



General Certificate of Secondary Education

Physics 4451

PHY3H

Unit Physics 3

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.

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Question 1

question	answers	extra information	mark
1(a)(i)	time (for a planet) to orbit / go round <u>the Sun</u>	accept 'planet's year' accept time to rotate the <u>Sun</u> just 'year' is insufficient do not accept Earth year / time for Earth to orbit the <u>Sun</u> do not accept time for a planet to revolve any reference to distance negates the answer	1
1(a)(ii)	either information from the internet is not always reliable / accurate or data is (more) reliable (if it has been checked)	accept to check it is correct / accurate / valid	1
1(a)(iii)	the greater the distance (from the Sun) the greater the (planet's) period	accept positive correlation accept if one increases then the other increases accept as distance increases it's longer do not accept they are (directly) proportional do not accept quicker period	1
1(a)(iv)	there is no relationship	accept 'none' / 'it is random' / 'no pattern'	1

Question 1 is continued on the next page . . .

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1(b)	(Sun's / star's) gravity		1
1(c)	(the) Milky Way	accept 'milky way'	1
1(d)	billions		1
Total			7

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Question 2

question	answers	extra information	mark
2(a)(i)	20 (Hz) to 20 000 (Hz) / 20 <u>k</u> Hz	or reversed order	1
2(a)(ii)	ultrasound / ultrasonic	do not accept sonic	1
2(b)	<p><u>examples</u></p> <p>discriminates against (young) people who are not being a nuisance</p> <p>discriminates against young people</p> <p>(just) moves the group to another meeting place</p> <p>discourages young people from shopping</p> <p>distresses babies</p> <p>it's morally / ethically wrong</p>	<p>allow any reasonable response</p> <p>'it bothers young people' is insufficient</p> <p>ignore reference to animals</p> <p>ignore damages hearing</p>	1
2(c)	(mechanical) <u>vibration</u>	accept <u>vibrations</u> in the air / particles	1
2(d)(i)	<p>the sound intensity gets (much) less the greater the distance from (the source of) the sound</p> <p>correct comparison from the graph eg sound is 100 (w/m^2) at 1 (m) but only 20 (w/m^2) at 2.5 (m)</p>	<p>allow the <u>closer</u> you are to the machine the more likely it is to damage your hearing</p> <p>accept the graph falls steeply (at first) and then more gently</p>	<p>1</p> <p>1</p>

Question 2 is continued on the next page . . .

PHY3H**Question 2 continued . . .**

question	answers	extra information	mark
2(d)(ii)	any two from: <ul style="list-style-type: none"> • (so) data can be compared • anomalous results can be checked / removed / identified • more than one set of data • intensity / loudness fluctuates 	increases reliability is insufficient improves accuracy is insufficient fair test is insufficient	2
Total			8

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Question 3

question	answers	extra information	mark
3(a)	(it is) magnetic	<p>or will carry (an alternating) magnetic field</p> <p>or magnetises and demagnetises (easily)</p> <p>reference to conduction negates the mark</p>	1
3(b)	so the current / electricity does not flow through the iron / core	<p>accept 'so the current / electricity / wires do not short (circuit)'</p> <p>responses in terms of heat insulation negate the mark</p> <p>ignore references to safety</p>	1
3(c)	5.75 or 5.8 or 6(.0)	<p>allow for 1 mark either</p> $\frac{230}{\text{p.d.}} = \frac{20\,000}{500}$ <p>or</p> $\text{p.d.} = 230 \div 40$	2
	V / volt(s)		1
Total			5

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Question 4

question	answers	extra information	mark
4(a)	the point at which the (total) mass seems to act / appears to be concentrated	accept 'weight' for 'mass' accept the point at which gravity seems to act do not accept a definitive statement eg where (all) the mass is	1
4(b)	wider / larger base lower centre of mass	marks are for a correct comparison accept lower centre of gravity / c of g	1 1
4(c)	<u>line of action</u> (of the weight) lies / falls inside the base the <u>resultant moment</u> returns mixer to its original position	in each case the underlined term must be used correctly to gain the mark accept there is no <u>resultant moment</u> / <u>resultant moment</u> is zero accept resulting moment for resultant moment do not accept converse argument	1 1
Total			5

