AQA GCSE Physics | 8463

SPECIFICATION POINT 4.6.2.5

Lenses (physics only)

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**25**
Available paper years	**2003–2025**

Using this booklet

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

Name: _____ **Date:** _____

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

4.6.2.5 Lenses (physics only)

Answer 01 · Mark scheme

June 2003 | 3451F | Original Q8 | Legacy

The full source mark scheme begins on page 47. Follow original question 8 in that document.

Answer 02 · Mark scheme

June 2005 | 3451 | Original Q10 | Legacy

The full source mark scheme begins on page 69. Follow original question 10 in that document.

Answer 03 · Mark scheme

June 2006 | 3451 | Original Q17 | Legacy

The full source mark scheme begins on page 87. Follow original question 17 in that document.

4.6.2.5 Lenses (physics only)

Answer 04 · Mark scheme

Question 7

question	answers	extra information	mark
(a)	converging **or** convex		1
(b)	(principal) focus **or** focal point		1
(c)	**either** (×)1.5 **or** (×)1½ **or** 150%	unambiguous evidence of appropriate measurements for **1** mark only eg 4 and 6 **or** 8 and 12 **or** 0.8 and 1.2	2
(d)	real rays cross to form it / formed at the intersection of real rays	accept 'image on the opposite side of the lens to the object' accept 'can be put onto a screen'	1
total			5

4.6.2.5 Lenses (physics only)

Answer 04 · Mark scheme

January 2008 | PHY3F | Original Q7 | Legacy

PHY3F

4.6.2.5 Lenses (physics only)

Answer 05 · Mark scheme June 2008 | PHY3F | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
(a)(i)	(angle of) refraction	take care **not** to credit 'angle of reflection'	1
(a)(ii)	normal	do **not** credit 'horizontal'	1
(b)	**either** (photographic) <u>film</u> **or** CCD(s) (charge-coupled device(s)) / CMOS(s) (sensor(s)) / (active) pixel sensor(s)	 accept 'LDR(s)' / 'light dependent resistor(s)' **not** lux meter do **not** accept light sensor(s)	1
(c)(i)	converging	**or** 'convex'	1
(c)(ii)	 **either** (0).35 **or** (0).4(1…)	do **not** give any credit for an answer greater than 1 **or** 7 ÷ 20 for **1** mark **or** clear evidence that appropriate measuring / counting, has been made for **1** mark	2
(d)	otherwise it will have no effect on the light detector **or** otherwise no (real) light will fall on the light detector	**or** 'a virtual / imaginary image will have no effect on the light detector' allow error carried forwards for 'light detector' allow so it can be formed on the film	1
total			7

4.6.2.5 Lenses (physics only)

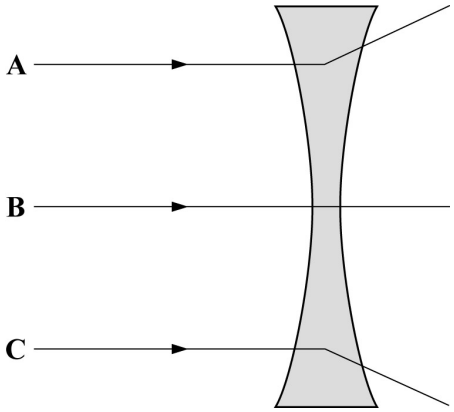
Answer 05 · Mark scheme June 2008 | PHY3F | Original Q6 | Legacy

PHY3F

4.6.2.5 Lenses (physics only)

Answer 06 · Mark scheme

Question 1

question	answers	extra information	mark
1(a)(i)	plane	accept any unambiguous indication	1
1(a)(ii)	normal		1
1(a)(iii)	incidence	accept any unambiguous indication	1
1(a)(iv)	be doubled	accept any unambiguous indication	1
1(b)(i)	diverging	accept any unambiguous indication	1
1(b)(ii)	**B** continues in a straight line (1) **A** refracted upwards and **C** refracted downwards (1)	accept any reasonable freehand attempt by eye ignore what happens in the lens **example** 	2
Total			**7**

4.6.2.5 Lenses (physics only)

Answer 06 · Mark scheme

January 2010 | PHY3F | Original Q1 | Legacy

PHY3F

4.6.2.5 Lenses (physics only)

Answer 07 · Mark scheme

Question 8

question	answers	extra information	mark
8(a)(i)	answer in the range 3.0 ↔ 3.1 inclusive	accept for 1 3.6 ÷ 1.2 or 3.7÷1.2 or 36 ÷ 12 or 37÷12 or 18 ÷ 6 or 18.5 ÷ 6 or 10.2 ÷ 3.4 or 102 ÷ 34 or answer in the range but with a unit eg 3 cm	2
8(a)(ii)	(principal) focus / focal (point(s)) / foci / focus	accept 'focusses' accept focals do **not** accept focal length	1
8(a)(iii)	at the intersection of virtual / imaginary rays	**or** 'where virtual / imaginary rays cross' **or** the rays of (real) light do not cross **or** the image on the same side (of the lens) as the object **or** the image is drawn as a dotted line **or** the image is upright do **not** accept 'cannot be put on a screen' do **not** accept any response which refers to reflected rays	1

Question 8 continues on the next page . . .

PHY3F

Question 8 continued . . .

question	answers	extra information	mark
8(b)(i)	another correct observation about relationship between values of **d** (1) (but) not the same relationship between corresponding values for magnification (1)	**example** 15 is three times bigger than 5 but 2.0 is not three times bigger than 1.2	2
8(b)(ii)	when the distance / **d** increases the magnification increases	**or** the converse accept 'there is a (strong) positive correlation' do **not** accept any response in terms of proportion / inverse proportion	1
8(b)(iii)	(student has) no evidence (outside this range)	accept data / results / facts for 'evidence'	1
Total			**8**

4.6.2.5 Lenses (physics only)

Answer 08 · Mark scheme

June 2010 | PHY3F | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)(i)	convex	accept 'diverging' do **not** accept convexed	1
5(a)(ii)	(principal) focus	accept 'focal (point)'	1
5(a)(iii)	reflection	accept angle of reflection	1
5(b)(i)	concave	accept 'converging' do **not** accept concaved	1
5(b)(ii)	(×) 1.5 / (×) 1½	**either** 30 ÷ 20 (1) **or** 3 ÷ 2 (1) **or** 15 ÷ 10 (1) ignore any units	2
Total			**6**

4.6.2.5 Lenses (physics only)

Answer 08 · Mark scheme June 2010 | PHY3F | Original Q5 | Legacy

PHY3F

4.6.2.5 Lenses (physics only)

Answer 09 · Mark scheme

Question 5

question	answers	extra information	mark
5	1.4	allow **1** mark for correct substitution ie 14 ÷ 10 **or** 28 ÷ 20	2
Total			**2**

4.6.2.5 Lenses (physics only)

Answer 09 · Mark scheme January 2011 | PHY3F | Original Q5 | Legacy

PHY3F

4.6.2.5 Lenses (physics only)

Answer 10 · Mark scheme

January 2011 | PHY3F | Original Q7 | Legacy

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 . . .

