1	AO1/1 4.8.2 WS1.2
2.6	Z any **one** from • (only one) shows the universe is expanding • (only one) shows the universe began (very) small	 only scores if Z is chosen	1 1	AO3/1b 4.8.2
Total			**7**	

4.5.6.1.2 Speed

Answer 106 · Mark scheme

June 2019 | 8463/2F | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
9.1	metre rule	allow metre ruler allow tape measure do not accept ruler do not accept metre stick	1	AO1/2 4.6.1.2 RPA8
9.2	(wave) speed = frequency × wavelength	allow v = f λ	1	AO1/1 4.6.1.2 RPA8
9.3	 80cm = 0.8m v = 55 × 0.8 v = 44 (m/s)	an answer of 44 (m/s) scores **3** marks this mark may be awarded if wavelength is incorrectly or not converted allow correct calculation using an incorrectly or not converted wavelength an answer of 4400 (m/s) scores **2** marks	 1 1 1	AO2/1 4.6.1.2 RPA8
9.4	move the (wooden) bridge to the right OR change the mass/weight (on the string) scores **1** mark add more masses/weights (to the string) scores both marks	 dependent on 1st mp being scored	1 1	AO2/2 4.6.1.2 RPA8

4.5.6.1.2 Speed

Answer 106 · Mark scheme

June 2019 | 8463/2F | Original Q9

9.5	**Level 2:** The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	3–4	AO3/3a 4.6.1.2 RPA8
	Level 1: The design/plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content add or take away masses from the string (ignore any stated values) adjust frequency using the signal generator and/or move the wooden bridge observe a steady / stationary pattern measure the wavelength calculate wave speed from frequency and wavelength a Level 1 answer should include a way of changing tension a complete Level 2 answer would include either changing frequency and/or moving the bridge		
Total		**11**	

4.5.6.1.2 Speed

Answer 107 · Mark scheme

November 2020 | 8463/1F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	the friction is decreased		1	AO1 4.1.2.1
02.2	$E_p = 62.5 \times 9.8 \times 16.0$ $E_p = 9800$ (J)		1 1	AO2 4.1.1.2
02.3	$E_k = 0.5 \times 62.5 \times 12^2$ $E_k = 4500$ (J)		1 1	AO2 4.1.1.2
02.4	Any **two** from: • speed (at bottom of slide) • friction *(*between sled and ground*)* • air resistance	allow mass/weight of rider (and sled) allow surface type	2	AO1 4.1.1.1
Total			**7**	

4.5.6.1.2 Speed

Answer 108 · Mark scheme

November 2020 | 8463/2F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	B to D		1	AO2 4.5.6.1.2
01.2	metre rule	allow tape measure allow ruler	1	AO1 4.5.6.1.2
01.3	so that each piece falls the same distance	allow to stop them from building up at the bottom	1	AO3 4.5.6.1.2
01.4	$\frac{34 + 37 + 34}{3}$ 35 (s)	allow $\frac{105}{3}$	1 1	AO2 4.5.6.1.2
01.5	cone the (mean) time is the lowest	 reason only scores if correct shape is selected allow it fell the fastest allow it had the most streamlined shape ignore reference to surface area	1 1	AO3 4.5.6.1.2
01.6	Time through air would be less.		1	AO3 4.5.6.1.2
01.7	w = 0.050 × 9.8 w = 0.49 (N)		1 1	AO2 4.5.1.3
01.8	Electrostatic force Magnetic force		1 1	AO1 4.5.1.2
Total			**12**	

4.5.6.1.2 Speed

Answer 109 · Mark scheme

November 2020 | 8463/2F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	R		1	AO1 4.6.1.2
03.2	S		1	AO1 4.6.1.2
03.3	$T = \frac{1}{0.20}$ T = 5(.0 s)		1 1	AO2 4.6.1.2
03.4	The wavelength decreases		1	AO1 4.6.1.2
03.5	Time taken by the wave to travel the length of the tray		1	AO1 4.6.1.2 RPA8
03.6	Depth of water		1	AO1 4.6.1.2 RPA8
03.7	as the depth increases, the speed increases	allow positive correlation (between speed and depth)	1	AO3 4.6.1.2 RPA8
03.8	0.49 (m/s)		1	AO2 4.6.1.2
Total			**9**	

4.5.6.1.2 Speed

Answer 110 · Mark scheme

November 2020 | 8463/2F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	velocity includes direction	allow velocity is a vector (quantity) **and** speed is a scalar (quantity)	1	AO1 4.5.6.1.3
07.2	(an equal) force from the air pushes on the engine/aircraft in the opposite direction	 only scores if first marking point scored accept to the left **or** forwards if no other marks scored, allow **1** mark for pushes the engine forwards	1 1	AO2 4.5.6.2.3
07.3	correct value for distance and corresponding time (eg 12 000 m and 50 s) $v = \frac{\text{their change in distance}}{\text{their change in time}}$ speed = 240 (m/s)	 this mark may be awarded if distance and/or time are incorrectly read **from the graph** allow a correctly calculated answer using their values of distance and time **from the graph**	1 1 1	AO2 4.5.6.1.4
07.4	acceleration = $\frac{\text{change in velocity}}{\text{time taken}}$ **or** $a = \frac{\Delta v}{t}$		1	AO1 4.5.6.1.5

4.5.6.1.2 Speed

Answer 110 · Mark scheme

November 2020 | 8463/2F | Original Q7

07.5	250 – 68 = 182 $0.14 = \frac{182}{t}$ $t = \frac{182}{0.14}$ t = 1300 (seconds)	 this mark may be awarded if the change in velocity is incorrectly/not calculated this mark may be awarded if the change in velocity is incorrectly/not calculated allow a correctly calculated answer using a change in velocity incorrectly/not calculated	1 1 1 1	AO2 4.5.6.1.5
07.6	work done = force × distance **or** W = F s		1	AO1 4.5.2
07.7	140 000 000 = force × 2000 $\text{force} = \frac{140\,000\,000}{2000}$ force = 70 000 (newtons)		1 1 1	AO2 4.5.2
Total			**15**	

4.5.6.1.2 Speed

Answer 111 · Mark scheme

November 2020 | 8463/2F | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	(force of) gravity fusion	do **not** allow weight	1 1	AO1 4.8.1.1
09.2	distance = speed × time **or** s = vt	allow a correct re-arrangement do **not** allow d = st	1	AO1 4.5.6.1.2
09.3	$1.5 \times 10^{11} = 3.0 \times 10^{8} \times t$ $t = \frac{1.5 \times 10^{11}}{3.0 \times 10^{8}}$ t = 500 (s)		1 1 1	AO2 4.5.6.1.2

09.4	**Level 3**: Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.		5–6	AO1 4.8.1.2
	Level 2: Scientifically relevant facts, events or processes are identified and their relevance is clear. The account is not fully accurate.		3–4	
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.		1–2	
	No relevant content		0	
	Indicative content: • fusion (processes in stars) produce new elements • cloud of gas / hydrogen **and** dust **OR** nebula • pulled together by gravity • causing increasing temperature (to start the fusion process) • (to become a) protostar • hydrogen nuclei fuse to form helium nuclei • and the star becomes main sequence • hydrogen begins to run out • helium nuclei fuse to make heavier elements • up to iron • the star expands (to become a) • red super giant • (the star collapses rapidly) and <u>explodes</u> • called a supernova • creating elements heavier than iron • and distributing them throughout the universe • leaving behind a neutron star • or a black hole.			
09.5	Temperature		1	AO1 4.6.3.2
Total			**13**	

4.5.6.1.2 Speed

Answer 112 · Mark scheme

November 2021 | 8463/1F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	gravitational potential kinetic	this order only	1 1	AO1 4.1.1.2 4.1.1.1
07.2	kinetic energy = 0.5 × mass × speed^2 **or** $E_k = ½mv^2$		1	AO1 4.1.1.2
07.3	$5040 = 0.5 \times m \times 12^2$ $m = \frac{5040}{0.5 \times 12^2}$ m = 70 (kg)		1 1 1	AO2 4.1.1.2
07.4	the thermal energy increases.		1	AO1 4.1.1.1
Total			**7**	

4.5.6.1.2 Speed

Answer 113 · Mark scheme

November 2021 | 8463/2F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	transverse		1	AO1 4.6.1.1
01.2	the water at point **X** moves up and down		1	AO2 4.6.1.1
01.3	$v = 2.0 \times 0.032$ $v = 0.064$ (m/s) m/s		1 1 1	AO2 AO2 AO1 4.6.1.2
01.4	energy		1	AO1 4.6
01.5	**D**		1	AO1 4.6.1.2
01.6	**B**		1	AO1 4.6.1.2
Total			**8**	

4.5.6.1.2 Speed

Answer 114 · Mark scheme

November 2021 | 8463/2F | Original Q2

Question 2

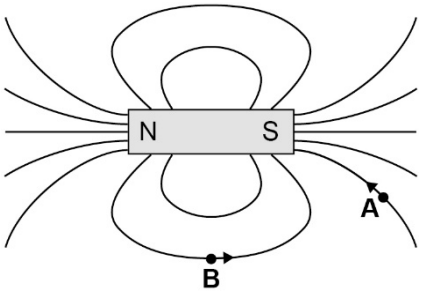
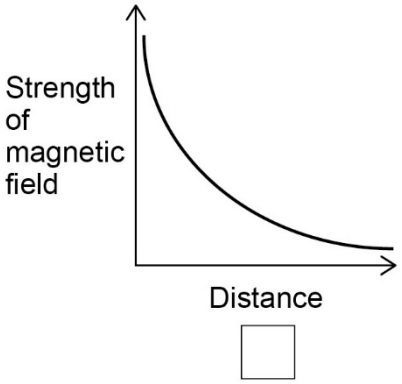
Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	friction		1	AO1 4.5.1.2
02.2	air resistance		1	AO1 4.5.1.2
02.3	**A = B**		1	AO1 4.5.6.2.2
02.4	$M = 150 \times 0.24$ $M = 36$ (Nm)		1 1	AO2 4.5.4
02.5	chain		1	AO2 4.5.4
02.6	5.8 m/s		1	AO2 4.5.6.1.5
02.7	$a = \frac{5.8}{20}$ $a = 0.29$ (m/s^2)	allow their v from question **02.6** allow a correctly calculated value using their v from question **02.6**	1 1	AO2 4.5.6.1.5
02.8	Deceleration		1	AO3 4.5.6.1.5
02.9	straight arrow drawn between home and school pointing towards school.		1	AO1 4.5.6.1.1
Total			**11**	

4.5.6.1.2 Speed

Answer 115 · Mark scheme

November 2021 | 8463/2F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	both arrows correct		1	AO1 4.7.1.2
07.2	a permanent magnet		1	AO1 4.7.1.1
07.3	third box ticked any **one** from • (the only graph) that shows the magnetic field getting weaker (as distance increases) • both other graphs show the magnetic field getting stronger (as the distance increases)	 only scores if correct box is chosen	1 1	AO3 4.7.1.2
07.4	steel cans are attracted to the electromagnet and are transferred to the container (by the conveyor belt) aluminium cans are not attracted to the electromagnet		1 1	AO1 4.7.1.2

	and are left behind on the table	If no other mark scored: Steel cans are attracted (to the electromagnet) but aluminium cans are not – scores one mark		
07.5	raise the height of the table use a larger potential difference / current **or** use a stronger electromagnet	allow longer legs on the table allow put a (non-magnetic) box on top of the table allow lower the electromagnet allow more turns on the coil (of the electromagnet) do **not** accept insert a (soft) iron core	1 1	AO3 4.7.2.1
07.6	distance travelled = speed × time **or** $s = v\,t$		1	AO1 4.5.6.1.2
07.7	$3.3 = 1.7 \times t$ $t = \frac{3.3}{1.7}$ $t = 1.941$ (s) $t = 1.9$ (s)	 allow a calculation using the given data incorrectly but correctly rounded to 2 sig figs	1 1 1 1	AO2 4.5.6.1.2
Total			**13**	

4.5.6.1.2 Speed

Answer 116 · Mark scheme

November 2021 | 8463/2F | Original Q8

Question 8

Question	Answers	Mark	AO/ Spec. Ref
08.1	**Level 2:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO1 4.5.6.3.3 4.5.6.3.4 4.1.1.2
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content Factors • poor condition of tyres • poor road surface • wet or icy road • poor/worn brakes Explanation • because of decreased friction Factors • increased mass of car/passengers Explanation • increases kinetic energy of car • more work needs to be done to stop car • increases momentum of the car Factor • road slopes downhill Explanation • (a component of) gravity opposes the braking force • resultant (braking) force is reduced allow answers in terms of reducing braking distance throughout A single factor with no related explanation is insufficient to score a mark		

4.5.6.1.2 Speed

Answer 116 · Mark scheme

08.2	resultant force = mass × acceleration		1	AO1 4.5.6.2.2
08.3	7200 = 1600 × *a* $a = \frac{7200}{1600}$ *a* = 4.5 (m/s^2)	ignore negatives throughout	1 1 1	AO2 4.5.6.2.2
08.4	15 (m) 38 (m) = 53 (m)	two correct values identified allow the correct addition of a misread braking distance and /or a misread thinking distance taken from the graph	1 1	AO3 4.5.6.3.1
08.5	$p = \frac{F}{A}$		1	AO1 4.5.5.1.1
08.6	120 000 = $\frac{60}{A}$ $A = \frac{60}{120\,000}$ *A* = 0.0005 *A* = 5 (.0) × 10^{-4} m^2	 allow an answer given to 2 sig figs from an incorrect calculation using the given data	1 1 1 1 1	AO2 AO2 AO2 AO2 AO1 4.5.5.1.1
Total			**16**	

4.5.6.1.2 Speed

Answer 117 · Mark scheme

June 2022 | 8463/1F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	tape measure **or** metre rule	allow ruler ignore metre stick	1	AO3 4.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	$E_p = 50 \times 9.8 \times 1.7$ $E_p = 833$ (J)		1 1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	$P = \frac{1800}{1.44}$ $P = 1250$ (W)		1 1	AO2 4.1.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	stop-clock C		1	AO3 4.1.1.4

4.5.6.1.2 Speed

Answer 117 · Mark scheme

June 2022 | 8463/1F | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	$E_k = 0.5 \times 70 \times 2.0^2$ $E_k = 140$ (J)		1 1	AO2 4.1.2.1

Total Question 2		**8**

4.5.6.1.2 Speed

Answer 118 · Mark scheme

June 2022 | 8463/2F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	ultraviolet travels at the same speed as visible light		1	AO1 4.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	D C	this order only	1 1	AO1 4.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	A 400 – 315 = 85 (nm) B 315 – 280 = 35 (nm) C 280 – 100 = 180 (nm) (ultraviolet) C (UVC)	three calculations correct 2 marks one or two calculations correct 1 mark mark dependent on all three calculations being made	2 1	AO2 4.6.2.1

4.5.6.1.2 Speed

Answer 118 · Mark scheme

June 2022 | 8463/2F | Original Q5

Question	Answers	Mark	AO / Spec. Ref.
05.4	**Level 2:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO3 4.6.2.3
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content.	0	
	Indicative content: • ozone absorbs all of the UVC • UVC is the most dangerous • ozone absorbs nearly all (95%) of the UVB • UVB has a medium risk • ozone does not absorb any UVA • ozone does not reduce risk from UVA • UVA is the least dangerous • the greater the ionising power the greater the absorption by ozone • the greater the ionising power the greater the risk • UV damages skin cells • can lead to skin cancer • can cause sunburn • UV can damage eyes • leads to problems with eyesight		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	our eyes detect visible light	allow it would be dark all the time allow specific effect ie plants couldn't grow	1	AO1 4.6.2.1

4.5.6.1.2 Speed

Answer 118 · Mark scheme

June 2022 | 8463/2F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	transmitted absorbed	this order only	1 1	AO1 4.6.2.6

Total Question 5		**13**

4.5.6.1.2 Speed

Answer 119 · Mark scheme

June 2022 | 8463/2F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	wavelength frequency	this order only	1 1	AO1 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	parallel		1	AO1 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	8000 Hz		1	AO2 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	period = $\frac{1}{8000}$ 0.000125 (s)	allow ecf from question **07.3**	1 1	AO2 4.6.1.2

4.5.6.1.2 Speed

Answer 119 · Mark scheme

June 2022 | 8463/2F | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	$\lambda = \frac{330}{6600}$ $\lambda = 0.050$ m	 allow 0.05	1 1 1	AO2 AO2 AO1 4.5.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6	distance (travelled) = speed × time **or** $s = vt$	allow any correct rearrangement	1	AO2 4.5.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.7	$13.2 = 330 \times t$ $t = \frac{13.2}{330}$ $t = 0.04$ (s)	 allow 0.040 (s)	1 1 1	AO2 4.5.6.1.2

4.5.6.1.2 Speed

Answer 119 · Mark scheme

June 2022 | 8463/2F | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.8	loudspeaker **B** is further from the technician (than speaker **A**) so the sound would take more time to travel (to the technician) so the sound from each speaker arrives at the technician at the same time	'it' means speaker **B**	1 1 1	AO3 4.6.1.2

Total Question 7		16

4.5.6.1.2 Speed

Answer 120 · Mark scheme

June 2022 | 8463/2F | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	any **two** from: • capacity of the battery • speed • mass / weight • uphill / downhill • stopping at traffic lights • condition of the road • (air) temperature • (incorrect) tyre pressure • streamlining of the car	allow energy/charge stored in battery allow efficiency of battery ignore size of the battery allow terrain ignore 'the road' only ignore 'weather' only allow efficiency of engine allow anything that would use charge from the battery **or** anything that will reduce the energy stored	2	AO3 4.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	acceleration = change in velocity/time (taken) **or** $a = \frac{\Delta v}{t}$	allow any correct rearrangement allow $a = \frac{v - u}{t}$ do **not** accept $a = \frac{v}{t}$	1	AO1 4.5.6.1.5

4.5.6.1.2 Speed

Answer 120 · Mark scheme

June 2022 | 8463/2F | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	$20 = \frac{28}{t}$ $t = \frac{28}{20}$ 1.4 (s)		1 1 1	AO2 4.5.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	$v^2 - 0^2 = 2 \times 10 \times 605$ $v^2 = 12\,100$ $v = 110$ (m/s)		1 1 1	AO2 4.5.6.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	work done = force × distance **or** $W = Fs$	allow any correct rearrangement	1	AO1 4.5.2

4.5.6.1.2 Speed

Answer 120 · Mark scheme

June 2022 | 8463/2F | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.6	*s* = 7500 (m)		1	AO2 4.5.2
	W = 4000 × 7500	allow correct substitution using incorrectly / not converted value of s	1	
	W = 30 000 000 (J)	allow correct calculation using incorrectly / not converted value of s	1	

Total Question 8		**13**

4.5.6.1.2 Speed

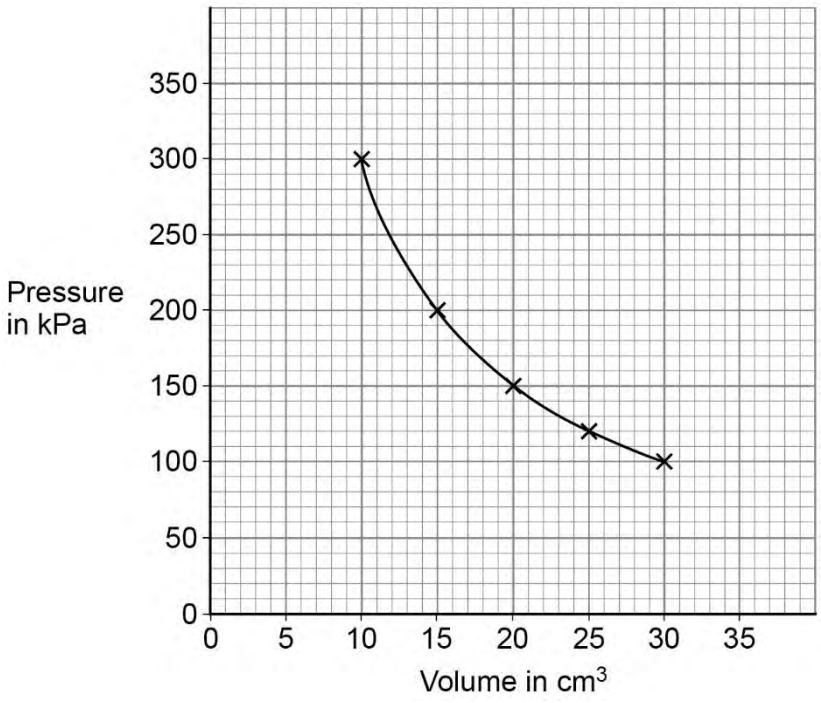
Answer 121 · Mark scheme

June 2023 | 8463/1F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	random directions		1	AO1 4.3.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	a range of speeds		1	AO1 4.3.3.1

Question	Answers	Mark	AO / Spec. Ref.
07.3	 2 marks for plotting 4 points correctly 1 mark for plotting 2 or 3 points correctly 1 mark for line of best fit	3	AO2 4.3.3.2

4.5.6.1.2 Speed

Answer 121 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	300 × 10 = constant constant = 3000	allow use of any correct pair of values	1 1	AO2 4.3.3.2

Question	Answers	Mark	AO / Spec. Ref.
07.5	<table><tr><th>Quantity</th><th>Decreases</th><th>Stays the same</th><th>Increases</th></tr><tr><td>Mean time between collisions of the particles with the tube</td><td></td><td></td><td>✓</td></tr><tr><td>Mean distance between the particles</td><td></td><td></td><td>✓</td></tr><tr><td>Mean speed of the particles</td><td></td><td>✓</td><td></td></tr></table> additional tick in a row negates the mark for that row	1 1 1	AO1 4.3.3.2

Total Question 7	10

4.5.6.1.2 Speed

Answer 122 · Mark scheme

June 2023 | 8463/2F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	kinetic thermal	this order only	1 1	AO1 4.5.6.3.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	(minimum braking) distance increases with increasing speed	allow positive correlation	1	AO2 4.5.6.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	increases		1	AO1 4.5.6.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	12.5 – 5.0 = 7.5 (m/s) $t = \frac{7.5}{0.25}$ t = 30 (s)	 this mark may be awarded if the change in velocity is incorrectly calculated allow a correctly calculated answer using a change in velocity incorrectly calculated	1 1 1	AO2 4.5.6.1.5

4.5.6.1.2 Speed

Answer 122 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	*F* = 1600 × 0.25 *F* = 400 (N)		1 1	AO2 4.5.6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	initial height of the ruler above the person's hand		1	AO3 4.5.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	there will be more variation in distances	allow reaction times for distances allow the three students tested are not typical	1	AO3 4.5.6.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	carry out the experiment listening to music then not listening to music (and compare the results)	 allow compare with original results	1 1	AO3 4.5.6.3.2

Total Question 2	**13**

4.5.6.1.2 Speed

Answer 123 · Mark scheme

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	the old model cannot explain new observations		1	AO1 4.8.1.1

Question	Answers	Mark	AO / Spec. Ref.
04.2	**Level 2:** Scientifically relevant features are identified; the way(s) in which they are similar / different is made clear and (where appropriate) the magnitude of the similarity / difference is noted.	3-4	AO1 AO3 4.8.1.1 4.8.1.3
	Level 1: Relevant features are identified and differences noted.	1-2	
	No relevant content.	0	
	Indicative content **Similarities** in both models: • the orbits of the Moon and / or planets are circular / elliptical • the Moon orbits the Earth • there is one star / Sun **Differences** In the current model: • the planets orbit the Sun, whereas in the old model the planets orbit the Earth • there are (two) more planets • there are also dwarf planets, whereas no dwarf planets are shown in the old model • other planets have moons, whereas other planets have no moons shown in the old model		

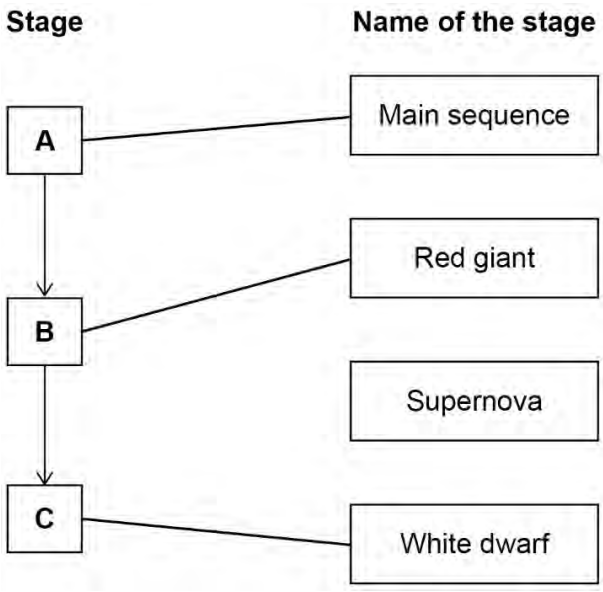
Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	it increases		1	AO3 4.8.1.1

4.5.6.1.2 Speed

Answer 123 · Mark scheme

June 2023 | 8463/2F | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	three bars drawn correctly three bars correctly labelled	allow tolerance of half a small square	1 1	AO2 4.8.1.1

Question	Answers	Mark	AO / Spec. Ref.
04.5	 2 marks for all lines correct 1 mark for 2 lines correct additional line from a box on the left negates the mark for that box	2	AO1 4.8.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	they are the best emitters of radiation		1	AO1 4.6.3.1

Total Question 4	11

4.5.6.1.2 Speed

Answer 124 · Mark scheme

June 2023 | 8463/2F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	wavelength = Q		1	AO1 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	amplitude = $\frac{R}{2}$		1	AO1 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	radio waves		1	AO1 4.6.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	s = 300 000 000 × 0.000009 s = 2700 (m)		1 1	AO2 4.5.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	satellite communications **or** cooking /heating food	allow WiFi	1	AO1 4.6.2.4

Total Question 5	**6**

4.5.6.1.2 Speed

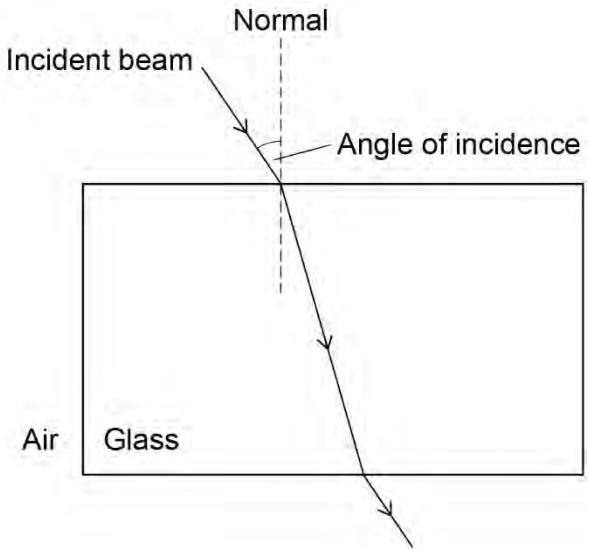
Answer 125 · Mark scheme

June 2023 | 8463/2F | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	it is harder to judge where the centre of the beam is		1	AO3 4.6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	ray shown refracted to the right of the normal as it enters the glass block refraction towards the normal emergent ray parallel to incident ray	 do **not** accept a continuation of the incident ray through the glass block ignore arrows	1 1 1	AO1 4.6.2.2



Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	1 degree		1	AO2 4.6.1.3

4.5.6.1.2 Speed

Answer 125 · Mark scheme

June 2023 | 8463/2F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	33 (°)		1	AO2 4.6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	absorbed		1	AO1 4.6.2.6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	wave speed = frequency × wavelength **or** $v = f\lambda$	allow correct re-arrangement	1	AO1 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.7	$3.0 \times 10^8 = 4.0 \times 10^{14} \times \lambda$ $\lambda = \frac{3.0 \times 10^8}{4.0 \times 10^{14}}$ $\lambda = 7.5 \times 10^{-7}$ (m)	 allow 0.000 000 75 (m)	1 1 1	AO2 4.6.1.2

Total Question 6	11

4.5.6.1.2 Speed

Answer 126 · Mark scheme

June 2023 | 8463/2F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	a satellite		1	AO1 4.8.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	arrow drawn towards the centre of the Earth from the Hubble Space Telescope		1	AO1 4.8.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	any correct change in distance with the correct change in time	e.g. 38 (km) and 5 (s)	1	AO2 4.5.6.1.4
	a correct substitution of a correct pair of values	e.g. $v = \frac{38}{5}$	1	
	a correctly calculated answer	e.g. v = 7.6 (km/s)	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	galaxy **C**		1	AO3 4.8.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	galaxy **C**		1	AO3 4.8.2

4.5.6.1.2 Speed

Answer 126 · Mark scheme

June 2023 | 8463/2F | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6	to check the observations are correct		1	AO1 4.8.2

Total Question 7	**8**

4.5.6.1.2 Speed

Answer 127 · Mark scheme

June 2023 | 8463/2F | Original Q10

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	7.1 (cm) 497 (m)	allow 7.0 to 7.3 (cm) allow 70 × their measurement of displacement	1 1	AO2 4.5.6.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.2	0 (N)		1	AO2 4.5.1.4

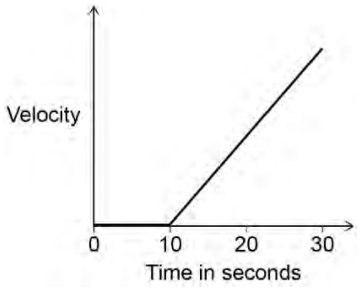
Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3	constant velocity	allow constant speed (in a straight line) do **not** accept stationary allow constant acceleration if a **mathematical error** in 02.2 gives a non-zero value for resultant force	1	AO1 4.5.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.4	any **one** from: • tension • normal contact (force) • upthrust	allow lift, thrust and water resistance allow normal reaction (force) ignore drag	1	AO1 4.5.1.2

4.5.6.1.2 Speed

Answer 127 · Mark scheme

June 2023 | 8463/2F | Original Q10

Question	Answers		Mark	AO / Spec. Ref.
10.5	horizontal line drawn to 10s along the *x*-axis		1	AO3 4.5.6.1.4
	line with a positive gradient starting from 10 s	allow an upward curving line with increasing gradient starting from 10 s  	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.6	line of best fit drawn and extrapolated to 10 km	do **not** accept a straight line	1	AO2 4.5.5.2
	28 (kPa)	allow 26 to 32 (kPa) allow a value correctly extrapolated from their line allow 2 marks for a correct mathematically extrapolated value	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.7	the average density of the air above the aeroplane decreases		1	AO3 4.5.5.2

Total Question 10	**10**

4.5.6.1.2 Speed

Answer 128 · Mark scheme

June 2024 | 8463/1F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	stretched length – original length		1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	$E_e = 0.5 \times 800 \times 7.5^2$ $E_e = 22\,500$ (J)		1 1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	kinetic energy = $0.5 \times 240 \times 15^2$ kinetic energy = 27 000 (J)		1 1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	$E_p = m \times g \times h$		1	AO1 4.1.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	$24\,000 = 240 \times 9.8 \times h$ $h = \frac{24\,000}{(240 \times 9.8)}$ $h = 10.2$ (m)	 allow 10 (m) allow a correct answer given to more than 3 s.f.	1 1 1	AO2 4.1.1.2

4.5.6.1.2 Speed

Answer 128 · Mark scheme

June 2024 | 8463/1F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	energy is transferred to the surroundings work is done against air resistance		1 1	AO1 4.1.2.1

Total Question 3	11

4.5.6.1.2 Speed

Answer 129 · Mark scheme

June 2024 | 8463/1F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	the volume decreased		1	AO1 4.3.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	the distance decreased		1	AO1 4.3.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	the frequency of collisions increased		1	AO1 4.3.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	the air pressure increased		1	AO1 4.3.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	the mean speed of the particles increases		1	AO1 4.3.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	$0.0130 = 2.60\times10^{-8} \times 1010 \times \Delta\theta$ $\Delta\theta = \dfrac{0.0130}{(2.60 \times 10^{-8} \times 1010)}$ $\Delta\theta = 495$ (°C)	 allow a correct answer given to more than 3 s.f.	1 1 1	AO2 4.1.1.3 4.3.2.2

Total Question 5	8

4.5.6.1.2 Speed

Answer 130 · Mark scheme

June 2024 | 8463/2F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec.
04.1	C		1	AO1 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec.
04.2	B		1	AO1 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec.
04.3	period = $\frac{1}{5000}$ period = 0.0002 (s)		1 1	AO2 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec.
04.4	any named electromagnetic wave	allow electromagnetic (wave)	1	AO1 4.6.2.1

Question	Answers	Extra information	Mark	AO / Spec.
04.5	F		1	AO1 4.6.1.1

Question	Answers	Extra information	Mark	AO / Spec.
04.6	wavelength = $\frac{330}{750}$ = 0.44 (m)		1 1	AO2 4.6.1.2

4.5.6.1.2 Speed

Answer 130 · Mark scheme

June 2024 | 8463/2F | Original Q4

Question	Answers	Mark	AO / Spec. Ref.
04.7	**Level 2:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	3–4	AO1 4.6.1.2
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content **method of making sound** eg cymbals, wooden blocks, starting pistol **measuring distance** • measuring distance between sound source and detector eg distance to wall, distance along track, distance between microphones • use of measuring instrument eg tape measure, trundle wheel, metre rule **measuring time** • timing started when sound made and timing stopped when sound heard • use of measuring instrument eg stopwatch, oscilloscope, data logger **extra detail** • dividing time by 2 or multiply distance by 2 for echo method • use of equation speed = $\frac{\text{distance}}{\text{time}}$		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.8	increases		1	AO3 4.6.1.2

Total Question 4	13

4.5.6.1.2 Speed

Answer 131 · Mark scheme

June 2024 | 8463/2F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	distance speed		1 1	AO1 4.5.6.1.1 4.5.6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	3200 (m)		1	AO2 4.5.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	average speed = $\frac{3200}{2000}$ = 1.6 (m/s)	allow ecf from question **05.2**	1 1	AO2 4.5.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	B It has the smallest gradient	MP2 is dependent on MP1	1 1	AO3 AO1 4.5.6.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	gravity		1	AO3 4.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	3.0 m/s		1	AO1 4.5.6.1.2

Total Question 5	**9**

4.5.6.1.2 Speed

Answer 132 · Mark scheme

June 2024 | 8463/2F | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	0 (N) the child isn't accelerating (vertically) **or** upwards forces are equal to the downwards forces	 MP2 dependent on MP1 allow forces are balanced	1 1	AO2 4.5.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	work done = force × distance **or** $W = F \times s$		1	AO1 4.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	$35 = F \times 2.8$ $F = \frac{35}{2.8}$ $F = 12.5$ (N)	 allow 13 (N)	1 1 1	AO2 4.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	the resistive force has decreased so the resultant force increases	allow friction (between the wheels and the floor) has decreased	1 1	AO3 4.5.1.4 4.5.6.2.1 4.5.6.2.2

4.5.6.1.2 Speed

Answer 132 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	moment = force × distance **or** $M = F \times d$		1	AO1 4.5.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.6	7.5 cm = 0.075 m $M = 2.0 \times 0.075$ $M = 0.15$ (Nm)	 allow a correct substitution of an incorrectly / not converted value of d allow an answer consistent with an incorrectly / not converted value of d	1 1 1	AO2 4.5.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.7	gear B rotates in the opposite direction (to gear A) **or** gear B rotates clockwise **or** gear B rotates faster than gear A (because) gear A exerts a force on gear B **or** (because) gear A causes a moment about the pivot of gear B		1 1	AO2 4.5.4

Total Question 9	**14**

4.5.6.1.2 Speed

Answer 133 · Mark scheme

June 2025 | 8463/1F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	the speed increased		1	AO1 4.3.3.1

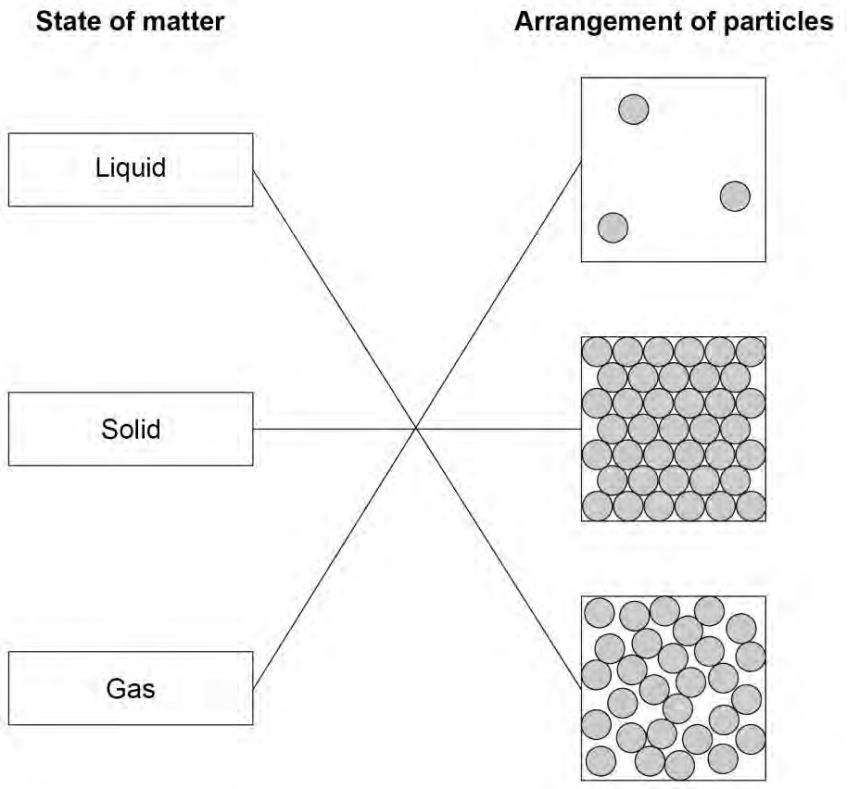
Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	the kinetic energy increased		1	AO1 4.3.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	the number of collisions each second increased		1	AO1 4.3.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	the force exerted increased		1	AO1 4.3.3.1

4.5.6.1.2 Speed

Answer 133 · Mark scheme

Question	Answers	Mark	AO / Spec. Ref.
04.5	 do **not** accept more than one line from a box on the left allow **1** mark for 1 or 2 correct lines	2	AO1 4.3.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	liquid		1	AO3 4.3.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	solid		1	AO3 4.3.1.2

4.5.6.1.2 Speed

Answer 133 · Mark scheme

<table>
<tr><th>Question</th><th>Answers</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td>04.8</td><td>
<table>
<tr><th></th><th>Decreases</th><th>Stays the same</th><th>Increases</th></tr>
<tr><td>Kinetic energy of particles</td><td></td><td>✓</td><td></td></tr>
<tr><td>Potential energy of particles</td><td></td><td></td><td>✓</td></tr>
</table>
do not accept more than one tick in each row
</td><td>1
1</td><td>AO1
4.3.2.1</td></tr>
<tr><td colspan="2">Total Question 4</td><td>10</td><td></td></tr>
</table>

4.5.6.1.2 Speed

Answer 134 · Mark scheme

June 2025 | 8463/1F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	current = $\frac{6.0}{12}$ current = 0.50 (A)		1 1	AO2 4.2.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	energy transferred = 6.0 × 8.0 energy transferred = 48 (J)		1 1	AO2 4.2.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	efficiency = $\frac{\text{useful output energy transfer}}{\text{total input energy transfer}}$		1	AO1 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	$0.70 = \frac{1.96}{\text{total input energy transfer}}$ total input energy transfer = $\frac{1.96}{0.70}$ total input energy transfer = 2.8 (J)		1 1 1	AO2 4.1.2.2

4.5.6.1.2 Speed

Answer 134 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	0.74 to 0.78 inclusive		1	AO2 4.1.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6	the line is curved **or** the line does not pass through the origin	allow the line is not straight allow the line is not linear	1	AO2 4.1.2.2

Total Question 7	**10**

4.5.6.1.2 Speed

Answer 135 · Mark scheme

June 2025 | 8463/1F | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	renewable: (an energy resource that is) replenished *(*as it is used*)* non-renewable: (an energy resource that is) finite	allow replaced for replenished ignore has an infinite supply ignore not running out allow limited supply ignore running out ignore won't last forever	1 1	AO1 4.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	density = $\frac{\text{mass}}{\text{volume}}$ **or** $\rho = \frac{m}{V}$		1	AO1 4.3.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	$1030 = \frac{824\,000}{V}$ $V = \frac{824\,000}{1030}$ $V = 800\ (m^3)$		1 1 1	AO2 4.3.1.1

4.5.6.1.2 Speed

Answer 135 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	any **two** from: • at very low flow speeds there is no power output • tidal power output is (always) greater than wind power output for the same flow speeds (above 0.25 m/s) • a change in flow speed makes a bigger difference to tidal power output than wind power output • there is a non-linear relationship between flow speed and power output	allow wind power needs a higher flow speed to get the same power output (as tidal power) ignore reference to exponential relationships do **not** accept flow speed of tidal is less than flow speed of wind ignore comments about reliability or efficiency	2	AO3 4.1.3

4.5.6.1.2 Speed

Answer 135 · Mark scheme

Question	Answers	Mark	AO / Spec. Ref.
08.5	**Level 2:** Relevant points (reasons / causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO3 4.1.3
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content • wind turbine is much larger than the tidal turbine • wind turbine causes more visual pollution than the tidal turbine • tidal turbine is hidden from view (as it is under water) • tidal turbine is less likely to cause noise pollution (as it is under water) • wind turbine is likely to make more noise • wind turbine needs more raw materials (for construction) • more wind turbines needed for same power output (at the same flow speed) • wind turbine will harm birds, whereas tidal turbine will not • tidal turbine may harm fish, whereas wind turbine will not		

Total Question 8	12

4.5.6.1.2 Speed

Answer 136 · Mark scheme

June 2025 | 8463/2F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	protractor		1	AO1 4.6.1.3 RPA9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	angle **B** in degrees / ° on y-axis		1	AO2 4.6.1.3 RPA9
	all points correctly plotted	allow a tolerance of $\pm \frac{1}{2}$ small square allow **1** mark for 3 plotted correctly	2	
	straight line of best fit drawn	allow a line of best fit from their plotted points	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	angle **A** is directly proportional to angle **B**		1	AO3 4.6.1.3 RPA9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	A		1	AO1 4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	D		1	AO1 4.6.1.2

4.5.6.1.2 Speed

Answer 136 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	$\lambda = \frac{0.125}{2.5}$		1	AO2
	0.050		1	AO2
	m	allow 5.0 cm	1	AO1
				4.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	$T = \frac{1}{2.5}$		1	AO2 4.6.1.2
	0.40 (s)	allow 0.4 (s)	1	

Total Question 1	13

4.5.6.1.2 Speed

Answer 137 · Mark scheme

June 2025 | 8463/2F | Original Q2

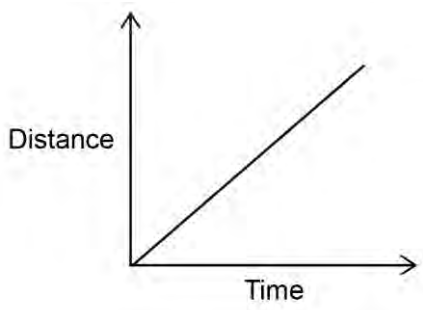
Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	$W = 75\,000 \times 9.8$ 735 000 (N)		1 1	AO2 4.5.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	$W = 850\,000 \times 80$ 68 000 000 (J)		1 1	AO2 4.5.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	$4 \times 850\,000$ 3 400 000 (N)		1 1	AO1 4.5.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	frictional force		1	AO1 4.5.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5			1	AO1 4.5.6.1.4

4.5.6.1.2 Speed

Answer 137 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	25 – 16 = 9 (m/s) $a = \frac{9}{150}$ 0.06 (m/s^2)	subsequent marks may be awarded if an incorrectly calculated change in velocity is used	1 1 1	AO2 4.5.6.1.5

Total Question 2	**11**

4.5.6.1.2 Speed

Answer 138 · Mark scheme

June 2025 | 8463/2F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	moon star	this order only	1 1	AO1 4.8.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	Milky Way		1	AO1 4.8.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	it will become a black dwarf		1	AO1 4.8.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	a very distant galaxy moves faster		1	AO1 4.8.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	red-shift		1	AO1 4.8.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	hot		1	AO1 4.8.2

4.5.6.1.2 Speed

Answer 138 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	the universe is getting bigger		1	AO1 4.8.2

Total Question 3	**8**

4.5.6.1.2 Speed

Answer 139 · Mark scheme

June 2025 | 8463/2F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	car **X** has a smaller maximum acceleration		1	AO3 4.5.6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	$F = 900 \times 2.5$ 2250 (N)	 allow 2300 (N)	1 1	AO2 4.5.6.2.2

Question	Answers	Mark	AO / Spec. Ref.
04.3	**Level 2:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	3–4	AO2 AO3 4.5.1.4 4.5.6.1.5 4.5.6.2.1 4.5.6.2.2
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content • driving force increases • driving force has a maximum value • driving force is greater than air resistance • there is a resultant forward force • air resistance increases (as speed increases) • resultant force decreases • air resistance becomes equal to the driving force (at maximum speed) • resultant force is zero For **Level 2** answers must include how both driving force and air resistance change.		

4.5.6.1.2 Speed

Answer 139 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	time		1	AO1 4.5.6.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	force		1	AO1 4.5.6.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	(thinking distance =) 20 **and** (braking distance =) 60	subsequent marks may be awarded if incorrect reading(s) are taken from the graph	1	AO2 4.5.6.3.1
	stopping distance = 20 + 60		1	
	80 (m)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	the driver becoming tired		1	AO1 4.5.6.3.2 4.5.6.3.3
	driving on a wet road		1	

Total Question 4	**14**

4.5.6.1.2 Speed

Answer 140 · Mark scheme

June 2025 | 8463/2F | Original Q8

Question 8

Question	Answers	Mark	AO / Spec. Ref.
08.1	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account	4–6	AO1 4.6.1.1 4.6.2.1
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear	1–3	
	No relevant content	0	
	Indicative content **Differences** • sound waves are mechanical whereas visible light waves are electromagnetic waves • sound waves require a medium to travel through whereas visible light waves can travel through a vacuum • sound waves are longitudinal whereas visible light waves are transverse • sound waves travel slower (in air) than visible light waves • sound waves travel faster in solids than in air whereas visible light waves travel slower in solids than in air • sound waves have longer wavelengths than visible light • sound waves have a lower frequency than visible light waves **Similarities** • both types of waves can be reflected • both types of waves can be refracted • both types of waves can be diffracted • both types of wave transfer energy		

4.5.6.1.2 Speed

Answer 140 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	speed = $\frac{\text{distance}}{\text{time}}$		1	AO1 4.5.6.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	$330 = \frac{13\,200}{t}$ **or** $13\,200 = 330 \times t$ $t = \frac{13\,200}{330}$ 40 (s)		1 1 1	AO2 4.5.6.1.2

Total Question 8	10

4.5.6.1.2 Speed

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme June 2003

GCSE

Physics

3451

Foundation

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Kathleen Tattersall: *Director General*

4.5.6.1.2 Speed

INFORMATION FOR EXAMINERS

1. General

The mark scheme for each question shows:

- the marks available for each part of the question;
- the total marks available for the question;
- the typical answer or answers which are expected;
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:
where consequential marking needs to be considered in a calculation;
or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; e.g. allow smooth / free movement.)

3. Marking points

3.1 Marking of Quality of Written Communication

Examiners are reminded of the need to assess QoWC by the following statement appearing in the appropriate parts of the mark scheme:

The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.

The maximum marks available to a candidate whose answer is not well expressed will be (the number of marks available –1).

3.2 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.3 Use of chemical symbols/formulae

If a candidate writes a chemical symbol/formula instead of a required chemical name, full credit can be given if the symbol/formula is correct and if, in the context of the question, such action is appropriate.

3.4 The marking of quantitative relationships

Full credit can be given for a correct quantitative relationship expressed in:

- named units;
- physical quantities;
- standard symbols;
- a combination of physical quantities and units.

No credit can be given for any quantitative relationship expressed in terms of:

- a combination of physical quantities, units and symbols;
- a diagram, e.g. the ohm's law triangle, unless the rest of the answer shows clearly that the candidate understands the relationships involved.

3.5 Marking procedure for calculations

3.5.1 Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown. However, if the answer is incorrect, mark(s) can be gained by correct substitution/working and this is shown in the 'extra information' column.

4.5.6.1.2 Speed

3.5.2 Where calculations are based on incorrectly recalled relationships, neither the incorrectly recalled relationship, nor the resulting calculation based on the incorrect relationship, will be credited.

3.6 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.7 Errors carried forward

There should be no error carried forward from a previous answer which has been based on wrong science. Any error in the answers to a structured question should be penalised once only.

Examples

(a) A candidate who calculates average speed using speed = time/distance **and** then proceeds to use this incorrect answer to calculate an acceleration based on the correct quantitative relationship should be given credit for the use of the correct acceleration relationship but none for either numerical answer.

(b) A candidate who incorrectly calculates average speed using speed = distance/time and then proceeds to use this incorrect value to calculate an acceleration based on the correct quantitative relationship, should be given credit for the use of both correct quantitative relationships **and** for the correct substitution and use of the incorrect value in the calculation of the rate of acceleration.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.8 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.9 Brackets

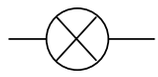
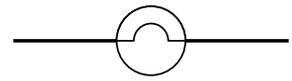
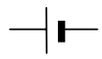
(…..) is used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.10 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

4.5.6.1.2 Speed

3451/F Q1

question	answers	extra information	mark
(a)	circuit symbol for a lamp correct 	accept  accept any standard of drawing providing circuit would work	1
	 circuit symbol for a cell correct		1
	2 lamps drawn in parallel with 3 cells	polarity of cells must be correct (+ to –) but cells may be either way around	1
(b)	4.5		1
(c)	the same as	accept any clear indication of the correct answer	1
total			5

4.5.6.1.2 Speed

3451/F Q2

question	answers	extra information	mark
(a)	gas		1
(b)	fuel burning stations produce electricity at any time / all the time	accept fuel available all the time	1
	wind generator can only produce when the wind is strong enough	accept it's not always windy	1
(c)	no fuel is burnt **or** no fuel is used **or** uses only energy from wind **or** does not emit harmful gases / soot / smoke	do **not** accept wind is natural / environmentally friendly / renewable answer must be in terms of wind, **not** negative of fuel burning specific examples of gases CO_2, SO_2, acid rain and greenhouse gases can be accepted ozone negates credit	1
total			4

4.5.6.1.2 Speed

3451/F Q3

question	answers	extra information	mark
(a)(i)	microwaves		1
(ii)	infra red		1
(iii)	ultrasonic		1
(b)(i)	B		1
(ii)	A		1
(c)	disturbance / vibration / movement	accept motion / force do **not** accept energy	1
	direction		1
(d)	sound wave	accept any clear indication of the correct answer	1
total			8

4.5.6.1.2 Speed

3451/F Q4

question	answers	extra information	mark
(a)(i)	heat		1
(ii)	temperature increases **or** (cause) convection (currents)	accept gets warmer accept gets hotter	1
(iii)	60% **or** 0.6	60 without % scores **1** mark 0.6 with a unit scores **1** mark 60 with incorrect unit scores **1** mark **or** correct substitution $\frac{120}{200}$ for **1** mark	2
(b)	street more (energy transferred as) light **or** less (energy transferred as) heat **or** useful energy output the highest	 can only score this mark if first mark scored all efficiencies calculated correctly score 2nd mark point	1 1
total			6

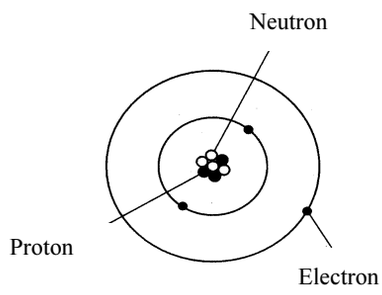
4.5.6.1.2 Speed

3451/F Q5

question	answers	extra information	mark
(a)	MN	accept 5.8, 8 seconds must include unit	1
(b)	LM	accept 0.8, 5.8 seconds must include unit	1
(c)(i)	0.8		1
(ii)	drinking alcohol		1
(d)	straight (by eye) line starting at 0.8 seconds line drawn steeper than LM starting before L	 ignore lines going beyond 2 seconds but line must exceed 2.5 metres per second before terminating	1 1
total			6

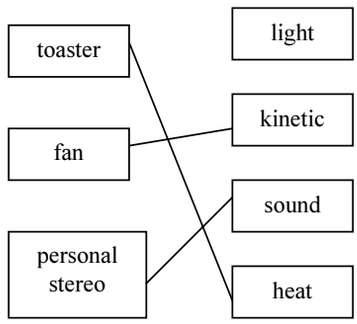
4.5.6.1.2 Speed

3451/F Q6

question	answers	extra information	mark
(a)(i)	each correct label scores 1 mark  		3
(ii)	neutron		1
(iii)	7 number of protons and neutrons **or** number of nucleons **or** number of particles in the nucleus	 accept number of particles in the centre only if first answer = 7	1 1
(b)(i)	50 ± 5		1
(ii)	50 ± 5	accept their (b)(i)	1
(iii)	less	accept any way of indicating the correct answer	1
total			9

4.5.6.1.2 Speed

3451/F Q7

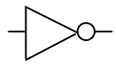
question	answers	extra information	mark
(a)	each correct line scores 1 mark  	if more than 3 lines are drawn mark incorrect ones first, to a maximum of 3 lines	3
(b)	toaster	accept 1.2 kW	1
(c)(i)	400		1
(ii)	£24 **or** 2400p	full credit for their (c)(i) × 6p for full credit the correct numerical answer must have the correct unit an answer of 24 or 2400 with no unit or the incorrect unit scores **1** mark (c)(i) × 6 incorrectly evaluated scores **1** mark	2
(d)	6	allow 6000 for **1** mark allow 3 × 2 for **1** mark	2
total			9

3451/F Q8

question	answers	extra information	mark
(a)(i)	point where the rays cross	do not credit if ambiguous	1
(ii)	converging (lens)	do **not** accept convex	1
(b)(i)	point where the rays appear to diverge from	this should appear to be within 10mm in front of the back of the arrows on the approximate centre line need not be accurately constructed using a ruler	1
(ii)	diverging (lens)	do **not** accept concave	1
(c)	converging film smaller than nearer to	accept any clear indication of the correct response e.g. ticking, ringing, writing in after a mistake	1 1 1 1
(d)(i)	(image) bigger than object / enlarge	accept just 'made bigger'	1
(ii)	it / real image can be put on a screen **or** real image on the opposite side of the lens to the object	accept 'not an imaginary or virtual image' assume 'it' refers to a real image do **not** credit 'it can be seen'	1
(e)	**either** (the converging lens is) thick in the middle thin(ner) at the edge **or** (both) sides bend outwards (1) in the middle (1) **or** one side bends in the middle (1) more than the other side bends inwards (in the middle) (1)	thickest in the middle gains **2** marks convex gains **2** marks suitable diagrams gains **2** marks	1 1
total			12