PHY3H**Question 5**

question	answers	extra information	mark
5(a)	motor (effect)		1
5(b)(i)	wire kicks further (forward)	accept moves for kicks accept moves more accept 'force (on the wire) increased'	1
5(b)(ii)	wire kicks back(wards) / into (the space in) the (horseshoe) magnet	accept moves for kicks accept 'direction of force reversed'	1
Total			3

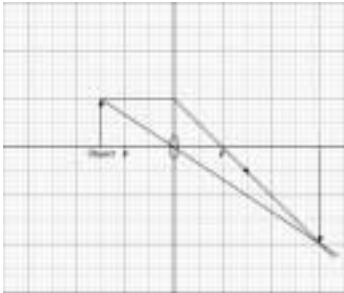
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Question 6

question	answers	extra information	mark
6(a)	38 400	allow 6.4×6000 for 1 mark	2
	Nm or newton metres	do not credit 'nm', 'mN' or 'metre newtons'	1
6(b)	16 000 (N) or 16 <u>k</u> N	allow 1 mark for $38\,400 \div 2.4$ accept their (a) $\div 2.4$ correctly calculated for 2 marks accept their (a) $\div 2.4$ for 1 mark	2
Total			5

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Question 7

question	answers	extra information	mark
7(a)	<p>any two for 1 mark each</p> <p>ray from the object's arrowhead</p> <ul style="list-style-type: none"> • through centre of lens • parallel to the axis then, when it reaches the lens, through F on the right • through F on the left then, when it reaches the lens parallel to the axis <p>image shown as vertical line from axis to where their <u>rays</u> intersect</p> <p>ray direction shown</p>	<p>deduct (1) from the first two marks if a ruler has not been used but the intention is clear</p> <p>example of a 4 mark response</p>  <p>if more than two construction lines have been drawn all must be correct to gain 2 marks</p> <p>construction lines drawn as dashed lines do not score credit</p> <p>image need not be marked with an arrowhead but, if it is, it must be correct</p> <p>only one correct direction arrow needed but there must not be any contradiction</p>	<p>2</p> <p>1</p> <p>1</p>
7(b)	<p>any two from:</p> <ul style="list-style-type: none"> • inverted • magnified • real 	<p>one correct feature gains 1 mark</p> <p>accept 'upside down'</p> <p>accept 'bigger'</p> <p>accept 'not virtual / not imaginary'</p> <p>ignore any reference to position</p> <p>an incorrect feature negates a correct response</p>	2
Total			6

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Question 8

question	answers	extra information	mark
8(a)	(enough) <u>dust and gas</u> (from space)	accept nebula for dust and gas accept hydrogen for gas mention of air negates this mark	1
	pulled together by: <ul style="list-style-type: none"> • gravitational attraction or • gravitational forces or • gravity 		1
8(b)	forces (in the star) are <u>balanced</u>	accept equal and opposite for balanced accept in equilibrium for balanced	1
	forces identified as gravity and <u>radiation pressure</u>	both forces are required gravitational forces inwards balance / equal radiation pressure outwards for 2 marks accept for 2 marks an answer in terms of sufficient hydrogen to keep the <u>fusion</u> reactions going accept for 1 mark an answer in terms of sufficient fuel to keep the <u>fusion</u> reactions going	1

Question 8 is continued on the next page . . .

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Question 8 continued . . .

8(c)	<p>(explodes as) a supernova</p> <p>any one from:</p> <ul style="list-style-type: none"> • outer layer(s) thrown into space • scatters dust and gas into space (for the formation of new stars) • elements distributed throughout space • matter left behind / core may form a neutron star • a black hole will form if the gravitational forces are enormous / sufficient mass is left behind 	<p>do not accept just 'thrown into space'</p> <p>do not accept just 'dust and gas'</p> <p>do not accept just 'distributed'</p> <p>do not accept just 'neutron star'</p> <p>do not accept just 'black hole'</p> <p>do not accept any references to 'dark bodies' or 'black dwarfs'</p> <p>black hole forms if star is large enough is insufficient</p>	<p>1</p> <p>1</p>
Total			6