AQA GCSE Physics | 8463

SPECIFICATION POINT 4.8.2

Red-shift (physics only)

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**23**
Available paper years	**2006–2025**

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.

4.8.2 Red-shift (physics only)

Answer 01 · Mark scheme

November 2006 | PHY1B | Original Q5 | Legacy

Five	**A**	a distant galaxy	**3**
	B	a satellite	**1**
	C	the Earth	**2**
	D	the Universe	**4**

4.8.2 Red-shift (physics only)

Answer 02 · Mark scheme

Question 4

question	answers	extra information	mark
(a)(i)	red shift	accept Doppler effect	1
(ii)	the universe is expanding		1
(b)(i)	big bang		1
(ii)	at the moment it is the best way of explaining…….		1
(c)(i)	visible / light		1
(ii)	the atmosphere does not block……..		1
(iii)	difficult to maintain **or** high cost to get into space	accept any feasible reason do not accept expensive on its own	1
total			7

4.8.2 Red-shift (physics only)

Answer 03 · Mark scheme March 2007 | PHY1B | Original Q4 | Legacy

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

Answer 04 · Mark scheme June 2007 | PHY1B | Original Q7 | Legacy

Seven	**3**	**4**	**1**	**2**

Answer 05 · Mark scheme November 2007 | PHY1B | Original Q7 | Legacy

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

Answer 06 · Mark scheme June 2008 | PHY1BP | Original Q6 | Legacy

Six	**A**	a false statement	**4**
	B	an observation	**2**
	C	a belief which science cannot prove	**1**
	D	a theory	**3**

	A	**B**	**C**	**D**

4.8.2 Red-shift (physics only)

Answer 07 · Mark scheme June 2008 | PHY1F | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
(a)	atmosphere distorts / blocks image	accept clouds block light / global dimming accept because of the atmosphere	1
		accept weather conditions	
	or		
	atmosphere scatters light	accept light pollution	
(b)		do **not** accept answers in terms of mirror size	
	Correct statement related to distance		1
	Sensible comment related to access		1
	eg		
	Hubble telescope is close enough (1) for a spacecraft / astronauts to reach (1)		
	or		
	James Webb is too far away (1) for astronauts to travel to (1)		
		do **not** accept easier to service on it's own	
(c)	To test the design ….		1
(d)	gamma rays	answers in any order	1
	X-rays		1
(e)	Big bang		1
total			7

4.8.2 Red-shift (physics only)

Answer 07 · Mark scheme June 2008 | PHY1F | Original Q4 | Legacy

PHY1F

Answer 08 · Mark scheme June 2009 | PHY1BP | Original Q7 | Legacy

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

Answer 09 · Mark scheme November 2009 | PHY1BP | Original Q7 | Legacy

Seven	**4**	**2**	**2**	**3**

4.8.2 Red-shift (physics only)

Answer 10 · Mark scheme January 2010 | PHY1F | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)(i)	(visible) light		1
5(a)(ii)	any **one** from: • less / no light pollution • less atmospheric distortion / interference • less / no cloud cover • **image / picture** is clearer	 accept no street lights accept less / thinner atmosphere do **not** accept no atmosphere accept less atmospheric pollution do **not** accept less pollution accept above the clouds do **not** accept gives a clearer view / signal	1
5(b)	on a satellite	accept in orbit / space accept in a high altitude balloon accept above the atmosphere do **not** accept on top of a mountain do **not** accept on a plane ignore any reason given correct or otherwise	1
5(c)	The Universe began from a very small point.		1
Total			**4**

4.8.2 Red-shift (physics only)

Answer 10 · Mark scheme

January 2010 | PHY1F | Original Q5 | Legacy

PHY1F

Answer 11 · Mark scheme

June 2010 | PHY1BP | Original Q7 | Legacy

Seven	4	3	1	4

4.8.2 Red-shift (physics only)

Answer 12 · Mark scheme June 2010 | PHY1F | Original Q5 | Legacy

Question 5

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

4.8.2 Red-shift (physics only)

Answer 12 · Mark scheme June 2010 | PHY1F | Original Q5 | Legacy

PHY1F

Answer 13 · Mark scheme November 2010 | PHY1BP | Original Q5 | Legacy

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

4.8.2 Red-shift (physics only)

Answer 14 · Mark scheme

Question 7

question	answers	extra information	mark
7(a)	frequency / pitch decreases	accept wavelength increases accept it / the note becomes deeper / lower it / the note decreases is insufficient quieter is neutral	1
7(b)(i)	Models can help to explain an effect or theory.		1
7(b)(ii)	(moving) loudspeaker represents the (moving) galaxy the decrease in frequency of the sound is like red-shift	accept sound waves represent light waves accept increase in frequency is like blue-shift accept answers in terms of wavelength change accept sound going away from you is like red-shift accept red-shift happens when galaxies / stars move away (from Earth) this accept only scores if first marking point scores	1 1
7(c)	big bang		1
Total			**5**

