



**General Certificate of Secondary  
Education**

**Science A 4405 / Physics 4403**

**PH1FP            Unit Physics 1**

**Mark Scheme**

*2012 examination – June series*

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 meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting 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 the standardisation meeting each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting 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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## 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 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 lines 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 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 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)

Student	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	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, as shown in the column 'answers', 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;

### 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.

## Quality of Written Communication and levels marking

In Question 8 students 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.

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

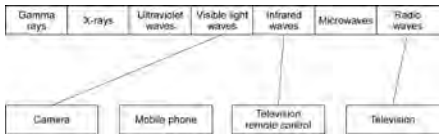
- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

**PH1FP****Question 1**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
<b>1(a)</b>	fan		1
	drill		1
	washing machine		1
		four circled including correct three scores <b>1</b> mark five circled scores zero	
<b>1(b)</b>	Appliances only transfer part of the energy usefully		1
	The energy transferred by appliances makes the surroundings warmer		1
<b>Total</b>			<b>5</b>

**PH1FP**

**Question 2**

question	answers	extra information	mark
<p><b>2(a)</b></p>	<p>3 lines drawn linking: camera to visible light television to radio waves remote control to infrared</p> 	<p>if more than one line is drawn from any device all those lines are incorrect</p>	<p>1 1 1</p>
<p><b>2(b)</b></p>	<p>300 000 km/s <b>or</b> 300 000 000 m/s</p>	<p>unit required  accept the same (as light) accept the speed of light</p>	<p>1</p>
<p><b>2(c)</b></p>	<p>a longer wavelength than</p>		<p>1</p>
<p><b>2(d)(i)</b></p>	<p>refraction</p>	<p>do <b>not</b> allow a misspelling that might be reflection</p>	<p>1</p>
<p><b>2(d)(ii)</b></p>	<p>travelling along the normal</p>	<p>accept light is at 90° to the surface / block  light is not entering at an angle is insufficient</p>	<p>1</p>
<p><b>Total</b></p>			<p><b>7</b></p>

**PH1FP****Question 3**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
<b>3(a)(i)</b>	any suitable risk eg being injured by a car	accept a measure to reduce the risk eg  stand well away from edge of pavement  stay on school grounds / don't go onto the street  be aware of the dangers of traffic  car travelling at high speed is insufficient	1
<b>3(a)(ii)</b>	increased		1
<b>3(b)(i)</b>	S  S		1  1
<b>3(b)(ii)</b>	big bang (theory)		1
<b>3(b)(iii)</b>	CMBR comes from all parts of the Universe		1
<b>3(b)(iv)</b>	At the moment it is the best way of explaining our scientific knowledge		1
<b>Total</b>			<b>7</b>



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## Question 4

question	answers	extra information	mark
4(a)(i)	A		1
4(a)(ii)	bar drawn with correct height	ignore width of bar	1
4(b)(i)	2.4	$E = P \times t$ allow 1 mark for correct substitution ie $1.2 \times 2$ provided no subsequent step shown	2
4(b)(ii)	36 or their (b)(i) $\times$ 15 correctly calculated  <b>or</b>  their (b)(i) $\times$ 0.15 correctly calculated with an answer given in £	allow 1 mark for correct substitution ie $2.4 \times 15$  <b>or</b>  their (b)(i) $\times$ 15  allow 1 mark for correct substitution  provided no subsequent step shown  an answer £0.36 gains both marks	2
<b>Total</b>			<b>6</b>

**PH1FP****Question 5**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
<b>5(a)</b>	gas (burning)		1
<b>5(b)(i)</b>	(transmission) cables and (step-up and step-down) transformers	if transformers are named ie step-up transformer then both step-up and step-down must be given  mention of power station or consumer negates mark	1
<b>5(b)(ii)</b>	voltage  more efficient		1  1
<b>5(c)</b>	increase		1
<b>Total</b>			<b>5</b>

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## Question 6

question	answers	extra information	mark
6(a)	letter C clearly marking a compression	accept C at any point in a compression  if more than one letter C marked all must be correct	1
6(b)(i)	straight continuous line drawn from loudspeaker to metal to sound sensor	judge by eye	1
	angle I = angle R	judge by eye  ignore any arrows on lines	1
6(b)(ii)	less sound reflected	accept energy for sound	1
	or  (some) sound passes through the glass	accept (some) sound absorbed by the glass	
6(b)(iii)	makes the sound louder		1
6(b)(iv)	340	$v = f \times \lambda$  allow 1 mark for correct substitution ie $850 \times 0.4$  provided no subsequent step shown	2
6(c)	echo		1
6(d)(i)	from 250 Hz to 750 Hz		1

Question 6 continues on the next page

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## Question 6 continued

question	answers	extra information	mark
6(d)(ii)	curtains reduce (percentage of) sound reflected more( than carpet)	accept curtains absorb more sound (than carpet)	1
	for all frequencies (shown)	accept for both marks an answer in terms of walls having a larger (surface) area to reflect sound and curtains reducing the amount of reflected sound more (than carpet)  answers less noisy or walls / curtains have a larger area gain 1 mark only  do <b>not</b> accept curtains are cheaper	1
<b>Total</b>			<b>11</b>

