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General Certificate of Secondary Education
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Science A / Physics PH1HP

(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 4(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)	warms it	do **not** accept answers in terms of waste gases **or** pollution	1
1(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
1(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
1(d)(i)	A system of cables and transformers		1
1(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 2

question	answers	extra information	mark
2(a)		accept steam / water vapour for water molecules	
	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 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
2(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 3

question	answers	extra information	mark
3(a)(i)	perpendicular	accept correct description	1
3(a)(ii)	light off – no / slow rotation		1
	light on – fast(er) rotation	accept starts rotating ignore references to energy transfers	1
3(b)	one ray drawn from wrist watch and reflected by mirror	accept solid or dashed lines	1
	two rays drawn from wrist watch and reflected by mirror with i = r for both rays	judge angles by eye	1
	one ray traced back behind mirror	accept solid or dashed lines	1
	image in correct position	judged by eye accept image marked where two reflected rays traced back cross behind the mirror	1
3(c)	cannot be formed on a screen **or** rays of light seem to come from it but do not pass through it	accept image formed behind the mirror	1
Total			**8**

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Question 4

question	answers	extra information	mark

4(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 4 continues on the next page . . .

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Question 4 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	
4(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**

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Question 5

question	answers	extra information	mark
5(a)	(water) particles / molecules gain energy / move faster	accept atoms for molecules ignore move more do **not** accept move with a bigger amplitude / vibrate more	1
	and (the particles / molecules) move apart		1
	this causes the water to become less dense	accept water expands ignore particles become less dense	1
	and the warm / hot water rises (through the tank)	accept (more energetic water) particles rise to the top ignore heat rises	1
5(b)	conduction		1
5(c)(i)	there is a bigger temperature difference between the water and the surrounding air	accept the water is hottest / hotter	1
	so the transfer of energy (from hot water) is faster	accept heat for energy ignore temperature falls the fastest	1
5(c)(ii)	120	allow **1** mark for converting kJ to J correctly, ie 4 032 000 **or** correctly calculating temperature fall as 8°C **or** allow **2** marks for correct substitution, ie 4 032 000 = m × 4200 × 8 answers of 0.12, 19.2 **or** 16.6 gain **2** marks answers of 0.019 **or** 0.017 gain **1** mark	3

Question 5 continues on the next page . . .

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Question 5 continued . . .

question	answers	extra information	mark
5(c)(iii)	water stays hot for longer		1
	so heater is on for less time	accept so less energy needed to heat water	1
	(so cost of the jacket is soon recovered from) lower energy costs / bills	accept short payback time	1
Total			**13**

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Question 6

question	answers	extra information	mark
6(a)(i)	produces carbon dioxide / nitrogen oxides that (may) contribute to global warming	accept greenhouse gases ignore pollutant gases accept causes global warming damages ozone layer negates this mark accept alternative answers in terms of: sulfur dioxide / nitrogen oxides causing acid rain	1 1
6(a)(ii)	carbon capture / storage **or** plant more trees **or** remove sulfur (before burning fuel)	answer must relate to part (a)(i) collecting carbon dioxide is insufficient	1
6(b)(i)	(power station can be used) to meet surges in demand	accept starts generating in a short time can be switched on quickly is insufficient	1
6(b)(ii)	can store energy for later use	accept renewable (energy resource) accept does not produce CO_2 / SO_2 / pollutant gases	1

Question 6 continues on the next page . . .

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Question 6 continued . . .

question	answers	extra information	mark
6(c)(i)	turbines do not generate at a constant rate	accept wind (speed) fluctuates accept wind is (an) unreliable (energy source)	1
6(c)(ii)	any **one** from: • energy efficient lighting (developed / used) • increased energy cost (so people more likely to turn off) • more people becoming environmentally aware	use less lighting is insufficient accept electricity for energy	1
Total			**7**

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Question 7

question	answers	extra information	mark
7(a)	10^{-15} metres to 10^{4} metres		1
7(b)(i)	any **one** from: • (TV / video / DVD) remote controls • (short range) data transmission • optical fibre (signals)	mobile phones is insufficient accept specific example, eg linking computer peripherals do **not** accept Bluetooth	1
7(b)(ii)	0.17	an answer 17 cm gains **3** marks an answer given to more than 2 significant figures that rounds to 0.17 gains **2** marks allow **1** mark for correct substitution, ie $3 \times 10^{8} = 1.8 \times 10^{9} \times \lambda$	3
7(c)	(maybe) other factors involved	accept a named 'sensible' factor, eg higher stress / sedentary lifestyle / overweight / smoking more / diet / hot office / age not testing enough people is insufficient unreliable data is insufficient	1
Total			**6**

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Question 8

question	answers	extra information	mark
8(a)(i)	origin of the Universe	accept (why) the Universe is expanding do **not** accept origin of the Earth	1
8(a)(ii)	provided more evidence to support the 'Big Bang' theory		1
8(b)(i)	red-shift	accept Doppler (shift)	1
8(b)(ii)	(at the point in time shown the observed spectrum from) star A (shows it) is moving away from the Earth light from star B shows a decrease in wavelength so star B is moving towards Earth	accept star A is moving away star A shows red-shift is insufficient accept light from star B shows blue-shift accept light from star B shows an increase in frequency	1 1 1
Total			**6**

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