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General Certificate of Secondary Education
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Science A / Physics PH1FP

(Specification 4405 / 4403)

Unit: Physics 1

Final

Mark Scheme

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 events which all examiners 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 examiner understands and applies it in the same correct way. As preparation for standardisation each examiner 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, examiners encounter unusual answers which have not been raised 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 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

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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 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.

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Question 1

question	answers	extra information	mark
1(a)(i)	77		1
1(a)(ii)	Oil		1
1(b)	water	accept H_2O	1
1(c)	Carbon dioxide causes global warming		1
Total			**4**

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Question 2

question	answers	extra information	mark
2(a)(i)	(visible) light	accept visible	1
2(a)(ii)	microwaves		1
2(b)	J		1
2(c)(i)	B		1
2(c)(ii)	shorter than		1
2(d)(i)	To find out if using a mobile phone is harmful to health		1
2(d)(ii)	any **two** from: • (X has a) low(er) SAR value • (maximum) energy absorbed (by the head) is less • (if mobiles are harmful) less likely to cause harm	"it" refers to mobile phone accept has a low(er) rate accept energy emitted (by phone) is less accept radiation for energy accept will not cause harm accept it is safer	2
Total			**8**

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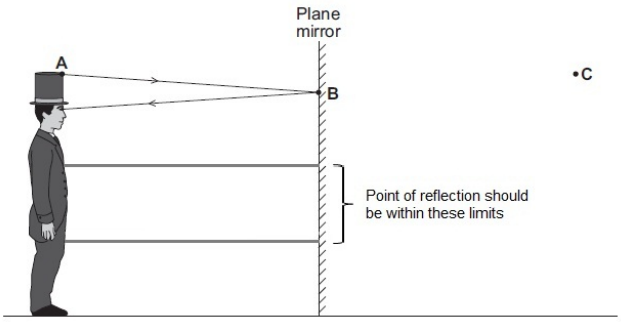
Question 3

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**

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Question 4

question	answers	extra information	mark
4(a)(i)	changing the distance may / will affect / change the voltmeter reading	accept so only one independent variable accept distance affects speed of wind (turbine) accept it is a control variable accept to give valid results fair test is insufficient to make the results accurate is insufficient	1
4(a)(ii)	any sensible practical suggestions, eg • so fan reaches a steady / full speed • so wind (turbine) reaches a steady / full speed • so voltmeter reaches / gives a steady reading	accept power for speed accept accurate or valid reading a correct reading is insufficient do **not** accept precise reading	1
4(a)(iii)	as the number of blades increases so does the (voltmeter) reading / output / voltage further relevant detail, eg • voltmeter increase is greatest up to 3 blades • voltmeter reading hardly changes with 4, 5 or 6 blades • increase is directly proportional up to 3 blades • it reaches a limit • a numerical example giving two pairs of numbers, eg 2 blades = 0.6V, 4 blades = 1V	number of blades affects the reading / output is insufficient accept does not change between 4 and 6 blades accept does not change after 4 / 5 blades	1 1
4(b)	C wind speed / strength varies	reason scores only if C is chosen accept wind is **not** constant / reliable	1 1
Total			**6**

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Question 5

question	answers	extra information	mark
5(a)(i)	vibrate / oscillate	accept a correct description move is insufficient	1
5(a)(ii)	336	allow **1** mark for correct substitution, ie 420 × 0.8(0) provided no subsequent step shown	2
5(b)(i)	frequency		1
5(b)(ii)	longer than 0.8 m		1
5(b)(iii)	Doppler		1
Total			**6**

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Question 6

question	answers	extra information	mark
6(a)(i)	temperature (increase) and time switched on are <u>directly proportional</u>	accept the idea of equal increases in time giving equal increases in temperature answers such as: • as time increases, temperature increases • positive correlation • linear relationship • temperature and time are proportional score **1** mark	2
6(a)(ii)	any **one** from: • energy transfer (from the block) to the surroundings • (some) energy used to warm the heater / thermometer (itself) • (metal) block is not insulated	"it" refers to the metal block accept lost for transfer accept air for surroundings accept takes time for heater to warm up	1
6(a)(iii)	15 000	allow **1** mark for correct substitution, ie 50 × 300 provided no subsequent step shown	2
6(b)	lead needs least energy to raise temperature by 1°C	reason only scores if lead is chosen accept needs less energy to heat it (by the same amount) lowest specific heat capacity is insufficient	1 1

Question 6 continues on the next page . . .

