AQA GCSE Physics | 8463

SPECIFICATION POINT 4.5.6.1.4

The distance–time relationship

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**20**
Available paper years	**2004–2024**

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.

4.5.6.1.4 The distance–time relationship

Answer 01 · Mark scheme June 2004 | 3451F | Original Q8 | Legacy

The full source mark scheme begins on page 33. Follow original question 8 in that document.

Answer 02 · Mark scheme June 2004 | 3462F3 | Original Q6 | Legacy

The full source mark scheme begins on page 54. Follow original question 6 in that document.

Answer 03 · Mark scheme June 2006 | 3451 | Original Q15 | Legacy

The full source mark scheme begins on page 71. Follow original question 15 in that document.

Answer 04 · Mark scheme June 2006 | 3462 | Original Q13 | Legacy

The full source mark scheme begins on page 91. Follow original question 13 in that document.

4.5.6.1.4 The distance–time relationship

Answer 05 · 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

4.5.6.1.4 The distance–time relationship

Answer 05 · Mark scheme

June 2008 | PHY2F | Original Q1 | Legacy

PHY2F

June 08

4.5.6.1.4 The distance–time relationship

Answer 06 · 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**

4.5.6.1.4 The distance–time relationship

Answer 06 · Mark scheme June 2009 | PHY2F | Original Q3 | Legacy

PHY2F

4.5.6.1.4 The distance–time relationship

Answer 07 · Mark scheme January 2010 | PHY2F | Original Q6 | Legacy

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**

4.5.6.1.4 The distance–time relationship

Answer 07 · Mark scheme

January 2010 | PHY2F | Original Q6 | Legacy

PHY2F

4.5.6.1.4 The distance–time relationship

Answer 08 · Mark scheme

Question 7

question	answers	extra information	mark
7(a)(i)	20 (Hz) to 20 000 (Hz) / 20 kHz	**or** reversed order	1
7(a)(ii)	ultrasound / ultrasonic	do **not** accept sonic	1
7(b)	examples discriminates against (young) people who are not being a nuisance discriminates against young people (just) moves the group to another meeting place discourages young people from shopping distresses babies it's morally / ethically wrong	allow any reasonable response 'it bothers young people' is insufficient ignore reference to animals ignore damages hearing	1
7(c)	(mechanical) vibration	accept vibrations in the air / particles	1
7(d)(i)	the sound intensity gets (much) less the greater the distance from (the source of) the sound correct comparison from the graph eg sound is 100 (w/m²) at 1 (m) but only 20 (w/m²) at 2.5 (m)	allow the closer you are to the machine the more likely it is to damage your hearing accept the graph falls steeply (at first) and then more gently	1 1

Question 7 is continued on the next page . . .

4.5.6.1.4 The distance–time relationship

PHY3F

Question 7 continued . . .

question	answers	extra information	mark
7(d)(ii)	any **two** from: • (so) data can be compared • anomalous results can be checked / removed / identified • more than one set of data • intensity / loudness fluctuates	increases reliability is insufficient improves accuracy is insufficient fair test is insufficient	2
Total			**8**

4.5.6.1.4 The distance–time relationship

Answer 09 · Mark scheme

November 2010 | PHY1BP | Original Q6 | Legacy

Six	**2**	**4**	**3**	**4**

4.5.6.1.4 The distance–time relationship

Answer 10 · Mark scheme

Question 7

question	answers	extra information	mark
7(a)	converging (lens)	accept ‘convex (lens)’ accept biconvex	1
7(b)	(principal) foci	accept ‘focus’ / ‘focuses’ / ‘focis’ focal point(s)	1
7(c)(i)	formed where (real) rays (of light) intersect / meet / cross	accept rays (of light) pass through the image accept ‘image is on the opposite side (of the lens to the object)’ accept (construction) lines cross over a response relating to a screen or similar is neutral lines are solid and not dotted is neutral	1
7(c)(ii)	inverted	accept any unambiguous correct indication	1
7(d)(i)	smooth curve which matches the points	judge by eye but do **not** accept point to point by ruler or otherwise	1
7(d)(ii)	continuous		1

Question 7 continues on the next page . . .