4.6.2.5 Lenses (physics only)

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**

4.6.2.5 Lenses (physics only)

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

PHY3F

4.6.2.5 Lenses (physics only)

Answer 11 · Mark scheme

June 2011 | PHY3F | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)(i)	(concave) mirror / reflector	do **not** allow convex mirror / reflector	1
6(a)(ii)	refraction		1
6(b)(i)	converging		1
6(b)(ii)	4	allow **1** mark for correct substitution ie 20 / 5 or 4 / 1 ignore any units	2
Total			**5**

4.6.2.5 Lenses (physics only)

Answer 11 · Mark scheme June 2011 | PHY3F | Original Q6 | Legacy

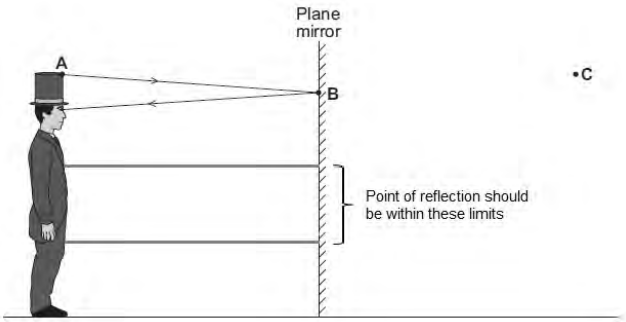
PHY3F

4.6.2.5 Lenses (physics only)

Answer 12 · Mark scheme

June 2013 | PH1FP | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)	C		1
3(b)	reflection at the mirror of ray from shoe to person's eye	may be drawn freehand	1
	angle of incidence = angle of reflection	judged by eye a ruler must have been used	1
	arrow to show correct direction on either incident or reflected ray	only one arrow needed but if more drawn must be no contradiction both incident and reflected ray must be shown	1
			
3(c)	virtual		1
Total			5

4.6.2.5 Lenses (physics only)

Answer 12 · Mark scheme

June 2013 | PH1FP | Original Q3 | Legacy

PH1FP

4.6.2.5 Lenses (physics only)

Answer 13 · Mark scheme

June 2013 | PH3FP | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)(i)	The width of the base of the raft The position of the centre of mass of the raft		1 1
4(a)(ii)	Design B		1
4(b)(i)	inverted real		1 1
4(b)(ii)	0.4	allow **1** mark for correct substitution, eg $\frac{8}{20}$ (in mm) **or** $\frac{0.8}{2}$ (in cm) **or** $\frac{0.008}{0.02}$ (in m) **or** $\frac{4}{10}$ (number of squares) ignore any units ignore negative sign	2
4(c)	this shape ticked: 		1
Total			**8**

4.6.2.5 Lenses (physics only)

Answer 13 · Mark scheme

June 2013 | PH3FP | Original Q4 | Legacy

PH3FP

4.6.2.5 Lenses (physics only)

Answer 14 · Mark scheme

June 2013 | PH3FP | Original Q7 | Legacy

Question 7

question	answers	extra information	mark
7(a)	cornea (LHS gap)	must be in correct space	1
	retina (RHS gap)		1
7(b)	iris **or** pupil		1
	to change the shape / curvature (of the surface) of the lens	accept to make the lens thinner / fatter to contract and relax is insufficient	1
	to focus the light (from the object, onto the retina)	accept to refract / change direction of light accept rays for light accept to form / focus an image (on the retina) to focus is insufficient	1
7(c)	the older (a human), the longer the near point (or vice versa) **or** young people have the shortest near point (or vice versa)	answer must be in terms of near point (or a description of), eg become increasingly long sighted as you get older allow near point increases with age do **not** accept eye sight deteriorates as you get older answers must be comparative	1
	the (rate of) change of the near point increases as you get older (or vice versa)	accept near point increases most rapidly after 40 this statement alone gains **2** marks: the (rate of) increase of the near point gets greater as you get older	1

Question 7 continues on the next page . . .

PH3FP

Question 7 continued . . .

question	answers	extra information	mark
7(d)	test / measure / use more people (to increase the range of ages) **or** test / measure / use more people with ages in between (those already measured)	accept test older / younger people accept increase sample size repeat the measurements (of the same people) is insufficient	1
7(e)	2.5	allow **1** mark for correct substitution and conversion to metres, ie $\frac{1}{0.4}$ provided no subsequent step shown an answer of 0.025 gains **1** mark	2
Total			**10**

4.6.2.5 Lenses (physics only)

Answer 14 · Mark scheme June 2013 | PH3FP | Original Q7 | Legacy

PH3FP

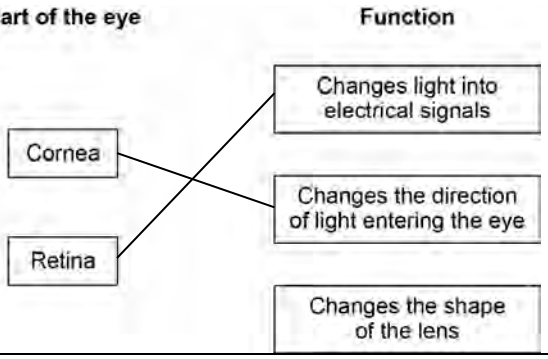
Answer 15 · Mark scheme June 2014 | PH3FP | Original Q3 | Legacy

The full source mark scheme begins on page 107. Follow original question 3 in that document.

