



# **General Certificate of Secondary Education**

*Science B 4462 / Physics 4451*

**PHY1H            Unit Physics 1**

## **Mark Scheme**

*2011 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 candidates' 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 candidates' 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 candidates' 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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## Marking Guidance for Examiners

### GCSE Science Papers

#### 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 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	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)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, 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, 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.

## PHY1H

## Question 1

question	answers	extra information	mark
1(a)(i)	radiation	ignore thermal / infrared	1
1(a)(ii)	black is a better / good absorber (of heat / radiation)	ignore reference to black being a good emitter  black absorbs heat is insufficient  do <b>not</b> accept black attracts / absorbs the Sun  do <b>not</b> accept black attracts heat	1
	(so) temperature rises faster  <b>or</b>  white is a worse / poor absorber (of heat / radiation) (1)  (so if white faces) temperature would rise slower (1)	must be an indication of heating up quicker  accept white is a better / good reflector (of heat / radiation)  ignore any reference to light	1
1(b)(i)	1.2 (hours) <b>or</b> 1 hour 12 minutes	no tolerance	1
1(b)(ii)	increases (rapidly at first then increases at a slower rate)	do <b>not</b> accept increases at a steady rate	1

Question 1 continues on the next page

## PHY1H

## Question 1 continued

question	answers	extra information	mark
1(c)(i)	<p>any <b>two</b> from:</p> <ul style="list-style-type: none"> <li>• (fill with) same mass / volume / amount of water</li> <li>• same level of (sun)light / sunshine</li>   <li>• outside for the same (length of) time</li> <li>• outside at same time (of day / year)</li> <li>• initial water temperature</li> <li>• the side of the bag facing the Sun</li> </ul>	<p>accept same heat / light source</p> <p>accept same place</p> <p>do <b>not</b> accept any factors to do with the construction of plastic bags eg thickness</p>	2
1(c)(ii)	<p>curved line drawn above given line</p>	<p>both lines must start from the same point</p> <p>ignore if continues beyond one hour or levels off after 1 hour</p> <p>do <b>not</b> accept a straight line</p>	1
<b>Total</b>			<b>8</b>

## PHY1H

## Question 2

question	answers	extra information	mark
2(a)(i)	decommissioning		1
2(a)(ii)	level of radiation <b>or</b> radiation dose (to workers) decreased	accept the isotope / cobalt(-60) has decayed (a lot)  accept the isotope / cobalt(-60) has decayed in 2 half lives  accept exposed to less radiation  do <b>not</b> accept no radiation left	1
	less hazardous / dangerous (to workers health)	accept safer  do <b>not</b> accept there is no hazard  accept allows reactor to cool (down)  an answer of radiation levels decrease by 75 % or drops to 25 % gains <b>2</b> marks	1
2(b)(i)	more in favour <b>or</b> fewer against	quoting figures alone is insufficient  do <b>not</b> accept it increases  ignore any reasons given	1

Question 2 continues on the next page

## PHY1H

## Question 2 continued

question	answers	extra information	mark
2(b)(ii)	<p>any <b>one</b> from:</p> <ul style="list-style-type: none"><li>• sample too small</li><li>• do not know how many (people) were asked</li><li>• different people asked (in different years)</li><li>• sample not representative (of population)</li><li>• people did not understand the questions</li><li>• do not know who carried out the surveys</li> <li>• do not know if surveys asked same questions</li></ul>	<p>do <b>not</b> accept they are biased unless acceptable reason for bias given</p>	1

Question 2 continues on the next page



## PHY1H

## Question 2 continued

question	answers	extra information	mark
2(b)(iii)	any <b>one</b> from: <ul style="list-style-type: none"> <li>• no / less pollutant gases produced</li> <li>• reliable source (of energy / electricity)</li> <li>• running out of fossil fuels</li> <li>• conserve fossil fuels</li> <li>• meet increasing demand</li> <li>• less reliance on imported fossil fuels / electricity</li> <li>• concentrated energy source(s)</li> <li>• lower transportation costs for fuel</li> <li>• to replace old <u>nuclear</u> power stations</li> </ul>	accept a named gas  accept does not contribute to global warming  accept a named fossil fuel  accept fossil fuels won't have to be used  accept named fossil fuel  ignore references to efficiency / job creation / local economy / selling electricity	1
2(c)	economic issues		1
<b>Total</b>			<b>7</b>

## PHY1H

## Question 3

question	answers	extra information	mark
3(a)(i)	microwave(s)		1
3(a)(ii)	has discrete values only <b>or</b> has only 2 states	accept can only be on or off  accept made up of 1 and 0 only  accept has high and low (values only)  accept a diagram with discrete levels  do <b>not</b> accept can be switched on and off	1
3(a)(iii)	any <b>one</b> from: <ul style="list-style-type: none"> <li>• less (prone to) interference</li> <li>• can be (easily) processed by computers</li> <li>• better quality (signal)</li> <li>• digital signals can be restored</li> <li>• information / data can be compressed</li> </ul>	it refers to signal  accept no interference  accept interference causes less / no permanent damage  accept noise / distortion for interference  accept can be processed without an analogue to digital converter  better on its own is insufficient  accept can send more information in same time  do <b>not</b> accept faster	1