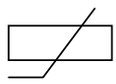
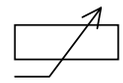
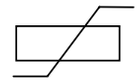
4.5.6.1.2 Speed

3451/F Q9

question	answers	extra information	mark
(a)(i)	off off on	all correct	1
(ii)	AND (gate)	accept and (gate)	1
(iii)	on on on	all correct	1
(iv)	OR (gate)	accept or (gate)	1
(b)(i)	1 0 **or** 0 1 0 1 1 0	do **not** credit on / off responses	1
(ii)		accept mirror image accept  accept with either or both parts shaded accept line through as shading	1
(c)		accept off for 0 and on for 1 throughout	
	0 0	both correct	1
	0 1	both correct	1
	1 1	both correct	1
	1 1	both correct	1

4.5.6.1.2 Speed

3451/F Q9 continued

(d)(i)		accept mirror image **or** inverted do **not** credit  **or**  or similar	1
(ii)	resistance decreases / increases / changes current (through it) increases / decreases / changes **or** temperature changes / increases / decreases (1) resistance changes / decreases / increases (1) (NTC thermistor) both marks independent but must be compatible to score **2** marks accept 'voltage across it decreases' for **2** marks but only if it is made clear that this refers to a thermistor in series		1 1
total			13

4.5.6.1.2 Speed

3451/F Q10

question	answers	extra information	mark
(a)(i)	friction	accept any way of indicating the correct answer	1
(ii)	gravity	accept any way of indicating the correct answer	1
(b)(i)	accelerates **or** speed / velocity increases	accept faster and faster (**1** mark) do **not** accept faster pace / falls faster or suggestions of a greater but constant speed	1
	downwards / falls	accept towards the Earth / ground this may score in part (b)(ii) if it does not score here and there is no contradiction between the two parts	1
(ii)	constant speed / velocity **or** terminal velocity / speed **or** zero acceleration	stays in the same place negates credit	1
total			5

4.5.6.1.2 Speed

3451/F Q11

question	answers	extra information	mark
(a)(i)	X – mantle		1
	Y – inner core	do **not** accept solid core	1
(ii)	different to the crust **or** contains a lot of (heavy) metals	accept iron and nickel for metals	1
	higher (average) density **or** denser	density higher than 5500 (kg/m^3) gets **2** marks	1
(b)	animals were able to move from one continent to the other		1
	(when bridge broke) animals evolved differently	accept animals adapted differently	1
(c)(i)	earthquakes occur at the boundary between plates **or** earthquakes occur where plates push against each other		1
	there are no plate boundaries running through Britain	accept Britain is not near the edge of a plate	1
(ii)	convection currents (in the mantle) **or** heat released by (natural) radioactive processes		1
total			9

4.5.6.1.2 Speed

3451/F Q12

question	answers	extra information	mark
(a)(i)	outside the Earth **or** not from the Earth	accept alien accept life from / on another planet / space accept our planet for Earth	1
(ii)	radio telescope(s)	do **not** accept telescopes do **not** accept satellite dishes do **not** accept radio receivers **or** transmitters	1
(b)(i)	galaxies	do **not** accept stars	1
(ii)	any **one** from: the pulses were regular pulses from space are usually random (scientists) thought technology had been used to produce the pulses neutron stars were unknown signals from a single point	 accept signals / beats for pulses accept noise for random pulses idea of regular but not continuous	1
(iii)	neutron star is (the matter / mass) left behind after a star / red giant explodes (as a super nova)	 accept after a super nova (explosion) neutron star causing super nova gets no credit	1 1
(c)(i)	carried on the balloon / equipment	accept carried by a rocket / aircraft / satellite birds negates credit	1
(ii)	on comets or meteors	accept meteorites / shooting stars accept returning space craft accept solar wind ignore asteroids accept ufo do **not** accept solar flares do **not** accept satellites	1
total			8

4.5.6.1.2 Speed

3451/F Q13

question	answers	extra information	mark
(a)	silver is a (good) reflector of <u>heat</u> (radiation) **or** silver reflects the heat (radiation)	fact heat = infra red ignore references to light accept shiny for silver good radiator negates the mark ignore references to good conductor do **not** accept bounce back	1
	less heat is lost through the board **or** more heat is retained by the shirt	explanation accept both sides of shirt heated reflects heat back up gets **1** mark only ignore mention of friction	1
(b)	metal soleplate	accept soleplate / bottom / metal do **not** accept outside / case	1
(c)	plastic **or** rubber	accept any named plastic do **not** accept wood	1
	it is a (good) insulator **or** it is a poor conductor	ignore mention of heat if in conjunction with electricity	1
(d)	**Quality of written communication** *The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.*	*Maximum of **2** marks if ideas not well expressed.*	
	pulls iron bolt down **or** attracts the iron bolt **or** moves bolt out of plunger	answers in terms of charges attracting or repelling gain no credit	1
	plunger pushed / moved to the right (by spring) **or** plunger released		1
	push switch opens / goes to off / goes to right	accept circuit is broken for maximum credit the points must follow a logical sequence 3 correct points but incorrect sequence scores **2** marks only ignore reset action	1
total			8

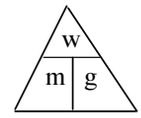
4.5.6.1.2 Speed

3451/F Q14

question	answers	extra information	mark
(a)(i)	any **one** from: the ground the air radon (gas) building materials buildings rocks / granite food cosmic rays **or** solar rays X-rays nuclear weapons testing nuclear power stations / accidents	 do **not** accept mobile phones accept from outer space accept sun but **not** sunlight accept medical uses	1
(ii)	2	allow $\frac{1200}{60\times10}$ **or** $\frac{1200}{600}$ **or** 120 for **1** mark	2
(b)	 alpha: the count rate is (greatly) reduced by the card **or** the card absorbs alphas but not betas beta: the count rate is (greatly) reduced by the metal **or** the thin metal absorbs alphas and betas **or** the thin metal absorbs all of the radiation (from the source) gamma: would pass through the thin metal but count rate is background **or** no radiation passing through **or** a higher reading would be recorded **or** to reduce the count to 2 would require much more than 3 mm of metal	answers must be comparative accept converse answers throughout accept paper for the card accept aluminium for the metal accept aluminium for the metal accept lead / aluminium for the metal	 1 1 1
total			6

4.5.6.1.2 Speed

3451/F Q15

question	answers	extra information	mark
(a)(i)	weight = mass × g.f.s.	accept w = m × g accept gravity for gfs accept  provided subsequent use of Δ correct do **not** accept N = kg × N/kg	1
(ii)	675	75 × 9 for **1** mark	2
(iii)	g.(f.s.) is higher (on Earth than Venus)	accept gravity for g.f.s. do **not** accept g.f.s. is lower unless answer states on Venus	1
(iv)	orbit time for Jupiter is <u>longer</u> / longest (than for the other planets)	do **not** give any credit for an answer that includes a comparison of diameter **or** a comparison of g.f.s.	1
(b)	**Quality of written communication** *The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.* any **two** from: dust <u>and</u> gas **or** remnants of a super nova pulled together by (force of) <u>gravity</u> nuclear fusion starts	*Maximum of **1** mark if ideas not well expressed.* accept hydrogen for dust and gas do **not** accept hydrogen burns although candidates may include more detail these points are essential to score the credit	2
total			7

4.5.6.1.2 Speed

3451/F Q16

question	answers	extra information	mark
(a)(i)	upright with the contacts at the bottom and still in place and unbent	no need for labels but incorrect label(s) cancel the mark accept a freehand drawing no need for details such as correct dimensions	1
	one blob of mercury touching <u>both</u> contacts	do **not** award mark if contacts bent to touch	1
(b)(i)	(X is a) battery	do **not** credit cell accept (set of) cells accept power supply do **not** accept power pack	1
	(Y is a) LED	**or** light emitting diode	1
(ii)	longer (time)	do **not** accept 'slower time'	1
(iii)	any **two** from:		2
	current less	do **not** accept current slower	
	(so) rate of flow of charge less **or** less coulombs per second		
	(so) discharge is slower	accept capacitor has charge for longer **or** charge lasts longer **or** (so total of) electrons take longer to travel round circuit	
(c)	4200	translation correct (= 4000) but percentage addition incorrect gains **1** mark translation incorrect but 5% addition is correct gains **1** mark accept 422.1 **or** 42.2 **or** 6.3 for **1** mark	2
	ohms **or** Ω	4.2 kilohms **or** 4.2 kΩ gains all **3** marks	1
total			10

4.5.6.1.2 Speed

3451/F Q17

question	answers	extra information	mark
(a)	point at which its mass (seems to) act **or** point at which gravity (seems to) act	accept …its weight acts accept correct statements if the intent is clear e.g. … if suspended, the centre of gravity will be directly under the point of suspension e.g. … (if the object is symmetrical), the centre of gravity is on the **or** an axis (of symmetry) do **not** credit just 'it is a point'	1
(b)	**Quality of written communication** *The answer to this question requires good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.* any **five** from: clamp (steel) rod (horizontally) hang plastic / sheet by rod through (one) hole hang plumb line from rod mark ends of plumb line on the sheet and use the ruler to draw a straight line repeat with other hole centre of mass is where the lines cross check by balancing at this point	*maximum of **4** marks if ideas not well expressed* **no** marks if method quite unworkable maximum of **3** marks if no 'repeat with other hole'	5
(c)(i)	(turning) effect **or** moment force distance	all three correct accept weight accept length	1
(ii)	17.6 Nm **or** newton metre(s)	allow 44 × 0.4 **or** 0.4 × 44 for **1** mark do **not** accept N/m **or** N/cm 1760 Ncm gains all **3** marks	2 1
total			10

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme June 2003

GCSE

Science: Double Award Co-ordinated

3462

Paper 3F

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Kathleen Tattersall: *Director General*

4.5.6.1.2 Speed

INFORMATION FOR EXAMINERS

1. General

The mark scheme for each question shows:

- the marks available for each part of the question;
- the total marks available for the question;
- the typical answer or answers which are expected;
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:
where consequential marking needs to be considered in a calculation;
or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; e.g. allow smooth / free movement.)

3. Marking points

3.1 Marking of Quality of Written Communication

Examiners are reminded of the need to assess QoWC by the following statement appearing in the appropriate parts of the mark scheme:

The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.

The maximum marks available to a candidate whose answer is not well expressed will be (the number of marks available –1).

3.2 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.3 Use of chemical symbols/formulae

If a candidate writes a chemical symbol/formula instead of a required chemical name, full credit can be given if the symbol/formula is correct and if, in the context of the question, such action is appropriate.

3.4 The marking of quantitative relationships

Full credit can be given for a correct quantitative relationship expressed in:

- named units;
- physical quantities;
- standard symbols;
- a combination of physical quantities and units.

No credit can be given for any quantitative relationship expressed in terms of:

- a combination of physical quantities, units and symbols;
- a diagram, e.g. the ohm's law triangle, unless the rest of the answer shows clearly that the candidate understands the relationships involved.

3.5 Marking procedure for calculations

3.5.1 Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown. However, if the answer is incorrect, mark(s) can be gained by correct substitution/working and this is shown in the 'extra information' column.

4.5.6.1.2 Speed

3.5.2 Where calculations are based on incorrectly recalled relationships, neither the incorrectly recalled relationship, nor the resulting calculation based on the incorrect relationship, will be credited.

3.6 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.7 Errors carried forward

There should be no error carried forward from a previous answer which has been based on wrong science. Any error in the answers to a structured question should be penalised once only.

Examples

(a) A candidate who calculates average speed using speed = time/distance **and** then proceeds to use this incorrect answer to calculate an acceleration based on the correct quantitative relationship should be given credit for the use of the correct acceleration relationship but none for either numerical answer.

(b) A candidate who incorrectly calculates average speed using speed = distance/time and then proceeds to use this incorrect value to calculate an acceleration based on the correct quantitative relationship, should be given credit for the use of both correct quantitative relationships **and** for the correct substitution and use of the incorrect value in the calculation of the rate of acceleration.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.8 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.9 Brackets

(…..) is used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

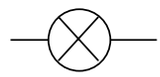
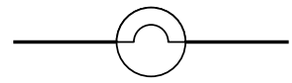
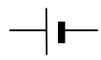
3.10 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

4.5.6.1.2 Speed

Double Award
Foundation Tier 3462/3F

3462/3F Q1

question	answers	extra information	mark
(a)	circuit symbol for a lamp correct 	accept  accept any standard of drawing providing circuit would work	1
	circuit symbol for a cell correct 		1
	2 lamps drawn in parallel with 3 cells	polarity of cells must be correct (+ to –) but cells may be either way around	1
(b)	4.5		1
(c)	the same as	accept any clear indication of the correct answer	1
total			5

4.5.6.1.2 Speed

3462/3F Q2

question	answers	extra information	mark
(a)	gas		1
(b)	fuel burning stations produce electricity at any time / all the time	accept fuel available all the time	1
	wind generator can only produce when the wind is strong enough	accept it's not always windy	1
(c)	no fuel is burnt **or** no fuel is used **or** uses only energy from wind **or** does not emit harmful gases / soot / smoke	do **not** accept wind is natural / environmentally friendly / renewable answer must be in terms of wind, **not** negative of fuel burning specific examples of gases CO_2, SO_2, acid rain and greenhouse gases can be accepted ozone negates credit	1
total			4

4.5.6.1.2 Speed

3462/3F Q3

question	answers	extra information	mark
(a)(i)	microwaves		1
(ii)	infra red		1
(iii)	ultrasonic		1
(b)(i)	B		1
(ii)	A		1
(c)	disturbance / vibration / movement direction	accept motion / force do **not** accept energy	1 1
(d)	sound wave	accept any clear indication of the correct answer	1
total			8

4.5.6.1.2 Speed

3462/3F Q4

question	answers	extra information	mark
(a)(i)	heat		1
(ii)	temperature increases **or** (cause) convection (currents)	accept gets warmer accept gets hotter	1
(iii)	60% **or** 0.6	60 without % scores **1** mark 0.6 with a unit scores **1** mark 60 with incorrect unit scores **1** mark **or** correct substitution $\frac{120}{200}$ for **1** mark	2
(b)	street more (energy transferred as) light **or** less (energy transferred as) heat **or** useful energy output the highest	 can only score this mark if first mark scored all efficiencies calculated correctly score 2nd mark point	1 1
total			6

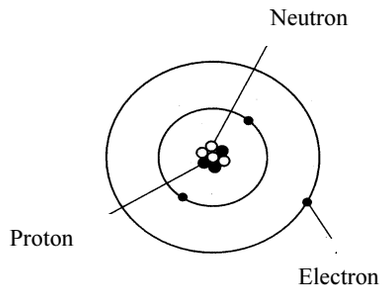
4.5.6.1.2 Speed

3462/3F Q5

question	answers	extra information	mark
(a)	MN	accept 5.8, 8 seconds must include unit	1
(b)	LM	accept 0.8, 5.8 seconds must include unit	1
(c)(i)	0.8		1
(ii)	drinking alcohol		1
(d)	straight (by eye) line starting at 0.8 seconds line drawn steeper than LM starting before L	 ignore lines going beyond 2 seconds but line must exceed 2.5 metres per second before terminating	1 1
total			6

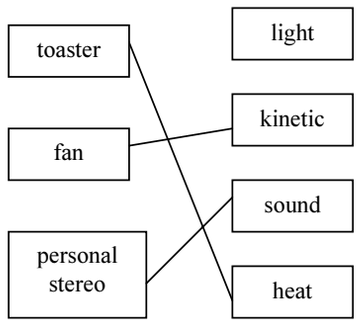
4.5.6.1.2 Speed

3462/3F Q6

question	answers	extra information	mark
(a)(i)	each correct label scores 1 mark  		3
(ii)	neutron		1
(iii)	7 number of protons and neutrons **or** number of nucleons **or** number of particles in the nucleus	 accept number of particles in the centre only if first answer = 7	1 1
(b)(i)	50 ± 5		1
(ii)	50 ± 5	accept their (b)(i)	1
(iii)	less	accept any way of indicating the correct answer	1
total			9

4.5.6.1.2 Speed

3462/3F Q7

question	answers	extra information	mark
(a)	each correct line scores 1 mark  	if more than 3 lines are drawn mark incorrect ones first, to a maximum of 3 lines	3
(b)	toaster	accept 1.2 kW	1
(c)(i)	400		1
(ii)	£24 **or** 2400p	full credit for their (c)(i) × 6p for full credit the correct numerical answer must have the correct unit an answer of 24 or 2400 with no unit or the incorrect unit scores **1** mark (c)(i) × 6 incorrectly evaluated scores **1** mark	2
(d)	6	allow 6000 for **1** mark allow 3 × 2 for **1** mark	2
total			9

4.5.6.1.2 Speed

3462/3F Q8

question	answers	extra information	mark
(a)(i)	friction	accept any way of indicating the correct answer	1
(ii)	gravity	accept any way of indicating the correct answer	1
(b)(i)	accelerates **or** speed / velocity increases	accept faster and faster (**1** mark) do **not** accept faster pace / falls faster or suggestions of a greater but constant speed	1
	downwards / falls	accept towards the Earth / ground this may score in part (b)(ii) if it does not score here and there is no contradiction between the two parts	1
(ii)	constant speed / velocity **or** terminal velocity / speed **or** zero acceleration	stays in the same place negates credit	1
total			5

4.5.6.1.2 Speed

3462/3F Q9

question	answers	extra information	mark
(a)(i)	X – mantle		1
	Y – inner core	do **not** accept solid core	1
(ii)	different to the crust **or** contains a lot of (heavy) metals	accept iron and nickel for metals	1
	higher (average) density **or** denser	density higher than 5500 (kg/m^3) gets **2** marks	1
(b)	animals were able to move from one continent to the other		1
	(when bridge broke) animals evolved differently	accept animals adapted differently	1
(c)(i)	earthquakes occur at the boundary between plates **or** earthquakes occur where plates push against each other		1
	there are no plate boundaries running through Britain	accept Britain is not near the edge of a plate	1
(ii)	convection currents (in the mantle) **or** heat released by (natural) radioactive processes		1
total			9

4.5.6.1.2 Speed

3462/3F Q10

question	answers	extra information	mark
(a)(i)	outside the Earth **or** not from the Earth	accept alien accept life from / on another planet / space accept our planet for Earth	1
(ii)	radio telescope(s)	do **not** accept telescopes do **not** accept satellite dishes do **not** accept radio receivers **or** transmitters	1
(b)(i)	galaxies	do **not** accept stars	1
(ii)	any **one** from: the pulses were regular pulses from space are usually random (scientists) thought technology had been used to produce the pulses neutron stars were unknown signals from a single point	 accept signals / beats for pulses accept noise for random pulses idea of regular but not continuous	1
(iii)	neutron star is (the matter / mass) left behind after a star / red giant explodes (as a super nova)	 accept after a super nova (explosion) neutron star causing super nova gets no credit	1 1
(c)(i)	carried on the balloon / equipment	accept carried by a rocket / aircraft / satellite birds negates credit	1
(ii)	on comets or meteors	accept meteorites / shooting stars accept returning space craft accept solar wind ignore asteroids accept ufo do **not** accept solar flares do **not** accept satellites	1
total			8

4.5.6.1.2 Speed

3462/3F Q11

question	answers	extra information	mark
(a)	silver is a (good) reflector of heat (radiation) **or** silver reflects the heat (radiation)	fact heat = infra red ignore references to light accept shiny for silver good radiator negates the mark ignore references to good conductor do **not** accept bounce back	1
	less heat is lost through the board **or** more heat is retained by the shirt	explanation accept both sides of shirt heated reflects heat back up gets **1** mark only ignore mention of friction	1
(b)	metal soleplate	accept soleplate / bottom / metal do **not** accept outside / case	1
(c)	plastic **or** rubber	accept any named plastic do **not** accept wood	1
	it is a (good) insulator **or** it is a poor conductor	ignore mention of heat if in conjunction with electricity	1
(d)	**Quality of written communication** *The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.*	*Maximum of **2** marks if ideas not well expressed.*	
	pulls iron bolt down **or** attracts the iron bolt **or** moves bolt out of plunger	answers in terms of charges attracting or repelling gain no credit	1
	plunger pushed / moved to the right (by spring) **or** plunger released		1
	push switch opens / goes to off / goes to right	accept circuit is broken for maximum credit the points must follow a logical sequence 3 correct points but incorrect sequence scores **2** marks only ignore reset action	1
total			8

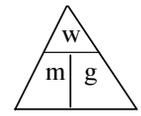
4.5.6.1.2 Speed

3462/3F Q12

question	answers	extra information	mark
(a)(i)	any **one** from: the ground the air radon (gas) building materials buildings rocks / granite food cosmic rays **or** solar rays X-rays nuclear weapons testing nuclear power stations / accidents	 do **not** accept mobile phones accept from outer space accept sun but **not** sunlight accept medical uses	1
(ii)	2	allow $\frac{1200}{60\times10}$ **or** $\frac{1200}{600}$ **or** 120 for **1** mark	2
(b)	 alpha: the count rate is (greatly) reduced by the card **or** the card absorbs alphas but not betas beta: the count rate is (greatly) reduced by the metal **or** the thin metal absorbs alphas and betas **or** the thin metal absorbs all of the radiation (from the source) gamma: would pass through the thin metal but count rate is background **or** no radiation passing through **or** a higher reading would be recorded **or** to reduce the count to 2 would require much more than 3 mm of metal	answers must be comparative accept converse answers throughout accept paper for the card accept aluminium for the metal accept aluminium for the metal accept lead / aluminium for the metal	 1 1 1
total			6

4.5.6.1.2 Speed

3462/3F Q13

question	answers	extra information	mark
(a)(i)	weight = mass × g.f.s.	accept w = m × g accept gravity for gfs accept  provided subsequent use of Δ correct do **not** accept N = kg × N/kg	1
(ii)	675	75 × 9 for **1** mark	2
(iii)	g.(f.s.) is higher (on Earth than Venus)	accept gravity for g.f.s. do **not** accept g.f.s. is lower unless answer states on Venus	1
(iv)	orbit time for Jupiter is <u>longer</u> / longest (than for the other planets)	do **not** give any credit for an answer that includes a comparison of diameter **or** a comparison of g.f.s.	1
(b)	**Quality of written communication** *The answer to this question requires ideas in good English in a sensible order with correct use of scientific terms. Quality of written communication should be considered in crediting points in the mark scheme.* any **two** from: dust <u>and</u> gas **or** remnants of a super nova pulled together by (force of) <u>gravity</u> nuclear fusion starts	*Maximum of **1** mark if ideas not well expressed.* accept hydrogen for dust and gas do **not** accept hydrogen burns although candidates may include more detail these points are essential to score the credit	2
total			7

GCSE 2004
June Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

Physics Specification B
3451/F

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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4.5.6.1.2 Speed

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4.5.6.1.2 Speed

GCSE PHYSICS

INFORMATION FOR EXAMINERS

1. General

The mark scheme for each question shows:

- the marks available for each part of the question;
- the total marks available for the question;
- the typical answer or answers which are expected;
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:
where consequential marking needs to be considered in a calculation;
or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; e.g. allow smooth / free movement.)

3. Marking points

3.1 Marking of Quality of Written Communication

Where *Quality of written communication* appears in the mark scheme, one mark is to be awarded for either of the following points:

- Using correct scientific terms
- Correct sequencing or linking of ideas or points

The mark scheme will specify which of the points is to be awarded in a particular question. A QoWC mark can be awarded for a scientific answer, even if it is not accurate. It cannot be awarded for a nonsensical or non-scientific answer.
On the script, the QoWC tick should be identified by a 'q' written next to it.

3.2 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

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Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.3 Use of chemical symbols/formulae

If a candidate writes a chemical symbol/formula instead of a required chemical name, full credit can be given if the symbol/formula is correct and if, in the context of the question, such action is appropriate.

3.4 The marking of quantitative relationships

Full credit can be given for a correct quantitative relationship expressed in:

- named units;
- physical quantities;
- standard symbols;
- a combination of physical quantities and units.

No credit can be given for any quantitative relationship expressed in terms of:

- a combination of physical quantities, units and symbols;
- a diagram, e.g. the ohm's law triangle, unless the rest of the answer shows clearly that the candidate understands the relationships involved.

3.5 Marking procedure for calculations

3.5.1 Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.
However:

- if the answer is incorrect, mark(s) can be gained by correct substitution/working and this is shown in the 'extra information' column;
- if the answer is correct, but an incorrect relationship is written in the working, then no marks can be awarded (see 3.5.2).

3.5.2 Where calculations are based on incorrectly recalled relationships, neither the incorrectly recalled relationship, nor the resulting calculation based on the incorrect relationship, will be credited.

3.6 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

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4.5.6.1.2 Speed

3.7 Errors carried forward

There should be no error carried forward from a previous answer which has been based on wrong science. Any error in the answers to a structured question should be penalised once only.

Examples

(a) A candidate who calculates average speed using speed = time/distance **and** then proceeds to use this incorrect answer to calculate an acceleration based on the correct quantitative relationship should be given credit for the use of the correct acceleration relationship but none for either numerical answer.

(b) A candidate who incorrectly calculates average speed using speed = distance/time and then proceeds to use this incorrect value to calculate an acceleration based on the correct quantitative relationship, should be given credit for the use of both correct quantitative relationships **and** for the correct substitution and use of the incorrect value in the calculation of the rate of acceleration.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.8 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.9 Brackets

(…..) is used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.10 Interpretation of marginal points

There will be times when the answer is almost, but not quite, correct. Some examiners would award a mark while others would not. In any one script, an attempt should be made to balance these nearly correct answers by giving the mark on some occasions but not on others. If this is not done, the marking would end up being too lenient or too harsh.