4.6.2.5 Lenses (physics only)

Answer 16 · Mark scheme

June 2015 | PH3FP | Original Q3 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. ref.
3(a)	lens iris	correct order only	1 1	AO1 P3.1.4a
3(b)		allow **1** mark for each correct line if more than one line drawn from any part box then all of those lines are wrong	2	AO1 P3.1.4a
3(c)	5	allow **1** mark for correct substitution, ie 1 / 0.2 provided no subsequent step shown	2	AO2 P3.1.4e
3(d)	The potential benefit of the procedure is greater than the risk.		1	AO3 SaLoSE
3(e)(i)	6(.0)		1	AO2 P3.1.4
3(e)(ii)	increasing age decreases the ability of the lens to change power	accept as you get older, the change in (lens) power gets less	1	AO3 P3.1.4
3(e)(iii)	1 dioptre		1	AO3 P3.1.4
Total			10	

4.6.2.5 Lenses (physics only)

Answer 16 · Mark scheme

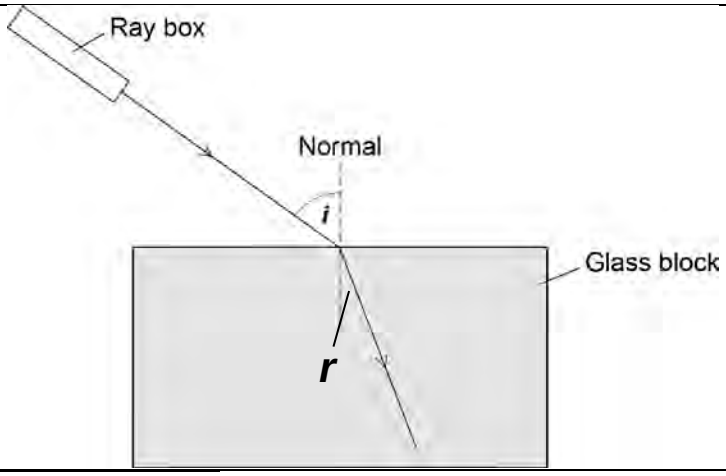
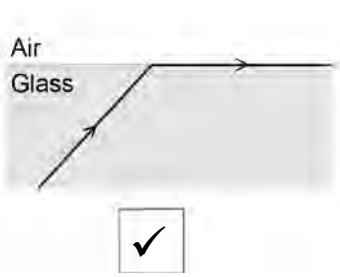
June 2015 | PH3FP | Original Q3 | Legacy



4.6.2.5 Lenses (physics only)

Answer 17 · Mark scheme

June 2015 | PH3FP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. ref.
5(a)(i)			1	AO1 P3.1.3c
5(a)(ii)	1 degree		1	AO3 P3.1.3c
5(a)(iii)	1.6	allow **1** mark for correct substitution, ie 0.80 / 0.5 provided no subsequent step shown working showing 1.59(9…..) scores zero	2	AO2 P3.1.3c
5(b)	2nd diagram ticked  ✓		1	AO1 P3.1.5a
5(c)(i)	any **one** correct description: • upright • virtual • diminished	treat multiple words as a list	1	AO1 P3.1.3d

Question 5 continued . . .

4.6.2.5 Lenses (physics only)

Answer 17 · Mark scheme

June 2015 | PH3FP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. ref.
5(c)(ii)	0.25	allow **1** mark for correct substitution, ie 1 / 4 or 5/20 provided no subsequent step shown ignore any unit	2	AO2 P3.1.3i
5(c)(iii)	Correcting short sight		1	AO1 P3.1.4b
Total			9	

4.6.2.5 Lenses (physics only)

Answer 17 · Mark scheme

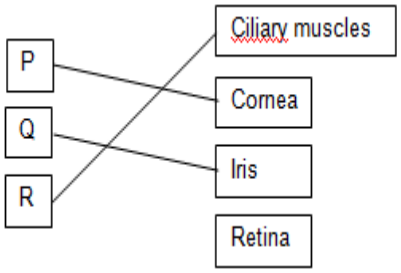
June 2015 | PH3FP | Original Q5 | Legacy



4.6.2.5 Lenses (physics only)

Answer 18 · Mark scheme

June 2016 | PH3FP | Original Q1 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)	P – Cornea Q – Iris R – Ciliary muscles		1 1 1	AO1 3.1.4a
1(b)	to let light into the eye	accept control the amount of light entering the eye	1	AO1 3.1.4a
1(c)	The closest distance to the eye that an object can be clearly seen		1	AO1 3.1.4c
1(d)	The lens changes shape		1	AO1 3.1.4e
1(e)	energy	accept heat	1	AO1 3.1.5c
1(f)	(because they think that) the results for animals may be different to those for humans **or** (because they think that) the animals could be harmed	accept disagreements on ethical, moral or religious grounds	1	AO3 3.1.5c
Total			8	

4.6.2.5 Lenses (physics only)

Answer 18 · Mark scheme

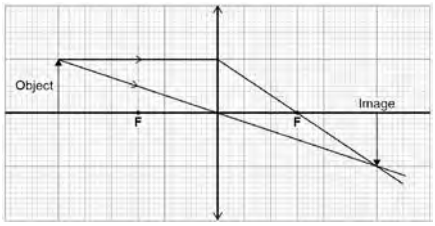
June 2016 | PH3FP | Original Q1 | Legacy



4.6.2.5 Lenses (physics only)

Answer 19 · Mark scheme

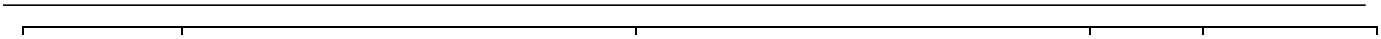
June 2017 | PH3FP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)(i)	refraction		1	AO1 3.1.3b
5(a)(ii)	real		1	AO1 3.1.3d
5(a)(iii)	1.5	allow **1** mark for correct substitution ie 3/2 provided no subsequent step	2	AO2 3.1.3i
5(b)(i)	**1** mark for each correct ray drawn • straight line through the centre of the lens continues • line parallel to the principal axis passes through focal point to right of lens 	rays should be drawn with a ruler ignore arrows on rays	2	AO2 3.1.3h
5(b)(ii)	Image drawn where the projected rays cross	image should extend from axis to the intersecting rays	1	AO2 3.1.3h
5(b)(iii)	principal focus	accept focal point	1	AO1 3.1.3c
5(c)(i)	**X**	accept **A**	1	AO1 3.1.5a
5(c)(ii)	**B**	do not accept **Y**	1	AO1 3.1.5a
Total			**10**	

