**General Certificate of Secondary Education
January 2013**

Additional Science / Physics   **PHY2F**

(Specification 4463 / 4451)

Unit 2: Physics 2

Final

Mark Scheme

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 events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process 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 standardisation each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised 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.

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 bullet points 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	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, 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, 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 or by each stage of a longer calculation.

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 Ignore / Insufficient / Do not allow

Ignore or insufficient is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

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Question 1

question	answers	extra information	mark
1(a)	96 (m)		1
1(b)(i)	similar shape curve drawn <u>above</u> existing line going <u>through</u> (0,0)	allow **1** mark for any upward smooth curve or straight upward line <u>above</u> existing line going through (0,0)	2
1(b)(ii)	Rain on the road		1
1(c)(i)	all three lines correctly labelled top line – **C** middle line – **B** bottom line – **A**	allow **1** mark for one correctly labelled accept 1.2 accept 0.9 accept 0.7	2
1(c)(ii)	any **two** from: • (table has) <u>both</u> variables are together • both (variables) could / would affect the reaction time • cannot tell original contribution • need to measure one (variable) on its own • need to control one of the variables	accept tired and music as named variables accept cannot tell which variable is affecting the drive (the most) accept need to test each separately fair test is insufficient	2
Total			8

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Question 2

question	answers	extra information	mark
2(a)	proton electron neutron	all 3 in correct order allow **1** mark for 1 correct do **not** accept letters p, e, n	2
2(b)	9 number of neutrons and protons	reason only scores if 9 is chosen	1 1
Total			**4**

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Question 3

question	answers	extra information	mark
3(a)	**1** mark for each correct line	if more than 1 line has been drawn from a box in **List A** then all those lines are marked incorrect	3
3(b)	higher in village B by 6 units	allow **1** mark for correctly obtaining a height difference of 180 (m) / 4 times higher – this refers to height not radiation levels accept for **3** marks in village A it is 2 units (extra) and in village B it is 8 units (extra) allow **1** mark for a correct radiation calculation based on incorrect height readings	1 2
Total			**6**

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Question 4

question	answers	extra information	mark
4(a)	**D – E**	reason only scores if D-E chosen	1
	shallowest slope / gradient	accept smallest distance in biggest time accept longest time to travel the same distance accept the line is not <u>as</u> steep accept it is a less steep line do **not** accept the line is not steep	1
4(b)	80 000	allow **1** mark for correct substitution, ie 16 000 × 5 provided no subsequent step shown	2
4(c)(i)	<u>straight</u> line starting at origin	accept within one small square of the origin	1
	passing through t = 220 and d = 500		1
4(c)(ii)	186	accept any value between 180 and 188 accept where their line intersects given graph line correctly read ±4 s	1
Total			**7**

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Question 5

question	answers	extra information	mark
5(a)(i)	connect the earth wire (to pin)	answers must be in terms of correcting the faults	1
	screw cable grip (across cable)	accept tighten the cable grip	1
5(a)(ii)	any **two** from: • fuse gets (very) hot • fuse melts • circuit breaks / switches off	accept blows for melts do **not** accept break / snap fuse / blow up accept stops current flowing	2
5(b)	any **two** from: • hairdryer is plugged into mains (electricity socket) **or** hairdryer is using 230 V • water conducts electricity • radio is low power / current / pd / voltage • (the current in / pd across) hairdryer more likely to give a (fatal) electric shock	it refers to hairdryer hairdryer works from the mains accept 240 for 230 do **not** accept water and electricity don't mix accept radio not connected to the mains do **not** accept radio is waterproof accept the idea of electrocution if hairdryer is wet accept the idea of radio not causing electrocution if wet	2
Total			**6**

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Question 6

question	answers	extra information	mark
6(a)	3rd box The negative charge in the water is repelled by the rod and the positive charge is attracted to the rod.		1
6(b)(i)	friction between bottles and conveyor belt / (plastic) guides	accept bottles rub against conveyor belt / (plastic) guides	1
	charge transfers between bottles and conveyor belt / (plastic) guides	accept specific reference eg electrons move onto / off the bottles reference to positive electrons / protons negates this mark	1
6(b)(ii)	(the atom) loses or gains one (or more) electrons		1
6(b)(iii)	charge will not (easily) flow off the conveyor belt / bottles	accept the conveyor belt / bottles is an insulator / not a conductor accept conveyor belt is rubber	1
Total			**5**

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Question 7

question	answers	extra information	mark
7(a)(i)	ammeter symbol correct and drawn in series	accept do **not** accept lower case a	1
	voltmeter symbol correct and drawn in parallel with the material	do **not** accept	1
7(a)(ii)	adjust / use the variable resistor **or** change the number of cells	accept change the resistance accept battery for cell accept change the pd / accept change the voltage accept increase / decrease for change	1
7(b)(i)	37.5 (Ω)	accept answer between 36 and 39 inclusive	1
7(b)(ii)	5.6(25) **or** their (b)(i) x 0.15	allow **1** mark for correct substitution ie 37.5 **or** their (b)(i) × 0.15 provided no subsequent step shown	2
7(c)(i)	the thick<u>er</u> the putty the low<u>er</u> the resistance	answer must be comparative accept the converse	1

Question 7 continues on the next page . . .

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Question 7 continued . . .

question	answers	extra information	mark
7(c)(ii)	any **one** from: • measuring length incorrectly • measuring current incorrectly • measuring voltage incorrectly • ammeter / voltmeter incorrectly calibrated • thickness of putty not uniform • meter has a zero error	accept may be different length do **not** accept different currents do **not** accept different voltage do **not** accept pieces of putty not the same unless qualified do **not** accept systematic / random error accept any sensible source of error eg putty at different temperatures do **not** accept human error without an explanation do **not** accept amount of putty not same	1
7(c)(iii)	repeat readings and take a mean	accept check results again accept do experiment again accept do it again and take mean(s) accept compare own results with other groups do **not** accept take more readings	1
Total			**9**

UMS Conversion Calculator: www.aqa.org.uk/umsconversion