Version 1.0: 21/07/2009

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Additional Science 4463/ Physics 4451

PHY2H Unit Physics 2

Mark Scheme

2009 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 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.

PHY2H

Question 1

<table>
<tr><th>question</th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>1(a)</td><td>
<table>
<tr><td>Particle</td><td>Relative Mass</td><td>Relative charge</td></tr>
<tr><td>Proton</td><td>1</td><td></td></tr>
<tr><td>Neutron</td><td></td><td>0</td></tr>
</table>
</td><td>accept one, accept +1
do not accept -1
accept zero
do not accept no charge/ nothing/ neutral unless given with 0</td><td>1

1</td></tr>
<tr><td>1(b)</td><td>equal numbers/amounts of protons and electrons

protons and electrons have equal but opposite charge</td><td>

accept protons charge +1 and electron charge -1
accept (charge on) proton cancels/balances (charge on) electron
accept positive (charges) cancel out the negative(charges)
neutrons have no charge is neutral
do not accept total charge of protons, electrons (and neutrons) is 0 unless qualified</td><td>1

1</td></tr>
</table>

Question 1 continues on the next page . . .

PHY2H

Question 1 continued . . .

question	answers	extra information	mark
1(c)(i)	(3) fewer neutrons . . .	accept lower/ smaller mass number do **not** accept different numbers of neutrons any mention of fewer/more protons or electrons negates mark accept answers in terms of U-238 providing U-238 is specifically stated i.e. U-238 has (3) more neutrons	1
1(c)(ii)	neutron		1
1(c)(iii)	(nuclear) fission	accept fision do **not** accept any spelling that may be taken as fusion	1
Total			**7**

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Question 2

question	answers	extra information	mark
2(a)(i)	gained electrons		1
2(a)(ii)	see if it exerts a force on another (charged) object **or** see if it will pick up (small) pieces of paper	accept repels another negative(ly charged)object accept attracts a positive(ly charged) object accept attracts or repels a charged object accept any correct way of showing an electrostatic effect i.e. bend a (slow moving) stream of water (from a tap) do **not** accept see if you get an electric shock on its own	1
2(b)(i)	plastic is an insulator stop them discharging **or** stop them being earthed	accept plastic is a poor conductor any mention of heat negates this mark accept keeps the charge on the person accept stop them being grounded do **not** accept so don't get an electric shock accept electricity cannot go to earth	1 1
2(b)(ii)	type of clothing could affect (build up of) charge/data	accept it is a variable/ factor (that needs to be controlled) do **not** accept fair test on its own	1
2(b)(iii)	there is a clear pattern **or** enough precision to tell difference (between the materials) **or** accept none of the results are within 0.1kV of the shock line or each other	accept there is a wide range of results	1

Question 2 continues on the next page . . .

PHY2H

Question 2 continued . . .

question	answers	extra information	mark
2(b)(iv)	any **two** from: • the material normally used has a value above the p.d likely to cause a shock • use a material that reduces pd (below 3.6 kV) • so people are less likely to be shocked • can put 'non-shock' seating in adverts • may sell more seats/ cars	accept use a material that reduces charge (on the person) accept so people will not feel a shock owtte	2
Total			**8**

PHY2H

Question 3

question	answers	extra information	mark
3(a)	gravity	accept weight do **not** accept mass accept gravitational pull	1
3(b)(i)	Initially force L greater than force M	accept there is a resultant force downwards	1
	(as speed increases) force M increases	accept the resultant force decreases	1
	when M = L, (speed is constant)	accept resultant force is 0 accept gravity/weighty for L accept drag/ upthrust/ resistance/friction for M do **not** accept air resistance for M but penalise only once	1
3(b)(ii)	terminal <u>velocity</u>		1
3(b)(iii)	0.15	accept an answer between 0.14 – 0.16 an answer of 0.1 gains no credit allow **1** mark for showing correct use of the graph	2
Total			**7**

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Question 4

question	answers	extra information	mark
4(a)(i)	210	allow **1** mark for correct substitution i.e. 35 × 6	2
	kg m/s **or** Ns	do **not** accept n for N accept 210 000g m/s for **3** marks	1
4(a)(ii)	840	if answer given is not 840 accept their (a)(i) in kg m/s ÷ 0.25 correctly calculated for both marks allow **1** mark for correct substitution i.e. 210 ÷ 0.25 or their (a)(i) ÷ 0.25	2
4(b)	increases the time to stop	accept increases impact time do **not** accept any references to slowing down time	1
	decreases rate of change in momentum	accept reduces acceleration/ deceleration reduces momentum is insufficient	1
	reduces the force (on the child)		1
4(c)	any **two** from: • insufficient range of tests/ thicknesses for required cfh	accept need data for thicknesses above 80 mm/ cfh 2.7m not enough tests is insufficient	2
	• (seems to be) some anomalous data		
	• *(*repeats) needed to improve reliability (of data)	accept data/ results are unreliable do **not** accept maybe systematic/ random error do **not** accept reference to precision	
	• need to test greater range/variety of dummies	accept children for dummies accept specific factor such as weight/height/size	

Question 4 continues on the next page . . .

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Question 4 continued . . .

question	answers	extra information	mark
4(d)	Tyres do not need to be dumped/ burned/ less land-fill/ saves on raw materials	accept less waste do **not** accept recycling on its own	1
Total			**11**

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Question 5

question	answers	extra information	mark
5(a)	47250	answers of 1350/ 33750/ 48600 gain **1** mark allow **1** mark for correct substitution using both 18 and 3	2
5(b)(i)	47250 or their (a)	accept statement 'same as the KE (lost)' ignore any units	1
5(b)(ii)	transformed into heat/ thermal energy	sound on its own is insufficient accept transferred/ lost/ for transformed do **not** accept any other form of energy included as a list	1
Total			**4**

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Question 6

question	answers	extra information	mark
6(a)(i)	0.0046	accept 4.6 mA allow **1** mark for correct substitution and transformation i.e. current = $\frac{230}{50\,000}$ an answer of 4.6 gains **1** mark	2
6(a)(ii)	• increases overall resistance • (in event of a shock) gives a smaller current	 accept gives smaller shock do **not** accept no shock/current	1 1
6(b)(i)	50 (hertz)	ignore units	1
6(b)(ii)	NO has the lowest current at which people cannot let go **or** YES changing the frequency changes the current by only a small amount	answer and reason needed accept a sensible reason in terms of their answer to (b) (i)	1

Question 6 continues on the next page . . .

PHY2H

Question 6 continued . . .

question	answers	extra information	mark
6(c)	a current flows through from the live wire/metal case to the earth wire	accept a current flows from live to earth do **not** accept on its own if the current is too high	1
	this current causes the fuse to melt	accept blow for melt	1
Total			**8**