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GCSE

# Science A / Physics

PH1FP

Mark scheme

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4405/4403

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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](http://aqa.org.uk)

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## Mark Scheme

### Information to Examiners

#### 1. General

The mark scheme for each question shows:

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

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

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

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

#### 2. Emboldening

- 2.1** In a list of acceptable answers where more than one mark is available ‘any **two** from’ is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.
- 2.2** A bold **and** is used to indicate that both parts of the answer are required to award the mark.
- 2.3** Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.
- 2.4** Any wording that is underlined is essential for the marking point to be awarded.

#### 3. Marking points

##### 3.1 Marking of lists

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

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

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

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

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

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

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

### 3.1 Use of chemical symbols / formulae

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

### 3.2 Marking procedure for calculations

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

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

### 3.3 Interpretation of 'it'

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

### 3.4 Errors carried forward

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

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

### 3.5 Phonetic spelling

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

### 3.6 Brackets

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

### 3.2 Ignore / Insufficient / Do not allow

Ignore 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.

## 4. Quality of Communication and levels marking

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

Students will be required to:

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

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

#### Level 1: basic

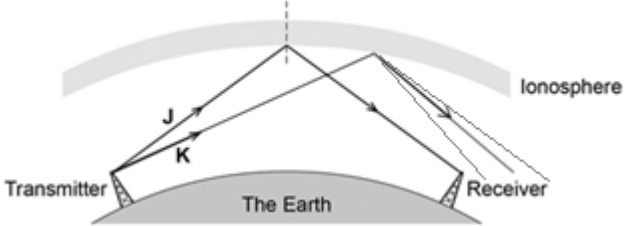
- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

#### Level 2: clear

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

#### Level 3: detailed

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

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

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

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



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



## Question 5 continued . . .

Question	Answers	Extra information	Mark	AO/Spec. ref.
5(c)(iii)	<p>any <b>one</b> from:</p> <ul style="list-style-type: none"> <li>• wind is a renewable energy source</li> <li>• do not use fuel</li> <li>• energy source is free</li> <li>• do not release carbon dioxide</li> <li>• do not release greenhouse gases</li> <li>• do not release sulfur dioxide</li> <li>• do not cause acid rain</li> <li>• do not cause climate change</li> <li>• do not cause global warming</li> <li>• do not cause global dimming</li> </ul>	<p>answer must be an advantage of wind, converse answers in terms of fossil fuels are insufficient</p> <p>accept do not release pollutant gases</p> <p>'no pollution' is insufficient</p>	1	AO1 P1.4.1f
<b>Total</b>			<b>11</b>	

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

Question	Answers	Extra information		Mark	AO / Spec. Ref.
7 (a)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 4 and apply a 'best-fit' approach to the marking.			6	AO2 AO3 P1.2 HSW
<b>0 marks</b>	<b>Level 1 (1-2 marks)</b>	<b>Level 2 (3-4 marks)</b>	<b>Level 3 (5-6 marks)</b>		
No relevant information	There is a relevant statement about an energy saving method	There is at least one clear comparison of energy saving methods and their cost effectiveness with an appropriate calculation	There is a comparison of energy saving methods and their cost effectiveness with appropriate calculations. Comparison to include further detail.		
<p><b>examples of physics points made in the response</b></p> <p><b>examples of relevant statements</b></p> <ul style="list-style-type: none"> <li>• energy efficient boiler saves the most (energy / money) per year</li> <li>• loft insulation costs the least to install</li> <li>• double-glazing costs the most to install</li> </ul> <p><b>examples of statements that include cost effectiveness</b></p> <ul style="list-style-type: none"> <li>• loft insulation is the most cost effective in the long term</li> <li>• double-glazing is the least cost effective</li> <li>• loft insulation has the shortest payback time</li> <li>• double-glazing has the longest payback time</li> <li>• payback time calculated for any method</li> </ul> <p><b>examples of further detail</b></p> <ul style="list-style-type: none"> <li>• for cost effectiveness install in the following order: loft, cavity wall, boiler, double-glazing</li> <li>• for reducing energy use install in the following order: boiler, loft, cavity wall, double glazing</li> <li>• don't install double-glazing for insulation purposes</li> <li>• double-glazing won't pay for itself in your lifetime</li> <li>• justified choice of best / worst method</li> </ul>		<p><b>extra information</b></p> <p>payback times:</p> <p>energy efficient boiler: 6.25 years</p> <p>loft insulation: 2 years</p> <p>double glazing: 100 years</p> <p>cavity wall insulation: 2.86 years</p>			

## Question 7 continued . . .

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

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

**Question 8 continues on the next page . . .**

Question	Answers	Extra information	Mark	AO / Spec. ref.
<b>8(c)(ii)</b>	the cost is equal to the number of kWh x the cost per kWh	accept (heating) bill depends on (number of) kWh used accept energy for kWh	1	AO3 AO2 P1.1
	calculation $0.8 / 8.0 = 0.1$ or 10%	allow $7.2 / 8.0 = 0.9$ or 90%	1	
<b>8(c)(iii)</b>	heating is on for more / less time (than anticipated)		1	AO3 P1.1
	because some days it is cooler / warmer (than anticipated)	accept other sensible suggestions  an answer giving two sensible situations gains <b>2</b> marks possible examples: <ul style="list-style-type: none"> <li>• some houses have different amounts of insulation</li> <li>• there are different styles of house</li> </ul> temperature (inside / outside) is always changing is insufficient	1	
<b>Total</b>			<b>9</b>	