Question 3 continues on the next page

## PHY1H

## Question 3 continued

question	answers	extra information	mark
3(b)	2 000 000 000	allow <b>1</b> mark for correct transformation and substitution  ie $\frac{300\,000\,000}{0.15}$ or $\frac{300\,000\,000}{15}$	2
	hertz	accept Hz  do <b>not</b> accept hz  accept kHz / MHz / GHz <b>but</b> for full credit the answer and unit must be consistent eg answers 2 GHz; 2000 MHz; 2 000 000 kHz gain <b>3</b> marks	1
3(c)(i)	infra red (radiation)	accept IR  ignore reference to light	1
3(c)(ii)	travel a shorter distance	do <b>not</b> accept faster	1
<b>Total</b>			<b>8</b>

PHY1H

Question 4

question	answers	extra information	mark
4(a)(i)	4	allow 1 mark for correct transformation and substitution  ie $\frac{0.6}{0.15}$  substitution only scores if no subsequent steps are shown	2
4(a)(ii)	diagram showing two output arrows with one arrow wider than the other with the narrower arrow labelled electrical / electricity / useful		1
4(a)(iii)	any <b>one</b> from: <ul style="list-style-type: none"> <li>• time of day / year</li> <li>• position of solar cells</li> <li>• angle of solar cells (to the Sun)</li> <li>• latitude</li> <li>• cloud cover</li> <li>• solar cells covered in dust / dirt</li> </ul> causes a change in intensity of sun(light)	accept charger for solar cells      accept any reasonable suggestion that would lead to a change in intensity of sun(light)  the weather is insufficient  do <b>not</b> accept any physical changes to the charger eg area  accept brightness for intensity accept a description of the reduction of intensity	1         1

**Question 4 continues on the next page**

## PHY1H

## Question 4 continued

question	answers	extra information	mark
4(b)	any <b>one</b> from: <ul style="list-style-type: none"> <li>• to check reliability / validity / accuracy</li> <li>• to avoid bias</li> </ul>		1
4(c)	any <b>two</b> from: <ul style="list-style-type: none"> <li>• produce no / less (air) pollution</li> <li>• energy is free</li> <li>• (energy) is renewable</li> <li>• conserves fossil fuel stocks</li> <li>• can be used in remote areas</li> <li>• do not need to connect to the National Grid</li> </ul>	accept named pollutant accept produces no waste (gases) accept it is a free resource do <b>not</b> accept it is free	2
<b>Total</b>			<b>8</b>

**PHY1H****Question 5**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
5(a)(i)	radio waves pass through the atmosphere	accept it is cheaper / easier to maintain	1
5(a)(ii)	computers process digital signals (more easily)	accept read for process accept computers cannot (easily) process analogue signals ignore references to interference	1
5(b)(i)	wavelength (of waves appears to) increase  <b>or</b> wavelength moves to longer / red end of spectrum	accept answers in terms of frequency decrease  accept wavelength stretched but not just wave is stretched  answers involving planets negates mark	1
5(b)(ii)	can measure change 20 times smaller	accept can measure (much) smaller change  accept detects with greater precision  accept can show more detail / stars  accept can detect weaker signals  can see things more clearly is insufficient	1

**Question 5 continues on the next page**

## PHY1H

## Question 5 continued

question	answers	extra information	mark
5(b)(iii)	Universe had a start point	mention of Earth / planets etc exploding / expanding negates answer	1
	Universe is (still) changing / expanding		1
5(c)	any <b>one</b> from: <ul style="list-style-type: none"> <li>• share ideas</li> <li>• can justify large development costs</li> <li>• makes new investigations possible</li> </ul>	accept cost shared  saves money is insufficient  accept any sensible suggestion	1
<b>Total</b>			<b>7</b>

## PHY1H

## Question 6

question	answers	extra information	mark
6(a)(i)	number of protons are the same	accept atomic number / number of electrons for number of protons	1
	number of neutrons are different	accept mass numbers are different – only if the first mark is awarded	1
6(a)(ii)	an electron from the nucleus	both parts needed	1
6(b)	decays at the same rate as it is made	accept decays as fast as it is made  accept absorbed / used by plants (in CO <sub>2</sub> ) at same rate as it is being made	1
6(c)(i)	3500	no tolerance	1
6(c)(ii)	adjusted age correctly obtained from the graph	accept values between 3700–3800 inclusive	1
	adjusted age +50	accept their <b>(c)(i)</b> used correctly to obtain an adjusted age from the graph  second mark can only be scored if first mark awarded  if no working shown an answer between 3750–3850 inclusive scores both marks  note: any line or mark made on the graph counts as working out	1
<b>Total</b>			<b>7</b>