3.11 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

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4.5.6.1.2 Speed

GCSE Physics
Foundation Tier 3451/F

3451F Q1

question	answers	extra information	mark
(a)	comet	correct order only	1
	elliptical		1
	Milky Way		1
	Universe		1
(b)(i)	D A C B	allow **2** marks for two letters in the correct place allow **1** mark for one letter in the correct place	3
(ii)	A		1
total			8

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4.5.6.1.2 Speed

3451F Q2

question	answers	extra information	mark
(a)	95		1
(b)	alpha	accept correct symbol	1
(c)	any **two** from: • radiation is outside the body • radiation will not reach (living) cells • radiation absorbed by the air	 accept detector is on ceiling or high up the wall accept radiation cannot pass through the body / skin accept cannot pass through the plastic casing do **not** accept because it is alpha radiation – unless qualified do **not** accept does not give off harmful substance do **not** accept cannot pass through building materials etc.	2
(d)	less (than)		1
total			5

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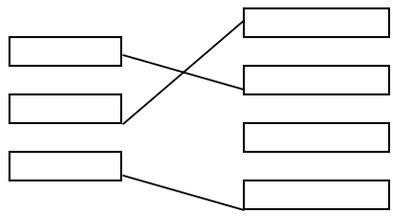
4.5.6.1.2 Speed

3451F Q3

question	answers	extra information	mark
(a)	generator	accept dynamo accept alternator	1
(b)(i)	1400	ignore units	1
(ii)	0.3 or 30%	any incorrect unit penalise **1** mark allow **1** mark for the correct use of 600 **or** 0.3% **or** 30	2
(c)	**1** mark for each correct link 	if more than 3 lines are drawn, mark only 3 lines starting with those that are incorrect	3
(d)(i)	110	no tolerance	1
(ii)	12	no tolerance	1
(iii)	wind speed may be too low to operate the generator	accept wind may not always blow accept power depends on wind speed accept does not generate if wind speed is too high accept does not generate if wind speed is above 12 (m/s) accept does not generate if wind speed is below 1.6 (m/s) accept it is unreliable do **not** accept answers referring to cost only	1
total			10

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4.5.6.1.2 Speed

3451F Q4

question	answers	extra information	mark
(a)	B E A D	allow **1** mark for each letter in the correct place, to a maximum of **3** marks	3
(b)	(a spark) may cause the (petrol vapour) to explode / ignite	accept petrol for (petrol vapour) accept catch fire for explode	1
	connect tanker to earth with a (conducting) wire / chain **or** earth the tanker	accept ground for earth	1
(c)	**Quality of written communication**	for a logical sequence	1
	any **two** from:		2
	• when current greater than fuse rating / value	accept when current too great for appliance do **not** accept 'if there is too much current' do **not** accept voltage or electricity	
	• fuse (becomes hot and) melts / burns out	accept fuse blows / breaks	
	• circuit is broken	accept circuit switched off this cannot score credit on its own	
total			8

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4.5.6.1.2 Speed

3451F Q5

question	answers	extra information	mark
(a)(i)	crust		1
(ii)	inner core is <u>solid</u> outer core is liquid	do **not** accept just rock inner core is denser / hotter than outer core gets **2** marks accept one is solid and one is liquid for **1** mark accept they are different densities for **1** mark wrong way round = **0** marks	1 1
(b)	seismograph		1
(c)	difficult to measure (slow) movement (1) of plates (1) dependent mark **or** difficult to measure friction / forces (1) between plates (1) dependent mark		1 1
(d)	geothermal		1
(e)(i)	5000		1
(ii)	2500		1
total			9

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4.5.6.1.2 Speed

3451F Q6

	answers	extra information	mark
(a)	converging image object image object shorter		1 1 1 1 1 1
(b)(i)	(Earth's) gravity	accept centripetal accept minor misspellings, however, do **not** credit any response which could be 'centrifugal'	1
(ii)	to(wards) (the centre of the) Earth	allow inwards do **not** accept downwards	1
(c)(i)	**either** friction (force) **or** centripetal force between the tyres / wheels and (the surface of) the road	 allow grip allow on the tyres / wheels **or** towards the centre of the bend / arc / circle	 1 1
(ii)	mass **or** speed **or** momentum radius / diameter	allow weight allow velocity do **not** credit 'curvature' or 'circumference'	1 1
(d)	centripetal	accept minor misspellings (see above)	1
total			13

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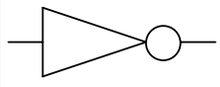
4.5.6.1.2 Speed

3451F Q7

	answers	extra information	mark
(a)(i)	two switches in series **and** circuit complete	ignore small imperfections	1
(ii)	two switches in parallel **and** circuit complete	ignore small imperfections	1
(iii)	one switch in parallel with the cell / lamp (but **not** both)	ignore small imperfections	1
(iv)	(i) AND (ii) OR (iii) NOT	accept 'and' accept 'or' accept 'not'	1 1 1
(b)(i)	when it is light the sensor sends on / high / 1 signal to the gate off / low / 0 sent to the lamp **or** when it is dark the sensor sends off / low / 0 signal to the gate (1) on / high / 1 sent to the lamp (1)		1 1
(ii)	any suitable application	e.g. to switch a security light on (and off) e.g. to switch a light on when it is dark do **not** credit just '… to switch a light on / off'	1
(c)(i)		accept shading-in of either or both parts end connections are not required accept any orientation	1
(ii)	1 0 **or** 0 1 0 1 1 0	all correct	1
(iii)	truth (table)		1
total			12

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4.5.6.1.2 Speed

3451F Q8

question	answers	extra information	mark
(a)	60		1
(b)	$5\frac{1}{2}$ hours	must include unit	1
(c)	30		1
(d)	30 minutes or $\frac{1}{2}$ hour	must include unit	1
(e)	D **and** E least steep part of the graph	accept finish for E accept correct numbers from axes with units accept covers smallest distance in a set time accept only moves 5 km in $1\frac{1}{2}$ hours (accept anything between 5 and 6) ignore horse is tired	1 1
total			6

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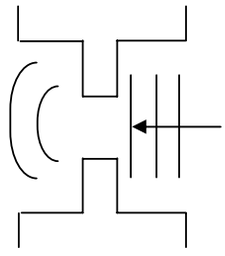
4.5.6.1.2 Speed

3451F Q9

question	answers	extra information	mark
(a)(i)	any **one** from: • (doctors) to see inside a patients body **or** endoscope • telephone cables • optical fibre / fibre optic lamps **or** (artificial) Christmas trees • data transfer **or** internet connection	 accept keyhole surgery do **not** accept flex **or** wires for cable accept decorative / ornamental lighting accept any feasible practical suggestion for taking light to a difficult to access place do **not** accept lighting unqualified do **not** accept lamp unqualified do **not** accept communications unless clarified	1
(ii)	(incident) ray angle greater than critical angle total internal reflection occurs	either order accept (incident) ray greater than 42° accept TIR do **not** accept just description of TIR	1 1
(b)(i)	waves shown diffracting in the correct direction 	ignore wavelength	1
(ii)	diffraction	accept diffract / diffracted	1
total			5

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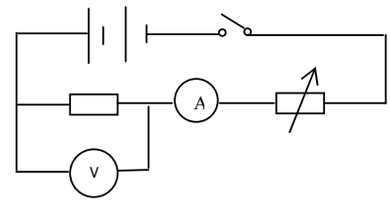
4.5.6.1.2 Speed

3451F Q10

question	answers	extra information	mark
(a)	all symbols correct	 accept push switch symbol switch may be open or closed any lines through symbols = **0** marks	1
	correct circuit drawn voltmeter must be across resistor only	polarity of cells not relevant provided they are joined correctly two cells are required in the diagram ignore the order of the components allow small gaps in circuit omission of any component = **0** marks	1
(b)(i)	potential difference = current × resistance	accept voltage or p.d. for potential difference accept $V = I \times R$ accept  provided subsequent use correct do **not** accept C for current	1
(ii)	2	 allow **1** mark for correct substitution wrong working loses both marks	2
(iii)	straight line drawn <u>through the origin</u> straight line passes through $I = 0.4, V =$ their (b)(ii) / 2 **and** 0.0	judge by eye this mark may be awarded if all points shown including these points are correct even if no line is drawn N.B. a curve scores **0** marks	1 1 dep
(c)	temperature <u>increases</u>	accept filament lamp / it gets <u>hotter</u> allow heat for temperature	1
total			8

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4.5.6.1.2 Speed

3451F Q11

question	answers	extra information	mark
(a)(i)	gamma rays	accept gamma accept correct symbol	1
(ii)	infra red	accept IR	1
(b)	ultraviolet <u>absorbed</u> by ink (energy) given out as light	 accept glows / luminous accept for **both** marks the ink is fluorescent do **not** accept answers in terms of uv being reflected	1 1
(c)	any **two** from: • UV can damage / kill / ionise / alter (normal) cells • change DNA structure **or** mutate • (normal) cells may become cancerous	 do **not** accept attacks cells **or** burns skin accept may cause (skin) cancer accept abnormal cell multiplication	2
(d)(i)	microwaves **and** infra red	both answers needed in either order do **not** accept heat for IR	1
(ii)	0.9	allow **1** mark for the <u>correct</u> use of 1.8 (kW) $(1.8 \times \frac{1}{2}$ or $1.8 \times 30)$ i.e. adding the correct 2 power values	2
total			9

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4.5.6.1.2 Speed

3451F Q12

question	answers	extra information	mark
(a)(i)	accelerating	accept getting faster accept speed / velocity increasing	1
(ii)	acceleration increases	accept velocity / speed increases more rapidly do **not** accept velocity / speed increases	1
(b)(i)	$\text{acceleration} = \frac{\text{change in velocity}}{\text{time (taken)}}$	accept $a = \frac{v - u}{t}$ **or** $a = \frac{v_1 - v_2}{t}$ do **not** accept velocity for change in velocity do **not** accept change in speed do **not** accept $a = \frac{v}{t}$	1
(ii)	15	allow **1** mark for an answer of 900 **or** for correct use of 540 seconds	2
(iii)	velocity includes direction	accept velocity is a vector (quantity) accept converse answer	1
(c)	force of gravity (between shuttle and Earth) plus correct orbital speed (makes shuttle move in a curve)	accept gravitational pull if used correctly accept forward motion **or** constant speed for orbital speed accept it is travelling fast enough accept for **2** marks the force of gravity provides the centripetal force	1 1
(d)	black is a good emitter of radiation **or** to limit the temperature rise inside the shuttle	accept heat for radiation accept the tiles are good insulation do **not** accept black absorbs heat on its own do **not** accept tiles are heat proof	1
total			9

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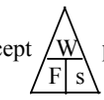
4.5.6.1.2 Speed

3451F Q13

question	answers	extra information	mark
(a)(i)	work (done) = force (applied) × distance (moved)	accept W = F × s or W = F × d accept  provided subsequent method is correct	1
(ii)	240 000 joules	allow **1** mark for correct substitution **or** correct use of 1200 (N) accept J do **not** accept j / Nm	2 1
(b)	800 (watts)	accept 0.8 kW accept their (a)(ii) ÷ 300 correctly evaluated for **2** marks allow **1** mark for correct substitution (a)(ii) ÷ 5 correctly evaluated for **1** mark	2
(c)(i)	any **one** from: • needs to raise the chair / lift • lifting more than one chair • energy transfer to the surroundings correctly qualified	 allow lifting more than 2 people implication of a heavier weight accept loss for transfer do **not** accept motor inefficient do **not** accept motor gets hot do **not** accept friction unless the location is specified as external to the motor	1
(ii)	electrical potential	accept electric **both** answers required for the mark	1
total			8

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4.5.6.1.2 Speed

3451F Q14

	answers	extra information	mark
(a)(i)	current		1
(ii)	resistance decreases	 accept 'the flow of electrons / current (through it) increases' for **1** mark do **not** credit just '… it will get warmer'	1 1
(b)	input sensor → controlled by the processor processor → detects changes in the environment output device → decides what action is needed	all pairs correct one pair correct for **1** mark	2
(c)(i)	potential divider	accept voltage divider	1
(ii)	4 (volts)	$6 \times \frac{30}{45}$ for **1** mark	2
(iii)	across the new resistor…(will) increase across R_2 … (will) decrease	 N.B. independent marks	1 1
total			10

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4.5.6.1.2 Speed

3451F Q15

	answers	extra information	mark
(a)	relay (normally open) (switch)	each mark is independent	1
	… switch on a (larger) current (in another circuit) **or** switch on a higher voltage circuit	do **not** accept switch on another circuit **or** smaller / equal current	1
	light emitting diode / LED	do **not** credit LDR	1
	… in one / direct / certain direction **or** from left to right	**or** when the cathode is connected to the negative terminal / side **or** when the left-hand side is connected to the positive terminal / side do **not** credit just '… is big enough' do **not** accept 'positive direction'	1
	AND gate	accept 'and' gate do **not** accept numerical values unless expanded	1
	… (both) inputs are on / high / 1 **or** current flows in both inputs		1
(b)	**Quality of written communication**	If in a sensible order which clearly indicates advantages or disadvantages, including answers in the form of a table **or** as bullet points Q ✓ Q X	1
	any **three** from: • advantage of mobile phones • drawback of mobile phones • benefit of the Internet • drawback of the Internet	e.g. more convenient for service engineers e.g. calls can be received away from base e.g. privacy can be more easily invaded e.g. drivers can be distracted e.g. microwaves / radio waves can / may cause damage to the brain e.g. access to educational material e.g. some material is salacious e.g. spam (on external e-mail) these are examples candidates may be credited for a variety of responses	3
total			10

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4.5.6.1.2 Speed

3451F Q16

question	answers	extra information	mark
(a)	**Y** and **Z** they have the same number of protons **or** same atomic number	 accept they have the same number of electrons **or** same number of protons **and** electrons allow only different in number of neutrons N.B. independent marks	1 1
(b)	**Quality of written communication** A – alpha particle passes straight through the empty space of the atom **or** it is a long way from the nucleus B – alpha particle <u>deflected</u> / <u>repelled</u> / <u>repulsed</u> by the (positive) <u>nucleus</u> C – alpha particle heading straight for the <u>nucleus</u> is <u>deflected</u> / <u>repelled</u> / <u>repulsed</u> backwards	for correct use of terms underlined in B **or** C Q ✓ Q X describes 3 tracks correctly for **2** marks describes 2 or 1 track correctly for **1** mark do **not** accept hits the nucleus do **not** accept answers referring to refraction do **not** accept answers in terms of reflected backwards unless qualified in terms of repulsion mention of difference in charge on nucleus negates that track	1 max 2
total			5

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GCSE 2004
June Series

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark Scheme

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

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.

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4.5.6.1.2 Speed

Further copies of this Mark Scheme are available from:

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SCIENCE: DOUBLE AWARD CO-ORDINATED

INFORMATION FOR EXAMINERS

1. General

The mark scheme for each question shows:

- the marks available for each part of the question;
- the total marks available for the question;
- the typical answer or answers which are expected;
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example:
where consequential marking needs to be considered in a calculation;
or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; e.g. allow smooth / free movement.)

3. Marking points

3.1 Marking of Quality of Written Communication

Where *Quality of written communication* appears in the mark scheme, one mark is to be awarded for either of the following points:

- Using correct scientific terms
- Correct sequencing or linking of ideas or points

The mark scheme will specify which of the points is to be awarded in a particular question. A QoWC mark can be awarded for a scientific answer, even if it is not accurate. It cannot be awarded for a nonsensical or non-scientific answer.
On the script, the QoWC tick should be identified by a 'q' written next to it.

3.2 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

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Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.3 Use of chemical symbols/formulae

If a candidate writes a chemical symbol/formula instead of a required chemical name, full credit can be given if the symbol/formula is correct and if, in the context of the question, such action is appropriate.

3.4 The marking of quantitative relationships

Full credit can be given for a correct quantitative relationship expressed in:

- named units;
- physical quantities;
- standard symbols;
- a combination of physical quantities and units.

No credit can be given for any quantitative relationship expressed in terms of:

- a combination of physical quantities, units and symbols;
- a diagram, e.g. the ohm's law triangle, unless the rest of the answer shows clearly that the candidate understands the relationships involved.

3.5 Marking procedure for calculations

3.5.1 Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.
However:

- if the answer is incorrect, mark(s) can be gained by correct substitution/working and this is shown in the 'extra information' column;
- if the answer is correct, but an incorrect relationship is written in the working, then no marks can be awarded (see 3.5.2).

3.5.2 Where calculations are based on incorrectly recalled relationships, neither the incorrectly recalled relationship, nor the resulting calculation based on the incorrect relationship, will be credited.

3.6 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

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3.7 Errors carried forward

There should be no error carried forward from a previous answer which has been based on wrong science. Any error in the answers to a structured question should be penalised once only.

Examples

(a) A candidate who calculates average speed using speed = time/distance **and** then proceeds to use this incorrect answer to calculate an acceleration based on the correct quantitative relationship should be given credit for the use of the correct acceleration relationship but none for either numerical answer.

(b) A candidate who incorrectly calculates average speed using speed = distance/time and then proceeds to use this incorrect value to calculate an acceleration based on the correct quantitative relationship, should be given credit for the use of both correct quantitative relationships **and** for the correct substitution and use of the incorrect value in the calculation of the rate of acceleration.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.8 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.9 Brackets

(…..) is used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.10 Interpretation of marginal points

There will be times when the answer is almost, but not quite, correct. Some examiners would award a mark while others would not. In any one script, an attempt should be made to balance these nearly correct answers by giving the mark on some occasions but not on others. If this is not done, the marking would end up being too lenient or too harsh.

3.11 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

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4.5.6.1.2 Speed

Double Award
Foundation Tier 3462/3F

3462/3F Q1

question	answers	extra information	mark
(a)	comet	correct order only	1
	elliptical		1
	Milky Way		1
	Universe		1
(b)(i)	D A C B	allow **2** marks for two letters in the correct place allow **1** mark for one letter in the correct place	3
(ii)	A		1
total			8

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4.5.6.1.2 Speed

3462/3F Q2

question	answers	extra information	mark
(a)	95		1
(b)	alpha	accept correct symbol	1
(c)	any **two** from: • radiation is outside the body • radiation will not reach (living) cells • radiation absorbed by the air	 accept detector is on ceiling or high up the wall accept radiation cannot pass through the body / skin accept cannot pass through the plastic casing do **not** accept because it is alpha radiation – unless qualified do **not** accept does not give off harmful substance do **not** accept cannot pass through building materials etc.	2
(d)	less (than)		1
total			5

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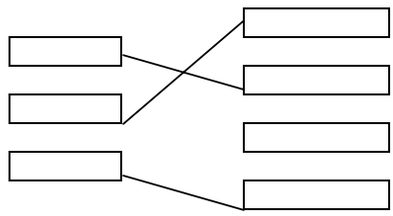
4.5.6.1.2 Speed

3462/3F Q3

question	answers	extra information	mark
(a)	generator	accept dynamo accept alternator	1
(b)(i)	1400	ignore units	1
(ii)	0.3 or 30%	any incorrect unit penalise **1** mark allow **1** mark for the correct use of 600 **or** 0.3% **or** 30	2
(c)	**1** mark for each correct link 	if more than 3 lines are drawn, mark only 3 lines starting with those that are incorrect	3
(d)(i)	110	no tolerance	1
(ii)	12	no tolerance	1
(iii)	wind speed may be too low to operate the generator	accept wind may not always blow accept power depends on wind speed accept does not generate if wind speed is too high accept does not generate if wind speed is above 12 (m/s) accept does not generate if wind speed is below 1.6 (m/s) accept it is unreliable do **not** accept answers referring to cost only	1
total			10

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4.5.6.1.2 Speed

3462/3F Q4

question	answers	extra information	mark
(a)	B E A D	allow **1** mark for each letter in the correct place, to a maximum of **3** marks	3
(b)	(a spark) may cause the (petrol vapour) to explode / ignite	accept petrol for (petrol vapour) accept catch fire for explode	1
	connect tanker to earth with a (conducting) wire / chain **or** earth the tanker	accept ground for earth	1
(c)	**Quality of written communication**	for a logical sequence	1
	any **two** from:		2
	• when current greater than fuse rating / value	accept when current too great for appliance do **not** accept 'if there is too much current' do **not** accept voltage or electricity	
	• fuse (becomes hot and) melts / burns out	accept fuse blows / breaks	
	• circuit is broken	accept circuit switched off this cannot score credit on its own	
total			8

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4.5.6.1.2 Speed

3462/3F Q5

question	answers	extra information	mark
(a)(i)	crust		1
(ii)	inner core is <u>solid</u> outer core is liquid	do **not** accept just rock inner core is denser / hotter than outer core gets **2** marks accept one is solid and one is liquid for **1** mark accept they are different densities for **1** mark wrong way round = **0** marks	1 1
(b)	seismograph		1
(c)	difficult to measure (slow) movement (1) of plates (1) dependent mark **or** difficult to measure friction / forces (1) between plates (1) dependent mark		1 1
(d)	geothermal		1
(e)(i)	5000		1
(ii)	2500		1
total			9

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4.5.6.1.2 Speed

3462/3F Q6

question	answers	extra information	mark
(a)	60		1
(b)	$5\frac{1}{2}$ hours	must include unit	1
(c)	30		1
(d)	30 minutes or $\frac{1}{2}$ hour	must include unit	1
(e)	D **and** E least steep part of the graph	accept finish for E accept correct numbers from axes with units accept covers smallest distance in a set time accept only moves 5 km in $1\frac{1}{2}$ hours (accept anything between 5 and 6) ignore horse is tired	1 1
total			6

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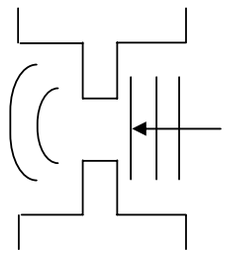
4.5.6.1.2 Speed

3462/3F Q7

question	answers	extra information	mark
(a)(i)	any **one** from: • (doctors) to see inside a patients body **or** endoscope • telephone cables • optical fibre / fibre optic lamps **or** (artificial) Christmas trees • data transfer **or** internet connection	 accept keyhole surgery do **not** accept flex **or** wires for cable accept decorative / ornamental lighting accept any feasible practical suggestion for taking light to a difficult to access place do **not** accept lighting unqualified do **not** accept lamp unqualified do **not** accept communications unless clarified	1
(ii)	(incident) ray angle greater than critical angle total internal reflection occurs	either order accept (incident) ray greater than 42° accept TIR do **not** accept just description of TIR	1 1
(b)(i)	waves shown diffracting in the correct direction 	ignore wavelength	1
(ii)	diffraction	accept diffract / diffracted	1
total			5

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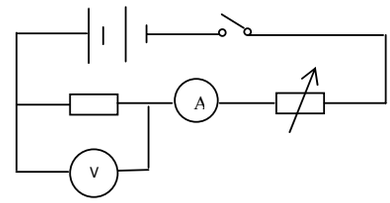
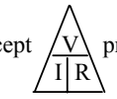
4.5.6.1.2 Speed

3462/3F Q8

question	answers	extra information	mark
(a)	all symbols correct	 accept push switch symbol switch may be open or closed any lines through symbols = **0** marks	1
	correct circuit drawn voltmeter must be across resistor only	polarity of cells not relevant provided they are joined correctly two cells are required in the diagram ignore the order of the components allow small gaps in circuit omission of any component = **0** marks	1
(b)(i)	potential difference = current × resistance	accept voltage or p.d. for potential difference accept $V = I \times R$ accept  provided subsequent use correct do **not** accept C for current	1
(ii)	2	 allow **1** mark for correct substitution wrong working loses both marks	2
(iii)	straight line drawn <u>through the origin</u> straight line passes through $I = 0.4, V =$ their (b)(ii) / 2 **and** 0.0	judge by eye this mark may be awarded if all points shown including these points are correct even if no line is drawn N.B. a curve scores **0** marks	1 1 dep
(c)	temperature <u>increases</u>	accept filament lamp / it gets <u>hotter</u> allow heat for temperature	1
total			8

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4.5.6.1.2 Speed

3462/3F Q9

question	answers	extra information	mark
(a)(i)	gamma rays	accept gamma accept correct symbol	1
(ii)	infra red	accept IR	1
(b)	ultraviolet <u>absorbed</u> by ink (energy) given out as light	 accept glows / luminous accept for **both** marks the ink is fluorescent do **not** accept answers in terms of uv being reflected	1 1
(c)	any **two** from: • UV can damage / kill / ionise / alter (normal) cells • change DNA structure **or** mutate • (normal) cells may become cancerous	 do **not** accept attacks cells **or** burns skin accept may cause (skin) cancer accept abnormal cell multiplication	2
(d)(i)	microwaves **and** infra red	both answers needed in either order do **not** accept heat for IR	1
(ii)	0.9	allow **1** mark for the <u>correct</u> use of 1.8 (kW) $(1.8 \times \frac{1}{2}$ or $1.8 \times 30)$ i.e. adding the correct 2 power values	2
total			9

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4.5.6.1.2 Speed

3462/3F Q10

question	answers	extra information	mark
(a)(i)	accelerating	accept getting faster accept speed / velocity increasing	1
(ii)	acceleration <u>increases</u>	accept velocity / speed increases <u>more</u> rapidly do **not** accept velocity / speed increases	1
(b)(i)	$\text{acceleration} = \frac{\text{change in velocity}}{\text{time (taken)}}$	accept $a = \frac{v - u}{t}$ **or** $a = \frac{v_1 - v_2}{t}$ do **not** accept velocity for change in velocity do **not** accept change in speed do **not** accept $a = \frac{v}{t}$	1
(ii)	15	allow **1** mark for an answer of 900 **or** for <u>correct</u> use of 540 seconds	2
(iii)	velocity includes direction	accept velocity is a vector (quantity) accept converse answer	1
(c)	force of gravity (between <u>shuttle</u> and Earth) plus correct orbital speed (makes <u>shuttle</u> move in a curve)	accept gravitational pull if used correctly accept forward motion **or** constant speed for orbital speed accept it is travelling fast enough accept for **2** marks the force of gravity provides the <u>centripetal</u> force	1 1
(d)	black is a good emitter of radiation **or** to limit the temperature rise inside the shuttle	accept heat for radiation accept the tiles are good insulation do **not** accept black absorbs heat on its own do **not** accept tiles are heat proof	1
total			9

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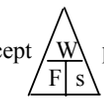
4.5.6.1.2 Speed

3462/3F Q11

question	answers	extra information	mark
(a)(i)	work (done) = force (applied) × distance (moved)	accept W = F × s or W = F × d accept  provided subsequent method is correct	1
(ii)	240 000 joules	allow **1** mark for correct substitution **or** correct use of 1200 (N) accept J do **not** accept j / Nm	2 1
(b)	800 (watts)	accept 0.8 kW accept their (a)(ii) ÷ 300 correctly evaluated for **2** marks allow **1** mark for correct substitution (a)(ii) ÷ 5 correctly evaluated for **1** mark	2
(c)(i)	any **one** from: • needs to raise the chair / lift • lifting more than one chair • energy transfer to the surroundings correctly qualified	 allow lifting more than 2 people implication of a heavier weight accept loss for transfer do **not** accept motor inefficient do **not** accept motor gets hot do **not** accept friction unless the location is specified as external to the motor	1
(ii)	electrical potential	accept electric **both** answers required for the mark	1
total			8

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4.5.6.1.2 Speed

3462/3F Q12

question	answers	extra information	mark
(a)	**Y** and **Z**		1
	they have the same number of protons **or** same atomic number	accept they have the same number of electrons **or** same number of protons **and** electrons allow only different in number of neutrons N.B. independent marks	1
(b)	**Quality of written communication**	for correct use of terms underlined in B **or** C Q ✓ Q X	1
	A – alpha particle passes straight through the empty space of the atom **or** it is a long way from the nucleus B – alpha particle deflected / repelled / repulsed by the (positive) nucleus C – alpha particle heading straight for the nucleus is deflected / repelled / repulsed backwards	describes 3 tracks correctly for **2** marks describes 2 or 1 track correctly for **1** mark do **not** accept hits the nucleus do **not** accept answers referring to refraction do **not** accept answers in terms of reflected backwards unless qualified in terms of repulsion mention of difference in charge on nucleus negates that track	max 2
total			5

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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Physics 3451/F
Specification B

Mark Scheme

2005 examination – June series

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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

4.5.6.1.2 Speed

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

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

4.5.6.1.2 Speed

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

4.5.6.1.2 Speed

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

4.5.6.1.2 Speed

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

4.5.6.1.2 Speed

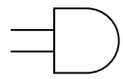
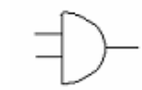
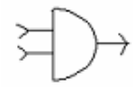
3451/F Q9

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…

4.5.6.1.2 Speed

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

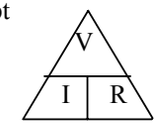
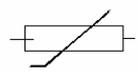
4.5.6.1.2 Speed

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

4.5.6.1.2 Speed

3451/F Q11

question	answers	extra information	mark
(a)(i)	$A_1 = 0.5$	ignore any units	1
	$A_4 = 0.5$	allow **1** mark for $A_1 = A_4 \neq 0.5$	1
(ii)	the resistance of **P** is more than 20 Ω		1
	a smaller current goes through P / A_2 (than 20 Ω)	dependent on getting 1st mark correct accept converse	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 	accept correct circuit symbol allow phonetic spelling	1
	resistance goes down (as temperature of thermistor goes up)	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
total			10

