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General Certificate of Secondary Education

Additional Science 4463/ Physics 4451

PHY2F Unit Physics 2

Mark Scheme

2010 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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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 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)	switch	allow answer circled in box	1
1(b)	24		1
1(c)	equal to 0.25 A		1
1(d)	4		1
Total			**4**

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Question 2

question	answers	extra information	mark
2(a)	repel	correct order only	1
	opposite		1
	attract		1
2(b)	refuelling an aircraft	reason cannot score if refuelling aircraft is not chosen	1
	a spark may cause an explosion / fire / ignite the fuel	accept the static for a spark accept named fuel there must be a consequence of having a spark do **not** accept answers in terms of people getting a shock or electrocuted	1
Total			**5**

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Question 3

question	answers	extra information	mark
3(a)	**R** has the greatest speed / velocity	reason cannot score if **R** is not chosen accept it is going at 28 m/s answer should be comparative	1 1
3(b)(i)	3250	allow **1** mark for correct substitution of 130 and 25 ie 130 × 25 accept 2600 or 3640 for **1** mark	2
3(b)(ii)	kg m/s	accept answer given in (b)(i) if no answer given here	1
3(c)(i)	increase it	accept make it slower accept slow it down accept make it longer accept (reactions) would be slower do **not** accept if the answer clearly refers to distance comparative answers expected	1
3(c)(ii)	increase it	accept make it longer do **not** accept if the answer clearly refers to time comparative answers expected	1
Total			**7**

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Question 4

<table>
<tr><th>question</th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>4(a)(i)</td><td>all correct
<table><tr><td>Number of protons</td><td>3</td></tr><tr><td>Number of electrons</td><td>3</td></tr><tr><td>Number of neutrons</td><td>4</td></tr></table></td><td>accept presented as a tally chart

allow 1 mark for 1 correct</td><td>2</td></tr>
<tr><td>4(a)(ii)</td><td>7

number of protons and neutrons</td><td>reason may score even if 7 not chosen

accept number of particles in the nucleus
accept number of nucleons

do not accept number of electrons and neutrons</td><td>1

1</td></tr>
<tr><td>4(b)</td><td>an ion</td><td></td><td>1</td></tr>
<tr><td>4(c)(i)</td><td>smaller than</td><td></td><td>1</td></tr>
<tr><td>4(c)(ii)</td><td>radon loses an alpha (particle)
or
radon loses an (alpha) particle
or
(mass of) polonium plus an alpha = (mass) radon
or
radon loses 2 protons and 2 neutrons (to become polonium)</td><td>accept radon has less protons and neutrons</td><td>1</td></tr>
<tr><td>Total</td><td></td><td></td><td>7</td></tr>
</table>

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Question 5

question	answers	extra information	mark
5(a)	a light-dependent resistor		1
5(b)	any **three** from: • resistance starts at 500 (kilohms) • (resistance) falls rapidly as intensity increases from 0 • (resistance) halves between 10 and 20 lux • (resistance) falls slightly between 20 and 50 lux **or** • (resistance) almost constant / levels out between 20 and 50 lux • at 50 lux, resistance = 10 (kilohms)	for full credit the word resistance must be used correctly at least once accept resistance falls accept brightness for intensity an answer resistance falls as intensity increases gains **2** marks - this may be combined with one of the bullet point marks for full credit	3
5(c)(i)	decrease		1
5(c)(ii)	resistance increases	this can score without (c)(i)	1

Question 5 continues on the next page . . .

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Question 5 continued . . .

question	answers	extra information	mark
5(d)	A circuit to switch on security lighting when it gets dark.		1
Total			**7**

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Question 6

question	answers	extra information	mark
6(a)	96	allow **1** mark for correct substitution ie 80 × 1.2	2
	newton or N	allow Newton do **not** allow n	1
6(b)(i)	direction		1
6(b)(ii)	velocity <u>and</u> time are continuous (variables)	answers must refer to both variables accept the variables are continuous / not categoric accept the data / 'it' is continuous accept the data / 'it' is not categoric	1
6(b)(iii)	**C**		1
	velocity is not changing	the **2** marks for reason may be scored even if **A** or **B** are chosen accept speed for velocity accept speed is constant (9 m/s) accept **not** decelerating accept **not** accelerating accept reached terminal velocity	1
	forces must be balanced **or** resultant force is zero	accept forces are equal accept arrows are the same length / size do **not** accept the arrows are equal	1
Total			**8**

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Question 7

question	answers	extra information	mark
7(a)(i)	(two) nuclei (of light elements) join forming a larger / heavier nucleus / one	accept hydrogen atoms for nuclei accept comparative term equivalent to larger accept forms a helium (nucleus / atom) this mark only scores if fusion is in terms of hydrogen atoms	1 1
7(a)(ii)	stars	accept a named star e.g. the Sun accept nebula mention of planets negates answer	1
7(b)(i)	any **one** from: • (currently) only experimental • reaction does not last long enough • use more energy than they produce	 allow difficult to control do **not** allow inefficient on its own	1
7(b)(ii)	any **one** from: • will give another source of energy • unlimited fuel supplies / energy • would not produce any radioactive waste • want to show that it can be done	do **not** accept answers only in terms of fossil fuels or carbon dioxide accept unlimited hydrogen accept less radioactive waste accept nuclear for radioactive do **not** accept toxic waste accept any sensible suggestion	1

Question 7 continues on the next page . . .

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Question 7 continued . . .

question	answers	extra information	mark
7(c)(i)	any **one** from: • repeating did not produce the same results / data • experiments were not / may not be reproducible • data / experiments were not valid	accept could not be repeated accept has not been repeated do **not** accept answers in terms of scientists being biased	1
7(c)(ii)	any **one** from: • cannot trust journalists • newspaper journalist may not have a science background • newspaper may publish what people want to read • newspaper may simplify ideas • people believe / trust the scientists writing the journal • people have heard of the scientists writing in the journal • scientists writing in the journal are famous • journal only publishes the work of respected / famous scientists • data is checked by other scientists before published in the journal	bias is insufficient on its own accept any sensible suggestion, these are examples they do not constitute a full list	1
Total			**7**