GCSE

Physics/Science A (Route 1)

PH1HP

Final Mark scheme

4403/4405

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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

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

3.2 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.

3.3 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 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.

3.6 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 Accept / allow

Accept is used to indicate an equivalent answer to that given on the left-hand side of the mark scheme. Allow is used to denote lower-level responses that just gain credit.

3.9 Ignore / Insufficient / Do not allow

Ignore of 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 **2** 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)	transverse		1	AO1 1.5.1c
1(b)	4.6×10^{14} (Hz)	an answer that rounds to 4.6×10^{14} scores 2 marks allow **1** mark for correct substitution ie $3.0 \times 10^{8} = f \times 6.5 \times 10^{-7}$	3	AO2 1.5.1j
1(c)	10^{-15} to 10^{4}		1	AO1 1.5.1e
Total			**5**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2	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.		6	AO1 AO2 AO3 1.1.1cde

0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant information	A description of how at least **one** feature makes design A better than design B.	A basic explanation in terms of physical processes of how some features of design A make it better than design B.	A clear and correct explanation in terms of physical processes, including direct comparisons, of how most features of design A make it better than design B.

examples of physics points made in the response

colour of pipe:

- black (pipe) surface is a good absorber of IR radiation / energy

material of pipe:

- metal pipes are good conductors

or

- metal pipes are better conductors than plastic pipes
- higher rate of energy transfer through metal pipe

colour of surface:

- (inside of solar panel is) white / shiny surface which is a good reflector of IR radiation to the pipe
- (inside of solar panel is) white / shiny surface which is a poor absorber of IR radiation

Insulation:

- layer of insulation reduces conduction through base of solar panel

length of pipe / surface area of pipe:

- water is in solar panel for longer time
- water absorbs more energy
- pipe absorbs more IR

design A has a greater water temperature increase (could be linked to any feature)

extra information

accept converse answers in terms of why design B is worse than design A

allow heat / radiation for IR throughout

Total			6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)	any **two** from: • length / area / size / shape of turbine blades • wind speed • angle of blades / hairdryer	ignore mass / weight / number of turbine blades ignore material of turbine blades accept distance / position of hairdryer allow power setting on hairdryer ignore speed of the turbine spinning	2	AO3 1.4.1b
3(b)(i)	3 points plotted correctly	allow **1** mark for 1 or 2 points plotted correctly ignore any line of best fit drawn	2	AO2 1.4.1b
3(b)(ii)	random (error)	ignore reference to anomaly	1	AO3 1.4.1b
3(b)(iii)	zero output voltage with 1 blade (as number of blades increases) output voltage increases	accept turbine didn't rotate with 1 turbine blade accept (as number of blades increases) speed increases do not accept direct proportion	1 1	AO3 1.4.1b
3(c)	any **two** from: • output voltage / power (required) • mass / weight / material / area / size / shape / length of blades • height / position / location of turbine • cost to construct turbine • environmental impact of wind turbine	ignore reference to efficiency ignore number of blades unqualified allow payback time accept reference to noise / visual pollution	2	AO3 1.4.1b
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	Doppler		1	AO1 1.5.4a
4(b)(i)	A frequency has increased	 accept frequency is higher (compared to the emitted frequency) accept wavelength has decreased reason only scores if A is chosen	1 1	AO2 AO3 1.5.4a
4(b)(ii)	C greater change in frequency	 accept greater change in wavelength reason only scores if C chosen	1 1	AO2 AO3 1.5.4a
Total			**5**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	wood / charcoal / peat	allow named solid dried plant material or animal product do not accept seashells	1	AO1 1.4.1a
5(b)	380 (°C)	allow **1** mark for correct substitution ie $8.36 \times 10^7 = 250 \times 880 \times \theta$	2	AO2 1.1.4d
5(c)	(white is a) poor emitter of IR radiation (curved surface) has a small surface area (to volume ratio) (high specific heat capacity means) large amount of energy needed to transfer to surroundings before temperature decreases (significantly) (low U-value means) concrete is a poor conductor **or** a (good) insulator	allow heat for IR ignore white is a good reflector only or poor absorber	1 1 1 1	AO1 AO2 1.1.4d 1.1.3c
Total			**7**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)	6.3 (W)	accept an answer that rounds to 6.3 W allow **1** mark for correct substitution ie $0.40 = \left(\frac{2.5}{\text{total power}}\right)$ **or** $40 = \left(\frac{2.5}{\text{total power}}\right) \times 100$	2	AO2 1.2.1d
6(b)	4 (hours)	allow **2** marks for an answer of 14 400 (seconds) **or** allow **2** marks for an answer of 240 (minutes) allow **1** mark for correct substitution ie 36 000 = 2.5 x t allow **2** marks for an answer of 0.004 allow **1** mark for an answer of 14.4 for a student who uses 6.3 W or 6.25 W allow **2** marks for an answer of 1.6 hours allow **1** mark for an answer of 5714 or 5760 or 5.71 or 5.76	3	AO2 1.3.1c
6(c)	lower power input (because) solar cells not pointed directly at Sun **or** large amount of cloud **or** solar cells in shade **or** dust on solar cells	allow less light ignore efficiency or description of energy transfer to the surroundings weather is insufficient	1 1	AO1 1.4.1c

6(d)		accept converse answers which refer to the phone switched off		AO2 1.3.1a,b
	(when the phone is switched on) energy from the solar cell is transferred to the battery and the phone **or** only some of the energy from the solar cell charges the battery	accept power for energy in first marking point only	1	
	(so) the battery stores less energy per second	takes less time to charge when switched off is insufficient	1	
Total			**9**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7(a)	transformer **J** increases the voltage and decreases the current	allow steps up for increases	1	AO1 1.4.2a,b,c
	(so lower current means) less energy wasted **or** less heating of the surroundings	allow heat for energy	1	
	(which) increases efficiency		1	
	(but) transformer **K** decreases the voltage to a safer / appropriate value (for consumers)	allow steps down for decreases if no other mark scored then allow **1** mark for transformer **J** is a step-up transformer <u>and</u> transformer **K** is a step-down transformer	1	
7(b)(i)	at times of low demand (for electricity)		1	AO1 1.4
	when there is a surplus (of electricity)		1	
	water is pumped from low level to high level	accept the turbine acts as a pump **or** the generator acts as a motor	1	
	energy is stored as gravitational potential energy	allow gpe for gravitational potential energy	1	
7(b)(ii)	can store / produce large amount of energy		1	AO1 1.4
	(means) power output increases rapidly	accept short start-up time	1	
Total			**10**	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8(a)	liquid molecules / particles (next to the chiller) move closer together		1	AO1 1.1.3a
	so liquid becomes more dense	allow liquid contracts	1	
	(so cooler liquid) sinks		1	
	(and) warmer liquid rises	accept less dense liquid rises	1	
8(b)	(rate of energy transfer) decreases		1	AO1 1.1.3d
	(as) temperature difference (between chiller and liquid) decreases		1	
8(c)	the bottle cools the air (around it)	accept the air transfers energy to the bottle	1	AO1 1.1.3a
	cooler air cannot hold as many water molecules / particles **or** water molecules / particles move closer together	allow much water vapour for many water molecules / particles ignore descriptions of forces between particles	1	
	water vapour turns into a liquid		1	
Total			**9**	