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General Certificate of Secondary Education
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Science A / Physics (Specification 4405 / 4403)

PH1HP

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 / ; eg 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 3(b) 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)	5(.0)		1
1(a)(ii)	35 **or** their (a)(i) × 7 correctly calculated	allow **1** mark for correct substitution, ie 5 **or** their (a)(i) × 7 provided no subsequent step shown	2
1(a)(iii)	525(p) **or** (£) 5.25 **or** their (a)(ii) × 15 correctly calculated	if unit p or £ given they must be consistent with the numerical answer	1
1(a)(iv)	decreases temperature difference (between inside and outside) decreases	 accept gradient (of line) decreases do **not** accept temperature (inside) decreases do **not** accept graph goes down	1 1
1(b)(i)	air (bubbles are) trapped (in the foam) (and so the) air cannot circulate / move / form convection current	do **not** accept air traps heat foam has air pockets is insufficient air is a good insulator is insufficient no convection current is insufficient answers in term of warm air from the room being trapped are incorrect and score no marks	1 1

Question 1 continues on the next page . . .

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Question 1 continued . . .

question	answers	extra information	mark
1(b)(ii)	how effective / good a material is as an insulator / at keeping energy in	accept heat for energy accept the lower the U-value the better the insulator accept the lower the U-value the lower the rate of energy / heat transfer	1
1(c)	it will increase because the glass is not (such) a good insulator (as the wall)	room will be cooler is insufficient the U-value has increased is insufficient	1 1
Total			**11**

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Question 2

question	answers	extra information	mark
2(a)	(matt) black is a good <u>emitter</u> of infrared / radiation	accept heat for infrared / radiation ignore reference to good absorber attracts heat negates this marking point	1
	to give maximum (rate of) energy transfer (to surroundings)	accept temperature (of coolant) falls fast(er) accept black emits more radiation for **1** mark black emits most radiation / black is the best emitter of radiation for **2** marks	1
2(b)	the fins increase the surface area	accept heat for energy	1
	so increasing the (rate of) energy transfer **or** so more fins greater (rate of) energy transfer		1
2(c)	114 000	allow **1** mark for correct temperature change, ie 15 (°C) **or** allow **2** marks for correct substitution, ie 2 × 3800 × 15 answers of 851 200 **or** 737 200 gain **2** marks **or** substitution 2 × 3800 × 112 **or** 2 × 3800 × 97 gains **1** mark an answer of 114 kJ gains **3** marks	3

Question 2 continues on the next page . . .

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Question 2 continued . . .

question	answers	extra information	mark
2(d)	increases the efficiency		1
	less (input) energy is wasted **or** more (input) energy is usefully used	accept some of the energy that would have been wasted is (usefully) used accept heat for energy	1
Total			**9**

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Question 3

question	answers	extra information	mark
3(a)	any **three** from: • gas can be switched on (and off) quickly but nuclear cannot • gas can be used to meet surges in demand • gas can contribute to / meet the base load • nuclear provides base load **or** nuclear is used to generate all of the time	gas has a short start-up time alone is insufficient accept specific times from graph, anything from 1700 to 2200	3

3(b)	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
0 marks	**Level 1 (1-2 marks)**	**Level 2 (3-4 marks)**	**Level 3 (5-6 marks)**	
No relevant content.	There is a brief description of one advantage **or** disadvantage of using either biogas or wind **or** makes a conclusion with a reason.	There is a description of some advantages **and / or** disadvantages for biogas **and / or** wind **or** there is a direct comparison between the two systems **and** at least one advantage / disadvantage **or** a detailed evaluation of one system only with a conclusion.	There is a clear and detailed comparison of the two systems. There must be a clear conclusion of which system would be best with at least one comparative reason given for the choice made.	

Question 3 continues on the next page . . .