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Question 6 continued . . .

question	answers	extra information	mark
6(c)(i)	convection conduction	correct order only	1 1
6(c)(ii)	¾ (year) **or** 0.75 **or** 9 months **or** 274 days	allow **1** mark for correct method, ie $\frac{12}{16}$ shown	2
Total			**11**

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Question 7

question	answers	extra information	mark
7(a)	warms it	do **not** accept answers in terms of waste gases **or** pollution	1
7(b)	80% **or** 0.8	answers of 80 **or** 0.8 plus a unit gain **1** mark **only** **or** allow **1** mark for a correct substitution, ie $\frac{16}{20}$ an answer of 35% **or** 0.35 gains **1** mark answers of 85%, 75%, 0.85 **or** 0.75 gain **1** mark	2
7(c)	some of the energy that would be wasted (by a coal-burning power station) is usefully used (to heat homes etc)	accept less waste energy accept energy used to heat homes etc	1 1
7(d)(i)	A system of cables and transformers		1
7(d)(ii)	less energy / power loss / wasted (in shorter cables)	accept no energy / power loss / wasted (in shorter cables) accept energy is lost when transmitted through cables do **not** accept electricity for energy	1
Total			**7**

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Question 8

question	answers	extra information	mark
8(a)	any **two** from: • water evaporates • water molecules / particles go into the air • mirror (surface) is cooler than (damp) air • water molecules / particles that hit the mirror lose energy • cooler air cannot hold as many water molecules / particles	accept steam / water vapour for water molecules accept water turns to steam accept the mirror / surface / glass is cold accept water molecules / particles that hit the mirror cool down	2
	(causes) condensation (on the mirror) **or** particles move closer together	accept steam changes back to water (on the mirror)	1
8(b)	mirror (surface) is warm	mirror is heated is insufficient	1
	(rate of) condensation reduced	accept no condensation (happens)	1
Total			**5**

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Question 9

question	answers	extra information	mark

9(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 5.			6
0 marks	**Level 1 (1–2 marks)**	**Level 2 (3–4 marks)**	**Level 3 (5–6 marks)**	
No relevant content.	There is a basic explanation of **one** feature **or** a simple statement relating reduction in energy transfer to **one** feature.	There is a clear explanation of **one** feature **or** a simple statement relating reduction in energy transfer to **two** features.	There is a detailed explanation of at least **two** features **or** a simple statement relating reduction in energy transfer to all **four** features.	

examples of the points made in response	extra information
plastic cap: • plastic is a poor conductor • stops convection currents forming at the top of the flask so stopping energy transfer by convection • molecules / particles evaporating from the (hot) liquid cannot move into the (surrounding) air so stops energy transfer by evaporation • plastic cap reduces / stops energy transfer by conduction / convection / evaporation glass container: • glass is a poor conductor so reducing energy transfer by conduction • glass reduces / stops energy transfer by conduction	accept throughout: heat for energy loss for transfer accept insulator for poor conductor

Question 9 continues on the next page . . .

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Question 9 continued . . .

question	answers	extra information	mark
	vacuum: • both conduction and convection require a medium / particles • so stops energy transfer between the two walls by conduction and convection • vacuum stops energy transfer by conduction / convection silvered surfaces: • silvered surfaces reflect infrared radiation • silvered surfaces are poor emitters of infrared radiation • infrared radiation (partly) reflected back (towards hot liquid) • silvered surfaces reduce / stop energy transfer by radiation	accept heat for infrared	
9(b)	(the ears have a) small <u>surface area</u>	ears are small is insufficient	1
	so reducing energy radiated / transferred (from the fox)	accept heat lost for energy radiated do **not** accept stops heat loss	1
Total			**8**

UMS Conversion Calculator: www.aqa.org.uk/umsconversion