AQA GCSE Physics | 8463

SPECIFICATION POINT 4.6.3.2

Perfect black bodies and radiation

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**7**
Available paper years	**2007–2024**

Using this booklet

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

Name: _____ **Date:** _____

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

4.6.3.2 Perfect black bodies and radiation

Answer 01 · Mark scheme

June 2007 | PHY1A | Original Q8 | Legacy

Eight	**4**	**3**	**1**	**2**

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Answer 02 · Mark scheme January 2008 | PHY1F | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
(a)(i)	digital	correct answer only	1
(ii)	(visible) light infra red	answer in either order accept IR	1 1
(b)(i)	25 (%)	do **not** accept ¼	1
(ii)	increases		1
(c)	tick (✓) in top and bottom box	both required	1
(d)	SHINY surfaces are good reflectors of infra-red radiation **or** black surfaces are POOR reflectors of infra-red radiation **or** black surfaces are good EMITTERS of infra-red radiation **or** black surfaces are good ABSORBERS of infra red radiation	accept white for shiny accept bad for poor accept insertion of 'not' before 'good' in statement	1
total			7

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Answer 02 · Mark scheme

January 2008 | PHY1F | Original Q2 | Legacy

PHY1F

Answer 03 · Mark scheme

March 2011 | PHY1BP | Original Q9 | Legacy

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

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Answer 03 · Mark scheme

March 2011 | PHY1BP | Original Q9 | Legacy

GCSE

SCIENCE A (4461) / PHYSICS (4451)

Objective Test Answer Key

PHY1BP (Radiation and the Universe)

March 2011

Higher Tier

Question	Key		
One	**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**
Two	**A**	Isotope **A**	**4**
	B	Isotope **B**	**1**
	C	Isotope **C**	**3**
	D	Isotope **D**	**2**

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

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Answer 04 · Mark scheme

June 2011 | PHY1BP | Original Q9 | Legacy

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

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Answer 05 · Mark scheme

June 2023 | 8463/2F | Original Q4

Question 4

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

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

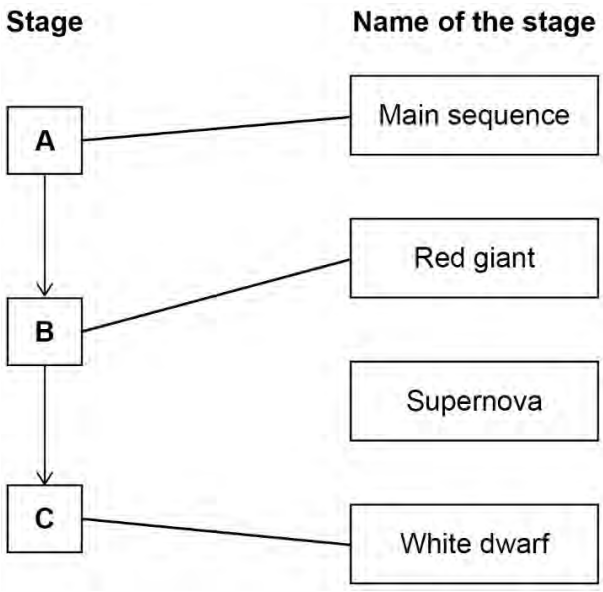
Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	it increases		1	AO3 4.8.1.1

4.6.3.2 Perfect black bodies and radiation

Answer 05 · Mark scheme

June 2023 | 8463/2F | Original Q4

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

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

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

Total Question 4	11

4.6.3.2 Perfect black bodies and radiation

Answer 06 · Mark scheme

June 2023 | 8463/2F | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	perpendicular		1	AO1 4.6.1.1

Question	Answers	Mark	AO / Spec. Ref.
09.2	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5-6	AO3
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3-4	AO1
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1-2	AO1
	No relevant content	0	
	Indicative content **Method:** • heat the water / kettle • add an equal volume of (hot) water to each flask • insert a thermometer into each flask • record the initial temperature from both flasks OR • place an IR detector near each flask • the distance between the IR detector and the flask should be the same each time • record initial reading from IR detectors • (and) start a stop clock • record the temperatures / readings after 10 minutes from both flasks • calculate the change in temperatures / readings during the 10 minutes • compare the results to test the hypothesis to access level 3 the method must allow the correct consideration of a temperature decrease for both flasks or the correct comparison of IR detected from both flasks		4.6.2.2

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Answer 06 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.3	during the 1st minute there is the greatest temperature difference (between the hot water and the surroundings)	 allow highest temperature or hottest MP 2 dependent on scoring MP1	1 1	AO2 AO1 4.6.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	the temperature (increase / change after 10 minutes)	allow the final temperature do not allow temperature decrease	1	AO1 4.6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	black surfaces absorb more (infrared than white surfaces) matt surfaces absorb more (infrared) than shiny surfaces of the same colour	allow black surfaces have a greater temperature increase (than white surfaces) allow matt surfaces have a greater temperature increase than shiny surfaces of the same colour if no other marks scored, allow 1 mark for matt black surface is the best absorber and shiny white surface is the worst absorber if no other marks scored, allow 1 mark for matt black has the greatest temperature increase and shiny white has the smallest temperature increase	1 1	AO3 4.6.2.2 4.6.3.1

