



**General Certificate of Secondary Education  
January 2013**

**Science A / Physics  
(Specification 4405 / 4403)**

**PH1FP**

**Unit: Physics 1**

**Final**

**Mark Scheme**

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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.

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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. Boldening

- 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 boldened. 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 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.

### **Quality of Written Communication and levels marking**

In Question 8(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
<p><b>1</b></p>	<pre> graph LR     G[Geothermal] --- UFW[Uses energy from falling water]     G --- UE[Uses energy from inside the Earth]     H[Hydroelectric] --- UFW     H --- UE     N[Nuclear] --- PDW[Produces dangerous waste]     IP[Is unpredictable]     PDW2[Produces dangerous waste]             </pre>	<p>allow <b>1</b> mark for each correct line</p> <p>if more than one line goes from an energy source then all lines from that energy source are wrong</p>	<p><b>3</b></p>
<p><b>Total</b></p>			<p><b>3</b></p>

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**Question 2**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
<b>2(a)</b>	electrical		1
	chemical		1
	light		1
<b>2(b)</b>	25 % <b>or</b> 0.25	allow <b>1</b> mark for correct substitution, ie $50 \div 200$ provided no subsequent step shown <b>or</b> answers of 25 with a unit <b>or</b> 0.25 with a unit gain <b>1</b> mark answers of 25 without a unit <b>or</b> 0.25% gain <b>1</b> mark	2
<b>2(c)</b>	the information board can be used anywhere it is needed		1
<b>Total</b>			<b>6</b>

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**Question 3**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
<b>3(a)(i)</b>	Z		1
<b>3(a)(ii)</b>	X		1
<b>3(b)(i)</b>	moving randomly		1
<b>3(b)(ii)</b>	stronger than		1
<b>3(c)(i)</b>	evaporation		1
<b>3(c)(ii)</b>	any <b>one</b> from: <ul style="list-style-type: none"> <li>• becomes windy</li> <li>• temperature increases</li> <li>• less humid</li> </ul>	accept (becomes) sunny “the sun” alone is insufficient	1
<b>Total</b>			<b>6</b>



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**Question 4**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
<b>4(a)(i)</b>	wavelength	accept frequency accept speed	1
<b>4(a)(ii)</b>	amplitude	accept energy height is insufficient	1
<b>4(a)(iii)</b>	sound		1
<b>4(b)(i)</b>	diffraction	accept diffract a description is insufficient	1
<b>4(b)(ii)</b>	0.12	allow <b>1</b> mark for correct substitution, ie $8 \times 0.015$ provided no subsequent step shown	2
	metre per second <b>or</b> m/s <b>or</b> metre/second	do <b>not</b> accept mps units must be consistent with numerical answers	1
<b>Total</b>			<b>7</b>

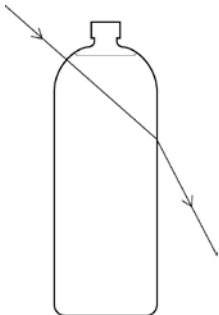
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**Question 5**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
<b>5(a)</b>	to reflect (the infrared)	accept (shiny surfaces) are good reflectors  ignore reference to incorrect type of wave	1
<b>5(b)</b>	black  best absorber (of infrared)	answer should be comparative black absorbs (infrared) is insufficient  accept good absorber (of infrared)  ignore reference to emitter ignore attracts heat ignore reference to conduction	1  1
<b>5(c)</b>	to reduce energy loss  <b>or</b> so temperature of water increases faster <b>or</b> reduces loss of water (by evaporation)	accept to stop energy loss accept heat for energy accept to stop / reduce convection  accept to heat water faster accept cooks food faster	1
<b>5(d)</b>	672 000	allow <b>1</b> mark for correct substitution, ie $2 \times 4200 \times 80$ provided no subsequent step shown	2
<b>Total</b>			<b>6</b>

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Question 6

question	answers	extra information	mark
6(a)	angle of refraction correctly identified	accept any correct indication	1
6(b)(i)	result at $i = 25^\circ$ identified		1
6(b)(ii)	measuring angle of refraction incorrectly	accept any practical suggestion that would lead to the angle $r$ being incorrect eg placing the protractor in the wrong place not marking the refracted ray correctly / accurately / ray box has been moved  do <b>not</b> accept measured angle $i$ and angle $r$ incorrectly do <b>not</b> accept plotted incorrectly	1
6(b)(iii)	greater than		1
6(c)	shown refracting out of the bottle with angle of refraction larger than angle of incidence  	allow <b>1</b> mark for refraction shown on correct side of normal with angle of refraction smaller than angle of incidence	2
6(d)(i)	People will have enough light to work inside their homes		1

Question 6 continues on the next page . . .

