



# **General Certificate of Secondary Education**

*Physics 4451*

**PHY3H**

**Unit Physics 3**

## **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.

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## Question 1

question	answers	extra information	mark
1(a)	microphone		1
1(b)(i)	vertical line from any maxima or minima to axis	do <b>not</b> penalise minor errors but do <b>not</b> allow unless intention is clear	1
1(b)(ii)	loudness / volume / intensity / energy	do <b>not</b> accept noise	1
1(c)	17	this answer only	1
1(d)	<p>the greater the distance, the smaller the amplitude</p> <p><b>or</b></p> <p>there is a (strong) negative correlation between distance and amplitude</p> <p><b>or</b></p> <p>there is an inverse square relationship between distance and amplitude</p>	<p>accept volume / intensity / energy / loudness for amplitude</p> <p>do <b>not</b> accept distance and amplitude are inversely proportional</p>	1
1(e)	20 Hz 20,000 Hz	<p>either order</p> <p>accept 20 kHz provided unit has been clearly changed</p>	1 1
<b>Total</b>			<b>7</b>

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## Question 2

question	answers	extra information	mark
2(a)(i)	turning effect	accept turning force accept force x distance (accept symbols only if correctly defined) do <b>not</b> accept newtons x metres	1
2(a)(ii)	stop apparatus falling over	accept holds the stand in place accept make it safer / stable references to balanced / equilibrium are insufficient	1
2(a)(iii)	as x increases y increases  in same proportion / ratios	   allow both marks for they are <u>directly</u> proportional  <b>or</b>  a specific example eg doubling y, doubles x  allow both marks for a correct answer giving figures eg they increase in the ratio of 1 to 7  allow for <b>1</b> mark positive correlation	1  1
2(a)(iv)	the centre of mass of the ruler is at the axis of rotation		1
2(b)	108  newton metres / Nm	allow <b>1</b> mark for correct substitution ie $240 \times 0.45$  symbols must be correct  for full credit the unit must be consistent with the numerical answer	2  1
<b>Total</b>			<b>8</b>

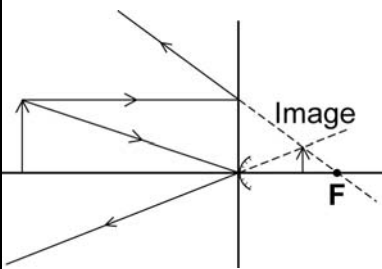
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## Question 3

question	answers	extra information	mark
3(a)	(Jupiter's) gravitational pull	accept (Jupiter's) gravity	1
3(b)	extrapolation which takes account of the line of best fit passing through the origin (+ / - 1 square)  a correct reading taken from the candidate's line ( + / - ½ square)	accept a straight line or curve  do <b>not</b> accept a line dot to dot   if no line drawn allow for <b>1</b> mark a value between 8 – 12 inclusive	1   1
3(c)	as the distance increases the time increases <b>or</b> as the distance decreases the time decreases <b>or</b> there is a positive correlation		1
3(d)	any <b>one</b> from: <ul style="list-style-type: none"> <li>computers able to process data</li> <li>telescopes in space / on satellites / above the Earth / atmosphere</li> <li>instruments other than optical telescopes (available)</li> </ul>	accept better / advanced technology  reference to satellites alone insufficient   accept any valid reason  do <b>not</b> accept just better telescopes	1
<b>Total</b>			<b>5</b>

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Question 4

question	answers	extra information	mark
4(a)	<u>convex</u>	do <b>not</b> accept convex lens do <b>not</b> accept diverging	1
4(b)	<p>two rays correctly drawn from the top of the object to the mirror with correct reflection</p> <p>image where <u>virtual</u> rays intersect behind the mirror then vertically downwards to the axis</p> <p>correct ray direction shown by arrow head</p>	<p>allow <b>1</b> mark for each</p> <p>only required once but any contrary or ambiguous direction cancels this mark</p> <p>last two marking points only score if rays are shown to be reflected</p> <p>example of a <b>4</b> mark response</p>  <p>the other acceptable rays are: from the top of the object directed towards C reflected back along its own path from the top of the object directed towards F reflected at the mirror parallel to the principal axis</p>	<p>2</p> <p>1</p> <p>1</p>

Question 4 continues on the next page



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## Question 4 continued

question	answers	extra information	mark
4(c)	diminished	accept smaller	1
	virtual	accept cannot be formed on a screen ignore imaginary either order but do <b>not</b> credit either response if directly contradicted eg diminished and enlarged virtual and real	1
<b>Total</b>			<b>7</b>

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## Question 5

question	answers	extra information	mark
5(a)	refraction		1
5(b)(i)	converging	accept convex	1
5(b)(ii)	cause the light (rays) to meet on / focus at retina / back of eye	do <b>not</b> accept hit the retina only	1
5(c)	silicone is removed from the lens(es)		1
	lens(es) thinner in / at the middle (than at the edge)		1
	<b>or</b> lens(es) became concave / diverging diverges(s) the light which (now) meets / focuses at the retina / back of the eye		1
<b>Total</b>			<b>6</b>

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## Question 6

question	answers	extra information	mark
6(a)	(forces due to) <u>gravity</u> and <u>radiation pressure</u>		1
	correct direction of forces		1
	(forces) are balanced / equilibrium / equal		1
		accept for <b>3</b> marks an answer in terms of sufficient hydrogen (1) to keep fusion reaction (1) reference to burn / burning negates this mark going at a continuous /steady rate (1)  if fuel is used instead of hydrogen maximum of <b>2</b> marks	
6(b)	the Sun will remain stable (for several billion years)		1
	based on evidence	accept a specific example of evidence eg that the Sun has remained stable during the life of our planet / for 4.5 billion years <b>or</b> still contains more than 50% hydrogen <b>or</b> by comparison with the lifecycle of (similar) stars  allow a refutation eg not based on prejudice / whim / hearsay / folk law / historical or religious authority	1
<b>Total</b>			<b>5</b>

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## Question 7

question	answers	extra information	mark
7(a)	400 000	allow <b>1</b> mark for correct substitution ie $\frac{25000}{?} = \frac{800}{12800}$ <b>or</b> $\frac{25}{?} = \frac{800}{12800}$	2
	volt(s) / V	an answer 400 gains <b>2</b> marks an answer 400 kilovolts / kV gains <b>3</b> marks although the unit mark is independent to gain <b>3</b> marks it must be consistent with the numerical value	1
7(b)	any <b>one</b> from: <ul style="list-style-type: none"> <li>• (so that there is) no short circuit</li> <li>• (so that the) current goes round the coil</li> <li>• (so that the) current does not enter the core</li> </ul>	do <b>not</b> accept any response in terms of heat insulation, safety or electric shock do <b>not</b> accept electricity for current	1

Question 7 continues on the next page

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## Question 7 continues

question	answers	extra information	mark
<b>7(c)</b>	(the alternating p.d. in the primary causes) an (alternating) current in the primary	reference to the current in the core negates this mark	1
	(causes an) <u>alternating / changing</u> (magnetic) field in the (iron) core		1
	<u>induces</u> (alternating) p.d. across the <u>secondary</u> (coil)	accept in / through or similar for across accept current for p.d. accept output (coil) for secondary (coil)  to gain <b>3</b> marks the sequence must be correct	1
<b>Total</b>			<b>7</b>