



General Certificate of Secondary Education

*Additional Science 4463 /
Physics 4451*

PHY2H Unit Physics 2

Mark Scheme

2011 Examination – January 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)(i)	120		1
1(a)(ii)	20	accept 140-their (a)(i) provided answer is not negative	1
1(a)(iii)	as speed increases		1
	drag force / water resistance / friction / D increases		1
	(until) D = 140 N or (until) D = T	forces balance is insufficient	1
1(b)(i)	(average) speed (of swimmer)		1
1(b)(ii)	any two from: <ul style="list-style-type: none"> more data force may vary (a lot) / change give more <u>reliable average</u> 	accept results for data do not accept more accurate data ignore references to anomalies ignore accurate / precise	2

Question 1 continues on the next page . . .

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Question 1 continued . . .

question	answers	extra information	mark
1(b)(iii)	<p>examples of acceptable responses:</p> <ul style="list-style-type: none"> • most / some females produce smaller forces • most / some males produce larger forces • some females swim as fast as males but use a smaller force • most of the faster swimmers are male • most of the slower swimmers are female • range of the (average) speed of males is smaller than the range of the (average) speed of females • range of the (average) force of the males is greater than the range of the (average) force of the females 	<p>do not accept <u>all</u> females produce smaller forces</p> <p>do not accept <u>all</u> males produce larger forces</p> <p>do not accept <u>all</u> males swim faster</p> <p>do not accept <u>all</u> females swim slower</p>	1
1(b)(iv)	exert maximum (hand) force (throughout the swim / stroke)	<p>accept (any method to) increase (hand) force</p> <p>practise more is insufficient</p>	1
Total			10

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Question 2

question	answers	extra information	mark
2(a)	3 rd box The negative charge in the water is repelled by the rod and the positive charge is attracted.		1
2(b)(i)	friction between bottles and conveyor belt / (plastic) guides charge transfers between bottles and conveyor belt / (plastic) guides	accept bottles rub against conveyor belt / (plastic) guides accept specific reference eg electrons move onto / off the bottles reference to positive electrons / protons negates this mark	1 1
2(b)(ii)	an <u>atom</u> that has lost / gained <u>electron(s)</u>	do not accept a charged particle	1
2(b)(iii)	charge will not (easily) flow off the conveyor belt	accept the conveyor belt / bottle is an insulator / not a conductor accept conveyor belt is rubber	1
Total			5

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Question 3

question	answers	extra information	mark
3(a)(i)	any one from: <ul style="list-style-type: none"> • food / drink • rocks / building materials • cosmic rays / rays from space 	accept correctly named example	1
3(a)(ii)	any one from: <ul style="list-style-type: none"> • nuclear power / coal power (stations) • nuclear accidents • nuclear weapons testing 	accept nuclear waste accept named accident eg Chernobyl accept named medical procedure which involves a radioactive source accept radiotherapy nuclear activity / radiation is insufficient do not accept CT scans	1
3(a)(iii)	different number of / fewer protons or different atomic number	accept does not have 86 protons accept only has 84 protons do not accept bottom number different reference to mass number negates this mark	1

Question 3 continues on the next page . . .

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Question 3 continued . . .

question	answers	extra information	mark				
3(b)	168	accept 169 if clear, correct method is shown allow 1 mark for a correct dose ratio involving the spine eg 2:140 etc or ratio of days to dose is 1.2 or ratio of dose to days is 0.83	2				
3(c)(i)	<table border="1"> <tr> <td>Group A</td> <td>Group B</td> </tr> <tr> <td>J M O</td> <td>K L N</td> </tr> </table>	Group A	Group B	J M O	K L N	all correct any order within each group	1
Group A	Group B						
J M O	K L N						
3(c)(ii)	similar (number) / same (number) / large (number)	accept the same specific number in each group eg three reference to other factors such as age is neutral	1				
3(c)(iii)	how many people in each group developed cancer	a clear comparison is required	1				

Question 3 continues on the next page . . .

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question	answers	extra information	mark
3(c)(iv)	<p>Yes the benefit of having the scan is greater than the risk</p> <p>or</p> <p>the risk is (very) small (compared to the chance from natural causes)</p> <p>No no additional risk is acceptable</p>	<p>there are no marks for Yes or No the mark is for the reason</p> <p>accept the risk is much greater from natural causes</p>	1
Total			9

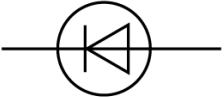
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Question 4

question	answers	extra information	mark
4(a)	1 080 000	allow 1 mark for correct substitution ie $\frac{1}{2} \times 15\,000 \times 12 \times 12$	2
4(b)	any one from: <ul style="list-style-type: none"> • KE (of wind) <u>more than</u> doubles • mass of air (hitting blades) <u>more than</u> doubles • area swept out by blades <u>more than</u> doubles • area swept out by blades increases <u>$\times 4$</u> 	do not accept blades are larger / have a bigger area	1
Total			3

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Question 5

question	answers	extra information	mark
5(a)	diode	accept LED	1
5(b)	<p>all symbols correct</p>  <p>diode</p> <p>voltmeter in parallel with component added in series</p>	<p>must include at least voltmeter and diode</p> <p>allow ecf from part (a) if the component is not identified as a diode</p> <p>allow symbol without the line through triangle</p> <p>ignore polarity of diode</p> <p>any additional components must not affect the ability to measure V and I for the diode / their (a)</p>	<p>1</p> <p>1</p>
5(c)(i)	0.05	<p>accept 50 mA</p> <p>accept between 0.048 and 0.050 inclusive</p>	1
5(c)(ii)	16	<p>$\frac{0.8}{0.05}$</p> <p>their (c)(i) correctly calculated gains both marks</p> <p>allow 1 mark for correct transformation and substitution</p> <p>ie $\frac{0.8}{0.05}$ or $\frac{0.8}{\text{their (c)(i)}}$</p> <p>allow 17 if using 0.048</p>	2
Total			6

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Question 6

question	answers	extra information	mark
6(a)(i)	0.25 (A)		1
6(a)(ii)	75 coulombs or C	allow 1 mark for converting 5 minutes to 300 seconds or allow 1 mark for correct substitution ie 0.25×300 allow 1 mark for an answer 1.25 allow 1 mark only for their (a)(i) $\times 300$ correctly calculated do not accept c	2 1
6(b)	any two from: <ul style="list-style-type: none"> • fault not repaired • larger current will (still) flow • aluminium foil will not melt (if a fault) • wiring will overheat / (may) cause a fire 	accept if a fault was to occur accept aluminium foil needs a higher current / charge to melt accept idea of fire hazard do not accept explode etc	2
Total			6

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Question 7

question	answers	extra information	mark
7(a)	direction		1
7(b)	54 000	allow 1 mark for calculating and identifying momentum as 10 800 or allow 1 mark for correct substitution into second equation ie $\frac{1200 \times 9}{0.2}$	2
7(c)	increases the time taken (for head) to stop	accept increases impact time do not accept reference to slowing down time unless qualified	1
	decreases rate of change in momentum	accept reduces acceleration / deceleration accept increases the time taken to reduce momentum to zero is worth 2 marks	1
	reduces the <u>force</u> (on the head)	reduces momentum is insufficient	1
Total			6