4.6.2.5 Lenses (physics only)

Answer 19 · Mark scheme

June 2017 | PH3FP | Original Q5 | Legacy



4.6.2.5 Lenses (physics only)

Answer 20 · Mark scheme

June 2017 | PH3FP | Original Q8 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8(a)	any **one** from: • They don't need replacing if your eyesight changes • They don't need an optician/specialist to prescribe them	accept they can be adjusted to see near or far objects allow only need one pair of glasses can be re-used by other people is insufficient ignore they are cheaper than traditional glasses they focus on objects at different distances is insufficient	1	AO3 3.1.4b

8(b)			6	AO1 AO3 3.1.4a 3.1.4b

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant comments	Describes how an image is formed by the eye **or** Identifies that the lens changes shape to focus light **or** Gives the reason why long **or** short sight gives a blurred image	Explains how an image is formed by the eye **and** **either** Identifies that the lens changes shape to focus light from objects at different distances **or** Gives the reason why long **or** short sight gives a blurred image	Clearly explains how an image is formed by the eye **and** **either** Explains how the lens changes shape to focus light from objects at different distances **or** Correctly identifies that in long sight the image is focused behind the retina **and** for short sight it is focused in front of the retina

4.6.2.5 Lenses (physics only)

Answer 20 · Mark scheme

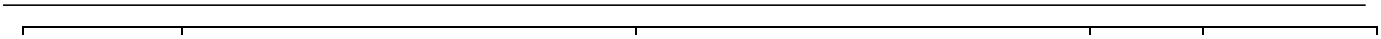
Examples of the points made in the response Explain how a normal eye forms an image:- • Light enters the eye through the pupil • Light is refracted at the cornea • Light is focused by the lens and the cornea • The image should be focused on the retina • The image is inverted, real and diminished Explain how light from objects at different distances forms an image:- • For objects at different distances the lens changes shape • The ciliary muscles pull the suspensory ligaments changing the shape of the lens • For distant objects the lens becomes less powerful • For nearby objects the lens becomes more powerful Explain why long and short sight cause blurred images:- • In long and short sight the (focused) image does not form on the retina • In long sight, the image forms behind the retina • In short sight, the image forms in front of the retina	**extra information** For distant objects the lens becomes thinner For nearby objects the lens becomes fatter In long sight the eyeball is too short In short sight the eyeball is too long	

Total			**7**

4.6.2.5 Lenses (physics only)

Answer 20 · Mark scheme

June 2017 | PH3FP | Original Q8 | Legacy



4.6.2.5 Lenses (physics only)

Answer 21 · Mark scheme

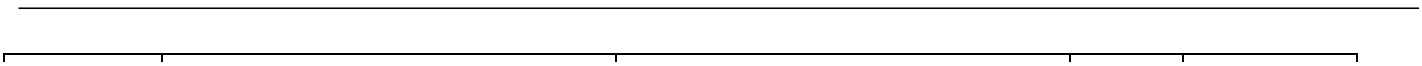
June 2018 | 8463/2F | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	B		1	AO1 4.6.2.5
02.2	upright virtual		1 1	AO1 4.6.2.5
02.3	image height = 9.5(mm) object height = 24(mm) magnification = $\frac{9.5}{24}$ **or** $\frac{\text{their image height}}{\text{their object height}}$ magnification = 0.4 **or** $\frac{\text{their image height}}{\text{their object height}}$ correctly calculated	an answer of 0.4 scores **4** marks allow any value between 9 and 10 inclusive allow 5 (squares) allow 12 (squares) allow an answer that rounds to 0.4 provided both object height and image height are correct ignore any units	 1 1 1 1	AO2 4.6.2.5
02.4	decrease		1	AO2 4.6.2.5
Total			**8**	

4.6.2.5 Lenses (physics only)

Answer 21 · Mark scheme

June 2018 | 8463/2F | Original Q2



4.6.2.5 Lenses (physics only)

Answer 22 · Mark scheme

June 2019 | 8463/2F | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8.1	focal length	this answer only	1	AO1/1 4.6.2.5
8.2	one correct line drawn from the top of the object, passing through the lens and crossing or meeting given line inverted image drawn at the correct position and length	ignore any arrow drawn on the line if two lines are drawn, both must be correct arrowhead required	1 1	AO2/2 4.6.2.5
8.3	similarity (both are) diminished difference concave is <u>virtual</u> and convex is <u>real</u> **or** concave is upright and convex is inverted	 allow smaller for diminished a comparison must be made ignore reference to positions of images	1 1	AO3/2a 4.6.2.5
8.4	$6.0 = \frac{9.0}{\text{object height}}$ $\text{object height} = \frac{9.0}{6.0}$ object height = 1.5 (mm)	an answer of 1.5 (mm) scores **3** marks provided working can be seen, an attempt to convert 9.0 mm to cm or m with all other steps correct scores **2** marks	 1 1 1	AO2/1 4.6.2.5
Total			**8**	

4.6.2.5 Lenses (physics only)

Answer 23 · Mark scheme

November 2021 | 8463/2F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	convex		1	AO1 4.6.2.5
05.2	image height = 0.8 (cm) **and** object height = 2 (.0 cm)	both correct for **1** mark	1	AO2 4.6.2.5
05.3	magnification = $\frac{0.8\ (cm)}{2\ (.0\ cm)}$ magnification = 0.4(0)	allow their measured object and image heights from question **05.2**	1 1	AO2 4.6.2.5
05.4	inverted real		1 1	AO3 4.6.2.5
05.5	black green	this order only	1 1	AO1 4.6.2.6
Total			**8**	

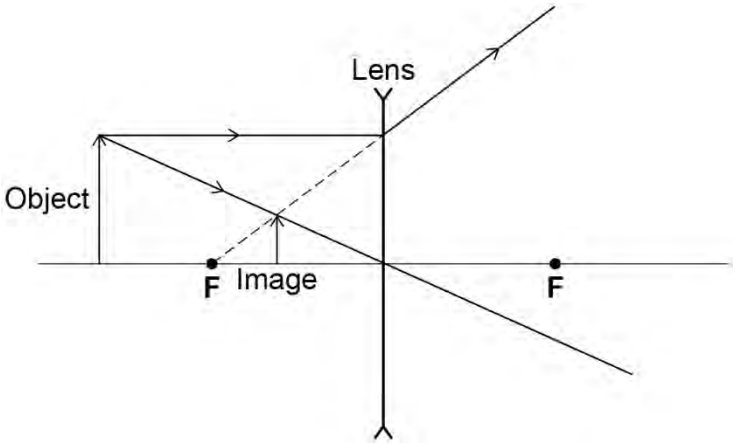
4.6.2.5 Lenses (physics only)