4.8.2 Red-shift (physics only)

Answer 15 · Mark scheme March 2011 | PHY1BP | Original Q5 | Legacy

Five	**A**	a belief that science cannot disprove		**1**
	B	a conclusion based on observations of red-shift		**3**
	C	a theory supported by scientific evidence but not direct observations		**4**
	D	a theory that science has disproved		**2**

	A	**B**	**C**	**D**

Answer 16 · Mark scheme June 2011 | PHY1BP | Original Q5 | Legacy

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

	A	**B**	**C**	**D**

Answer 17 · Mark scheme November 2011 | PHY1BP | Original Q3 | Legacy

Three	**A**	a distant galaxy	**3**
	B	a satellite	**1**
	C	the Earth	**2**
	D	the Universe	**4**

Answer 18 · Mark scheme November 2011 | PHY1BP | Original Q7 | Legacy

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

4.8.2 Red-shift (physics only)

Answer 19 · Mark scheme

June 2012 | PH1FP | Original Q3 | Legacy

Question 3

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

4.8.2 Red-shift (physics only)

Answer 19 · Mark scheme

June 2012 | PH1FP | Original Q3 | Legacy

PH1FP

4.8.2 Red-shift (physics only)

Answer 20 · Mark scheme

January 2013 | PH1FP | Original Q7 | Legacy

Question 7

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

4.8.2 Red-shift (physics only)

Answer 20 · Mark scheme

January 2013 | PH1FP | Original Q7 | Legacy

PH1FP

4.8.2 Red-shift (physics only)

Answer 21 · Mark scheme

June 2019 | 8463/2F | Original Q2

Question 2

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

4.8.2 Red-shift (physics only)

Answer 22 · Mark scheme

June 2023 | 8463/2F | Original Q7

Question 7

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

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

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

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

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

4.8.2 Red-shift (physics only)

Answer 22 · Mark scheme

June 2023 | 8463/2F | Original Q7

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

Total Question 7	**8**

4.8.2 Red-shift (physics only)

Answer 23 · Mark scheme

June 2025 | 8463/2F | Original Q3

Question 3

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

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

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

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

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

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

4.8.2 Red-shift (physics only)

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

Total Question 3	**8**

4.8.2 Red-shift (physics only)

Answer 21 · Examiner comments

June 2019 | 8463/2F | Original Q2

Question 2 (Low demand)

02.1 Just over 50% of the students gave the correct answer, wavelength. Most of the other students wrote frequency.

02.2 Just under 60% of the students gave the correct answer.

02.3 Nearly 73% of the students made the correct choice.

02.4 Only just over half of the students scored this mark. The most common incorrect answers included the idea of the universe being very big when it began.

02.5 Just over 85% of the students appreciated that scientific evidence supports the Big Bang theory.

02.6 Although 57% of the students scored both marks the idea that graph Z is the only one to show the universe expanding was often not well expressed.

4.8.2 Red-shift (physics only)

Answer 22 · Examiner comments June 2023 | 8463/2F | Original Q7

07.1

75% of students knew that satellite is the name given to an object that orbits a planet.

07.2

A significant number of students did not attempt this question. This is common when students are asked to complete a diagram. Many did show an arrow from the Hubble Space Telescope to Earth. Some drew multiple arrows. A lack of precision from where the arrow started prevented some students from scoring the mark.

07.3

53% of students scored full marks on this calculation of speed from a distance–time graph. The most obvious way of doing this was to use the full gradient which gives 38km in 5 seconds, which was the most common method used by the students. However, many students took different intervals along the line and provided they used the correct numbers the calculation was accepted. This meant a range of velocities could be derived. Common ones were 15km in 2s, 4km in 0.5s,

Answer 22 · Examiner comments June 2023 | 8463/2F | Original Q7

23km in 3s. 8% scored one mark for correctly identifying a change in distance with the corresponding change in time.

07.4

65% of students could identify the galaxy moving away from Earth the fastest from the light spectra.

07.5

77% of students could identify the galaxy furthest away from Earth from the light spectra.

07.6

74% of students understood why it is important that scientific observations are peer reviewed.

4.8.2 Red-shift (physics only)

Questions matter

GCSE

Physics

8463/2F

Report on the examination

Version: 1.0
June 2025

© 2025 AQA

4.8.2 Red-shift (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.

© 2025 AQA

4.8.2 Red-shift (physics only)

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.

4.8.2 Red-shift (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

4.8.2 Red-shift (physics only)

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

4.8.2 Red-shift (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

4.8.2 Red-shift (physics only)

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

4.8.2 Red-shift (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

4.8.2 Red-shift (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.