4.5.6.1.2 Speed

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

4.5.6.1.2 Speed

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

4.5.6.1.2 Speed

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…

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

4.5.6.1.2 Speed

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

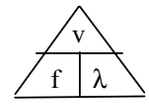
4.5.6.1.2 Speed

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

4.5.6.1.2 Speed

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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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

4.5.6.1.2 Speed

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

4.5.6.1.2 Speed

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

4.5.6.1.2 Speed

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

4.5.6.1.2 Speed

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

4.5.6.1.2 Speed

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

4.5.6.1.2 Speed

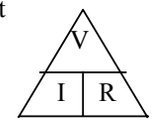
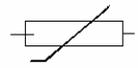
Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2005 June series

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

4.5.6.1.2 Speed

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

4.5.6.1.2 Speed

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

4.5.6.1.2 Speed

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 lowest 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

4.5.6.1.2 Speed

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…

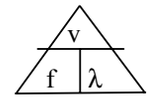
3462/3F Q12 cont…

(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

4.5.6.1.2 Speed

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

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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Physics 3451/F
Specification B

Mark Scheme

2006 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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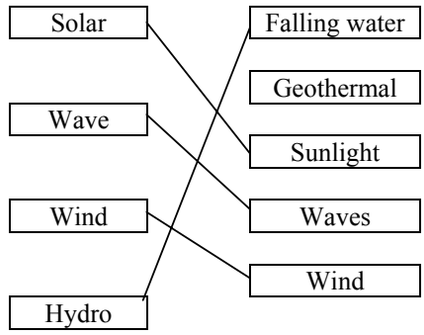
4.5.6.1.2 Speed

Physics (Specification B)
Foundation Tier 3451/F

3451/F Q1

question	answers	extra information	mark
(a)	4 correct lines drawn  	**1** mark for each correct line if more than 4 lines are drawn mark incorrect ones first. Mark only 4 lines	4
(b)	4		1
(c)(i)	nuclear		1
(ii)	(natural) gas	do **not** accept natural	1
total			7

4.5.6.1.2 Speed

3451/F Q2

question	answers	extra information	mark
(a)(i)	ultra violet		1
(ii)	kill the cells	accept destroys the cells accept makes cells cancerous accept damage cells accept harms cells accept changes DNA accept cause cells to mutate accept skin cells for cells accept cause cancer do **not** accept skin for cells do **not** accept burns the cells	1
(b)(i)	the sunbed uses an alternating current (a.c.) supply		1
(ii)	10.8	accept **1** mark for correct substitution of power in W or kW and time in hours or seconds	2
total			5

4.5.6.1.2 Speed

3451/F Q3

question	answers	extra information	mark
(a)(i)	M		1
(ii)	K		1
(iii)	J		1
(iv)	O		1
(b)(i)	billions of years		1
(ii)	red giant	any answer in terms of explosion or supernova is **incorrect**	1
	contracts / shrinks to	incorrect reference to black hole negates **1** mark	1
	white dwarf		1
total			8

4.5.6.1.2 Speed

3451/F Q4

question	answers	extra information	mark
(a)(i)	A and C	**both** answers must be correct in either order	1
(ii)	A and B	**both** answers must be correct in either order	1
(iii)	same number of protons plus neutrons **or** same number of nucleons	accept number of particles in nucleus the same do **not** accept they add up to 6 unless qualified	1
(b)(i)	any **two** from: • boron - 12 • carbon - 14 • oxygen - 15 • lead - 209	**both** required both name **and** number must be given	1
(ii)	any **two** from: • boron - 11 • carbon - 12 • oxygen - 16 • lead - 207	**both** required both name **and** number must be given	1
(c)	alpha		1
total			6

4.5.6.1.2 Speed

3451/F Q5

question	answers	extra information	mark
(a)	(good) insulator	accept does not conduct (electricity) accept does not conduct heat or electricity do **not** accept does not conduct heat outside is tough is insufficient	1
(b)	fuse		1
(c)	connect the green and yellow / earth wire	accept wires must be connected to screws	1
	swap the brown and blue wires round		1
total			4

3451/F Q6

question	answers	extra information	mark
(a)	fossils	answers can be in either order	1
	water		1
(b)	increased		1
(c)	radio telescope		1
total			4

4.5.6.1.2 Speed

3451/F Q7

question	answers	extra information	mark
(a)(i)	electrical		1
	kinetic	accept movement	1
(ii)	heat	answers can be in either order	1
	sound		1
(b)(i)	360	accept **1** mark for correct substitution	2
(ii)	watt		1
(c)	the stairlift is not moving the stairlift is moving at constant speed	**both** answers are required for the mark	1
total			8

3451/F Q8

question	answers	extra information	mark
(a)(i)	(up) further **or** (up) faster	any reference to downwards movement loses credit accept <u>with</u> more force accept motion would increase	1
(ii)	down	accept the opposite way accept drop	1
(b)(i)	direct current		1
(ii)	Z		1
total			4

4.5.6.1.2 Speed

3451/F Q9

question	answers	extra information	mark
(a)	level of radiation (detected) will not change	ignore reference to particles	1
	if thickness of aluminium changes	accept for **both** marks a specific example eg if the aluminium gets thicker the level of radiation detected stays the same. accept for **1** mark gamma will pass through aluminium	1
	QoWC for 2 points in a sensible sequence		1
(b)	S W T V	all in correct order accept **2** marks for 2 correct accept **1** mark for 1 correct	3
total			6

4.5.6.1.2 Speed

3451/F Q10

<table>
<tr><th>question</th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>(a)</td><td>thermistor(s)
LDR(s)
switch(es)
LED(s)
buzzer(s)
motor(s)</td><td>1 mark each
or light dependent resistor(s)
or light emitting diode(s)</td><td>6</td></tr>
<tr><td>(b)(i)</td><td><table><tr><th>1st input</th><th>2nd input</th><th>Output</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table></td><td>all correct</td><td>1</td></tr>
<tr><td>(ii)</td><td><table><tr><th>Input</th><th>Output</th></tr><tr><td>0</td><td>1</td></tr><tr><td>1</td><td>0</td></tr></table></td><td>both correct</td><td>1</td></tr>
<tr><td>(iii)</td><td><table><tr><th>1st input</th><th>2nd input</th><th>Output</th></tr><tr><td>0</td><td>0</td><td>0</td></tr><tr><td>1</td><td>0</td><td>1</td></tr><tr><td>0</td><td>1</td><td>1</td></tr><tr><td>1</td><td>1</td><td>1</td></tr></table></td><td>all correct</td><td>1</td></tr>
<tr><td>(c)(i)</td><td></td><td>do not credit any attempt which could equally well be a poorly drawn attempt at the symbol for a cell</td><td>1</td></tr>
<tr><td>(ii)</td><td>charge

increases</td><td>accept ‘electrons’
accept ‘energy
or gets bigger/larger</td><td>1

1</td></tr>
<tr><td>total</td><td></td><td></td><td>12</td></tr>
</table>

4.5.6.1.2 Speed

3451/F Q11

question	answers	extra information	mark
(a)(i)	A		1
(ii)	B		1
(iii)	mass is larger	credit if the response is clear by some other means e.g. it is ringed	1
	wire is shorter	credit if the response is clear by some other means e.g. it is ringed	1
(b)	moment		1
	distance		1
(c)(i)	1		1
(ii)	5		1
(iii)	any **two** from • remove slotted mass(es) • slide (slotted) masses / weights nearer pivot • slide forcemeter away from the pivot • slide rod to the left	 **or** ….. to the left **or** ….. to the right **or** …. so that the slotted masses side is shorter **or** …. so that the forcemeter side is longer	2
(d)	centre of the rectangle	accept *2*mm tolerance any direction	1
	centre of the circle	accept *2*mm tolerance any direction	1
	on centre line and 10mm above base	accept *2*mm tolerance any direction	1
total			13

4.5.6.1.2 Speed

3451/F Q12

question	answers	extra information	mark
(a)	0.05 (A)	ignore incorrect units if given accept 'the same' / 'the same as K' / 'the same as the other ammeter' do **not** accept 'same as the other meter'	1
(b)(i)	any **two** from: • two cells are joined + to +	answers in terms of current gain no marks accept one cell in the wrong way accept two cells are joined back-to-back accept two cells are joined – to – accept battery for cell do **not** accept answers in terms of all the cells or in terms of energy only	2
	• some of the cells potential difference is across the diode / ammeters / wires **or** the pd of the cells is shared by all components	accept voltage for pd do **not** accept using up pd	
	• the other components have a resistance	accept a named component / components / wire has a resistance	
	• cells not fully charged **or** cells partially run down	do **not** accept voltage of cells is less than 1.5 unless explained do **not** accept cells are not as powerful unless explained	
	• cells have an internal resistance		
(ii)	the diode has a (very) high resistance (in the reverse direction)		1
	a diode only conducts / allows current to flow in one direction	accept little / no current flows do **not** accept blocks / cuts flow	1

Continued

4.5.6.1.2 Speed

3451/F Q12

question	answers	extra information	mark
(c)	**QoWC** for the use of the word resistance	annotate Q✓ Q✗ accept resistant	1
	accept increase / change / decrease throughout question but a contradiction loses **one** mark with change as neutral		
	as the pd / current increases / changes	accept voltage for pd must be correctly linked to at least one of the following points accept	1
	the temperature of the filament increases / changes	lamp / bulb for filament accept filament becomes hotter	1
	increasing / changing the **resistance** of the lamp		1
		accept for **1** mark only the filament lamp does not obey Ohm's law	
total			9

4.5.6.1.2 Speed

3451/F Q13

question	answers	extra information	mark
(a)	0.5		1
	hertz	accept Hz but **not** HZ / hz / hZ accept (waves) per second **or** / sec **or** / s **or** s^{-1} **or** sec^{-1}	1
(b)	any **one** from: • any named part of the electromagnetic spectrum • S – waves / secondary waves • wave on a rope	 do **not** accept seismic waves / earthquake do **not** accept slinky unless clearly described	1
(c)	transverse – disturbance / vibration is perpendicular to the direction of energy transfer / wave travel	accept a correctly labelled diagram	1
	longitudinal – disturbance / vibration is parallel to the direction of energy transfer / wave travel	accept a correctly labelled diagram part explanation of the difference between transverse **and** longitudinal gains **1** mark	1
(d)(i)	TIR shown	needs to stay inside water jet ignore number of reflections **or** arrow heads lines straight by eye	1
(ii)	bigger than	any indication of correct answer	1
total			7

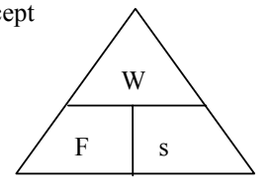
4.5.6.1.2 Speed

3451/F Q14

question	answers	extra information	mark
(a)	W		1
	has only two states **or** is either on or off	accept discrete values only do **not** credit answer purely in terms of shape	1
(b)	any **one** from:		1
	• higher quality	accept clearer do **not** accept easier to read ignore faster accept <u>less</u> distortion **or** <u>less</u> weakening of signal strength do **not** accept no distortion / weakening on its own	
	• increased carrying capacity	accept more information can be sent **or** more channels	
	• errors can be rectified		
total			3

4.5.6.1.2 Speed

3451/F Q15

question	answers	extra information	mark
(a)(i)	all points plotted accurately	accept **1** mark for 5 correct plots ± ½ small square on stopping distance	2
	line of best fit must be continuous	accept attempt at a reasonable curve does not need to go through 0 0 do **not** accept a straight line do **not** accept dot-to-dot	1
(ii)	4 to 6 (metres)	accept ecf from (a)(i) accept **1** mark for value taken correctly from graph at 25mph **or** correct method shown	2
(b)(i)	0.7 (s)	incorrect unit = 0 marks	1
(ii)	constant speed / velocity	accept (continued as) 30mph accept did not change / stayed the same accept no acceleration	1
(iii)	3.3(s)	penalise incorrect unit once only	1
(iv)	reaction time <u>increases</u> / is <u>longer</u> **or** thinking distance <u>increases</u>	do **not** accept reaction time slower **or** reactions are slower	1
	stopping distance / it <u>increases</u>	do **not** accept travels at constant speed for longer	1
(c)(i)	work done = force (applied) × distance (moved)	accept W = F × s or W = F × d accept  provided subsequent method is correct	1

Continued

4.5.6.1.2 Speed

3451/F Q15

question	answers	extra information	mark
(ii) **E**	2100	accept 2.1 kilo accept **1** mark for using 7000 N	2
(iii)	2100 (joules)	accept their (c)(ii)	1
total			14

4.5.6.1.2 Speed

3451/F Q16

question	answers	extra information	mark
(a)(i)	refraction		1
(ii)	it changes speed **or** change in density	accept it speeds up do **not** accept it slows down do **not** accept air is more dense than glass	1
(b)(i)	sound / waves <u>diffract</u> through the gap (in the wall) **or** over the wall **or** because the gate is open	do **not** accept reflection this only scores if first marking point is given accept for **1** mark only sound / waves go through the gap and <u>spread out</u> **or** diagram showing wave fronts spreading out from open gates if diagram is labelled as diffraction both marks can be scored	1 1
(ii)	less diffraction	accept no diffraction accept gates <u>absorb</u> sound / noise / waves accept gates <u>reflect</u> sound / noise / waves do **not** accept rebounds / stops / blocks out	1
total			5

4.5.6.1.2 Speed

3451/F Q17

question	answers	extra information	mark
(a)	both rays brought to a focus at F on the right	do **not** have to be continued beyond F	1
	lines have been drawn **accurately** with a ruler	only credit if 1st mark credited do **not** credit if contradictory arrow(s) added	1
(b)	rays seem to come from a focus at G on the left and continued to the right of the lens	this mark is for the current idea of divergence	1
	lines have been drawn **accurately** with a ruler	only credit if 1st mark credited do **not** credit if contradictory arrow(s) added	1
(c)	…lens… …image… …object… …image… ...object… …lens…	lens as 1st and 6th words (1) image and object in the correct order 2nd and 3rd words (1) image and object in correct order 4th and 5th words (1)	max 3
(d)(i)	correct statement about real image real rays intersect / cross to form a real image **or** a real image can be formed on a screen **or** real image is (always) on the opposite side (of the lens) **or** real image is (always) upside down (to the object)	may be credited from a correct diagram	1
	correct statement about virtual / imaginary image virtual / imaginary rays intersect / cross to form a virtual image **or** a virtual / imaginary image cannot **or** virtual / imaginary image is (always) on the same side (of the lens) **or** virtual / imaginary image is (always) same way up (as the object)	may be credited from a correct diagram	1

Continued

4.5.6.1.2 Speed

3451/F Q17

question	answers	extra information	mark
(ii)	**either** image needs to fall on / affect the film **or** image needs to fall on / affect the light sensors / charged coupled devices (CCDs) (in a digital camera / mobile phone) **or** image needs to cause a chemical reaction (in / on the film)		1
total			10

4.5.6.1.2 Speed

3451/F Q18

<table>
<tr><th>question</th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>(a)</td><td>AND (gate)

OR (gate)

NOT (gate)

LED or light emitting diode</td><td>accept ‘and’

accept ‘or’

accept ‘not’ or invert gate

accept ‘led’</td><td>1

1

1

1</td></tr>
<tr><td>(b)(i)</td><td>NOT (gate) and AND (gate)</td><td>both in either order or ‘(the) gates’

any additions lose the mark</td><td>1</td></tr>
<tr><td>(ii)</td><td><table><tr><th>Switch for fire</th><th>Tilt switch</th><th>Signal to relay</th></tr><tr><td>0</td><td>0</td><td>…0…</td></tr><tr><td>0</td><td>1</td><td>…0…</td></tr><tr><td>1</td><td>0</td><td>…1…</td></tr><tr><td>1</td><td>1</td><td>…0…</td></tr></table></td><td>all correct

allow off or no
off no
on yes
off no</td><td>1</td></tr>
<tr><td>(iii)</td><td>(relay) acts as / is a switch

either
small current from the electronic / control circuit / system (1)

large current through the output / (electric) fire (1)

or

full current through electronic control system (1)

may damage components / lead to overheating / electric shock (1)

QoWC for correct use of the scientific term ‘current’</td><td>accept implication that it works as a switch e.g. ‘turns on fire’

or ‘small current through the coil (of the relay)’

do not accept small current is turned into a large current

annotate Q✓ Q×

if answer in terms of voltage isolation / voltage/ p.d. accept QoWC mark for correct use</td><td>1

1

1

1</td></tr>
<tr><td>total</td><td></td><td></td><td>10</td></tr>
</table>

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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science: Double Award 3462/3F
Specification B

Mark Scheme

2006 examination - June series

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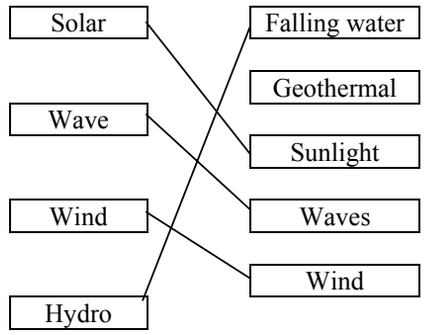
Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

Double Award (Co-ordinated)
Foundation Tier 3462/3F

3462/3F Q1

question	answers	extra information	mark
(a)	4 correct lines drawn  	**1** mark for each correct line if more than 4 lines are drawn mark incorrect ones first. Mark only 4 lines	4
(b)	4		1
(c)(i)	nuclear		1
(ii)	(natural) gas	do **not** accept natural	1
total			7

4.5.6.1.2 Speed

3462/3F Q2

question	answers	extra information	mark
(a)(i)	ultra violet		1
(ii)	kill the cells	accept destroys the cells accept makes cells cancerous accept damage cells accept harms cells accept changes DNA accept cause cells to mutate accept skin cells for cells accept cause cancer do **not** accept skin for cells do **not** accept burns the cells	1
(b)(i)	the sunbed uses an alternating current (a.c.) supply		1
(ii)	10.8	accept **1** mark for correct substitution of power in W or kW <u>and</u> time in hours or seconds	2
total			5

4.5.6.1.2 Speed

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

3462/3F Q3

question	answers	extra information	mark
(a)(i)	M		1
(ii)	K		1
(iii)	J		1
(iv)	O		1
(b)(i)	billions of years		1
(ii)	red giant	any answer in terms of explosion or supernova is **incorrect**	1
	contracts / shrinks to	incorrect reference to black hole negates **1** mark	1
	white dwarf		1
total			8

4.5.6.1.2 Speed

3462/3F Q4

question	answers	extra information	mark
(a)(i)	A and C	**both** answers must be correct in either order	1
(ii)	A and B	**both** answers must be correct in either order	1
(iii)	same number of protons plus neutrons **or** same number of nucleons	accept number of particles in nucleus the same do **not** accept they add up to 6 unless qualified	1
(b)(i)	any **two** from: • boron - 12 • carbon - 14 • oxygen - 15 • lead - 209	**both** required both name **and** number must be given	1
(ii)	any **two** from: • boron - 11 • carbon - 12 • oxygen - 16 • lead - 207	**both** required both name **and** number must be given	1
(c)	alpha		1
total			6

4.5.6.1.2 Speed

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

3462/3F Q5

question	answers	extra information	mark
(a)	(good) insulator	accept does not conduct (electricity) accept does not conduct heat or electricity do **not** accept does not conduct heat outside is tough is insufficient	1
(b)	fuse		1
(c)	connect the green and yellow / earth wire	accept wires must be connected to screws	1
	swap the brown and blue wires round		1
total			4

3462/3F Q6

question	answers	extra information	mark
(a)	fossils	answers can be in either order	1
	water		1
(b)	increased		1
(c)	radio telescope		1
total			4

4.5.6.1.2 Speed

3462/3F Q7

question	answers	extra information	mark
(a)(i)	electrical		1
	kinetic	accept movement	1
(ii)	heat	answers can be in either order	1
	sound		1
(b)(i)	360	accept **1** mark for correct substitution	2
(ii)	watt		1
(c)	the stairlift is not moving the stairlift is moving at constant speed	**both** answers are required for the mark	1
total			8

3462/3F Q8

question	answers	extra information	mark
(a)(i)	(up) further **or** (up) faster	any reference to downwards movement loses credit accept <u>with</u> more force accept motion would increase	1
(ii)	down	accept the opposite way accept drop	1
(b)(i)	direct current		1
(ii)	Z		1
total			4

4.5.6.1.2 Speed

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

3462/3F Q9

question	answers	extra information	mark
(a)	level of radiation (detected) will not change	ignore reference to particles	1
	if thickness of aluminium changes	accept for **both** marks a specific example eg if the aluminium gets thicker the level of radiation detected stays the same. accept for **1** mark gamma will pass through aluminium	1
	QoWC for 2 points in a sensible sequence		1
(b)	S W T V	all in correct order accept **2** marks for 2 correct accept **1** mark for 1 correct	3
total			6

4.5.6.1.2 Speed

3462/3F Q10

question	answers	extra information	mark
(a)	0.05 (A)	ignore incorrect units if given accept 'the same' / 'the same as K' / 'the same as the other ammeter' do **not** accept 'same as the other meter'	1
(b)(i)	any **two** from: • two cells are joined + to +	answers in terms of current gain no marks accept one cell in the wrong way accept two cells are joined back-to-back accept two cells are joined – to – accept battery for cell do **not** accept answers in terms of all the cells or in terms of energy only	2
	• some of the cells potential difference is across the diode / ammeters / wires **or** the pd of the cells is shared by all components	accept voltage for pd do **not** accept using up pd	
	• the other components have a resistance	accept a named component / components / wire has a resistance	
	• cells not fully charged **or** cells partially run down	do **not** accept voltage of cells is less than 1.5 unless explained do **not** accept cells are not as powerful unless explained	
	• cells have an internal resistance		
(ii)	the diode has a (very) high resistance (in the reverse direction)		1
	a diode only conducts / allows current to flow in one direction	accept little / no current flows do **not** accept blocks / cuts flow	1

Continued

4.5.6.1.2 Speed

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

3462/3F Q10

question	answers	extra information	mark
(c)	**QoWC** for the use of the word resistance	annotate Q✓ Q✗ accept resistant	1
	accept increase / change / decrease throughout question but a contradiction loses **one** mark with change as neutral		
	as the pd / current increases / changes	accept voltage for pd must be correctly linked to at least one of the following points accept	1
	the temperature of the filament increases / changes	lamp / bulb for filament accept filament becomes hotter	1
	increasing / changing the **resistance** of the lamp	accept for **1** mark only the filament lamp does not obey Ohm's law	1
total			9

4.5.6.1.2 Speed

3462/3F Q11

question	answers	extra information	mark
(a)	0.5		1
	hertz	accept Hz but **not** HZ / hz / hZ accept (waves) per second **or** / sec **or** / s **or** s^{-1} **or** sec^{-1}	1
(b)	any **one** from: • any named part of the electromagnetic spectrum • S – waves / secondary waves • wave on a rope	 do **not** accept seismic waves / earthquake do **not** accept slinky unless clearly described	1
(c)	transverse – disturbance / vibration is perpendicular to the direction of energy transfer / wave travel	accept a correctly labelled diagram	1
	longitudinal – disturbance / vibration is parallel to the direction of energy transfer / wave travel	accept a correctly labelled diagram part explanation of the difference between transverse **and** longitudinal gains **1** mark	1
(d)(i)	TIR shown	needs to stay inside water jet ignore number of reflections **or** arrow heads lines straight by eye	1
(ii)	bigger than	any indication of correct answer	1
total			7

4.5.6.1.2 Speed

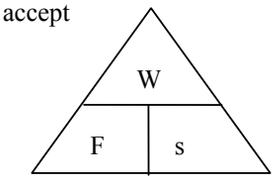
Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

3462/3F Q12

question	answers	extra information	mark
(a)	W		1
	has only two states **or** is either on or off	accept discrete values only do **not** credit answer purely in terms of shape	1
(b)	any **one** from:		1
	• higher quality	accept clearer do **not** accept easier to read ignore faster accept <u>less</u> distortion **or** <u>less</u> weakening of signal strength do **not** accept no distortion / weakening on its own	
	• increased carrying capacity	accept more information can be sent **or** more channels	
	• errors can be rectified		
total			3

4.5.6.1.2 Speed

3462/3F Q13

question	answers	extra information	mark
(a)(i)	all points plotted accurately	accept **1** mark for 5 correct plots ± ½ small square on stopping distance	2
	line of best fit must be continuous	accept attempt at a reasonable curve does not need to go through 0 0 do **not** accept a straight line do **not** accept dot-to-dot	1
(ii)	4 to 6 (metres)	accept ecf from (a)(i) accept **1** mark for value taken correctly from graph at 25mph **or** correct method shown	2
(b)(i)	0.7 (s)	incorrect unit = 0 marks	1
(ii)	constant speed / velocity	accept (continued as) 30mph accept did not change / stayed the same accept no acceleration	1
(iii)	3.3(s)	penalise incorrect unit once only	1
(iv)	reaction time <u>increases</u> / is <u>longer</u> **or** thinking distance <u>increases</u>	do **not** accept reaction time slower **or** reactions are slower	1
	stopping distance / it <u>increases</u>	do **not** accept travels at constant speed for longer	1
(c)(i)	work done = force (applied) × distance (moved)	accept W = F × s or W = F × d accept  provided subsequent method is correct	1
(ii)	2100	accept 2.1 kilo accept **1** mark for using 7000 N	2
(iii)	2100 (joules)	accept their (c)(ii)	1
total			14

4.5.6.1.2 Speed

Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

3462/3F Q14

question	answers	extra information	mark
(a)(i)	refraction		1
(ii)	it changes speed **or** change in density	accept it speeds up do **not** accept it slows down do **not** accept air is more dense than glass	1
(b)(i)	sound / waves <u>diffract</u> through the gap (in the wall) **or** over the wall **or** because the gate is open	do **not** accept reflection this only scores if first marking point is given accept for **1** mark only sound / waves go through the gap and <u>spread out</u> **or** diagram showing wave fronts spreading out from open gates if diagram is labelled as diffraction both marks can be scored	1 1
(ii)	less diffraction	accept no diffraction accept gates <u>absorb</u> sound / noise / waves accept gates <u>reflect</u> sound / noise / waves do **not** accept rebounds / stops / blocks out	1
total			5

Version 1.0: 0707

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science B 4462 / Physics 4451

PHY1F Unit Physics 1

Mark Scheme

2007 examination - June series

4.5.6.1.2 Speed

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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Dr Michael Cresswell, Director General.

