



# **General Certificate of Secondary Education**

## **Science B 4462 / Physics 4451**

**PHY1H      Unit 1 Physics**

# **Mark Scheme**

*2009 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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## 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 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**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
1(a)(i)	HESS	accept gamma	1
1(a)(ii)	infra red	accept IR accept answers written in table  do <b>not</b> accept heat	1
1(b)	clearer / more detailed / sharper / less distorted image  any <b>one</b> from: <ul style="list-style-type: none"> <li>• no light pollution</li> <li>• light is not scattered by the atmosphere</li> </ul>	do <b>not</b> accept image is bigger  accept no clouds to prevent observations  accept light is scattered by the atmosphere (implies William Herschel) accept light does (not have to) pass through the atmosphere accept air for atmosphere  do <b>not</b> accept answers in terms of distance	1  1

**Question 1 continues on the next page ...**

## PHY1H

## Question 1 continued . . .

question	answers	extra information	mark
1(c)	any <b>two</b> from: <ul style="list-style-type: none"> <li>• <u>microwaves absorbed</u> by water (molecules)</li> <li>• signal strength greater (in dry environment)</li> <li>• more sensitive (in dry environment)</li> <li>• detect weaker signals (in dry environment)</li> <li>• more detailed / clearer image (in dry environment)</li> </ul>	accept more microwaves reach telescope  accept harder to detect signals in a humid environment  accept image contains more information  do <b>not</b> accept better image	2
1(d)	a fourth / extra galaxy / star	accept a planet / another object / source	1
<b>Total</b>			<b>7</b>

## PHY1H

## Question 2

question	answers	extra information	mark
2(a)(i)	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) <u>signal</u></li> <li>• signal can be restored</li> </ul>	accept interference causes less / no permanent damage accept no interference accept noise / distortion for interference  accept can be processed without an analogue to digital converter  accept clearer <u>signal</u>  do <b>not</b> accept faster / sends more information	1
2(a)(ii)	cooking  <b>or</b>  satellite communication	do <b>not</b> accept microwave (oven)  accept radar accept (microwave) telescopes accept Wi-Fi  do <b>not</b> accept radio	1
2(b)(i) E	compare (the health of) mobile phone users with non-mobile phone users	must be an implied comparison between users and non-users  any idea of doing an experiment negates the mark	1
2(b)(ii) E	increase the sample size	accept use more people accept have a large sample size repeat the research / test is neutral	1

Question 2 continues on the next page ...

## PHY1H

## Question 2 continued . . .

question	answers	extra information	mark
2(b)(iii)	ethical		1
2(c)(i)	so the phones can be compared (fairly)	a fair test is insufficient accept different tests (may) give different results  do <b>not</b> accept to make the results reliable, unless qualified eg all variables are controlled do <b>not</b> accept bias unless qualified	1
2(c)(ii)	yes all are below the legal limit / 2 (W/kg)  <b>or</b> no and any <b>one</b> from: <ul style="list-style-type: none"> <li>• even absorbing a small amount of energy may be harmful</li> <li>• no proof that small amounts of energy are not harmful</li> </ul>	accept microwaves for energy accept emits energy absorbed by head / other parts of body  accept because the SAR value is not 0 (W/kg)	1
2(d)	any <b>one</b> from: <ul style="list-style-type: none"> <li>• to get an independent opinion</li> <li>• company scientists may be biased</li> </ul>	accept company scientists may manipulate results	1
<b>Total</b>			<b>8</b>



**PHY1H****Question 3**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
3(a)(i)	0.6	accept 60% allow <b>1</b> mark for useful energy = 480 answer 0.6 with any unit or 60 gains <b>1</b> mark only	2
3(a)(ii)	transferred to surroundings	accept goes into the air accept heats the surroundings up accept gets spread out accept transferred into heat (only)  do <b>not</b> accept wasted / lost unless qualified destroyed negates mark transferred into light / sound negates mark	1
3(b)(i)	1.75	allow <b>1</b> mark for converting to kW  answers of 0.7, 0.525, 0.35, 0.875, 1.05, 5.25 gains <b>1</b> mark answers of 1750 or 17.5 gains <b>1</b> mark	2
3(b)(ii)	21p or £0.21 or their (b)(i) × 12		1

**Question 3 continues on the next page ...**

**PHY1H****Question 3 continued . . .**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
<b>3(c)</b>	any <b>two</b> from: <ul style="list-style-type: none"> <li>• (more) electricity needs to be generated</li> <li>• (more) power stations needed</li> <li>• (more) fossil fuels burnt</li> <li>• (more) pollutant gases emitted</li> </ul>	(more) electricity is being used  accept named fossil fuel  accept named gas accept harmful for pollutant accept greenhouse gases accept atmospheric pollution  accept answer in terms of any form of electricity generation and an associated environmental problem	<b>2</b>
<b>Total</b>			<b>8</b>