4.5.6.1.4 The distance–time relationship

PHY3F

Question 7 continued . . .

question	answers	extra information	mark
7(d)(iii)	as distance increases, magnification decreases	accept negative correlation a statement 'inversely proportional' is incorrect and limits maximum mark for this part question to **1**	1
	further detail eg magnification falls steeply between 40 and 50 cm **or** magnification begins to level out after / at 70 cm		1
Total			**8**

4.5.6.1.4 The distance–time relationship

Answer 10 · Mark scheme January 2011 | PHY3F | Original Q7 | Legacy

PHY3F

4.5.6.1.4 The distance–time relationship

Answer 11 · 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**

4.5.6.1.4 The distance–time relationship

Answer 11 · Mark scheme June 2011 | PHY3F | Original Q7 | Legacy

PHY3F

Answer 12 · Mark scheme November 2011 | PHY1BP | Original Q7 | Legacy

Seven	**2**	**4**	**2**	**2**

4.5.6.1.4 The distance–time relationship

Answer 13 · Mark scheme

January 2013 | PH1FP | Original Q7 | Legacy

Question 7

question	answers	extra information	mark
7(a)(i)	red-shift	accept Doppler (effect)	1
7(a)(ii)	the Universe is expanding		1
7(a)(iii)	N		1
7(b)	Why was the Universe created?		1
Total			**4**

4.5.6.1.4 The distance–time relationship

Answer 13 · Mark scheme

January 2013 | PH1FP | Original Q7 | Legacy

PH1FP

4.5.6.1.4 The distance–time relationship

Answer 14 · 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 . . .

4.5.6.1.4 The distance–time relationship

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**

4.5.6.1.4 The distance–time relationship

Answer 14 · Mark scheme

June 2013 | PH2FP | Original Q6 | Legacy

PH2FP

4.5.6.1.4 The distance–time relationship

Answer 15 · 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**	

4.5.6.1.4 The distance–time relationship

Answer 15 · Mark scheme

June 2014 | PH2FP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO spec ref

4.5.6.1.4 The distance–time relationship

Answer 16 · 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

4.5.6.1.4 The distance–time relationship

Answer 16 · 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**	

4.5.6.1.4 The distance–time relationship

Answer 16 · Mark scheme

June 2016 | PH2FP | Original Q8 | Legacy

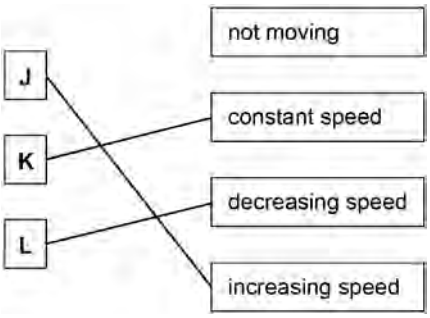


4.5.6.1.4 The distance–time relationship

Answer 17 · 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**	

4.5.6.1.4 The distance–time relationship

Answer 18 · 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

4.5.6.1.4 The distance–time relationship

Answer 18 · Mark scheme

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**	

4.5.6.1.4 The distance–time relationship

Answer 19 · 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

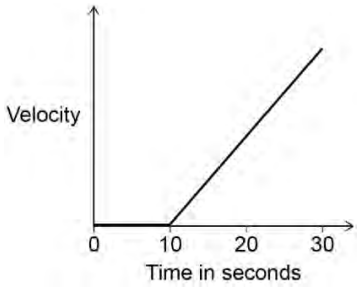
Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3	constant velocity	allow constant speed (in a straight line) do **not** accept stationary allow constant acceleration if a **mathematical error** in 02.2 gives a non-zero value for resultant force	1	AO1 4.5.6.2.1