4.5.6.1.2 Speed

MARK SCHEME

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following lines is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. (Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error/contradiction negates each correct response. So, if the number of error/contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

4.5.6.1.2 Speed

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward are kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

4.5.6.1.2 Speed

PHY1F Question 1

	answers	extra information	mark
(a)(i)	grid	accept any way of indicating correct answer	1
(ii)	increases voltage	accept any way of indicating correct answer	1
(iii)	230 V	accept any way of indicating correct answer	1
(iv)	reduce	accept any way of indicating correct answer	1
(b)(i)	increases the temperature	accept make it hotter / heat goes into the air accept convection currents accept sensible comment eg sound energy / it buzzes ignore pollutes the air	1
(ii)	less than 100%		1
total			6

4.5.6.1.2 Speed

PHY1F Question 2

	answers	extra information	mark
(a)	coal		1
(b)	fossil fuels can be used to generate electricity at any time a few large power stations can generate the electricity for a million homes	if more than 2 boxes ticked, mark incorrect boxes first	1 1
(c)(i)	no fuel is burnt	accept a named fuel accept nothing is burnt accept does not use (fossil) fuel	1
(ii)	kinetic		1
(iii)	any **two** from: • cause <u>noise</u> pollution • cause <u>visual</u> pollution • need concrete for bases • new roads / infrastructure needed • may interfere with TV / radio / mobile phone signals • dangerous to birds • do not generate all of the time • need a lot of generators • high <u>initial</u> / <u>capital</u> costs • reduces house prices	accept causes pollution for **1** mark accept generates <u>only</u> when the wind blows do **not** accept 'generate when the wind blows' do **not** accept 'take up a lot of space / land'	2
total			7

4.5.6.1.2 Speed

PHY1F Question 3

	answers	extra information	mark
(a)(i)	7pm	accept 19.00 / 1900	1
(ii)	8pm	accept 20.00 / 2000	1
	temperature drops more slowly	accept heat for temperature accept line is less steep	1
(b)	insulator		1
	conduction*	*answers can be either way around	1
	convection*		1
(c)(i)	4 (years)		1
(ii)	it is the cheapest / cheaper / cheap	do **not** accept answers in terms of heat rising or DIY	1
	has the shortest / shorter payback time	do **not** accept short payback time	1
total			9

4.5.6.1.2 Speed

PHY1F Question 4

	answers	extra information	mark
(a)(i)	any **one** from: • gamma • X-rays • infra red • microwaves • radio	 accept correct symbol accept IR do **not** accept heat do **not** accept TV	1
(ii)	all the waves travel at the same speed		1
(b)(i)	(skin) cancer / melanoma	accept damage eyesight accept sunburn do **not** accept sun tan do **not** accept sunstroke	1
(ii)	higher levels of UV greater risk to health / risk of skin cancer / (more) protection needed / most likely to get burnt / damage skin	accept UV at its strongest / sun's rays are strongest ignore 'sun is at its hottest' ignore 'sun is at its highest' accept greater damage to / easier to damage cells / mutate cells ignore just 'affect your health' must be idea of greater adverse effect on health	1 1
total			5

4.5.6.1.2 Speed

PHY1F Question 5

	answers	extra information	mark
(a)	C		1
(b)(i)	easy to maintain / access **or** (currently) cheaper than a space telescope **or** can modify (easily) an existing telescope **or** telescopes can be larger **or** can test new types of telescope (easily)	do **not** accept 'easier to use' do **not** accept easier to supply with power	1
(ii)	atmosphere does not block / distort the image	accept picture / data for image accept 'more detailed / clearer image / data / picture accept 'no light pollution' accept 'can look at the Earth' do **not** accept 'can see further' do **not** accept 'better view' do **not** accept 'clear view' do **not** accept 'can see more clearly'	1
total			3

4.5.6.1.2 Speed

PHY1F Question 6

	answers	extra information	mark
(a)(i)	electromagnetic (wave / radiation)	accept em (wave / radiation) ignore reference to frequency	1
(ii)	gamma can penetrate the crate / box / packaging	accept converse (but must relate to both alpha and beta) ignore just gamma radiation kills bacteria accept can get through to food	1
(iii)	neutrons		1
(b)(i)	absorb gamma / radiation	accept it stops / reduces the radiation	1
(ii)	any **one** from: • slow down the conveyor belt • food does more than one circuit • stay on the conveyor belt longer • food closer to the source / radiation	ignore larger doses / use more of the source ignore thinner packaging	1

Continued on next page

4.5.6.1.2 Speed

Question 6 continued

	answers	extra information	mark
(c)(i)	idea of testing food on humans / animals		1
	no (measured) ill effects **or** monitor their health	accept monitor people that have eaten the food accept a measurement / comparison for **1** mark eg measure the amount of radiation in treated food comparison plus a reason for the comparison would get **2** marks eg idea of measuring level of radiation in treated food **with** no measurable increase in level = **2** marks **or** comparing it to untreated food = **2** marks	1
(ii)	so can make own decision about eating or not eating treated food	accept may be against their religious / moral views accept some people prefer food that hasn't been tampered with ignore in case they don't like the idea of eating treated food accept don't want to eat treated food ignore might be allergic to the food eg think it will give them cancer = **0** marks think it will give you cancer so I need to know so that I can choose = **1** mark	1
total			8

4.5.6.1.2 Speed

PHY1F Question 7

	answers	extra information	mark
(a)	the outside colour of the cans		1
(b)(i)	18 (°C) **or** 88 to 70	ignore negative sign	1
(ii)	8 (°C) **or** 70 to 62	ignore negative sign	1
(c)	greater temperature difference between water and surroundings (at start)	must mention temperature difference ignore just water hotter accept energy used to heat cans initially	1
(d)	black		1
	temperature falls the fastest (in L)	accept (can L) loses more heat / cools quicker accept heat for temperature	1
	black is a good / the best / better emitter (of heat / radiation)	accept converse ignore black is best absorber	1
total			7

4.5.6.1.2 Speed

GCSE
PHYSICS
PH3FP
Mark scheme

4403
June 2014

Version: 1.0 Final

4.5.6.1.2 Speed

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Information to Examiners

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- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

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2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

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3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of error / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Candidate	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column or by each stage of a longer calculation.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

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3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Ignore / Insufficient / Do <u>not</u> allow

Ignore or insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

Quality of Written Communication and levels marking

In Question 9(a) candidates are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Candidates will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear

- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed

- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

4.5.6.1.2 Speed

Question	Answers	Extra information	Mark	AO spec ref
1(a)	transmits absorbs	correct order	1 1	AO1 3.1.1b
1(b)	light	allow ultra violet **or** UV **or** infrared **or** IR **or** gamma	1	AO1 3.1.1b
1(c)	20	allow **1** mark for correct working, ie $\frac{60}{3}$ provided no subsequent step	2	AO2 3.1.1b
1(d)	Killing cancer cells		1	AO1 3.1.1b
Total			**6**	

4.5.6.1.2 Speed

Question	Answers	Extra information	Mark	AO spec ref
2(a)	3000	allow **1** mark for correct substitution, ie 600 × 5 provided no subsequent step	2	AO2 3.2.2b
2(b)	anticlockwise moment	must be both words	1	AO1 3.2.2c
2(c)(i)	3400	allow 3.4 kilo (newtons)	1	AO2 3.2.2c
2(c)(ii)	as the distance (of the girl from point A) increases, force F increases	allow gets bigger for increases force is (directly) proportional to distance will negate any correct response	1	AO3 4.5.3
Total			**5**	

Question	Answers	Extra information	Mark	AO spec ref
3(a)	<table><tr><th></th><th>Digital Camera</th><th>Eye</th></tr><tr><td>Cornea</td><td></td><td>✓</td></tr><tr><td>Lens</td><td>✓</td><td>✓</td></tr><tr><td>Pupil</td><td></td><td>✓</td></tr><tr><td>CCD</td><td>✓</td><td></td></tr></table>	ignore shaded row each correct row = **1** mark	3	AO1 3.1.4a, d
3(b)	long		1	AO1 3.1.4b
3(c)	lens A it is a concave / diverging lens	 this mark is only gained if lens A is stated any reference to lens material or mass of lens negates this mark allow it will focus light onto the retina	1 1	AO1 3.1, 3.1.4b
3(d)	The refractive index of the lens material		1	AO1 3.1.4f
3(e)	4	ignore any signs allow **1** mark for correct substitution, ie $\frac{1}{0.25}$ provided no subsequent step	2	AO2 3.1.4e

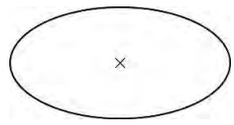
Question 3 continues on the next page . . .

4.5.6.1.2 Speed

Question 3 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
3(f)	Cauterising open blood vessels		1	AO1 3.1.5f
3(g)	5	allow **1** mark for correct substitution, ie $\frac{70}{14}$ provided no subsequent step	2	AO2 3.1.3i
Total			**12**	

4.5.6.1.2 Speed

Question	Answers	Extra information	Mark	AO spec ref
4(a)	concentrated		1	AO1 3.2.1a
4(b)		judge by eye	1	AO2 3.2.1c
4(c)	C A D	3 correct = **2** marks 1 or 2 correct = **1** mark	2	AO1 3.2.1a
4(d)	Lower the athlete's seating position Move the wheels further apart		1 1	AO2 3.2
Total			**6**	

4.5.6.1.2 Speed

Question	Answers	Extra information	Mark	AO spec ref
5(a)	hydraulic		1	AO1 3.2.3
5(b)	9	allow **1** mark for a correct substitution, ie $\frac{1800}{200}$ provided no subsequent step	2	AO2 3.2.3c
5(c)	an environmental		1	AO3 SALoSE
Total			**4**	

Question	Answers	Extra information	Mark	AO spec ref
6(a)(i)	increase		1	AO3 3.3.1a, 4.5.4
6(a)(ii)	A and B and B and C	both required for the mark either order	1	AO3 3.3.1a, 4.5.4
6(a)(iii)	any **two** from: • size of nail **or** nail material • current • (size of) paper clip • length of wire	 allow (same) nail allow (same) cell allow p.d. same amount of electricity is insufficient accept type/thickness of wire	2	AO3 4.1b
6(b)	4 B picks up the same number as C, so this electromagnet would pick up the same number as A **or** direction of current does not affect the strength of the electromagnet	 allow it has got the same number of turns as A	1 1	AO3 3.3.1a, 4.5.4
6(c)	2	allow 1 or 3	1	AO3 3.3.1a, 4.5.4
Total			**7**	

Question	Answers	Extra information	Mark	AO spec ref
7(a)	(sound waves) which have a frequency higher than the upper limit of hearing for humans **or** a (sound) wave (of frequency) above 20 000 Hz	sound waves that cannot be heard is insufficient a wave of frequency 20 000 Hz is insufficient	1	AO1 3.1.2a
7(b)	640	an answer of 1280 gains **2** marks allow **2** marks for the correct substitution ie 1600 × 0.40 provided no subsequent step allow **2** marks for the substitution $\frac{1600 \times 0.80}{2}$ provided no subsequent step allow **1** mark for the substitution 1600 × 0.80 provided no subsequent step allow **1** mark for the identification that time (boat to bed) is 0.4	3	AO2 3.1.2c
7(c)	any **one** from: • pre-natal scanning / imaging • imaging of a named organ (that is not surrounded by bone), eg stomach, bladder, testicles • Doppler scanning blood flow	accept heart do **not** allow brain **or** lungs (either of these negates a correct answer)	1	AO1 3.1.2d

Question 7 continues on the next page . . .

Question 7 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
7(d)	advantage any **one** from: • (images are) high quality or detailed or high resolution • (scan) produces a slice through the body • image can be viewed from any direction • an image can be made of <u>any</u> part (inside the body) • easier to diagnose **or** see a problem (on the image) disadvantage any **one** from: • (the X-rays used **or** scans) are <u>ionising</u> • mutate cells **or** cause mutations **or** increase chances of mutations • turn cells cancerous **or** produce abnormal growths **or** produce rapidly growing cells • kill cells • shielding is needed	clearer / better image is sufficient allow images are (always) 3D / 360° allow whole body can be scanned allow a description of what ionising is allow for cells: DNA / genes / chromosomes / nucleus / tissue damage cells is insufficient can be dangerous (to human health) unqualified, is insufficient	1 1	AO1 3.1
Total			**7**	

Question	Answers	Extra information	Mark	AO spec ref
8(a)	gravitational attraction (between the satellite and the Earth)	allow gravity allow weight of the satellite	1	AO1 3.2.4b
8(b)	any **two** from: • mass of satellite • speed / velocity (of satellite) • radius of orbit / circle	allow height above the Earth radius / height alone is insufficient	2	AO1 3.2.4c
8(c)(i)	increasing the height (above the Earth's surface) increases the time (for one orbit)	allow a positive correlation allow as one gets bigger, the other gets bigger, or vice versa ignore they are directly proportional	1	AO3 4.5.3
8(c)(ii)	there is no relationship / correlation		1	AO3 4.5.3
8(d)	Isaac Newton was a respected scientist who had made new discoveries before		1	AO3 3.2.4, SALoSE
Total			**6**	

Question	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 5, and apply a 'best-fit' approach to the marking.		Mark	AO spec ref
9(a)			6	
0 marks	**Level 1 (1–2 marks)**	**Level 2 (3–4 marks)**	**Level 3 (5–6 marks)**	AO1 3.3.2
No relevant / correct content.	**Either** there is an attempt at a description of the construction of a transformer **or** a correct statement of the effect of one type of transformer on the input p.d.	There is a description of the construction of a transformer **and** a correct statement of the effect of one type of transformer on the input p.d.	There is a clear description of the construction of a transformer **and** there is a correct description of how transformers affect the input p.d.	

details of construction:	extra information
a (laminated) core	
core is made from a magnetic material / iron	
2 coils	
the coils are made from an electrical conductor / copper	
the coils are covered in plastic / insulation	
the coils are (usually) on opposite sides	
step-up transformer has more turns on secondary coil than (its) primary (or vice versa)	
step-down transformer has less turns on secondary coil than (its) primary (or vice versa)	
effect on input p.d. :	
step-up transformer, the output p.d. is greater (than the input p.d.)	accept voltage for p.d.
step-down transformer, the output p.d. is lower (than the input p.d.)	

Question 9 continues on the next page . . .

Question 9 continued . . .

Question	Answers	Extra information	Mark	AO spec ref
9(b)	switch mode (transformer)		1	AO1 3.3.2j
Total			**7**	

AQA

GCSE

Science A / Physics

PH1FP

Mark scheme

4405/4403
June 2015

Version/Stage: 1.0 Final

4.5.6.1.2 Speed

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' 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.

Further copies of this mark scheme are available from aqa.org.uk

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PMT

Mark Scheme

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of errors / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.1 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.2 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column or by each stage of a longer calculation.

3.3 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.4 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.5 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.6 Brackets

(.....) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.2 Ignore / Insufficient / Do not allow

Ignore of insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

4. Quality of Communication and levels marking

In Question **7a** students are required to produce extended written material in English, and will be assessed on the quality of their communication as well as the standard of the scientific response.

Students will be required to:
- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

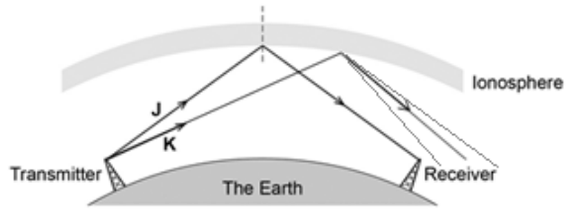
The following general criteria should be used to assign marks to a level:

Level 1: basic
- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear
- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed
- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar

4.5.6.1.2 Speed

Question	Answers	Extra information	Mark	AO / Spec. ref.
1(a)(i)	reflection of wave **K** at or within the ionosphere angle i = angle r  	allow dashed lines 'judge by eye' tolerance for the reflected ray is between the first e and last r ignore arrows a reflected ray to the receiver doesn't score 2nd mark additional rays shown doesn't score 2nd mark	1 1	AO2 P1.5.2b
1(a)(ii)	normal		1	AO1 P1.5.2a
1(b)(i)	microwave		1	AO1 P1.5.1k
1(b)(ii)	refraction		1	AO1 P1.5.1g
1(c)	All electromagnetic waves are transverse. All electromagnetic waves have the same speed in a vacuum.		1 1	AO1 P1.5.1b, c, d
Total			**7**	

4.5.6.1.2 Speed

Question	Answers	Extra information	Mark	AO / Spec. ref.
2(a)	chemical kinetic sound	correct order only	1 1 1	AO1 P1.2.1a
2(b)	48% or 0.48	an answer of 0.48 with a unit gains **1** mark an answer of 0.48% gains **1** mark an answer of 48 with or without a unit gains **1** mark	2	AO2 P1.2.1d
Total			**5**	

Question	Answers	Extra information	Mark	AO / Spec. ref.
3(a)(i)	because they contain free electrons		1	AO1 P1.1.3a
3(a)(ii)	because they are good absorbers of infrared radiation		1	AO1 P1.1.1c
3(b)(i)	insulators		1	AO1 P1.1.3a
3(b)(ii)	the rate of energy transfer would be lower.		1	AO1 P1.1.3c
3(c)	power time	allow the temperature (of the oven) watts or wattage is insufficient	1 1	AO1 P1.3.1b
3(d)	it can be switched on / off remotely	accept sensible suggestions about remote operation eg can be turned on / off from work **or** food can be cooked before you get home	1	AO3 P1.1
Total			**7**	

4.5.6.1.2 Speed

Question	Answers	Extra information	Mark	AO / Spec. ref.
4(a)	20 790 (J)	an answer of 21 000 (J) (2 s.f.) gains **2** marks allow **1** mark for correct substitution: ie E = 0.33 x 4200 x 15 provided no subsequent step shown	2	AO2 P1.1.4d
4(b)	temperature		1	AO1 P1.1.4d
4(c)	(top pan) balance	accept scales do **not** accept a scale do **not** accept weighing scales do **not** accept newtonmeter do **not** accept spring balance	1	AO1 P1.1.4d
4(d)	dark / black / (dark) grey convection	 correct order only	1 1	AO1 P1.1.1c P1.1.3c
4(e)(i)	created	accept made	1	AO1 P1.2.1a
4(e)(ii)	increases		1	AO1 P1.2.1c
Total			**8**	

Question	Answers	Extra information	Mark	AO/Spec. ref.
5(a)(i)	high levels of infrared radiation (from the Sun)	allow lots of (solar) energy (available) do **not** accept 'heat' for infrared 'it is hot' is insufficient 'lots of sunlight' is insufficient	1	AO2 P1.4.1a
5(a)(ii)	reflected		1	AO1 P1.5.1g
5(a)(iii)	boiler turbine transformer	correct order only	1 1 1	AO1 P1.4.1a
5(b)	2 100 000 (kWh)	allow **1** mark for correct substitution i.e. 140 000 x 15 provided no subsequent step	2	AO2 P1.3.1c
5(c)(i)	only 1 wind turbine was considered **or** other wind turbines may have generated more electricity only 1 week's weather was reported on **or** wind speed varies from one week to another	accept only one location is considered accept insufficient sample size 'wind speed varies' is insufficient	1 1	AO3 P1.4
5(c)(ii)	any **one** from: • wind speed is too high / low • wind is unreliable	allow no wind allow too windy allow wind is variable	1	AO1 P1.4

Question 5 continues on the next page . . .

Question 5 continued . . .

Question	Answers	Extra information	Mark	AO/Spec. ref.
5(c)(iii)	any **one** from: • wind is a renewable energy source • do not use fuel • energy source is free • do not release carbon dioxide • do not release greenhouse gases • do not release sulfur dioxide • do not cause acid rain • do not cause climate change • do not cause global warming • do not cause global dimming	answer must be an advantage of wind, converse answers in terms of fossil fuels are insufficient accept do not release pollutant gases 'no pollution' is insufficient	1	AO1 P1.4.1f
Total			**11**	

4.5.6.1.2 Speed

Question	Answers	Extra information	Mark	AO / Spec. ref.
6(a)(i)	C		1	AO2 P1.5.4a
6(a)(ii)	The speed of star **B** is less than the speed of star **D**.		1	AO3 P1.5.4b
6(b)	300 000 000 m/s	allow **1** mark for correct substitution ie 200 000 x 1500 provided no subsequent step shown allow unit correctly indicated in list if not written in answer space	2 1	AO2 AO1 P1.5.1j
Total			**5**	

4.5.6.1.2 Speed

MARK SCHEME – GCSE SCIENCE A / PHYSICS – PH1FP– JUNE 2015

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7 (a)	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.		6	AO2 AO3 P1.2 HSW

0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant information	There is a relevant statement about an energy saving method	There is at least one clear comparison of energy saving methods and their cost effectiveness with an appropriate calculation	There is a comparison of energy saving methods and their cost effectiveness with appropriate calculations. Comparison to include further detail.

examples of physics points made in the response	extra information
examples of relevant statements • energy efficient boiler saves the most (energy / money) per year • loft insulation costs the least to install • double-glazing costs the most to install **examples of statements that include cost effectiveness** • loft insulation is the most cost effective in the long term • double-glazing is the least cost effective • loft insulation has the shortest payback time • double-glazing has the longest payback time • payback time calculated for any method **examples of further detail** • for cost effectiveness install in the following order: loft, cavity wall, boiler, double-glazing • for reducing energy use install in the following order: boiler, loft, cavity wall, double glazing • don't install double-glazing for insulation purposes • double-glazing won't pay for itself in your lifetime • justified choice of best / worst method	payback times: energy efficient boiler: 6.25 years loft insulation: 2 years double glazing: 100 years cavity wall insulation: 2.86 years

PMT

Question 7 continued . . .

Question	Answers	Extra information	Mark	AO / Spec. ref.
7(b)(i)	how effective a material is as an insulator	accept 'heat' for energy accept how effective a material is at keeping energy in accept the lower the U-value the better the insulator accept the lower the U-value the lower the rate of energy transfer	1	AO1 P1.1.4a
7(b)(ii)	(the U-value) decreases		1	AO1 P1.1.4b
Total			**8**	

4.5.6.1.2 Speed

MARK SCHEME – GCSE SCIENCE A / PHYSICS – PH1FP– JUNE 2015

Question	Answers	Extra information	Mark	AO / Spec. ref.
8(a)(i)	0.5 °C		1	AO3 P1.1
8(a)(ii)	data is continuous **or** both variables are continuous **or** independent variable is continuous **or** time is continuous	accept results / measurements for data accept data is not categoric one variable is continuous is insufficient air temperature is continuous is insufficient	1	AO3 P1.1
8(b)(i)	20.5 (°C)		1	AO2 P1.1
8(b)(ii)	60 (minutes)	accept 1 hour	1	AO2 P1.1
8(c)(i)	so a comparison can be made **or** outside temperature is a control variable	accept: (outside) temperature would affect energy required (to maintain temperature of the house) **or** (outside) temperature would affect internal temperature (of the house) **or** heat loss will be faster on a cold day outside temperature will affect the results is insufficient fair test is insufficient	1	AO3 P1.1

Question 8 continues on the next page . . .

PMT

MARK SCHEME – GCSE SCIENCE A / PHYSICS – PH1FP– JUNE 2015

Question	Answers	Extra information	Mark	AO / Spec. ref.
8(c)(ii)	the cost is equal to the number of kWh x the cost per kWh calculation 0.8 / 8.0 = 0.1 or 10%	accept (heating) bill depends on (number of) kWh used accept energy for kWh allow 7.2 / 8.0 = 0.9 or 90%	1 1	AO3 AO2 P1.1
8(c)(iii)	heating is on for more / less time (than anticipated) because some days it is cooler / warmer (than anticipated)	 accept other sensible suggestions an answer giving two sensible situations gains **2** marks possible examples: • some houses have different amounts of insulation • there are different styles of house temperature (inside / outside) is always changing is insufficient	1 1	AO3 P1.1
Total			**9**	

GCSE

Additional Science / Physics

PH2FP

Mark scheme

4408/4403
June 2015

Version/Stage: 1.0: Final

4.5.6.1.2 Speed

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Mark Scheme

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of errors / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

4.5.6.1.2 Speed

Example 1: What is the pH of an acidic solution? (1 mark)

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column or by each stage of a longer calculation.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(.....) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Accept / allow

Accept is used to indicate an equivalent answer to that given on the left-hand side of the mark scheme. Allow is used to denote lower-level responses that just gain credit.

3.9 Ignore / Insufficient / Do not allow

Ignore of insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

4. Quality of Communication and levels marking

In Question **8c** students are required to produce extended written material in English, and will be assessed on the quality of their communication as well as the standard of the scientific response.

Students will be required to:
- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: basic
- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear
- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed
- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

4.5.6.1.2 Speed

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
1(a)	increases	accept reaches highest value do **not** accept increases and decreases	1	AO2 2.3.2	**E**
1(b)(i)	increases		1	AO1 2.3.2m	**A**
1(b)(ii)	increases		1	AO1 2.3.2m	**A**
1(c)	18 watt	allow **1** mark for correct substitution i.e. 12 x 1.5 provided no subsequent step accept W answer may be indicated in the list	2 1	AO2 2.4.2c AO1 2.4.2c	**E**
Total			**6**		

4.5.6.1.2 Speed

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
2(a)	inside the Sun		1	AO1 2.6.2b	**A**
2(b)	fusion		1	AO1 2.6.2a	**G**
2(c)	energy		1	AO1 2.6.2f	**A**
Total			**3**		

4.5.6.1.2 Speed

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
3(a)	3 (.0)	allow **1** mark for correct substitution i.e. 25 x 0.12 provided no subsequent step	2	AO2 2.1.5d	**E**
3(b)(i)	elastic potential kinetic	correct order only	1 1	AO1 2.1.5c 2.2	**G**
3(b)(ii)	increases to 80(mm) (or more)	 accept any number greater than 75 an answer 'it (more than) doubles' gains both marks	1 1	AO3 2.1.5a	**E**
3(c)(i)	weight		1	AO1 2.1	**A**
3(c)(ii)	Downward speed increases		1	AO1 2.1.1e	**A**
Total			**8**		

4.5.6.1.2 Speed

PMT

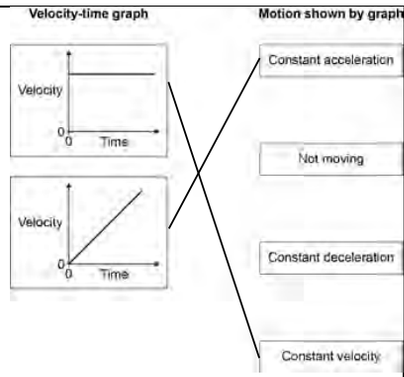
MARK SCHEME – GCSE ADDITIONAL SCIENCE / PHYSICS – PH2FP– JUNE 2015

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
4(a)(i)	(3-pin) plug	do **not** accept plug socket	1	AO1 2.4.1d	**E**
4(a)(ii)	live and neutral		1	AO1 2.4.1e	**A**
4(a)(iii)	double		1	AO1 2.4.1j	**G**
4(b)	Direct current (d.c.) only		1	AO1 2.4.1a	**A**
4(c)(i)	live		1	AO1 2.4.1g	**G**
4(c)(ii)	too great a current flows	accept a surge of current accept too great a power accept an electrical fault do **not** accept voltage / energy / electricity too high	1	AO1 2.4.1g	**E**
4(c)(iii)	can be reset (disconnects circuit) faster	accept does not need replacing cheaper is insufficient does not melt is insufficient quicker to fix / replace is insufficient	1 1	AO2 2.4	**E**
Total			**8**		

4.5.6.1.2 Speed

PMT

MARK SCHEME – GCSE ADDITIONAL SCIENCE / PHYSICS – PH2FP– JUNE 2015

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
5(a)		if more than one line is drawn from a graph then all those lines are wrong allow **1** mark for 1 correct line	2	AO1 2.1.2f	**G**
5(b)	speed		1	AO1 2.1.2d	**G**
5(c)(i)	2.25	allow **1** mark for correct substitution i.e. $a = \frac{9-0}{4}$ or $a = \frac{9}{4}$ provided no subsequent step	2	AO2 2.1.2e	**E**
5(c)(ii)	The air resistance increases		1	AO1 2.1.4a	**A**
5(d)	2000 J mass is half **or** kinetic energy depends on mass	 do **not** accept weight for mass	1 1	AO2 2.2.1g	**E**
Total			**8**		

4.5.6.1.2 Speed

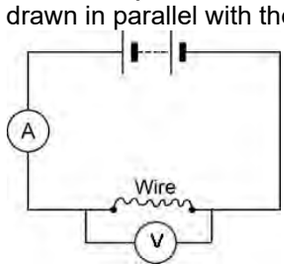
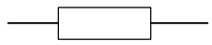
PMT

MARK SCHEME – GCSE ADDITIONAL SCIENCE / PHYSICS – PH2FP– JUNE 2015

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
6(a)	cell damage *or* cancer	accept kills/mutates cells radiation poisoning is insufficient ionising is insufficient	1	AO3 2.5.2g	**E**
6(b)(i)	any **one** from: • use tongs to pick up source • wear gloves • use (lead) shielding • minimise time (of exposure) • maximise distance (between source and teacher)	accept any other sensible and practical suggestion ignore reference to increasing / decreasing the number / thickness of lead sheets	1	AO3 2.5	**E**
6(b)(ii)	<u>background</u>		1	AO1 2.5.2b	**E**
6(c)(i)	curve drawn *from point 2,160*	do **not** accept straight lines drawn from dot to dot	1	AO2 2.5	**E**
6(c)(ii)	(also) increases	less radiation passes through is insufficient	1	AO3 2.5	**E**
6(c)(iii)	50	accept any value from 40 to 56 inclusive	1	AO3 2.5	**E**
6(d)	gamma only gamma (radiation) can pass through lead	 accept alpha **and** beta cannot pass through lead a general property of gamma radiation is insufficient	1 1	AO2 2.5.2e	**E**
Total			**8**		

4.5.6.1.2 Speed

Question	Answers	Extra information	Mark	AO / Spec. ref.	ID
7(a)(i)	p.d. is (directly) proportional to current **or** gradient/slope is constant ***or*** the lines show constant resistance	accept lines are straight / diagonal	1	AO2 2.3.2d/e/g	**E**
7(a)(ii)	C for the same p.d. the current is the smallest	reason only scores if C is chosen accept lowest gradient **and** the gradient = 1/R	1 1	AO2 2.3.2i	**E**
7(b)(i) clip with table 1	ohm	accept correct symbol Ω accept an answer written in Table 1 if not given in answer space	1	AO1 2.3.2h	**E**
7(b)(ii)	K and L only length varies	reason only scores if both K and L are chosen accept type of metal and the diameter are the same	1 1	AO3 2.3.2	**E**
7(b)(iii)	measure the resistance of more wires made from different metals	accept test more (types of) metals measure the resistance of more wires is insufficient they only use two metals is insufficient	1	AO3 2.3.2	**E**

7(c)(i)	voltmeter symbol correct and drawn in parallel with the wire 	accept voltmeter symbol correct and drawn in parallel with the battery	1	AO1 2.3.2c/f	**E**
7(c)(ii)	correct symbol drawn 	symbol must be rectangular	1	AO1 2.3.2c	**E**
Total			**9**		

Question	**Answers**	**Extra information**	**Mark**	**AO / Spec. ref.**	**ID**
8(a)	(an equal amount of) positive charge	do **not** accept charge on the atom / nucleus is positive	1	AO3 2.5.1	**E**
8(b)(i)	a (significant) number of alpha particles were scattered by more than 4° **or** alpha particles deflected backwards measurements / results could not be explained by 'plum pudding' model **or** measurements / results did not support predictions	accept (some) measurements / results were unexpected can be explained by the nuclear model is insufficient accept measurements / results did not support hypothesis	1 1	AO1 2.5 AO1	**E**
8(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**

4.5.6.1.2 Speed

PMT

MARK SCHEME – GCSE ADDITIONAL SCIENCE / PHYSICS – PH2FP– JUNE 2015

Question 8 continues on the next page . . .