Answer 24 · Mark scheme

June 2023 | 8463/2F | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	principal focus		1	AO1 4.6.2.5

Question	Answers	Mark	AO / Spec. Ref.
08.2	ray through the centre of the lens image in correct position and with correct orientation  	1 1	AO2 4.6.2.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3	upright virtual	allow right way up ignore not real ignore it is on the same side of the lens	1 1	AO3 4.6.2.5

4.6.2.5 Lenses (physics only)

Answer 24 · Mark scheme

June 2023 | 8463/2F | Original Q8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	$3.5 = \frac{\text{image height}}{1.6}$ image height = 3.5 × 1.6 image height = 5.6 (mm)		1 1 1	AO2 4.6.2.5

Total Question 8	8

4.6.2.5 Lenses (physics only)

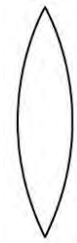
Answer 25 · Mark scheme

June 2025 | 8463/2F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	principal focus		1	AO1 4.6.2.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	refraction		1	AO1 4.6.2.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3			1	AO1 4.6.2.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	image height =2.0 (cm) **and** object height = 0.8 (cm)		1	AO2 4.6.2.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	magnification = $\frac{2.0}{0.8}$ 2.5	allow ecf from **05.4**	1 1	AO2 4.6.2.5

4.6.2.5 Lenses (physics only)

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	magnification is a ratio		1	AO1 4.6.2.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.7	colourless glass: (white) light is transmitted	allow all colours / wavelengths / frequencies (of white light) are transmitted	1	AO3 4.6.2.6
	blue glass: (only) blue light is transmitted		1	
	all other colours / wavelengths / frequencies of light are absorbed	allow blue glass will absorb green and red light	1	

Total Question 5	**10**

4.6.2.5 Lenses (physics only)

ASSESSMENT and QUALIFICATIONS ALLIANCE

Mark scheme June 2003

GCSE

Physics

3451

Foundation

Copyright © 2003 AQA and its licensors. All rights reserved.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales 3644723 and a registered charity number 1073334
Registered address: Addleshaw Booth & Co., Sovereign House, PO Box 8, Sovereign Street, Leeds LS1 1HQ
Kathleen Tattersall: *Director General*

4.6.2.5 Lenses (physics only)

INFORMATION FOR EXAMINERS

1. General

The mark scheme for each question shows:

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

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

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

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

2. Emboldening

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

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

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

3. Marking points

3.1 Marking of Quality of Written Communication

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

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

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

4.6.2.5 Lenses (physics only)

3.2 Marking of lists

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

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

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

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

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

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

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

3.3 Use of chemical symbols/formulae

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

3.4 The marking of quantitative relationships

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

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

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

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

3.5 Marking procedure for calculations

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

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

3.6 Interpretation of 'it'

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

3.7 Errors carried forward

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

Examples

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

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

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

3.8 Phonetic spelling

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

3.9 Brackets

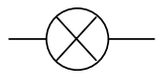
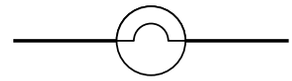
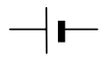
(…..) is used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.10 Unexpected Correct Answers not in the Mark Scheme

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

4.6.2.5 Lenses (physics only)

3451/F Q1

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

4.6.2.5 Lenses (physics only)

3451/F Q2

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

4.6.2.5 Lenses (physics only)

3451/F Q3

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

4.6.2.5 Lenses (physics only)

3451/F Q4

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

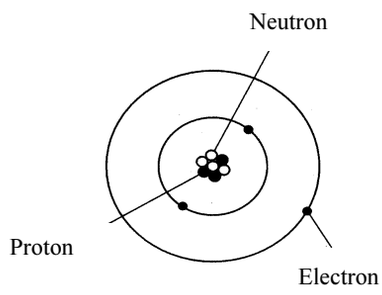
4.6.2.5 Lenses (physics only)

3451/F Q5

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

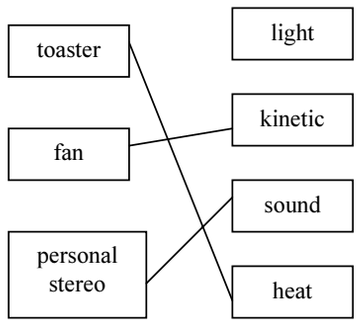
4.6.2.5 Lenses (physics only)

3451/F Q6

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

4.6.2.5 Lenses (physics only)

3451/F Q7

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

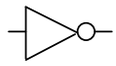
4.6.2.5 Lenses (physics only)

3451/F Q8

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

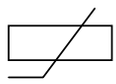
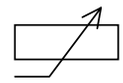
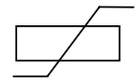
4.6.2.5 Lenses (physics only)

3451/F Q9

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

4.6.2.5 Lenses (physics only)

3451/F Q9 continued

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

4.6.2.5 Lenses (physics only)

3451/F Q10

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

4.6.2.5 Lenses (physics only)

3451/F Q11

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

4.6.2.5 Lenses (physics only)

3451/F Q12

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

4.6.2.5 Lenses (physics only)

3451/F Q13

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

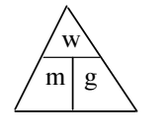
4.6.2.5 Lenses (physics only)

3451/F Q14

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

4.6.2.5 Lenses (physics only)

3451/F Q15

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

4.6.2.5 Lenses (physics only)

3451/F Q16

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

4.6.2.5 Lenses (physics only)

3451/F Q17

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

Version 1.0: *27092005*

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Physics 3451/F
Specification B

Mark Scheme

2005 examination – June series

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

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

Copyright © 2005 AQA and its licensors. All rights reserved.