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

4.5.6.1.4 The distance–time relationship

Answer 19 · 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 line with a positive gradient starting from 10 s	 allow an upward curving line with increasing gradient starting from 10 s 	1 1	AO3 4.5.6.1.4

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

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**

4.5.6.1.4 The distance–time relationship

Answer 20 · 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**

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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4.5.6.1.4 The distance–time relationship

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4.5.6.1.4 The distance–time relationship

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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4.5.6.1.4 The distance–time relationship

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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4.5.6.1.4 The distance–time relationship

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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4.5.6.1.4 The distance–time relationship

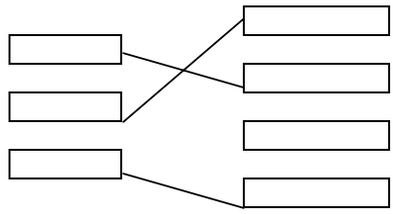
3451F Q2

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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4.5.6.1.4 The distance–time relationship

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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4.5.6.1.4 The distance–time relationship

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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4.5.6.1.4 The distance–time relationship

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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4.5.6.1.4 The distance–time relationship

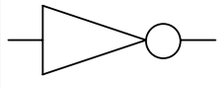
3451F Q6

	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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4.5.6.1.4 The distance–time relationship

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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4.5.6.1.4 The distance–time relationship

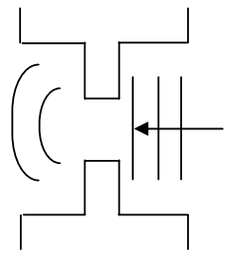
3451F Q8

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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4.5.6.1.4 The distance–time relationship

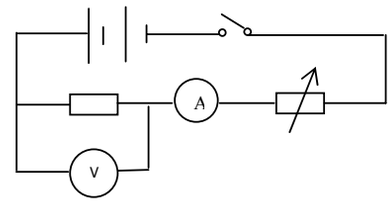
3451F Q9

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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4.5.6.1.4 The distance–time relationship

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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4.5.6.1.4 The distance–time relationship

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 1.8×30) i.e. adding the correct 2 power values	2
total			9

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4.5.6.1.4 The distance–time relationship

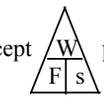
3451F Q12

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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4.5.6.1.4 The distance–time relationship

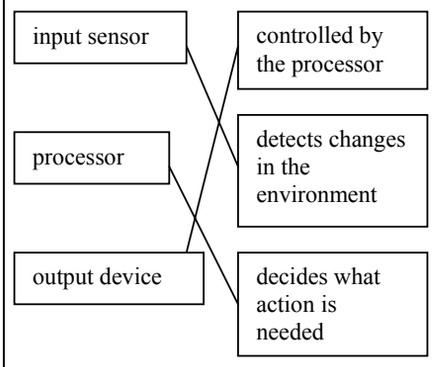
3451F Q13

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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4.5.6.1.4 The distance–time relationship

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)		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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4.5.6.1.4 The distance–time relationship

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	1
	… (both) inputs are on / high / 1 **or** current flows in both inputs	do **not** accept numerical values unless expanded	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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4.5.6.1.4 The distance–time relationship

3451F Q16

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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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.

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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4.5.6.1.4 The distance–time relationship

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4.5.6.1.4 The distance–time relationship

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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4.5.6.1.4 The distance–time relationship

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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4.5.6.1.4 The distance–time relationship

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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4.5.6.1.4 The distance–time relationship

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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4.5.6.1.4 The distance–time relationship

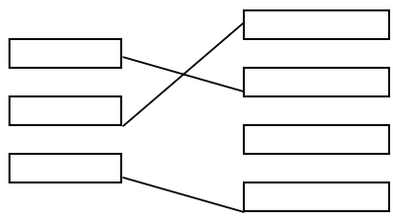
3462/3F Q2

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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4.5.6.1.4 The distance–time relationship

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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4.5.6.1.4 The distance–time relationship

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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4.5.6.1.4 The distance–time relationship