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
8(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 5 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 **plus 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

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 orbiting it in an atom	accept protons and neutrons have the same mass accept electrons have tiny / negligible mass zero mass is neutral		

Total		**10**

4.5.6.1.2 Speed

AQA

GCSE

Science A / Physics

PH1FP

Mark scheme

4405/4403
June 2016

Version 1.0: Final Mark Scheme

4.5.6.1.2 Speed

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' 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.

Further copies of this mark scheme are available from aqa.org.uk

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Mark Scheme

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of errors / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution? (1 mark)

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Full marks can be given for a correct numerical answer, without any working shown.

However, if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column or by each stage of a longer calculation.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation e.c.f. in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(.....) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Accept / allow

Accept is used to indicate an equivalent answer to that given on the left-hand side of the mark scheme. Allow is used to denote lower-level responses that just gain credit.

3.9 Ignore / Insufficient / Do not allow

Ignore of insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

4. Quality of Communication and levels marking

In Question **7(b)** students are required to produce extended written material in English, and will be assessed on the quality of their communication as well as the standard of the scientific response.

Students will be required to:
- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: basic
- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear
- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed
- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

4.5.6.1.2 Speed

MARK SCHEME – GCSE SCIENCE A / PHYSICS – PH1FP– JUNE 2016

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)	geothermal nuclear biofuel		1 1 1	AO1 1.4.1a 1.4.1d
1(b)	gravitational (potential) kinetic sound		1 1 1	AO1 1.3.1a 1.4.1b
1(c)(i)	90% or 0.9(0)	an answer of 0.9(0) with a unit gains **1** mark an answer of 90 with no unit or an incorrect unit gains **1** mark	2	AO2 1.2.1d
1(c)(ii)	60 (MW)	allow 10%	1	AO2 1.2.1b
1(c)(iii)	increased		1	AO1 1.2.1c
Total			**10**	

4.5.6.1.2 Speed

MARK SCHEME – GCSE SCIENCE A / PHYSICS – PH1FP– JUNE 2016

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	46 200	accept 46 000 allow **1** mark for correct substitution ie 0.5 x 4200 x 22 provided no subsequent step	2	AO2 1.1.4d
2(b)	Energy is used to heat the kettle.		1	AO2 1.2.1b
2(c)	9 (pence)	allow **1** mark for correct substitution ie 0.6 x 15 provided no subsequent step	2	AO2 1.3.1d
2(d)(i)	conduction and convection		1	AO1 1.1.3a
2(d)(ii)	any **one** from: • water stays hotter for longer (than a 'conventional' kettle) • water boiled less often • less energy transferred to the surroundings • (new design is) more efficient		1	AO2 1.2
Total			**7**	

4.5.6.1.2 Speed

MARK SCHEME – GCSE SCIENCE A / PHYSICS – PH1FP– JUNE 2016

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)(i)	any **one** from: • (visible) light • UV / ultra violet • X-ray • gamma / γ-ray		1	AO1 1.5.1e
3(a)(ii)	less than less than the same as		1 1 1	AO1 1.5.1d 1.5.1e
3(b)(i)	(the) Big Bang (theory)		1	AO1 1.5.4e
3(b)(ii)	the red-shift of light from distant galaxies		1	AO1 1.5.4c
Total			**6**	

4.5.6.1.2 Speed

MARK SCHEME – GCSE SCIENCE A / PHYSICS – PH1FP– JUNE 2016

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	dependent		1	AO3 1.1.3b
4(b)	The equipment has a better resolution.		1	AO3 1.1.3
4(c)	(probe) C largest difference between reading and actual temperature	allow 103.2 reason only scores if C chosen accept larger it is 3.2 greater is insufficient comparing C with only one other probe is insufficient	1 1	AO3 1.1.3
4(d)(i)	12(°C)	accept a value between 12.0 and 12.2 inclusive	1	AO2 1.1.3d
4(d)(ii)	140 (seconds) <u>temperature</u> starts to rise	accept an answer between 130 and 150 inclusive only scores if time mark awarded accept the <u>temperature</u> was lowest (at this time)	1 1	AO2 AO3 1.1.3b
4(d)(iii)	increase	accept faster (rate)	1	AO1 1.1.3b
Total			**8**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	it would decrease the time		1	AO3 1.2.1a
5(b)	720 (J)	allow **1** mark for correct substitution ie 12 x 60 provided no subsequent step	2	AO2 1.3.1c
5(c)	dense rises falls	 accept equivalent words accept equivalent words	1 1 1	AO1 1.1.3a
5(d)	 decreases decreases decreases	more than one tick in any row negates the mark	 1 1 1	AO3 1.1.3c 1.1.3d
Total			**9**	

4.5.6.1.2 Speed

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)	frequency		1	AO1 1.5.3b
6(b)	echo(es)		1	AO1 1.5.3c
6(c)	spreading (out) equal to	changing direction is insufficient moving apart is insufficient bending is insufficient accept: similar to same (order of magnitude) as slightly smaller than slightly larger than	1 1	AO1 1.5.1g
6(d)	340 (m/s)	allow **1** mark for correct substitution ie 25 000 x 0.0136 provided no subsequent step or allow 1 mark for a correct calculation showing an incorrect value from conversion to hertz x 0.0136 an answer of 0.34 gains **1** mark	2	AO2 1.5.1j
6(e)	(a wave where the) oscillations are parallel to the direction of energy transfer causing (areas of) compression and rarefaction	both marking points may appear as labels on a diagram accept vibrations for oscillations accept in same direction as for parallel to allow direction of wave (motion) for direction of energy transfer accept correct description in terms of particles mechanical wave is insufficient needs a medium to travel through is insufficient	1 1	AO1 1.5.1b
Total			**8**	

4.5.6.1.2 Speed

MARK SCHEME – GCSE SCIENCE A / PHYSICS – PH1FP– JUNE 2016

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)	any **one** from: • high cost of installing overhead power lines or underground cables or pylons • high cost as (very) long cables needed • amount of electricity required is too low	allow not enough (surplus) electricity would be generated	1	AO1 1.4.1e

Question 7 continues on the next page . . .

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7 (b)	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 5 and apply a 'best-fit' approach to the marking.		6	3 AO1 2 AO2 1 AO3 1.4.1b

0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant information	at least **one** advantage **or one** disadvantage of either method	at least **one** advantage **and one** disadvantage is stated for **one** method **and** a different advantage **or** disadvantage is stated for the other method	clear comparison of advantages **and** disadvantages of **each** method

examples of physics points made in the response	extra information
Advantages of both methods:	
• both renewable sources of energy	
• both have no fuel (cost)	accept carbon neutral
• both have very small (allow 'no') running costs	accept no greenhouse gases
• no carbon dioxide produced	accept doesn't contribute to global warming
Advantages of wind:	
• higher average power output	produces more energy is insufficient
Advantages of hydroelectric:	
• constant / reliable power (output)	
• lower (installation) cost	
Disadvantages of wind:	
• higher (installation) cost	
• variable / unreliable power output	
• (may) kill birds / bats	
Disadvantages of hydroelectric:	
• lower power output	
• (may) kill fish or (may) damage habitats	
• more difficult to set up (within river)	
Disadvantages of both methods	
• (may be) noisy	
• visual pollution	ignore payback time unless no other relevant points made ignore time to build for both

Total			7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8(a)	a proportion / percentage of the energy is wasted	allow heat for energy allow some energy is wasted	1	AO2 1.2.1b 1.2.1c
	(wasted) energy is transferred to surroundings **or** energy is needed to heat pan (before food is heated)		1	
8(b)	(fins have a) large(r) surface area	accept fins increase the surface area	1	AO1 1.1.1c 1.1.1e 1.1.3c
	(black metal surface is a) good / better absorber of infrared radiation	allow 'heat' or 'energy' for infrared radiation ignore good emitter of infrared radiation not a good reflector is insufficient	1	
8(c)	the higher the temperature (of the saucepan) the greater the rate at which infrared radiation is emitted	accept converse answer allow the higher the temperature the more infrared radiation is emitted allow there is a positive correlation	1	AO2 1.1.1b
Total			**5**	

4.5.6.1.2 Speed

Answer 100 · Examiner comments June 2018 | 8463/2F | Original Q1

Question 1 (Low demand)

01.1 Nearly all students identified the correct galaxy.

01.2 Most students completed this calculation correctly. A small minority scored one mark by showing a correct substitution followed by an incorrect numerical answer.

01.3 Just under half of the students gave the correct answer. Many of those students giving an incorrect answer of 4 were including Pluto as a planet.

01.4 Over 90% of students gave a value within the correct range.

01.5 The majority of students multiplied the given numbers, rather than dividing 9 by 0.6.

Answer 101 · Examiner comments June 2018 | 8463/2F | Original Q3

Question 3 (Low demand)

03.1 94% of the students gave the correct answer.

03.2 This was poorly answered with just over 50% of the students scoring zero. There was a lot of confusion between wavelength and frequency, with many students stating that frequency is the distance between two adjacent waves. Those students scoring one mark understood the need to count the number of waves passing a point in a given time but not in one second.

03.3 Most of the students were able to correctly substitute the given value for frequency into the equation and calculate the period. 24% of the students knew that the period is measured in seconds; the majority giving metres/second.

4.5.6.1.2 Speed

Answer 102 · Examiner comments

June 2018 | 8463/2F | Original Q12

Question 12 (Standard demand)

12.1 Regrettably, this part of the question assessed content that we had stipulated would only be assessed on the Higher tier. All students were awarded full marks for this part of the question.

12.2 Only just over 6% of the students were able to use the information presented in Figure 16 to calculate the frequency of the wave.

12.3 34% of the students were able to give this equation.

12.4 Those students that could recall the correct equation generally scored all three marks. Most of the students that scored zero did so because they either substituted the values into an incorrect equation or did not use the frequency calculated for question 12.2. It was common to see a frequency of 10 Hz being used instead.

12.5 Regrettably, this part of the question assessed content that we had stipulated would only be assessed on the Higher tier. All students were awarded full marks for this part of the question.

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

4.5.6.1.2 Speed

Answer 104 · Examiner comments June 2019 | 8463/2F | Original Q1

Question 1 (Low demand)

01.1 Just over half of the students scored this mark.

01.2 Only 3% of the students scored zero with nearly 85% of the students identifying the description of the motion to score both marks.

01.3 Most of the students did not appreciate that the race was over 100m, although it was stated in the information given. Many students gave the total distance the athlete travelled ie 125m.

01.4 Although the distance of the race was repeated in the question, many of the students simply calculated the total distance over the total time. Those students who did select the correct distance often read the time axis incorrectly.

01.5 Only 35% of the students correctly identified the average running speed of a person.

Answer 105 · Examiner comments June 2019 | 8463/2F | Original Q2

Question 2 (Low demand)

02.1 Just over 50% of the students gave the correct answer, wavelength. Most of the other students wrote frequency.

02.2 Just under 60% of the students gave the correct answer.

02.3 Nearly 73% of the students made the correct choice.

02.4 Only just over half of the students scored this mark. The most common incorrect answers included the idea of the universe being very big when it began.

02.5 Just over 85% of the students appreciated that scientific evidence supports the Big Bang theory.

02.6 Although 57% of the students scored both marks the idea that graph Z is the only one to show the universe expanding was often not well expressed.

4.5.6.1.2 Speed

Answer 106 · Examiner comments

June 2019 | 8463/2F | Original Q9

Question 9 (Standard demand)

09.1 This question was successfully completed by 29% of the students. Both 'ruler' and 'metre stick' were common unacceptable answers. There were numerous other answers such as ammeter, oscilloscope and timer.

09.2 This equation was not well known with only 33% of the students scoring the mark.

09.3 Just over 60% of the students scored zero or did not attempt this question. A mark was awarded for converting the distance into metres, however this was rarely done.

09.4 Students could answer this in one of two ways, either with reference to the wooden bridge or with altering the mass hanging from string. Just over 23% of the students scored both marks, mainly for adding more masses as opposed to indicating which way the wooden bridge should be moved.

09.5 Nearly 20% of the students did not attempt this question. Many of those that did attempt the question gave a detailed written description of the apparatus shown in the diagram; this was not worth any marks. Those students that scored some marks identified the need to alter the mass on the string to adjust the tension. Some students correctly identified the need to measure the wavelength and then multiply this by the frequency as the way to determine the wave speed. However many students simply stated they would 'measure' the wave speed which was not creditworthy. Less than 1% of the students identified the need to move the bridge or adjust the frequency in order to see a wave pattern.

4.5.6.1.2 Speed

Answer 117 · Examiner comments

June 2022 | 8463/1F | Original Q2

Question 2 (Low demand)

02.1 About 80% of students answered this question correctly. ‘Metre stick’ was ignored, so if students gave a list eg ‘metre stick or tape measure’ they could still score the mark.

02.2 About 90% of students completed this calculation correctly, scoring 2 marks.

02.3 About 90% of students completed this calculation correctly, scoring 2 marks.

02.4 90% of students identified the correct stop-clock.

02.5 90% of students completed this calculation correctly, scoring 2 marks. The most common mistake was to not square the speed. This would then just score a mark for the substitution, if correct.

4.5.6.1.2 Speed

Answer 118 · Examiner comments June 2022 | 8463/2F | Original Q5

Question 5 (Low and standard demand)

05.1 Very few of the students seemed to know that all electromagnetic waves travel at the same speed in a vacuum.

05.2 The order of the waves in the electromagnetic spectrum was not well known with only about 40% of the students scoring both marks.

05.3 The majority of the students demonstrated an understanding of 'range'. About 10% of students did not attempt the question.

05.4 Very few of the students related the information in Table 4 and Figure 10 to the relative risk of harm to people. Few of the students scored more than 1 mark with about 13% of the students not attempting the question. Most of the students that scored 1 mark did so for giving a general trend or stating that UV can cause skin cancer.

05.5 Many of the students tried to give a more complex answer than required, which were commonly incorrect. The most common correct answers involved being able to see or the idea that if light did not get through it would be dark all the time.

05.6 Nearly three quarters of the students scored at least one mark, often for completing the second blank space correctly.

Answer 119 · Examiner comments June 2022 | 8463/2F | Original Q7

Question 7 (Low and standard demand)

07.1 Most of the students scored at least 1 mark with the majority scoring both.

07.2 The answers were split 50/50 between parallel and perpendicular.

07.3 About three quarters of the students chose the correct answer.

07.4 Very few of the students appeared to see the link between part 07.3 and 07.4. Those choosing the correct answer in 07.3 often went on to use the value 8 rather than 8000 and so scored zero. The students scoring both marks often did so for choosing the wrong answer '8' in part 07.3 but then using it in this calculation.

07.5 About 30% of the students failed to score 3 marks as they were unable to give the correct unit of wavelength.

07.6 Almost all the students were able to use the equations sheet to give the correct equation. A few students only wrote the three symbols inside a triangle - this is not an equation and so scored zero.

07.7 A significant minority of the students were unable to rearrange the equation correctly and thus ended up with an incorrect answer. Over half of the students scored all 3 marks.

07.8 Very few of the answers given linked the three marking points together in a logical, well written sequence. The idea that the sound from speaker B would take more time to reach the technician was often omitted. Approximately 15% of the students did not attempt the question.

4.5.6.1.2 Speed

Answer 120 · Examiner comments June 2022 | 8463/2F | Original Q8

Question 8 (Standard demand)

08.1 Many of the students were able to give one factor but only about one quarter went on to score both marks. A significant number of the students gave vague answers such as 'weather' and so scored zero.

08.2 Almost all the students were able to use the equations sheet to give the correct equation. 4% of the students did not attempt to give an equation

08.3 A significant number of the students multiplied the two values together and so scored zero. Approximately 10% of the students did not attempt the question.

08.4 Approximately 50% of the students scored 2 or 3 marks. A common error was to misunderstand what a calculated value of 12100 was. Some of the students thought this to be the final velocity whilst others went on to work out 12100 squared as the final velocity. Those scoring zero often failed to show any working out and so could not be given any of the 'method' marks.

08.5 Despite the equation sheet being given, 5% of the students did not give an equation.

08.6 The vast majority of the students did not convert the distance to metres and so scored only 2 marks.

Answer 121 · Examiner comments June 2023 | 8463/1F | Original Q7

Question 7 (Low and Standard Demand)

07.1 89% of students correctly identified the direction of the particles.

07.2 56% of students correctly identified the movement of the particles.

Answer 121 · Examiner comments June 2023 | 8463/1F | Original Q7

07.3 30 % of student scored 3 marks, while 58 % of students scored 2 marks for completeing this graph Lines of best fit extended beyond the plotted points were ignored. The line of best fit needed to pass through, or close to, every point to score. Dot to dot lines were not acceptable.

07.4 86% of students scored 2 marks for this calculation.

07.5 Only 7% of students scored 3 marks, while 35% scored 2 marks and 36% scored 1 mark for identifying the effect of increatsng the volume of the gas.

4.5.6.1.2 Speed

Answer 122 · Examiner comments — June 2023 | 8463/2F | Original Q2

02.1

22 % of students scored 1 mark and 61 % of students scored both marks for identifying the energies

02.2

The majority of the students identified the correct relationship between the speed and the braking distance. Those that didn't described the graph rather than mentioning braking distance or speed, or used incorrect phrases eg 'directly proportional'.

02.3

84% of students knew that braking distance increases when a road becomes icy.

02.4

This 3-mark question required students to calculate the change in velocity then use this correctly to determine the time taken. Many students failed to show how they calculated the change in velocity and could not be awarded any marks.

Answer 122 · Examiner comments — June 2023 | 8463/2F | Original Q2

02.5

86 % scored 2 marks for calculating the resultant force. Common mistakes involved dividing instead of multiplying, or calculating 1600 x 0.25^2, the squared apparently being inferred from the unit of deceleration (m/s^2).

02.6

77% of students were able to identify the control variable for the investigation.

02.7

Many students correctly stated that there would be a greater number of results, which could lead to a change in the mean. But some simply stated that different people have different reaction times. Credit was also given for those that stated the reaction times of 3 children tested may not be representative of the whole class. However, some only answered by saying 'only 3 children were tested' which was insufficient to get the mark.

02.8

30 % scored 1 mark and only 33 % scored 2 marks. Rather than describing a change to the experiment students would state how they thought music would affect the reaction time, or why music would affect the reaction time.
Many who got 1 mark suggested they did the experiment with music on but did not say to compare with previous results or do it with music off.

4.5.6.1.2 Speed

Answer 123 · Examiner comments June 2023 | 8463/2F | Original Q4

04.1

90% of students recognised the reason why a new scientific model would need to be introduced.

04.2

Some students gained all four marks through well-structured comparisons between the models. Those who listed features that were unconnected gained a maximum of 2 marks. Some students did not achieve any marks through a lack of detail in their statements.

04.3

Students were asked to state the time increases, most achieved this, a common alternative was 'it takes longer'. Many students used the table headings to successfully describe the relationship. Many who did not score made comments about the speed increasing or the distance being greater or simply said the time changes.

04.4

Most students scored 2 marks, with only 3.5% getting no marks. The most common error was not identifying the correct scale of the graph ,resulting in the bars being the incorrect height.

04.5

21% of students were able to identify the order of two stages in the life cycle of the Sun correctly. 19% were able to identify all three stages in the correct order.

04.6

57% of students knew that black bodies are the best emitters of radiation.

Answer 124 · Examiner comments June 2023 | 8463/2F | Original Q5

05.1

48% of students recognised the wavelength of a transverse wave.

05.2

47% of students recognised the correct amplitude of a transverse wave.

05.3

93% of students knew that radio waves are used for communication.,

05.4

The majority of students calculated the distance correctly

05.5

The majority of students scored this mark. The most common correct answer was heating food. Common incorrect answers included TV and computers.

4.5.6.1.2 Speed

Answer 125 · Examiner comments June 2023 | 8463/2F | Original Q6

06.1

50% of students knew that a wide beam of light makes it more difficult to judge where the centre of the beam is.

06.2

Many students found completing the path taken by the ray through the block very difficult very difficult, with many scoring no marks. Some treated the normal line as mirror and drew a reflected ray either inside the block or against the edge of it.

06.3

21% of students were able to identify the resolution of the protractor.

06.4

The vast majority of students were able to calculate the mean.

06.5

Only 25% of students gave the correct word ‘absorbed’. Common incorrect answers included blocked, emitted, filtered, reflected and refracted.

06.6

The vast majority of students gave the correct equation. For those few that didn’t score, it was most frequently because they did not attempt the question, in spite of having the formula sheet.

06.7

A significant number of students scored 2 marks because they could not calculate the powers of ten correctly, giving an answer of 7.5×10^{21}. A number of students scored no marks because they showed an incorrect rearrangement but omitted to show the substitution step first.

Answer 126 · Examiner comments June 2023 | 8463/2F | Original Q7

07.1

75% of students knew that satellite is the name given to an object that orbits a planet.

07.2

A significant number of students did not attempt this question. This is common when students are asked to complete a diagram. Many did show an arrow from the Hubble Space Telescope to Earth. Some drew multiple arrows. A lack of precision from where the arrow started prevented some students from scoring the mark.

07.3

53% of students scored full marks on this calculation of speed from a distance–time graph. The most obvious way of doing this was to use the full gradient which gives 38km in 5 seconds, which was the most common method used by the students. However, many students took different intervals along the line and provided they used the correct numbers the calculation was accepted. This meant a range of velocities could be derived. Common ones were 15km in 2s, 4km in 0.5s,

4.5.6.1.2 Speed

Answer 126 · Examiner comments June 2023 | 8463/2F | Original Q7

23km in 3s. 8% scored one mark for correctly identifying a change in distance with the corresponding change in time.

07.4

65% of students could identify the galaxy moving away from Earth the fastest from the light spectra.

07.5

77% of students could identify the galaxy furthest away from Earth from the light spectra.

07.6

74% of students understood why it is important that scientific observations are peer reviewed.

Answer 127 · Examiner comments June 2023 | 8463/2F | Original Q10

10.1

Only 9% of students calculated the displacement correctly. Those who did not gain the mark simply measured the route taken by the aircraft and scaled that distance up. A small minority didn't attempt the question.

10.2

27% of students gained the mark for the resultant force. Some missed out a force, others did not know how to combine the forces.

10.3

6% of students, who calculated the resultant force correctly, also scored this mark. Very few correctly described the motion using simplistic descriptions like moving forwards or moving slowly, rather than describing the motion in terms of velocity speed and acceleration. It was common to see the aircraft was "stationary", even though the question says it is moving.

10.4

Some students confused energy and force. It was common to see non-contact forces given. 20% of students could name an additional contact force.

4.5.6.1.2 Speed

Answer 127 · Examiner comments

10.5

6% of students scored 1 mark, usually for drawing an upward line/curve from 10s. Only 23 % of students scored 2 marks.

10.6

A minority of students attempted to draw a smooth curve and extrapolate this to the 10km line. Those who did generally obtained full marks by using the graph correctly, with 12% of students scoring both marks. A number of students miscalculated the scale on the graph and quoted incorrect values from their line. It was more common to see a straight line, which often allowed the award of 1 mark for a correct reading of the value.

10.7

50% of students knew that as the height of the aeroplane above the ground increased, the average density of the air decreased.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

4.5.6.1.2 Speed

Answer 128 · Examiner comments June 2024 | 8463/1F | Original Q3

Question 3 (Low / Standard demand)

03.1 53% of students scored a mark for this question showing how the extension of a bungee cord should be calculated.

03.2 90% of students scored both marks for correctly calculating the elastic potential energy.

03.3 90% of students scored both marks for correctly calculating the maximum kinetic energy.

03.4 95% of students chose the correct equation. However, in this exam series students were provided with a Physics Equations Sheet.

03.5 56% of students scored all 3 marks for this standard demand calculation question.
For 3 mark calculations, these general principles apply:
The 1st mark is for the substitution.
The 2nd mark is for the rearrangement.
The 3rd mark is for the answer.
In straightforward calculations, no working needs to be shown, but students should be encouraged to do so just in case the final answer is incorrect.
If the answer is correct, 3 marks can score.

