



# **General Certificate of Secondary Education**

*Science B 4462 / Physics 4451*

**PHY1H            Unit Physics 1**

## **Mark Scheme**

*2010 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.

### 3.8 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use the ? area in the CMI+ software to forward such answers to a Senior Examiner.

## PHY1H

## Question 1

question	answers	extra information	mark
1(a)	conduction		1
1(b)(i)	any <b>one</b> from: <ul style="list-style-type: none"> <li>• starting temperature (of cold water)</li> <li>• pipe length</li> <li>• pipe diameter</li> <li>• pipe (wall) thickness</li> <li>• volume of cold water</li> <li>• temperature of hot water (in)</li> <li>• time</li> </ul>	temperature is insufficient accept size of pipe accept amount for volume	1
1(b)(ii)	(type of) material is categoric	accept one variable is categoric accept variable(s) are categoric accept it is categoric accept variable(s) are not continuous descriptions of variables ie names and numbers is insufficient	1
1(b)(iii)	copper greatest temperature change	only scores if copper chosen accept heat for temperature accept heated water the fastest accept it was hottest (after 10 minutes) accept it is the best / a good conductor	1 1

Question 1 continues on the next page . . .

**PHY1H****Question 1 continued . . .**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
1(c)	larger (surface) area	accept the pipe is longer  accept hot (dirty) water (inside pipe) is in contact with the cold water (outside pipe) for a longer time  the pipe is a spiral is insufficient	1
<b>Total</b>			<b>6</b>

## PHY1H

## Question 2

question	answers	extra information	mark
2(a)	gamma will pass through the body <b>or</b> alpha will not pass through the body	it refers to gamma  answers must relate to the body  accept skin for body	1
	gamma is only slightly ionising <b>or</b> alpha is heavily ionising	accept gamma causes less damage to cells / tissue  do <b>not</b> accept gamma causes no damage to cells  less harmful is insufficient	1
2(b)(i)	(both graphs show an initial) increase in count-rate	accept both show an increase	1
2(b)(ii)	only the right kidney is working correctly		1
	any <b>two</b> from:  <ul style="list-style-type: none"> <li>• count-rate / level / line for right kidney decreases (rapidly)</li> <li>• count-rate / level / line for <u>left</u> kidney does not change</li> <li>• radiation is being passed out / into urine - if referring to right kidney</li> <li>• radiation is not being passed out - if referring to the left kidney</li> </ul>	if incorrect box chosen maximum of <b>1</b> mark can be awarded  reference to named kidney can be inferred from the tick box  it decreases is insufficient  it does not change is insufficient	2

Question 2 continues on the next page . . .

**PHY1H****Question 2 continued . . .**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
<b>2(c)(i)</b>	time taken for number of nuclei to halve <b>or</b> time taken for the count-rate to halve		1
<b>2(c)(ii)</b>	short half-life - the level of radiation (in the body) decreases rapidly  to a safe / very small level <b>or</b> a long half-life - the radiation remains in the body / for a long time  level of radiation remains high	it refers to short life isotope      answers in terms of damage eg cancer are insufficient	1  1
<b>Total</b>			<b>9</b>



## PHY1H

## Question 3

question	answers	extra information	mark
3(a)(i)	2.1	correct answer only	1
3(a)(ii)	3.15 or their (a)(i) $\times$ 1.5 correctly calculated  kilowatt-hour	allow <b>1</b> mark for correct substitution ie $2.1 \times 1.5$ or their (a)(i) $\times$ 1.5  accept kWh  or a substitution $2100 \times 5400$ scores <b>1</b> mark  $2100 \times 5400$ incorrectly calculated with answer in joules scores <b>2</b> marks  an answer of 11 340 000 scores <b>2</b> marks  an answer of 11 340 000J scores <b>3</b> marks	2       1
3(a)(iii)	most (input) energy is usefully transformed	accept does not waste a lot of energy  accept most of the output / energy is useful  do <b>not</b> accept it does not waste energy	1

Question 3 continues on the next page . . .

