



**General Certificate of Secondary
Education**

**Additional Science 4463 /
Physics 4451**

PHY2H Unit Physics 2

Mark Scheme

2012 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 students' 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 students' 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 students' 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 students 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)

Student	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)

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student 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.

Quality of Written Communication and levels marking

In Question 8 students are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Students will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: Basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: Clear

- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: Detailed

- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

PHY2H**Question 1**

question	answers	extra information	mark
1(a)	B gradient / slope is the steepest / steeper	reason only scores if B is chosen	1
		answers must be comparative accept steepest line ignore greatest speed	1
1(b)	(velocity includes) direction	'it' refers to velocity	1
Total			3

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Question 2

question	answers	extra information	mark
2(a)	2.75	allow 1 mark for correct substitution, ie $\frac{11}{4}$ or $\frac{23 - 12}{4}$ provided no subsequent step shown	2
	m/s ²		1
2(b)	driving force increases		1
	frictional force increases	accept air resistance / drag for frictional force	1
	driving force > frictional force		1
Total			6

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Question 3

question	answers	extra information	mark
3(a)	electrons transfer / removed	do not accept negatively charged atoms for electrons	1
	to the rod / from the cloth	this only scores if first mark given this does not score if there is reference to any original charge on cloth or rod 'it' refers to the rod accept negative charge transfer to rod / removed from cloth for 1 mark transfer of positive charge / positive electrons scores zero	1
3(b)(i)	rods / charges repel		1
	creating downward / extra force (on the balance)	accept pushing (bottom) rod downwards do not accept increasing the weight / mass charges attracting scores zero	1

Question 3 continues on the next page

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Question 3 continued

question	answers	extra information	mark
3(b)(ii)	the (repulsion) force increases as the distance between the <u>charges</u> decreases	<p>accept there is a negative correlation between (repulsion) force and distance between <u>charges</u></p> <p>or</p> <p>(repulsion) force and distance between <u>charges</u> are inversely proportional</p> <p>for both marks</p> <p>examples of 1 mark answers</p> <p>force increases as distance decreases</p> <p>force and distance are inversely proportional</p> <p>negative correlation between force and distance</p> <p>repels more as distance decreases</p> <p>if given in terms of attracting or attraction force this mark does not score</p>	2
Total			6

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Question 4

question	answers	extra information	mark
4(a)(i)	also double	increases is insufficient	1
4(a)(ii)	<u>variable</u> resistor	accept rheostat / potentiometer	1
4(b)(i)	the data / results / variables are continuous	accept data / results / variables are not categoric / discrete	1
4(b)(ii)	misreading the ammeter	do not accept misreading the meter / results do not accept misreading the ammeter and / or voltmeter reading / human error is insufficient	1
4(b)(iii)	straight line <u>from the origin</u> drawn passing close / through points at 1 V, 5 V, 6 V and ignoring anomalous point	do not accept line drawn 'dot-to-dot'	1
4(b)(iv)	yes supports prediction or (straight) line passes through the origin	mark is for the reason accept a mathematical argument, eg when p.d. went from 2 to 4 the current went from 0.3 to 0.6 it's directly proportional is insufficient	1
Total			6

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Question 5

question	answers	extra information	mark
5(a)(i)	(connect) 30 (cells)		1
	in series		1
5(a)(ii)	current always flows in the same direction		1
	or current only flows one way		
5(a)(iii)	36 000	allow 1 mark for correctly converting 2 hours to 7200 seconds	2
	coulombs / C	answers 10 or 600 score 1 mark do not accept c	1
5(b)(i)	2160	allow 1 mark for correct substitution, ie $\frac{1}{2} \times 120 \times 6^2$ answers of 1620 or 540 score 1 mark	2

Question 5 continues on the next page

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Question 5 continued

question	answers	extra information	mark
5(b)(ii)	reduce it		1
	any one from: <ul style="list-style-type: none"> • draws a larger current (from battery) • motor draws greater power (from battery) • greater resistance force (to motion) / air resistance / drag / friction 	accept energy per second for power accept more energy needed to move the bicycle accept less streamlined more mass to carry is insufficient	1
Total			10

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Question 6

question	answers	extra information	mark
6(a)	(moving in) different / opposite directions	accept one has positive momentum the other negative momentum accept they have different velocities	1
6(b)(i)	momentum before = momentum after or (total) momentum stays the same	accept no momentum is lost accept no momentum is gained	1
6(b)(ii)	2.2	allow 1 mark for calculation of teenagers' momentum as 22 (kgm/s) and allow 1 mark for correct statement, eg momentum before = momentum after or allow 2 marks for a numerical expression of above, eg $55 \times 0.4 = m \times 10$ or $0 = (55 \times 0.4) + (m \times (-10))$	3
6(c)	any two from: <ul style="list-style-type: none"> • work is done • (against) friction • (transforming) (kinetic) energy into heat 	any reference to increasing friction negates this marking point	2
Total			7

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Question 7

question	answers	extra information	mark
7(a)(i)	(total) number of protons plus neutrons	accept number of nucleons accept amount for number do not accept number of particles in the nucleus	1
7(a)(ii)	number of neutrons decreases by one number of protons increases by one	 accept for both marks a neutron changes into a proton	1 1
7(b)(i)	$^{208}_{81}\text{Th}$	 correct order only	1 1
7(b)(ii)	the number of protons determines the element alpha and beta decay produce different changes to the number of protons or alpha and beta decay produce different atomic numbers	accept atomic number for number of protons there must be a comparison between alpha and beta which is more than a description of alpha and beta decay alone ignore correct reference to mass number	1 1
Total			7

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