03.6 27% of students scored 2 marks for this question, while 59% scored 1 mark. This question tested understanding of energy dissipation in energy transfers. A lot of students only ticked one box, ignoring the rubric of the question.

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Answer 129 · Examiner comments June 2024 | 8463/1F | Original Q5

Question 5 (Low / Standard demand)

05.1 48% of students understood that the volume of air in the syringe decreased.

05.2 83% of students understood that the distance between the particles decreased.

05.3 85% of students understood that the frequency of collisions increased.

05.4 86% of students understood that the air pressure increased.

05.5 85% of students answered this question correctly, linking temperature increase to the mean speed of gas particles.

05.6 A standard demand calculation of temperature change, which was a good discriminator between students who could or could not rearrange an equation. 35% of students scored 3 marks, while 45% of students scored no marks.

4.5.6.1.2 Speed

Answer 130 · Examiner comments June 2024 | 8463/2F | Original Q4

04.1
Only 28% of students identified the amplitude of the wave correctly. The most common incorrect response was option A, which was double the amplitude.

04.2
Most students knew which arrow represented the wavelength of the wave.

04.3
Most students got full marks for this calculation of period, and expressed the answer as a decimal or in standard form. A significant number tried to convert from standard form into a decimal value and were unable to do so correctly

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Answer 130 · Examiner comments June 2024 | 8463/2F | Original Q4

04.4
39% of students correctly answered, giving an electromagnetic wave. The most common incorrect answer was sound.

04.5
50 % of students identified the rarefaction in a longitudinal wave correctly.

04.6
49% scored both marks for this calculation of wavelength. Those that didn't often substituted the numbers the wrong way round.

04.7
There were a wide range of answers, with a minority of students providing a valid method to determine the speed of sound and reaching level 2. Most students got the idea of making a sound, the better responses had a way of making a short sharp sound. Many were unsure of the distance required for the experiment to work, and descriptions of how the timings will occur were often vague. The better responses indicated when the stopwatch would be started and when it would be stopped.

04.8
Most attempted this question, but a minority concluded that when going from air to water the wavelength of a sound wave increases.

4.5.6.1.2 Speed

Answer 131 · Examiner comments June 2024 | 8463/2F | Original Q5

05.1
37% of students identified two scalar quantities from the list, and. 40% could identify one.

05.2
87% of students were able to read the correct value from the distance-time graph.

05.3
Most students correctly used their answer from 05.2 to calculate the average speed.

05.4
Only 2% of students scored both marks, as many found it difficult to explain why they had chosen the correct section of the graph.

05.5
Many students scored this mark about doing work against gravity.

05.6
79% of students scored this mark for recalling the typical running speed of a person.

Answer 132 · Examiner comments June 2024 | 8463/2F | Original Q9

09.1
42% of students correctly gave the resultant vertical force on the child as 0N, but then failed to score the second mark point, as they stated that the child is not moving or there is no force acting. Only 3% understood the concept that a stationary object has forces acting on it, but those forces are balanced.

09.2
93% of students managed to write down the correct equation for the moment of a force.

09.3
A well answered calculation of force, with 74% of students gaining all 3 marks. Some students tried to convert the units.

09.4
Only 0.5% of students scored 2 marks for explaining why the speed of the baby walker increased as the baby moved onto the hard floor, and 52% scored 1 mark. Most students understood that the friction was less on the hard floor but did not go on to describe what happens to the resultant force.

09.5
93% of students chose the correct equation for the moment of a force.

09.6

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4.5.6.1.2 Speed

Answer 132 · Examiner comments

This calculation of the moment of the force was well answered with 14% of students scoring all 3 marks. About 72% forgot to convert the cm to m, or made a mistake converting, and scored 2 marks.

09.7

This question related to interaction of two gears. Of those that scored marks, most got the first mark point for stating the gears moved in opposite directions, with the minority discussing the different speeds. Very few achieved the second mark point. For those who did, it was for stating gear A exerts a force on gear B. A few attempted to explain it as gear A causing a moment about the pivot of gear B but some mentioned momentum instead of moment, thereby causing confusion in the response.

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4.5.6.1.2 Speed

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

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4.5.6.1.2 Speed

Answer 133 · Examiner comments June 2025 | 8463/1F | Original Q4

04.1
Just over 90 % of the students knew that the speed of the gas particles increased.

04.2
Nearly 80 % of the students knew that the kinetic energy of the gas particles increased.

04.3
Nearly 90 % of the students knew that the number of collisions each second increased.

04.4
Just over 70 % of the students knew that the force exerted by the gas particles increased.

04.5
When completing a matching type questions students should be encouraged to draw straight lines only.

04.6
Just fewer than 50 % of the students identified the state as liquid.

04.7
Just over 50 % of the students identified the state as solid.

Answer 133 · Examiner comments June 2025 | 8463/1F | Original Q4

04.8
Students found this question about internal energy difficult. Only about 11 % of the students scored 2 marks, while a further 33 % of the students scored 1 mark.

4.5.6.1.2 Speed

Answer 134 · Examiner comments June 2025 | 8463/1F | Original Q7

07.1

This was a grade 1-3 calculation of current with just over 90 % of the students scoring 2 marks.

07.2

A grade 1-3 calculation of energy transferred with 95 % of the students scoring 2 marks.

07.3

About 94 % of the students identified the correct equation for efficiency.

07.4

Just over half of the students scored 3 marks on this calculation using the efficiency equation. Many students struggled to rearrange the equation correctly scoring just one mark for the substitution. Students should be encouraged to substitute first then rearrange, as many students did both actions in one go using an incorrect rearrangement and so scored no marks.

07.5

Nearly 60 % of the students scored 1 mark for predicting the efficiency of the motor.

07.6

Just fewer than 50 % of the students scored this mark. Students who tried to describe the relationship were less successful than students who just described the shape of the line. Students who stated that the gradient changes also scored the mark, as a better description than the line is curved.

Answer 135 · Examiner comments June 2025 | 8463/1F | Original Q8

08.1

The idea that energy resources can or cannot be used again still persists and does not score any marks. The idea of 'running out' and 'not running out' was insufficient to score. Very few students used the word stated in the specification which is 'replenished'. 'Replaced' was allowed and 'produced' was the least creditworthy answer for the renewable energy definition. About 4 % of the students scored 2 marks and a further 30 % scored 1 mark.

08.2

Almost all of the students scored this mark for writing down the equation which links density, mass and volume.

4.5.6.1.2 Speed

Answer 135 · Examiner comments June 2025 | 8463/1F | Original Q8

08.3

Almost 70 % of the students scored 3 marks. Students who did not get the correct final answer could have scored 1 mark if they had substituted into the equation first before rearranging their equation, which was usually the reason their final answer was incorrect.

08.4

Almost none of the students scored 2 marks, while about 9 % of the students scored 1 mark. Students who wrote that tidal power output was greater than wind power did not score a mark without reference to a particular flow speed. If wind flow speed was a consistent 2 m/s and tidal flow speed never reached 0.75 m/s the wind turbine's power output would be greater.

08.5

Some students didn't understand the term 'environmental impact' and focussed their answers on reliability, efficiency and cost, scoring no marks. To score within level 2, students needed to make at least one comparative statement about a factor for both turbines. The simplest way of doing this was to compare relative size.
An answer;
'The wind turbine is larger, but harms birds. The tidal turbine harms fish but does not cause visual pollution' would have scored 4 marks.
Just fewer than 20 % of the students scored 3 or 4 marks, while almost 60 % of the students scored 1 or 2 marks.

4.5.6.1.2 Speed

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GCSE
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4.5.6.1.2 Speed

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4.5.6.1.2 Speed

General

Grade 1-3 calculation questions were well answered, where the equation is always given and students will not be required to rearrange the equation. Grade 4-5 calculation questions involving equation recall were answered better this year than in 2018 and students are scoring many of their marks on the paper by answering the subsequent calculation questions correctly. At grade 4-5 students are expected to be able to either rearrange an equation or convert a unit, so it is beneficial for students to be able to quickly identify if the units given in a question are correct for the use in the equation. Question 10.1 was generally well attempted and students who had carried out Required Practical Activity 2 would have had a material advantage over those who hadn't.

Handwriting sometimes makes it very difficult for examiners to read what has been written. Students who have handwriting that is difficult to read may benefit from a scribe or from word processing their answers in exams.

Levels of demand

Questions are set at two levels of demand on this paper:

- low demand questions are targeted at students working at grades 1–3
- standard demand questions are targeted at students working at grades 4–5.

A student's final grade, however, is based on their attainment across the qualification as a whole, not just on questions that may have been targeted at the level at which they are working.

Question 1 (Low demand)

01.1 Around 77% of students scored 2 marks. Around 16% of students scored 1 mark.

01.2 Only around 8% of students scored 2 marks. Both evaporation and change of state were common, insufficient answers for the first marking point. Less than half of the students scored 1 mark. The marking points were independent, so if the change of state was incorrect eg melting, the student could still score the second marking point.

01.3 Around 91% of students scored 2 marks. In calculations where students are provided with the equation (grades 1-3) students are not expected to rearrange the equation. Some students incorrectly tried to convert the kg into g and scored 0 marks.

01.4 Approximately 82% of students scored 3 marks. In calculations where students are provided with the equation (grades 1-3) students are not expected to rearrange the equation. Some students incorrectly tried to convert the kg into g and scored 0 marks for the calculation. Some students set out their calculation, but then multiplied the two values rather than dividing.

Question 2 (Low demand)

02.1 About 67% of students identified the correct decay equation.

02.2 More than three quarters of the students identified why alpha radiation is dangerous inside the human body.

02.3 Just below three quarters of students scored 2 marks. Most correct answers read the values from the graph as intended (460, 280) and students didn't need the tolerance given in the mark scheme.

02.4 About 60% of students correctly estimated the mass remaining.

02.5 Students found this question difficult, with around 55% of students scoring 2 marks and around 27% of students scoring 1 mark.

Question 3 (Low demand)

03.1 Approximately 45% of students scored 1 mark for identifying a measuring instrument that could be used. About 9% of students scored 2 marks for describing an appropriate way to use it. Pythagoras was insufficient as the triangle described would not give the height of the zip wire.

03.2 Students were often very successful in calculation, with around 91% scoring 2 marks.

03.3 This question gave a good spread of marks. Over a fifth scored 3 marks, almost two fifths scored 2 marks and slightly below a quarter scored 1 mark. Gravitational potential energy or gravitational field strength were insufficient to score a mark.

Question 4 (Low demand)

04.1 Over a third of students answered this question correctly.

04.2 About 14% of students answered this question correctly.

04.3 This question about the alpha particle scattering experiment discriminated well between students. Around 16% of students scored 3 marks, around 45% of students scored 2 marks and around 30% of students scored 1 mark.

04.4 About 77% of students correctly identified what reproducible means. .

Question 5 (Low demand)

05.1 The most common correct answers linked CO_2 to global warming. Around 38% of students scored 2 marks and around 35% scored 1 mark. Common incorrect answers were usually vague and mentioned air pollution without being specific. There were many students who incorrectly linked CO_2 with the ozone layer.

05.2 Over half of the students scored 2 marks and over a third scored 1 mark. Insufficient answers included hydro and water. Answers using specification wording eg the tides were acceptable, as were terms like tidal, etc. Oil was insufficient as this was assumed to be non-renewable oil as opposed to palm oil or other biofuel oils.

05.3 Around 83% of students scored 2 marks for this percentage calculation. An answer of 78 scored 1 mark even if spurious calculations followed.

05.4 About 67% of students scored 2 marks. Quite a large number of misreads from the graph resulting in 0 marks and around 29% of students scored 0 marks.

4.5.6.1.2 Speed

05.5 Only around 5% of students scored 2 marks whilst half of the students scored 1 mark. Some students failed to make the connection between the time of day and sunrise. Some students talked vaguely about the energy stored by solar panels, confusing them with solar heating panels rather than solar photovoltaic panels.

Question 6 (Low and Standard demand)

06.1 More than half of the students scored 2 marks. To score a mark a comparative statement was needed eg lower, not low mass of power source. A statement using the word 'better' would be insufficient.

06.2 Around 64% of students scored 2 marks. Many students scored 1 mark for truncating and not rounding their answers, an answer of 26.08 would score only 1 mark for the substitution.

06.3 This question discriminated well, with about 16% scoring 2 marks and more than half scoring 1 mark. 'Increases the battery's power output' was insufficient to score a mark. 'Battery lasts longer' was insufficient to score a mark.

06.4 The quantities in the question are given in alphabetical order; there is no need for students to recall the equation in this order. Any correct rearrangement of the equation or use of the correct symbols for quantities was allowed. A mixture of symbols and words would also score the mark. Approximately 70% of students answered this question correctly.

06.5 It was encouraging to see many Foundation tier students successfully rearranging the equation. Around 77% of students scored 3 marks.

Question 7 (Low and Standard demand)

07.1 About 86% of students answered this question correctly.

07.2 Approximately 83% of students answered this question correctly. Students should refer to the Physics specification for the accepted symbols for circuit components. Textbooks and revision guides do not necessarily use the specification symbols. The circles in the component symbol scored a mark even if shown as blobs rather than circles.

07.3 Around 93% of students scored 2 marks. At grade 1-3, the equation is given and no rearrangement of the equation is needed. Students need to simply substitute and calculate the answer.

07.4 Around 93% of students scored 2 marks. At grade 1-3, the equation is given and no rearrangement of the equation is needed. Students need to simply substitute and calculate the answer.

07.5 About 23% of students answered this question correctly.

07.6 About 38% of students answered this question correctly.

07.7 Students can recall the equation in any correct rearrangement. The stem of the question lists the quantities in alphabetical order, so that there is no suggestion of the correct order.

Correct letters for quantities are acceptable in place of the quantity names. Voltage or p.d. were acceptable for potential difference. Approximately 57% of students answered this question correctly.

07.8 The first mark is for the substitution into the correct equation. The second mark is for the correct rearrangement of the correct equation. The third mark is for the correct final answer. About 58% of students scored 3 marks for this question. Grade 4-5 calculation questions require either a unit change or a rearrangement of the equation.

Question 8 (Low and Standard demand)

08.1 Around 63% of students answered this question correctly.

08.2 Around 86% of students answered this question correctly. Some students gave a precaution instead of a risk, which was insufficient.

08.3 Around 62% of students answered this question correctly, demonstrating that students still confuse the terms resolution and range.

08.4 Around 96% of students answered this question correctly.

08.5 Many students failed to substitute correctly into the equation that was printed on the Physics Equations Sheet. Many students multiplied the 3 values given in the question, which scored zero marks. The unit mark was independent, but a large number of students failed to recognise the correct unit from the box. More than a third of students scored 4 marks and around 16% of students scored 3 marks. A quarter of students scored 1 mark for either the correct unit or the correct substitution.

Question 9 (Standard demand)

09.1 About 45% of students correctly identified the meaning of power input.

09.2 Only a quarter of students scored this mark. Students can recall the equation in any correct rearrangement. The stem of the question lists the quantities in alphabetical order, so that there is no suggestion of the correct order. Correct letters for quantities are acceptable in place of the quantity names. Voltage or p.d. were acceptable for potential difference.

09.3 Around 13% of students scored 3 marks and about 81% scored zero. Students found this question difficult to answer, presumably due to their inability to recall the correct equation in the preceding question.

09.4 More than half of students answered this correctly. Some students failed to score the mark by writing input for both the denominator and the numerator.

09.5 Students who successfully recalled the equation in **09.4** were likely to score all 3 marks for this question. Only around 15% of students scored zero.

09.6 Many students restated the stem, rather than going the extra stage in the reasoning and linking to efficiency because thermal energy is also transferred by the light bulb. A number of students believed that knowing the rate at which the bulbs emitted visible light was a

safety concern related to the household electrics. Only around 1% of students scored 2 marks, about 16% of students scored 1 mark and around 73% of students scored zero marks.

Question 10 (Standard demand)

10.1 This question produced a good spread of marks. A mean score of 2.1 was achieved by students on the Foundation tier. Students who had experience of a similar practical benefitted from this as they were able to describe a method in sufficient detail to achieve Level 2. To achieve Level 3, a student needed to indicate that several values of number of layers were used, referring to the interval of 8 layers (as the graph showed) or that the experiment should be done with no layers. A control variable was also needed, either the initial temperature of the water, or the volume of water in each experiment. Some students gained no credit by describing different required practical methods. Around 2% of students scored 6 marks, around 15% of students scored 4 marks and about a fifth of students scored 2 marks. Around 10% of students didn't attempt the question.

10.2 Many students stated that it wasn't necessary to use both as it would be confusing. The datalogger would produce too much data was a common insufficient answer. A number of students stated that using a normal thermometer would be more appropriate, scoring zero marks. Less than 1% of students scored 2 marks and less than a fifth of students scored 1 mark.

Question 11 (Standard demand)

11.1 Over two-fifths of students scored 3 marks for this question. It wasn't necessary to give the answer to an appropriate number of significant figures, so answers of 0.502, 0.50 and 0.5 were all creditworthy. Some students calculated the jump height to be unlikely values; students should be encouraged to consider whether it is likely that someone can jump a height of 4.92 m, a commonly seen answer achieved by multiplying the 2 values given (41 × 0.12). Less than half of the students scored zero marks.

11.2 A common incorrect answer was E_k = mass × speed, since these were the quantities given in the question. A number of students also left out the 0.5 value even if they remembered that speed should be squared. Velocity was allowed instead of speed in the equation. Correct symbols were acceptable for the quantities in the equation. About 30% of students answered this question correctly.

11.3 Despite being asked to recall the equation in 11.2, most students simply multiplied or divided the 2 values given in the question (3.0 and 270), scoring 0 marks. Only around 19% of students scored 3 marks.

11.4 Some students commented on muscle mass and strength which were insufficient to score marks. Clear comparisons, including at least one difference and one similarity, were needed to score 4 marks. This question discriminated well between students; around 6% of students scored 4 marks, around 29% of students scored 2 marks and around 13% of students scored zero.

4.5.6.1.2 Speed

11.5 Some students failed to score a mark because they simply restated the question, 'the scientist wanted the highest muscle power reading' without adding any value. The answer either needed to refer to the effect of repetition on performance (improvement or worsening) or that it was the maximum (or peak) muscle power that the scientist was investigating. A fifth of students answered this question correctly.

4.5.6.1.2 Speed

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

4.5.6.1.2 Speed

Questions matter

GCSE

Physics

8463/2F

Report on the examination

Version: 1.0
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4.5.6.1.2 Speed

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General comments

Students should pay attention to the number of options that need to be ticked when doing multiple choice questions. They should make sure they cross out wrong options when they change their minds, as marks cannot be awarded where there are multiple ticks instead of one.

Many students demonstrated good maths skills, although there are always issues with rearrangements. Formula triangles are not always helpful. Students who had correctly written down an equation in a previous question and then tried to use a formula triangle often scored no marks, because they don't understand how to use them. If they had substituted into the equation from the equations sheet they would have scored the 1st mark.

Students had access to the equations sheet for this examination series. A minority of the students however did not use them to find the appropriate equation.

Levels of demand

Questions are set at two levels of demand on this paper:

- Low demand questions are targeted at students working at grades 1–3.
- Standard demand questions are targeted at students working at grades 4–5.

A student's final grade, however, is based on their attainment across the qualification, not just on questions that may have been targeted at the level at which they are working.

01.1

Over 90 % of the students knew that a protractor is used to measure angles. The phonetic spelling of protractor was allowed.

01.2

Almost 70% of the students scored all four marks for completing the graph. Despite a clear instruction a significant number did not label the y-axis. A number of the students did not use a ruler to draw the line of best fit.

01.3

Most of the students correctly identified the relationship between the angle of incidence and the angle of reflection.

01.4

Half of the students knew which measurement was the amplitude of a wave. Most of the others thought the vertical distance between a peak and a trough was the amplitude.

01.5

About 80 % of the students knew which line showed the wavelength of the wave. The most common incorrect answer was the distance showing half the wavelength.

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4.5.6.1.2 Speed

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01.6

Over 90 % of the students correctly calculated the wavelength. Those who did not achieve full marks mainly did so by not choosing the correct unit for wavelength, with Pa being a popular incorrect choice.

01.7

This was well answered, with most of the students scoring both marks. A few inverted the equation and thus calculated the period incorrectly.

02.1

Most of the students correctly calculated the weight of coal.

02.2

Just over 90% of the students were able to use the work done equation correctly. Those that did not get full marks tended to put an additional step into the calculation by dividing the answer 68 000 000 by 4; the number of engines in total.
Occasionally a student would attempt to convert the number calculated into standard form. Whilst not being penalised, this was not required.

02.3

Well answered by most students. As with part 02.2, occasionally a student would attempt to convert the number calculated into standard form.

02.4

Nearly 90% of the students could identify that friction was a contact force.

02.5

Most of the students identified the correct distance-time graph for constant speed.

02.6

This was the 1st calculation that was more challenging for many students. A common error was to use only one of the quoted velocities to calculate the acceleration rather than using the difference between the velocities. However just over 80 % did score full marks, with 10 % scoring zero or not attempting the question.

03.1

Approximately 60% of the students scored both marks. Often students did not know the correct word for a natural satellite. However, many correctly identified ‘star’ for the second word.

03.2

Most of the students knew that we are part of the Milky Way galaxy.

03.3

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4.5.6.1.2 Speed

Only about 40 % of the students knew that the Sun will eventually become a black dwarf. The most popular wrong answer was that it would become a black hole.

03.4

Just fewer than 40 % of the students knew that a very distant galaxy moves faster than a nearer galaxy.

03.5

About 70 % of the students knew that an increase in the wavelength of light from a distant galaxy is called red-shift.

03.6

About 60 % of the students selected the correct word to describe the beginning of the universe.

03.7

Almost 80 % of the students knew that the universe is expanding.

04.1

Just over 70 % of the students were able to make the connection between the mass of a vehicle and how it would affect the maximum acceleration.

04.2

Over 90 % of the students scored full marks for calculating the resultant force using F = ma. However, some of the students thought that the value of acceleration needed to be squared and then multiplied by mass.

04.3

This level of response question proved too challenging for many. Only just over 1 % of the students scored full marks. Most identified that the driving force would increase, but fewer recognised that as this happened the air resistance would also increase, with many stating that the air resistance would decrease as the cars speed increased.

04.4

Most of the students knew that the thinking distance is affected by the driver's reaction time.

04.5

Just fewer than 70 % of the students were aware that the braking distance is the distance travelled under the braking force.

04.6

Only just over 20 % of the students scored full marks for using the graph of distance against speed to find the stopping distance. The correct distances were often identified from the graph. However, these were then either subtracted from each other, divided or multiplied rather than added.

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4.5.6.1.2 Speed

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04.7

Nearly 80 % of the students identified factors that would increase the stopping distance of a car. Despite two being emboldened twice in the question, some students only ticked one box.

05.1

The principal focus was correctly identified by just over 60 % of the students.

05.2

About 80 % of the students knew that the change in direction of light as it enters a lens is called refraction.

05.3

Nearly 70 % the students recognised the shape of a convex lens.

05.4

Under a half of the students managed to correctly measure the object height and image height. This may have been due to a lack of skill or a lack of equipment.

05.5

This was much more successfully answered than part 05.4 with nearly 90 % of the students scoring both marks. These students used their values from part 05.4 to calculate magnification.

05.6

Just fewer than 50 % of the students knew that magnification is a ratio, but almost the same number thought it is a power.

05.7

This was a challenging question. Most of the students that did score a mark were awarded only the first mark point. This was for explaining that white light is transmitted through colourless glass. A lot of the students think of white light as an entity in itself rather than the result of the colours of the visible light combined. Few used the word transmitted but rather described it as passing through or goes through.
For the 2nd and 3rd mark points many of the students decided that white light was reflected or refracted, reinforcing the misconception that white light is a single entity rather than being made up of a combination of wavelengths. The idea that filters would absorb different wavelengths of light seemed to be difficult for the students to express, with very few achieving the third mark.

06.1

Only just over 30 % of the students could identify two magnetic materials from the list, with about 60 % being able to identify one. Again, a number of students ticked just one box or more than two boxes.

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4.5.6.1.2 Speed

06.2
Just over 70 % of the students correctly named the iron nails as induced magnets.

06.3
Just fewer than 40 % of the students knew the direction of the magnetic field.

06.4
Nearly 80 % of the students recognised the shape of the magnetic field around a current carrying wire.

06.5
Very few of the students could give two changes that would increase the magnetic field strength. 'Increasing the current' was a common correct response. Many of the students answered 'increasing the number of coils' as such they were implying the wire was already coiled and not answering the question asked, which was about the straight wire shown in Figure 10.

07.1
Nearly 60 % of the students understood what is meant by the moment of a force. The most common incorrect option was 'The direction of the force.'

07.2
The correct resultant moment was selected by just over 80 % of the students.

07.3
Students generally answered this well, identifying position 7 and on which side of the balance the tag should be placed. Some indicated this on the diagram which was an accepted alternative response, provided what was written did not contradict it.

07.4
Some students wrote the equation for the moment of a force in words and then in symbols. This risks not gaining the mark if either is incorrect. Also, correct use of symbols should be stressed, especially when they are given in the question. It was surprising that some of the students scored zero or did not attempt to write down an equation despite having the equations sheet.

07.5
Almost three quarters of the students were able to rearrange the equation and then calculate the distance between the pivot and the tag on the balance.

08.1
Most of the students found this level of response question difficult to answer. Only just over 1 % gave a level 2 answer. Many of the students scored 2, 1 or 0 marks. Of those that scored a mark the most common response was light travels faster than sound. Many also tried to describe light and sound as transverse and longitudinal waves, with the majority getting this

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confused. Very few identified acceptable similarities. Common answers that did not gain credit included light travels at the speed of light, sound travels at the speed of sound, light can be seen and sound cannot be seen.

08.2

Just fewer than 80 % of the students choose the correct equation for calculating speed.

08.3

This question required students to rearrange the equation. About three quarters of the students scored all three marks.

09.1

About 65 % of the students correctly stated the independent variable in this investigation.

09.2

Just over 40 % of the students scored both marks for identifying a risk of harm and a suitable safety precaution to reduce the risk. Too few students connected a hazard, such as a falling weight, becoming a risk of harm when it hit or hurt the student.

09.3

Students were expected to clearly describe two improvements to the arrangement shown that would improve the accuracy of the results. Many had difficulty describing their ideas clearly and answers were often too vague to gain credit.

09.4

Almost 40 % of the students scored this mark usually by explaining that the spring length was not 0 cm rather than describing the relationship between spring length and force.

09.5

This was not successfully answered, with only about 2 % of the students scoring both marks and a further 13 % scoring one mark. The 1st mark point was for stating or giving a clear description of inelastic deformation. Of those who were awarded marks most of them described how the spring had reached or passed its limit of proportionality.

09.6

Over 90 % of the students selected the correct equation.

09.7

Nearly 80 % of the students scored all three marks. Those that did not often rearranged the equation incorrectly.

10.1

Only about 5% of the students correctly calculated the uncertainty correctly from either the range or the mean.

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10.2

Just over 40 % of the students identified that a random error had caused the variation in this investigation. A greater proportion of the students thought there was a systematic error but this would not have accounted for the variation in the results.

10.3

This mark was awarded for a clear description of variation in the way the ball was dropped. For example, through different heights, at different speeds, or a different delay each time. Common answers giving reaction time or human error were too vague, to be awarded marks unless qualified.

10.4

Just fewer than 30 % of the students scored all three marks. Many of the students took only one value from the graph rather than a corresponding pair of values and so scored 0. Those that used a pair of correct values often then used them the wrong way round when calculating the gradient.

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Mark Ranges and Award of Grades

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