Physics (Specification B)
Foundation Tier 3451/F

3451/F Q1

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

3451/F Q2

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

4.6.2.5 Lenses (physics only)

3451/F Q3

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

4.6.2.5 Lenses (physics only)

3451/F Q4

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

3451/F Q5

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

4.6.2.5 Lenses (physics only)

3451/F Q6

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

4.6.2.5 Lenses (physics only)

3451/F Q7

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

4.6.2.5 Lenses (physics only)

3451/F Q8

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

4.6.2.5 Lenses (physics only)

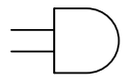
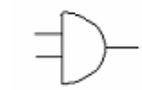
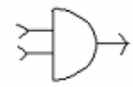
3451/F Q9

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

cont…

4.6.2.5 Lenses (physics only)

3451/F Q9 cont…

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

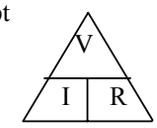
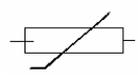
4.6.2.5 Lenses (physics only)

3451/F Q10

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

4.6.2.5 Lenses (physics only)

3451/F Q11

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

4.6.2.5 Lenses (physics only)

Physics B – AQA GCSE Mark Scheme, 2005 June series

3451/F Q12

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

4.6.2.5 Lenses (physics only)

3451/F Q13

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

4.6.2.5 Lenses (physics only)

3451/F Q14

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

cont…

3451/F Q14 cont…

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

4.6.2.5 Lenses (physics only)

3451/F Q15

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

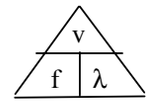
4.6.2.5 Lenses (physics only)

3451/F Q16

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

4.6.2.5 Lenses (physics only)

3451/F Q17

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

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.

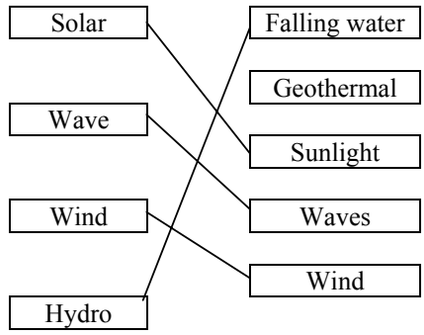
It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment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

Copyright © 2006 AQA and its licensors. All rights reserved.

4.6.2.5 Lenses (physics only)

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

4.6.2.5 Lenses (physics only)

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

4.6.2.5 Lenses (physics only)

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

4.6.2.5 Lenses (physics only)

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

4.6.2.5 Lenses (physics only)

Physics B – AQA GCSE Mark Scheme, 2006 June series

3451/F Q5

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

3451/F Q6

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

4.6.2.5 Lenses (physics only)

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

4.6.2.5 Lenses (physics only)

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

4.6.2.5 Lenses (physics only)

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>

4.6.2.5 Lenses (physics only)

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

4.6.2.5 Lenses (physics only)

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

4.6.2.5 Lenses (physics only)

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

4.6.2.5 Lenses (physics only)

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

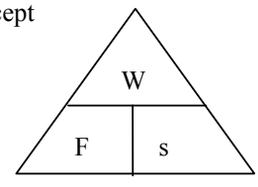
4.6.2.5 Lenses (physics only)

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

4.6.2.5 Lenses (physics only)

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 increases / is longer **or** thinking distance increases	do **not** accept reaction time slower **or** reactions are slower	1
	stopping distance / it increases	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

4.6.2.5 Lenses (physics only)

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

4.6.2.5 Lenses (physics only)

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

4.6.2.5 Lenses (physics only)

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

4.6.2.5 Lenses (physics only)

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

4.6.2.5 Lenses (physics only)

3451/F Q18

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

OR (gate)

NOT (gate)

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

accept ‘or’

accept ‘not’ or invert gate

accept ‘led’</td><td>1

1

1

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

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

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

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

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

or

full current through electronic control system (1)

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

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

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

do not accept small current is turned into a large current

annotate Q✓ Q×

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

1

1

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

4.6.2.5 Lenses (physics only)

AQA

GCSE
PHYSICS

PH3FP
Mark scheme

4403
June 2014

Version: 1.0 Final

4.6.2.5 Lenses (physics only)

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

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

Further copies of this Mark Scheme are available from aqa.org.uk

Copyright © 2014 AQA and its licensors. All rights reserved.
AQA retains the copyright on all its publications. However, registered schools/colleges for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to schools/colleges to photocopy any material that is acknowledged to a third party even for internal use within the centre.

4.6.2.5 Lenses (physics only)

Information to Examiners

1. General

The mark scheme for each question shows:

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

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

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

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

2. Emboldening

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

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

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

3. Marking points

3.1 Marking of lists

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

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

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

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

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

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

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

3.2 Use of chemical symbols / formulae

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

3.3 Marking procedure for calculations

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

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

3.4 Interpretation of 'it'

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

3.5 Errors carried forward

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

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

3.6 Phonetic spelling

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

3.7 Brackets

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

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

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

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

Quality of Written Communication and levels marking

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

Candidates will be required to:

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

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

Level 1: basic

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

Level 2: clear

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

Level 3: detailed

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

4.6.2.5 Lenses (physics only)

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

4.6.2.5 Lenses (physics only)

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

4.6.2.5 Lenses (physics only)

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

Question 3 continues on the next page . . .

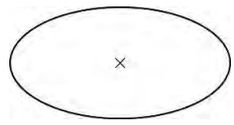
4.6.2.5 Lenses (physics only)

Question 3 continued . . .

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

4.6.2.5 Lenses (physics only)

MARK SCHEME – GCSE Physics – PH3FP – June 2014

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

4.6.2.5 Lenses (physics only)

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

4.6.2.5 Lenses (physics only)

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

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

Question 7 continues on the next page . . .

Question 7 continued . . .

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

4.6.2.5 Lenses (physics only)

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

4.6.2.5 Lenses (physics only)

Question	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5, and apply a 'best-fit' approach to the marking.			Mark	AO spec ref
9(a)				6	
0 marks	**Level 1 (1–2 marks)**	**Level 2 (3–4 marks)**	**Level 3 (5–6 marks)**		AO1 3.3.2
No relevant / correct content.	**Either** there is an attempt at a description of the construction of a transformer **or** a correct statement of the effect of one type of transformer on the input p.d.	There is a description of the construction of a transformer **and** a correct statement of the effect of one type of transformer on the input p.d.	There is a clear description of the construction of a transformer **and** there is a correct description of how transformers affect the input p.d.		

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

Question 9 continues on the next page . . .

Question 9 continued . . .