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Question 3 continued . . .

examples of the points made in the response	extra information
Biogas	
• renewable	
• energy resource is free	
• reliable energy source	accept works all of the time
• does not depend on the weather	
• uses up (animal) waste products	
• concentrated energy source	
• cheaper (to buy and install)	accept once only
• shorter payback-time (than wind)	
• adds carbon dioxide to the atmosphere	when waste burns it produces carbon dioxide is insufficient
• contributes to the greenhouse effect **or** contributes to global warming	
• no transport cost for fuels	
Wind turbine	
• renewable	
• energy resource is free	
• not reliable	
• depends on the weather / wind	
• will be times when not enough electricity generated for the farm's needs	
• dilute energy source	
• longer payback-time (than biogas)	
• more expensive (to buy and install)	accept once only
• does not produce any carbon dioxide	accept pollutant gases for carbon dioxide accept does not pollute air
	produces visual or noise pollution is insufficient harmful gases is insufficient

Total			**9**

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Question 4

question	answers	extra information	mark
4(a)	refracted into the block, angle r < i		1
	refracted correctly out of block, two rays in air parallel	judge by eye if first mark not scored allow **1** mark for correct refraction shown as ray leaves the block	1
4(b)(i)	the angle of refraction is (always) less than the angle of incidence		1
	the angle of refraction increases as the angle of incidence increases	accept angle i and angle r are **not** directly proportional accept there is positive correlation	1
4(b)(ii)	(for the same angle of incidence) the angle of refraction in plastic is less than the angle of refraction in water	accept (for the same angle of incidence) plastic refracts light more than water accept it is less	1
4(c)(i)	accept any sensible suggestion to do with being able to see inside (during daylight hours) eg able to (see to) work / cook inside	accept to see what they are doing lights up the room is insufficient ignore no need to pay for electricity	1
4(c)(ii)	accept any <u>ethical</u> suggestion, eg • fair access to energy for all • unequal use of energy resources • consequences for the future of decisions made now • damage to global environment affects all	damage to the environment is insufficient	1
Total			**7**

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Question 5

question	answers	extra information	mark
5(a)(i)	gamma	accept correct symbol	1
5(a)(ii)	any **one** from: • (ultraviolet has a) higher frequency • (ultraviolet has a) greater energy • (ultraviolet has a) shorter wavelength	ultraviolet cannot be seen is insufficient ignore ultraviolet causes cancer etc	1
5(b)	1.2×10^7 / 12 000 000 hertz / Hz / kHz / MHz	allow **1** mark for correct substitution, ie $3 \times 10^8 = f \times 25$ do **not** accept hz **or** HZ answers 12 000 kHz **or** 12 MHz gain **3** marks for full credit the numerical answer and unit must be consistent	2 1
5(c)(i)	away (from each other)	accept away (from the Earth) accept receding	1
5(c)(ii)	distance (from the Earth) speed galaxy is moving	accept how far away (it is)	1 1
5(c)(iii)	(Universe is) expanding		1
Total			**9**

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Question 6

question	answers	extra information	mark
6(a)	any **one** from: • energy / source is constant • energy / source does not rely on uncontrollable factors • can generate all of the time	accept a specific example, eg the weather will not run out is insufficient	1
6(b)	(dismantle and) remove radioactive waste / materials / fuel	accept nuclear for radioactive knock down / shut down is insufficient	1
6(c)	any **two** from: • reduce use of fossil fuelled power stations • use more nuclear power • use (more) renewable energy sources • make power stations more efficient • (use) carbon capture (technology)	accept specific fossil fuel accept use less fossil fuel accept build new nuclear power stations accept a named renewable energy source do **not** accept natural for renewable do **not** accept use less non-renewable (energy) sources	2
6(d)	(by increasing the voltage) the current is reduced this reduces the energy / power loss (from the cable) and this increases the efficiency (of transmission)	 accept reduces amount of waste energy accept heat for energy do **not** accept stops energy loss 	1 1 1
Total			**7**

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Question 7

question	answers	extra information	mark
7(a)	there are strong forces (of attraction) between the particles in a solid	accept molecules / atoms for particles throughout accept bonds for forces	1
	(holding) the particles close together **or** (holding) the particles in a fixed pattern / positions	particles in a solid are less spread out is insufficient	1
	but in a gas the forces between the particles are negligible	accept very small / zero for negligible accept bonds for forces	1
	so the particles spread out (to fill their container)	accept particles are not close together gas particles are not in a fixed position is insufficient	1
7(b)(i)		accept molecules / atoms for particles throughout	
	particles are (shown) leaving (the liquid / container)	accept particles are escaping particles are getting further apart is insufficient	1
7(b)(ii)		accept molecules / atoms for particles throughout accept speed / velocity for energy throughout	
	particles with most energy leave the (surface of the) liquid	accept fastest particles leave the liquid	1
	so the <u>mean / average</u> energy of the remaining particles goes down		1
	and the lower the average energy (of the particles) the lower the temperature (of the liquid)		1
Total			**8**

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