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Answer 06 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.6	pressure = $\frac{\text{force}}{\text{area}}$		1	AO1 4.5.5.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.7	area of base = 0.0144 (m^2)	do not allow this or subsequent marks unless base area is used	1	AO2 4.5.5.1.1
	$1500 = \frac{F}{0.0144}$	this mark may be awarded if base area is incorrectly calculated	1	
	$F = 1500 \times 0.0144$	this mark may be awarded if base area is incorrectly calculated	1	
	$F = 21.6$ (N)	this mark may be awarded if base area is incorrectly calculated allow 22 (N)	1	

Total Question 9	17

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Answer 07 · Mark scheme

June 2024 | 8463/2F | Original Q1

Question 1

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.2	dust and gas		1	AO1 4.8.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.3	gravitational force		1	AO1 4.8.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.4	fusion		1	AO1 4.8.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.5	visible light takes the same time as infrared radiation		1	AO1 4.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.6	greater		1	AO1 4.6.2.1

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Answer 07 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	greater rate than the Earth the Sun is at a higher temperature	 allow the Sun has a greater surface area MP2 is dependent on MP1	1 1	AO3 4.6.3.1

Total Question 1	**8**

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Answer 05 · Examiner comments June 2023 | 8463/2F | Original Q4

04.1

90% of students recognised the reason why a new scientific model would need to be introduced.

04.2

Some students gained all four marks through well-structured comparisons between the models. Those who listed features that were unconnected gained a maximum of 2 marks. Some students did not achieve any marks through a lack of detail in their statements.

04.3

Students were asked to state the time increases, most achieved this, a common alternative was ‘it takes longer’. Many students used the table headings to successfully describe the relationship. Many who did not score made comments about the speed increasing or the distance being greater or simply said the time changes.

04.4

Most students scored 2 marks, with only 3.5% getting no marks. The most common error was not identifying the correct scale of the graph ,resulting in the bars being the incorrect height.

04.5

21% of students were able to identify the order of two stages in the life cycle of the Sun correctly. 19% were able to identify all three stages in the correct order.

04.6

57% of students knew that black bodies are the best emitters of radiation.

Answer 06 · Examiner comments June 2023 | 8463/2F | Original Q9

09.1

12% of students gave the answer perpendicular or a correct description of perpendicular. Common incorrect responses included parallel, opposite, and proportional.

09.2

29% of responses were level 1 and 45% were level 2. Very few students explained the need to calculate the temperature change or to compare the readings on infrared detectors. A number of students suggested using cold water, or even described a different practical. Students were not penalised for using tiny volumes of water, but many students have no concept of how much 50 ml is, for example.

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Answer 06 · Examiner comments

June 2023 | 8463/2F | Original Q9

09.3

Many students scored zero as they had selected the incorrect box. The reason had to state greatest/highest temperature, or the liquid was the hottest. A higher temperature or hotter liquid was insufficient to gain this mark. 21% of students scored both marks.

09.4

31% of students gained this mark. There seemed to be confusion as to which variable was the dependent variable. The majority of students gave control variables or the independent variable as their answer.

09.5

The most common response related to the matt black surface and the shiny white surface. This was awarded 1 mark. Some students did mention that black was the best absorber but failed to adequately describe the relative absorbance of matt versus shiny surfaces, as they did not explain this only applied for the same colour surface. Some students gave their response in terms of emission or reflection of IR radiation, both of which scored zero. Only 2% of students were able to give two meaningful conclusions.

09.6

90% of students correctly identified the formula for calculating pressure.

09.7

47% of students achieved full marks in this calculation. Many scored zero, as they calculated the total surface area, the volume or used the length of the cube.

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Answer 07 · Examiner comments June 2024 | 8463/2F | Original Q1

01.1
98% of students could name our galaxy correctly.

01.2
This question was well answered with 80% of students knowing what the Sun was formed from.

01.3
70% of students were able to name a force involved in the formation of the Sun.

01.4
There was some confusion about the process which releases energy in stars, with only 56% choosing fusion. The most common wrong answer was combustion. Very few students did not attempt this question.

01.5
This question proved more challenging, with only 15% of students understanding that all types of electromagnetic radiation travel at the same speed in a vacuum or space.

01.6
53% of students knew that infrared radiation has a greater frequency than visible light.

01.7
This question was well answered with 49 % of students scoring one mark for knowing that the Sun emits infrared radiation at a greater rate than Earth and a further 34% of students scoring both marks because they could give a reason why.