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

4.6.2.5 Lenses (physics only)

Answer 21 · Examiner comments June 2018 | 8463/2F | Original Q2

Question 2 (Low demand)

02.1 The position of the principal focus was not well known. Only 15% of the students gave the correct answer 'B'.

02.2 Despite having the diagram, only 10% of the students chose the two correct words to describe the image. A further 60% were able to correctly choose one correct word. Many students chose mutually exclusive pairs of words such as 'real and virtual' or 'inverted and upright'.

02.3 Just over 50% of the students measured both the image height and object height accurately and completed a correct calculation to score all 4 marks. A further 22% measured one height accurately and completed the calculation correctly to score 3 marks.

02.4 Nearly 70% of students scored this mark.

Answer 22 · Examiner comments June 2019 | 8463/2F | Original Q8

Question 8 (Standard demand)

08.1 About 10% of the students did not attempt this question with a further 84% giving an incorrect answer.

08.2 Nearly 13% of the students did not attempt this question. Few of the students drew a second ray to produce the image position. Rays started from all positions in front or behind the lens, not passing through the focus or incorrectly refracting at the lens. Even when a correct ray was drawn the image was often not drawn in, or if drawn had the wrong size or orientation.

08.3 Most of students scored zero or did not attempt this question. Answers for similarity included 'both produce an image' and 'the images are the same size'. Answers for difference often did not include a comparison and gave only one part of the required answer.

08.4 About 57% of the students picked the correct equation and completed the calculation to score all 3 marks. However, a significant number of students that identified the equation then substituted incorrectly or simply multiplied 9 and 6 to give an answer of 54.

4.6.2.5 Lenses (physics only)

Answer 24 · Examiner comments

June 2023 | 8463/2F | Original Q8

08.1

Only 12% of students could name the principal focus. The most common wrong answer was focus point.

08.2

The vast majority of students did not attempt to complete the ray diagram or scored zero. Many student drew multiple rays from various parts of the diagram in all directions. Even fewer identified where to draw the correct image. X % of students scored 2 marks, while X % of students scored 1 mark.

08.3

Most students gave similarities of the ray diagrams rather than the images.

08.76% of students obtained all 3 marks. Of those who didn't, some started with an incorrectly rearranged equation and thus scored zero. The most common error was dividing the magnification by the object height, instead of multiplying, to get the image height.

4.6.2.5 Lenses (physics only)

Questions matter

GCSE
Physics
8463/2F

Report on the examination

Version: 1.0
June 2025

© 2025 AQA

4.6.2.5 Lenses (physics only)

Further copies of this report are available from aqa.org.uk

AQA retains the copyright on all its publications. However, registered centres for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to centres to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Report on the examination – GCSE - Physics – 8463/2H – June 2025

General comments

Students should pay attention to the number of options that need to be ticked when doing multiple choice questions. They should make sure they cross out wrong options when they change their minds, as marks cannot be awarded where there are multiple ticks instead of one.

Many students demonstrated good maths skills, although there are always issues with rearrangements. Formula triangles are not always helpful. Students who had correctly written down an equation in a previous question and then tried to use a formula triangle often scored no marks, because they don't understand how to use them. If they had substituted into the equation from the equations sheet they would have scored the 1st mark.

Students had access to the equations sheet for this examination series. A minority of the students however did not use them to find the appropriate equation.

Levels of demand

Questions are set at two levels of demand on this paper:

- Low demand questions are targeted at students working at grades 1–3.
- Standard demand questions are targeted at students working at grades 4–5.

A student's final grade, however, is based on their attainment across the qualification, not just on questions that may have been targeted at the level at which they are working.

01.1

Over 90 % of the students knew that a protractor is used to measure angles. The phonetic spelling of protractor was allowed.

01.2

Almost 70% of the students scored all four marks for completing the graph. Despite a clear instruction a significant number did not label the y-axis. A number of the students did not use a ruler to draw the line of best fit.

01.3

Most of the students correctly identified the relationship between the angle of incidence and the angle of reflection.

01.4

Half of the students knew which measurement was the amplitude of a wave. Most of the others thought the vertical distance between a peak and a trough was the amplitude.

01.5

About 80 % of the students knew which line showed the wavelength of the wave. The most common incorrect answer was the distance showing half the wavelength.

© 2025 AQA and its licensors. All rights reserved.

4.6.2.5 Lenses (physics only)

Report on the examination – GCSE - Physics – 8463/2H – June 2025

01.6

Over 90 % of the students correctly calculated the wavelength. Those who did not achieve full marks mainly did so by not choosing the correct unit for wavelength, with Pa being a popular incorrect choice.

01.7

This was well answered, with most of the students scoring both marks. A few inverted the equation and thus calculated the period incorrectly.

02.1

Most of the students correctly calculated the weight of coal.

02.2

Just over 90% of the students were able to use the work done equation correctly. Those that did not get full marks tended to put an additional step into the calculation by dividing the answer 68 000 000 by 4; the number of engines in total.
Occasionally a student would attempt to convert the number calculated into standard form. Whilst not being penalised, this was not required.

02.3

Well answered by most students. As with part 02.2, occasionally a student would attempt to convert the number calculated into standard form.

02.4

Nearly 90% of the students could identify that friction was a contact force.

02.5

Most of the students identified the correct distance-time graph for constant speed.

02.6

This was the 1st calculation that was more challenging for many students. A common error was to use only one of the quoted velocities to calculate the acceleration rather than using the difference between the velocities. However just over 80 % did score full marks, with 10 % scoring zero or not attempting the question.

03.1

Approximately 60% of the students scored both marks. Often students did not know the correct word for a natural satellite. However, many correctly identified ‘star’ for the second word.

03.2

Most of the students knew that we are part of the Milky Way galaxy.

03.3

© 2025 AQA

Only about 40 % of the students knew that the Sun will eventually become a black dwarf. The most popular wrong answer was that it would become a black hole.

03.4

Just fewer than 40 % of the students knew that a very distant galaxy moves faster than a nearer galaxy.

03.5

About 70 % of the students knew that an increase in the wavelength of light from a distant galaxy is called red-shift.

03.6

About 60 % of the students selected the correct word to describe the beginning of the universe.

03.7

Almost 80 % of the students knew that the universe is expanding.

04.1

Just over 70 % of the students were able to make the connection between the mass of a vehicle and how it would affect the maximum acceleration.

