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General Certificate of Secondary Education

Additional Science 4463 /
Physics 4451

PHY2H Unit Physics 2

Mark Scheme

2012 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 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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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 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	Pluto, Mars, Moon	1
2	Pluto, 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.

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Question 1

question	answers	extra information	mark
1(a)(i) (E)	friction between the beads and pipe	accept beads rub against the pipe	1
	(cause) <u>electrons</u> to transfer	accept electrons are lost/gained do **not** accept negatively charged atoms for electrons	1
	from the pipe **or** to the beads	3rd mark point only scores if 2nd mark scores do **not** accept from the (negatively) charged pipe do **not** accept to the (positively) charged beads accept negative charge transfer to the beads for **1** mark provided 2nd or 3rd marking point not awarded mention of positive charge transfer negates last 2 marking points	1
1(a)(ii) (E)	<u>volume</u> (of beads) **or** <u>length</u> of pipe **or** speed the beads are poured **or** angle of pipe	accept (75)cm^3 accept use the same pipe poured the same way is insufficient	1
1(b)(i) (E)	the larger the beads the less charge	do **not** accept inversely proportional negative correlation is insufficient	1

Question 1 continues on the next page . . .

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Question 1 continued . . .

1(b)(ii) (E)	(total) charge decrease beads in contact with pipe (walls) for less time OR smaller surface area (to rub against)	results would be lower/smaller would be insufficient accept less contact (between beads and pipe) accept beads in pipe for less time accept less pipe to rub against less friction is insufficient	1 1
1(c)(i) (E)	(pumping very) fine powders greater charge (build up) **or** higher pd/voltage **or** greater energy	reason only scores if (very)fine powders given accept more static (electricity) accept an answer that correctly relates back to the experimental data accept larger surface area to volume (ratio)	 1
1(c)(ii) (E)	idea of earthing (the pipe)	accept use metal pipes do **not** accept use larger particles	1
1(d) (E)	to compare (the relative risks) **or** different conditions change the MIE value	fair test is insufficient you can only have one independent variable is insufficient accept different conditions change the results do **not** accept avoid bias	1
Total			**10**

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Question 2

question	answers	extra information	mark
2(a)(i) (E)	(nuclear) fission is the splitting of a (large atomic) nucleus (nuclear) fusion is the joining of (two atomic) nuclei (to form a larger one)	do **not** accept particle/atom for nucleus do not accept particles/atoms for nuclei	1 1
2(a)(ii) (E)	energy	accept heat/radiation/nuclear energy accept gamma (radiation) do not accept neutrons/neutrinos	1
2(b)(i) (E)	uranium (-235)	accept U (-235) ignore any numbers given with uranium accept thorium accept MOX (mixed oxide) do **not** accept hydrogen	1
2(b)(ii) (E)	(same) number of protons	accept (same) atomic number accept (same) positive charge ignore reference to number of electrons	1
Total			**5**

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Question 3

question	answers	extra information	mark
3(a) (E)	**A** constant speed / velocity	accept steady pace do **not** accept terminal velocity do **not** accept stationary	1
	B acceleration	accept speeding up	1
	C deceleration	accept slowing down accept accelerating backwards accept accelerating in reverse do **not** accept decelerating backwards	1
3(b)(i) (E)	the distance the car travels under the braking force	accept braking <u>distance</u>	1
3(b)(ii) (E)	speed/velocity/momentum		1
3(c)(i) (E)	5000 (N) to the left	**both** required accept 5000(N) with the direction indicated by an arrow drawn pointing to the left accept 5000(N) in the opposite direction to the force of the car (on the barrier) accept 5000(N) towards the car	1
3(c)(ii) (E)	to measure/detect forces exerted (on dummy / driver during the collision)		1
3(c)(iii) (E)	4	allow **1** mark for showing a triangle drawn on the straight part of the graph **or** correct use of two pairs of coordinates	2
	m/s^2	do **not** accept mps^2	1
Total			**10**

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Question 4

question	answers	extra information	mark
4(a)(i) (E)	2	allow **1** mark for correct substitution i.e. 0.8 × 2.5 provided no further step shown	2
4(a)(ii) (E)	straight line drawn from origin to 2, 0.8 **or** their (a)(i), 0.8		1
	curve from 2, 0.8 to 12,2 **or** their (a)(i) 0.8 to 12,2	accept curve from 2, 0.9 to 12,2 **or** their (a)(i) 0.9 to 12,2 'convex' curve required accept a curve that flattens between 10 and 12V	1
4(a)(iii) (E)	filament / lamp gets hot	accept temperature increases	1
4(b) (E)	108	allow **1** mark for correct substitution i.e. 1.5 × 72 provided no further step shown	2
Total			**7**

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Question 5

question	answers	extra information	mark
5(a) (E)	has an equal amount of positive charge	accept pudding/it is positive	1
5(b) (E)	(experimental) results could not be explained using 'plum pudding' model **or** (experimental) results did not support plum pudding model	 accept (experimental) results disproved plum pudding model	1
5(c)(i) (E)	**A** – most of atom is empty space **or** most of atom concentrated at the centre **B** – nucleus is positive (so repels alpha particles) **C** – nucleus is very small **or** nucleus is a concentrated mass	 accept nucleus has the same charge as alpha accept nucleus is positive if not scored for B accept nucleus has a very concentrated charge	1 1 1
5(c)(ii) (E)	(if predictions correct, this) supports the new model	answers should be in terms of the nuclear model accept supports his/new/nuclear theory accept proves for supports accept shows predictions/ Rutherford was correct	1
Total			**6**

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Question 6

question	answers	extra information	mark
6(a) (E)	98	allow **1** mark for correct substitution ie ½ × 0.16 × 35 × 35 provided no subsequent step shown an answer of 98 000 scores 0	2
6(b)(i) (E)	9.6	allow **1** mark for (change in velocity =) 60 ignore negative sign	2
6(b)(ii) (E)	9600 **or** their (b)(i) ÷ 0.001 correctly calculated, unless (b) (i) equals 0	ignore negative sign	1
6(c) (E)	increases the time to reduce/change momentum (to zero)	only scores if 1st mark scored decreases rate of change of momentum scores both marks provided there are no contradictions accept decreased acceleration/deceleration equations on their own are insufficient	1 1
Total			**7**

UMS Conversion Calculator
http://web.aqa.org.uk/UMS/index.php