## PHY1H

## Question 3 continued . . .

question	answers	extra information	mark
3(b)	the room is losing energy / heat		1
	at the same rate as the heater supplies it	this mark only scores if the first is scored  do <b>not</b> accept heater reaches same temperature as room / surroundings  rate of heat gain = rate of heat loss scores both marks	1
<b>Total</b>			<b>7</b>

## PHY1H

## Question 4

question	answers	extra information	mark
4(a)(i)	<p>any <b>two</b> from:</p> <ul style="list-style-type: none"> <li>• travel at the same speed (through a vacuum)</li> <li>• can travel through a vacuum / space</li> <li>• transfer energy</li> <li>• can be reflected</li> <li>• can be refracted</li> <li>• can be diffracted</li> <li>• can be absorbed</li> <li>• can be transmitted</li> <li>• transverse</li> </ul>	<p>accept travel at the speed of light accept air for vacuum do <b>not</b> accept air for vacuum</p> <p>accept any other property common to electromagnetic waves</p> <p>accept travel at the same speed through a vacuum for both marks</p> <p>do <b>not</b> accept both radiated from the Sun</p>	2
4(a)(ii)	<p>infra red</p> <p>radio(waves)</p>	<p><b>both</b> required for the mark</p> <p>accept IR for infra red</p>	1

Question 4 continues on the next page . . .

## PHY1H

## Question 4 continued . . .

question	answers	extra information	mark
4(b)	2400000000	correct transformation and substitution gains <b>1</b> mark ie $\frac{300000000}{0.125}$ or $\frac{300000000}{12.5}$ an answer of 24000000 gains <b>1</b> mark <b>either</b> 2400000 kHz <b>or</b> 2400 MHz scores <b>3</b> marks but the symbol only scores the 3 <sup>rd</sup> mark if it is correct in every detail	2
	hertz	accept Hz do <b>not</b> accept hz	1
4(c)(i)	presented (scientific) evidence / data	do an experiment / investigation is insufficient	1
4(c)(ii)	to find out if there is a hazard (or not)	accept to find out if it is safe accept not enough evidence to make a decision not enough evidence is insufficient	1
<b>Total</b>			<b>8</b>

## PHY1H

## Question 5

question	answers	extra information	mark
5(a)(i)	tidal / tides	do <b>not</b> accept water / waves	1
5(a)(ii)	<p>any <b>three</b> from:</p> <ul style="list-style-type: none"> <li>• shorter journey time</li> <li>• less pollution from traffic</li> <li>• energy source is free</li> <li>• energy source / tides are predictable</li> <li>• produces less / no pollutant gases (than fuel burning power stations)</li> <li>• conserves supplies of fossil fuels</li> <li>• uses renewable energy (to generate electricity)</li> <li>• provides employment</li> <li>• no visual / noise pollution</li> </ul>	<p>accept easier to go from town to town accept less petrol / fuel used</p> <p>accept CO<sub>2</sub> / carbon emissions reduced</p> <p>accept no CO<sub>2</sub> / greenhouse gases produced accept air pollution for pollutant gases</p> <p>less harm to the environment is insufficient</p> <p>the electricity is cheaper is insufficient</p> <p>do <b>not</b> accept produces no radioactive waste</p> <p>the pollution mark scores twice only if it is clear one reference is to traffic and the other is to electricity generation</p>	3

Question 5 continues on the next page . . .

**PHY1H****Question 5 continued . . .**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
<b>5(b)(i)</b>	(sometimes) electricity demand may be greater than supply (of electricity from the system) <b>or</b> can sell (excess) electricity (to the National Grid)	accept in case turbines / generators fail	1
<b>5(b)(ii)</b>	decreases the current  reducing energy loss (along cables)	accept increases the voltage  accept less heat / thermal energy lost / produced	1  1
<b>Total</b>			<b>7</b>

## PHY1H

## Question 6

question	answers	extra information	mark
6(a)	wavelength (of light appears to) increase	accept frequency (appears to) decrease  accept light moves to the red end of the spectrum  do <b>not</b> accept it moves to the red end of the spectrum  do <b>not</b> accept light becomes redder	1
6(b)(i)	<b>M</b> is closer (to the Earth) than <b>N</b>		1
	<b>M</b> is moving (away from the Earth) slower than <b>N</b>		1
6(b)(ii)	520	an answer between 510 and 530 inclusive gains <b>1</b> mark	2
6(b)(iii)	more recent  data more reliable <b>or</b> improved equipment / techniques <b>or</b> data obtained from more (distant) galaxies	no mark for this but must be given to gain reason mark  accept data is more accurate  more technology is insufficient  accept a wider range of data  accept data closer to the line of best fit <b>or</b> data less scattered  accept no anomalous result(s)  accept all data fits the pattern	1
6(c)	wavelength is decreased		1
	frequency is increased		1
<b>Total</b>			<b>8</b>