04.2

Over 90 % of the students scored full marks for calculating the resultant force using F = ma. However, some of the students thought that the value of acceleration needed to be squared and then multiplied by mass.

04.3

This level of response question proved too challenging for many. Only just over 1 % of the students scored full marks. Most identified that the driving force would increase, but fewer recognised that as this happened the air resistance would also increase, with many stating that the air resistance would decrease as the cars speed increased.

04.4

Most of the students knew that the thinking distance is affected by the driver's reaction time.

04.5

Just fewer than 70 % of the students were aware that the braking distance is the distance travelled under the braking force.

04.6

Only just over 20 % of the students scored full marks for using the graph of distance against speed to find the stopping distance. The correct distances were often identified from the graph. However, these were then either subtracted from each other, divided or multiplied rather than added.

© 2025 AQA

4.6.2.5 Lenses (physics only)

Report on the examination – GCSE - Physics – 8463/2H – June 2025

04.7

Nearly 80 % of the students identified factors that would increase the stopping distance of a car. Despite two being emboldened twice in the question, some students only ticked one box.

05.1

The principal focus was correctly identified by just over 60 % of the students.

05.2

About 80 % of the students knew that the change in direction of light as it enters a lens is called refraction.

05.3

Nearly 70 % the students recognised the shape of a convex lens.

05.4

Under a half of the students managed to correctly measure the object height and image height. This may have been due to a lack of skill or a lack of equipment.

05.5

This was much more successfully answered than part 05.4 with nearly 90 % of the students scoring both marks. These students used their values from part 05.4 to calculate magnification.

05.6

Just fewer than 50 % of the students knew that magnification is a ratio, but almost the same number thought it is a power.

05.7

This was a challenging question. Most of the students that did score a mark were awarded only the first mark point. This was for explaining that white light is transmitted through colourless glass. A lot of the students think of white light as an entity in itself rather than the result of the colours of the visible light combined. Few used the word transmitted but rather described it as passing through or goes through.
For the 2nd and 3rd mark points many of the students decided that white light was reflected or refracted, reinforcing the misconception that white light is a single entity rather than being made up of a combination of wavelengths. The idea that filters would absorb different wavelengths of light seemed to be difficult for the students to express, with very few achieving the third mark.

06.1

Only just over 30 % of the students could identify two magnetic materials from the list, with about 60 % being able to identify one. Again, a number of students ticked just one box or more than two boxes.

© 2025 AQA

Report on the examination – GCSE - Physics – 8463/2H – June 2025

06.2
Just over 70 % of the students correctly named the iron nails as induced magnets.

06.3
Just fewer than 40 % of the students knew the direction of the magnetic field.

06.4
Nearly 80 % of the students recognised the shape of the magnetic field around a current carrying wire.

06.5
Very few of the students could give two changes that would increase the magnetic field strength. 'Increasing the current' was a common correct response. Many of the students answered 'increasing the number of coils' as such they were implying the wire was already coiled and not answering the question asked, which was about the straight wire shown in Figure 10.

07.1
Nearly 60 % of the students understood what is meant by the moment of a force. The most common incorrect option was 'The direction of the force.'

07.2
The correct resultant moment was selected by just over 80 % of the students.

07.3
Students generally answered this well, identifying position 7 and on which side of the balance the tag should be placed. Some indicated this on the diagram which was an accepted alternative response, provided what was written did not contradict it.

07.4
Some students wrote the equation for the moment of a force in words and then in symbols. This risks not gaining the mark if either is incorrect. Also, correct use of symbols should be stressed, especially when they are given in the question. It was surprising that some of the students scored zero or did not attempt to write down an equation despite having the equations sheet.

07.5
Almost three quarters of the students were able to rearrange the equation and then calculate the distance between the pivot and the tag on the balance.

08.1
Most of the students found this level of response question difficult to answer. Only just over 1 % gave a level 2 answer. Many of the students scored 2, 1 or 0 marks. Of those that scored a mark the most common response was light travels faster than sound. Many also tried to describe light and sound as transverse and longitudinal waves, with the majority getting this

© 2025 AQA

confused. Very few identified acceptable similarities. Common answers that did not gain credit included light travels at the speed of light, sound travels at the speed of sound, light can be seen and sound cannot be seen.

08.2

Just fewer than 80 % of the students choose the correct equation for calculating speed.

08.3

This question required students to rearrange the equation. About three quarters of the students scored all three marks.

09.1

About 65 % of the students correctly stated the independent variable in this investigation.

09.2

Just over 40 % of the students scored both marks for identifying a risk of harm and a suitable safety precaution to reduce the risk. Too few students connected a hazard, such as a falling weight, becoming a risk of harm when it hit or hurt the student.

09.3

Students were expected to clearly describe two improvements to the arrangement shown that would improve the accuracy of the results. Many had difficulty describing their ideas clearly and answers were often too vague to gain credit.

09.4

Almost 40 % of the students scored this mark usually by explaining that the spring length was not 0 cm rather than describing the relationship between spring length and force.

09.5

This was not successfully answered, with only about 2 % of the students scoring both marks and a further 13 % scoring one mark. The 1st mark point was for stating or giving a clear description of inelastic deformation. Of those who were awarded marks most of them described how the spring had reached or passed its limit of proportionality.

09.6

Over 90 % of the students selected the correct equation.

09.7

Nearly 80 % of the students scored all three marks. Those that did not often rearranged the equation incorrectly.

10.1

Only about 5% of the students correctly calculated the uncertainty correctly from either the range or the mean.

© 2025 AQA

4.6.2.5 Lenses (physics only)

10.2

Just over 40 % of the students identified that a random error had caused the variation in this investigation. A greater proportion of the students thought there was a systematic error but this would not have accounted for the variation in the results.

10.3

This mark was awarded for a clear description of variation in the way the ball was dropped. For example, through different heights, at different speeds, or a different delay each time. Common answers giving reaction time or human error were too vague, to be awarded marks unless qualified.

10.4

Just fewer than 30 % of the students scored all three marks. Many of the students took only one value from the graph rather than a corresponding pair of values and so scored 0. Those that used a pair of correct values often then used them the wrong way round when calculating the gradient.

© 2025 AQA

4.6.2.5 Lenses (physics only)

Report on the examination – GCSE - Physics – 8463/2H – June 2025

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

© 2025 AQA and its licensors. All rights reserved.