**PH1FP**

**Question 7**

question	answers	extra information	mark
<p><b>7(a)</b></p>	<p>any <b>two</b> from:</p> <ul style="list-style-type: none"> <li>• black is a good emitter of (infrared radiation)</li> <li>• large surface (area)</li> <li>• matt surfaces are better emitters (than shiny surfaces)</li> </ul>	<p>accept heat for radiation</p> <p>ignore reference to absorbing radiation</p> <p>accept matt surfaces are good emitters</p> <p>ignore reference to good conductor</p>	<p>2</p>
<p><b>7(b)</b></p>	<p>90 % or 0.9(0)</p>	<p>efficiency =</p> $\frac{\text{useful energy out}}{\text{total energy in}} (\times 100\%)$ <p>allow <b>1</b> mark for correct substitution</p> <p>ie <math>\frac{13.5}{15}</math></p> <p>provided no subsequent step shown</p> <p>an answer of 90 scores <b>1</b> mark</p> <p>an answer of 90 / 0.90 with a unit scores <b>1</b> mark</p>	<p>2</p>
<p><b>7(c)</b></p>	<p>(producing) light</p>	<p>allow (producing) sound</p>	<p>1</p>

**Question 7 continues on the next page**

## PH1FP

## Question 7 continued

question	answers	extra information	mark
7(d)	any <b>two</b> from: <ul style="list-style-type: none"><li>• wood is renewable</li> <li>• (using wood) conserves fossil fuels</li> <li>• wood is carbon neutral</li></ul>	accept wood grows again / quickly accept wood can be replanted  accept doesn't use fossil fuels  accept a description  cheaper / saves money is insufficient	2
7(e)	2550000         joules /J	$E = m \times c \times \theta$  allow <b>1</b> mark for correct substitution ie $100 \times 510 \times 50$ provided no subsequent step shown  answers of 1020000, 3570000 gain <b>1</b> mark  accept kJ / MJ  do <b>not</b> accept j    for full credit the unit and numerical answer must be consistent	2         1
<b>Total</b>			<b>10</b>

## PH1FP

## Question 8

question	answers	extra information	mark
8(a)(i)	energy from hot rocks in the Earth	accept heat that occurs naturally in the Earth  accept steam / hot water rising to the Earth's surface  accept an answer in terms of the energy released by radioactive decay in the Earth  heat energy is insufficient	1
8(a)(ii)	water is pumped / moved  up (to a higher reservoir)	  this mark point only scores if first mark point is awarded	1  1
8(b)			6
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 4 and apply a 'best-fit' approach to the marking.			
<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 at least one advantage or disadvantage for either the planned wind turbines or the suggested electricity power link.	There is a description of advantages and disadvantages for either the planned wind turbines or the suggested electricity power link. <b>or</b> A description of the advantages or disadvantages for both the planned wind turbines and the suggested electricity power link.	There is a clear and detailed description of at least one advantage and one disadvantage for both the planned wind turbines and suggested electricity power link.

Question 8 continues on the next page

**PH1FP**

**Question 8 continued**

examples of the points made in the response	extra information
<p><b>Offshore wind turbines</b></p> <p><b>advantages</b></p> <ul style="list-style-type: none"> <li>• renewable (energy resource)</li> <li>• low running costs</li> <li>• energy is free</li> <li>• no gas emissions (when in use)</li>   <li>• land is not used (up)</li> </ul> <p><b>disadvantages</b></p> <ul style="list-style-type: none"> <li>• unreliable – accept wind does not always blow</li> <li>• hazard to birds / bats</li> <li>• visual pollution – do not accept noise pollution</li>   <li>• difficulty of linking turbines to the National Grid</li> <li>• large initial cost</li> <li>• difficult to erect / maintain</li> <li>• CO<sub>2</sub> emissions in manufacture (of large number of turbines)</li> </ul>	<p><b>accept a named gas eg CO<sub>2</sub></b>  <b>accept no fuel is burned</b>  <b>accept less dependent on fossil fuels</b></p> <p><b>ignore references to destroying or harming habitats</b></p> <p><b>do not allow if clearly referring to onshore wind turbines</b></p> <p><b>do not accept spoils landscape</b></p> <p><b>accept a lot of maintenance needed</b></p>

**Question 8 continues on the next page**



**PH1FP**

**Question 8 continued**

<p><b>examples of the points made in the response</b></p> <p><b>Suggested Link</b></p> <p><b>advantages</b></p> <ul style="list-style-type: none"> <li>• income for Iceland</li> <li>• using Iceland's (available) energy (resources)</li> <li>• provide electricity when wind does not blow / reliable</li> <li>• provide electricity at times of peak demand</li> <li>• even out fluctuations in supply</li> <li>• excess electricity from Britain (windy days) to Iceland and used to pump water up to store energy</li> <li>• Britain less dependent on fossil fuels</li> </ul> <p><b>disadvantages</b></p> <ul style="list-style-type: none"> <li>• large initial cost</li> <li>• power loss along a long cable</li> <li>• (engineering) difficulties in laying / maintaining the cable</li> </ul>	<p><b>extra information</b></p> <p>accept using (Iceland's) renewable energy (resources)</p> <p>do <b>not</b> accept reduce the amount of Iceland's wasted energy</p> <p>accept Britain needs fewer (new) power stations</p> <p>accept conserves fossil fuels</p> <p>accept expensive (to lay cables)</p> <p>accept difficult to repair (if damaged)</p>
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<b>Total</b>			<b>9</b>
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