## PHY1H

## Question 4

question	answers	extra information	mark
4(a)	decrease in oil  PLUS  any <b>one</b> from: <ul style="list-style-type: none"> <li>• increase in (proportion of) coal</li> <li>• increase in (proportion of) nuclear</li> <li>• increase in (proportion of) gas</li> </ul>	must have decrease in (proportion of) oil <u>and</u> increase in (proportion of) coal / nuclear / gas	1
4(b)(i)	(nuclear) fission	accept fision  do <b>not</b> accept any answer that looks like fusion	1
4(b)(ii)	<u>water</u> heated to produce (high pressure) steam  <u>steam</u> turns turbine which drives generator		1  1

Question 4 continues on the next page . . .

## PHY1H

## Question 4 continued . . .

question	answers	extra information	mark
4(b)(iii)	<p>any <b>two</b> from:</p> <ul style="list-style-type: none"> <li>• produces no pollutant <u>gases</u></li> <li>• it is reliable <b>or</b> can generate all of the time</li> <li>• concentrated energy source <b>or</b> produces a lot of energy from a small mass</li> <li>• produces only small volume of (solid) waste</li> <li>• fossil fuels will last longer</li> <li>• will need to buy less fuel from other countries</li> </ul>	<p>accept named gas or greenhouse gases accept no atmospheric pollution accept harmful for pollutant accept does not contribute to global warming</p> <p>do <b>not</b> accept no pollution on its own do <b>not</b> accept better for the environment unless qualified</p> <p>accept a named fossil fuel accept fossil fuels are running out</p> <p>do <b>not</b> accept fossil fuels are non-renewable unless qualified</p> <p>accept no new fossil fuel power stations needed</p> <p>do <b>not</b> accept it is cheap do <b>not</b> accept import less electricity</p>	2
4(b)(iv)	<p>it is / can be radioactive</p> <p><b>or</b></p> <p>emits radiation (from the nuclei)</p>	<p>do <b>not</b> accept answers in terms of kills cells / cancer</p> <p>accept emits gamma (rays)</p>	1

Question 4 continued on the next page . . .

**PHY1H****Question 4 continued . . .**

<b>question</b>	<b>answers</b>	<b>extra information</b>	<b>mark</b>
<b>4(c)</b>	coal (burning) power stations / burning coal produces carbon dioxide	they refers to coal-burning power stations  accept sulfur dioxide / nitrogen oxides for CO <sub>2</sub>	1
	(increased) CO <sub>2</sub> increases / contributes to / causes global warming / greenhouse effect	mention of ozone layer negates this mark  do <b>not</b> accept CO <sub>2</sub> warms atmosphere	1
<b>Total</b>			<b>9</b>

## PHY1H

## Question 5

question	answers	extra information	mark
5(a)	conduction	do <b>not</b> accept conductor	1
5(b)	the freezer greater <u>temperature</u> difference (between freezer and room)	both parts needed do <b>not</b> accept because it is the coldest	1
5(c)	any <b>two</b> from: <ul style="list-style-type: none"> <li>• poor absorber of heat / radiation</li> <li>• reflects heat / radiation (from room away from fridge-freezer )</li> <li>• reduces heat transfer <u>into</u> the fridge-freezer</li> <li>• reduces power consumption of fridge-freezer</li> </ul>	accept does not absorb heat poor emitter of heat / radiation is neutral  do <b>not</b> accept it is a bad conductor / good insulator	2
<b>Total</b>			<b>4</b>

## PHY1H

## Question 6

question	answers	extra information	mark
6(a)(i)	gamma hardly ionises the air	accept does not ionise accept gamma radiation is not charged  do <b>not</b> accept answers in terms of danger of gamma or other properties	1
6(a)(ii)	half-life (too) short	accept need frequent replacement 'it' refers to curium-242	1
6(a)(iii)	(two) fewer neutrons	accept different numbers of neutrons if a number is specified it must be correct  do <b>not</b> accept more neutrons unless curium-244 is specified	1
6(b)(i)	gamma	accept correct symbol	1
6(b)(ii)	both absorbed by the metal / steel / weld	only scores if (b)(i) is correct accept cannot pass through the metal / steel / weld	1
6(c)(i)	put source into water at <b>one</b> point on bank	accept the idea of testing different parts of the river bank at different times	1
	see if radiation is detected in polluted area	accept idea of tracing	1
6(c)(ii)	2.7 (days)	allow <b>1</b> mark for showing correct use of the graph	2
<b>Total</b>			<b>9</b>