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**Question 6 continued . . .**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
<b>6(d)(ii)</b>	accept any sensible suggestion eg does not work at night no control over light cannot switch on and off	do <b>not</b> accept roof leaks  eg cannot control brightness	1
<b>Total</b>			<b>8</b>

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**Question 7**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
<b>7(a)(i)</b>	red-shift	accept Doppler (effect)	1
<b>7(a)(ii)</b>	the Universe is expanding		1
<b>7(a)(iii)</b>	N		1
<b>7(b)</b>	Why was the Universe created?		1
<b>Total</b>			<b>4</b>

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Question 8

question	answers	extra information	mark
8(a)	any <b>three</b> from: <ul style="list-style-type: none"> <li>• gas can be switched on (and off) quickly but nuclear cannot</li> <li>• gas can be used to meet surges in demand</li> <li>• gas can contribute to / meet the base load</li> <li>• nuclear provides base load</li> </ul> <b>or</b> 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
8(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
<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 content.	There is a brief description of one advantage <b>or</b> disadvantage of using either biogas or wind <b>or</b> makes a conclusion with a reason.	There is a description of some advantages <b>and / or</b> disadvantages for biogas <b>and / or</b> wind <b>or</b> there is a direct comparison between the two systems <b>and</b> at least one advantage / disadvantage <b>or</b> 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 8 continues on the next page . . .

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**Question 8 continued . . .**

<p><b>examples of the points made in the response</b></p> <p><b>Biogas</b></p> <ul style="list-style-type: none"> <li>• renewable</li> <li>• energy resource is free</li> <li>• reliable energy source</li> <li>• does not depend on the weather</li> <li>• uses up (animal) waste products</li> <li>• concentrated energy source</li> <li>• cheaper (to buy and install)</li> <li>• shorter payback-time (than wind)</li> <li>• adds carbon dioxide to the atmosphere</li> </ul> <p>• contributes to the greenhouse effect <b>or</b> contributes to global warming</p> <ul style="list-style-type: none"> <li>• no transport cost for fuels</li> </ul> <p><b>Wind turbine</b></p> <ul style="list-style-type: none"> <li>• renewable</li> <li>• energy resource is free</li> <li>• not reliable</li> <li>• depends on the weather / wind</li> <li>• will be times when not enough electricity generated for the farm's needs</li> <li>• dilute energy source</li> <li>• longer payback-time (than biogas)</li> <li>• more expensive (to buy and install)</li> <li>• does not produce any carbon dioxide</li> </ul>	<p><b>extra information</b></p> <p>accept works all of the time</p> <p>accept once only</p> <p>when waste burns it produces carbon dioxide is insufficient</p> <p>accept once only</p> <p>accept pollutant gases for carbon dioxide</p> <p>accept does not pollute air</p> <p>produces visual or noise pollution is insufficient</p> <p>harmful gases is insufficient</p>		
<b>Total</b>			<b>9</b>

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Question 9

question	answers	extra information	mark
9(a)(i)	5(.0)		1
9(a)(ii)	35 <b>or</b> their (a)(i) $\times$ 7 correctly calculated	allow <b>1</b> mark for correct substitution, ie 5 <b>or</b> their (a)(i) $\times$ 7 provided no subsequent step shown	2
9(a)(iii)	525(p) <b>or</b> (£) 5.25 <b>or</b> their (a)(ii) $\times$ 15 correctly calculated	if unit p or £ given they must be consistent with the numerical answer	1
9(a)(iv)	decreases  temperature difference (between inside and outside) decreases	accept gradient (of line) decreases  do <b>not</b> accept temperature (inside) decreases do <b>not</b> accept graph goes down	1  1
9(b)(i)	air (bubbles are) trapped (in the foam)  (and so the) air cannot circulate / move / form convection current	do <b>not</b> 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 9 continues on the next page . . .



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**Question 9 continued . . .**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
<b>9(b)(ii)</b>	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
<b>9(c)</b>	it will increase	room will be cooler is insufficient	1
	because the glass is not (such) a good insulator (as the wall)	the U-value has increased is insufficient	1
<b>Total</b>			<b>11</b>

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