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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4.5.6.1.4 The distance–time relationship

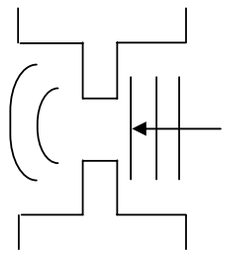
3462/3F Q6

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	accept finish for E accept correct numbers from axes with units	1
	least steep part of the graph	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
total			6

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4.5.6.1.4 The distance–time relationship

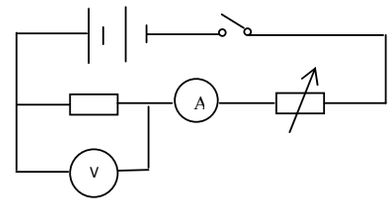
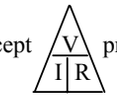
3462/3F Q7

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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4.5.6.1.4 The distance–time relationship

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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4.5.6.1.4 The distance–time relationship

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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4.5.6.1.4 The distance–time relationship

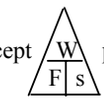
3462/3F Q10

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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4.5.6.1.4 The distance–time relationship

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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4.5.6.1.4 The distance–time relationship

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 <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	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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Version 1.0: 0906

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.

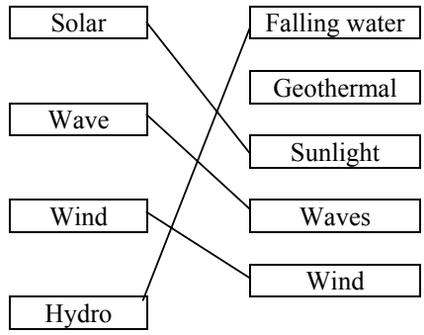
It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment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

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4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

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 swap the brown and blue wires round	accept wires must be connected to screws	1 1
total			4

3451/F Q6

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

4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

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>

4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

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

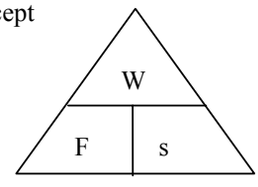
4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

3451/F Q18

question	answers	extra information	mark
(a)	AND (gate) OR (gate) NOT (gate) LED or light emitting diode	accept 'and' accept 'or' accept 'not' **or** invert gate accept 'led'	1 1 1 1
(b)(i)	NOT (gate) and AND (gate)	**both** in either order **or** '(the) gates' any additions lose the mark	1
(ii)	Switch for fire / Tilt switch / Signal to relay 0 / 0 / …**0…** 0 / 1 / **…0…** 1 / 0 / **…1…** 1 / 1 / **…0…**	all correct allow off **or** no off no on yes off no	1
(iii)	(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'	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	1 1 1 1
total			10

Version 1.0: 0906

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science: Double Award 3462/3F
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.

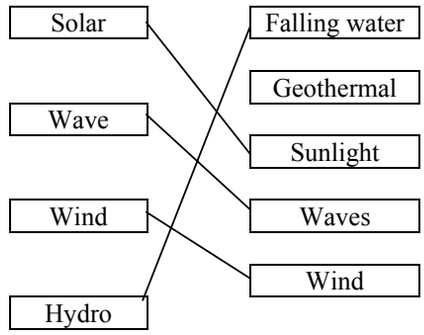
It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment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

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4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

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 and time in hours or seconds	2
total			5

4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

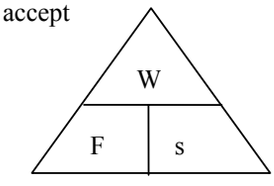
Science: Double Award (Co-ordinated) – AQA GCSE Mark Scheme, 2006 June series

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

4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

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

4.5.6.1.4 The distance–time relationship

Answer 17 · 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 19 · 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.

4.5.6.1.4 The distance–time relationship

Answer 19 · Examiner comments

June 2023 | 8463/2F | Original Q10

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.

4.5.6.1.4 The distance–time relationship

Answer 20 · 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.