Version 1.0: 21.07

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Physics 4451

PHY3H Unit 3 Physics

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.

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Question 1

question	answers	extra information	mark
1(a)(i)	secondary(coil) / output (coil)	do **not** accept just coil	1
1(a)(ii)	core (laminated soft) iron	do **not** accept for either mark it is made out of iron ore allow **1** mark for 'it is made out of iron core'	1 1
1(a)(iii)	magnetic field (which is) changing / alternating	accept magnetism / magnetic force direction (of field) changes / strength (of field) varies scoring second mark is dependent on first mark	1 1
1(b)	...step-up .... step-down ...	both in the correct order	1
1(c)	Do not build new houses .... Build new power lines away	 deduct **1** mark for any other(s) to a minimum total of (0)	1 1
Total			**8**

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Question 2

question	answers	extra information	mark
2(a)	C → B (1st two boxes) D → A (end two boxes)	allow **1** mark for either linkage in any position	1 1
2(b)	any **two** from: • more powerful / stronger magnet • smaller gap between coil and magnet • coil with more turns / longer coil • coil with bigger area	 do **not** accept just bigger magnet accept more coils do **not** accept just bigger coil do **not** accept just more wire do **not** accept shake faster do **not** accept shake for longer	2
2(c)(i)	the longer the torch is shaken, the longer the light lasts	accept the converse accept it is a (strong) positive (non-linear) relationship do **not** accept '.... are (directly) proportional ....'	1

Question 2 is continued on the next page . . .

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Question 2

question	answers	extra information	mark
2(c) (ii)	any **two** from: • if this investigation is repeated the result would not be the same • rate / amplitude / angle of shaking could vary • personal judgement when the LED / light has 'gone out' • results / data / measurements have not been repeated / averaged		2
Total			**7**

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Question 3

question	answers	extra information	mark
3(a)	the <u>normal</u>		1
3(b)	v		1
3(c)	any **one** from: • light has moved from glass to air / from air to glass • speed of light has changed • angle of incidence is less than the critical angle • change in density (of medium)	 accept light has changed medium beware of contradictions for this marking point eg light has moved from glass to air and slowed down gets zero **or** (angle) i < (angle) c **or** (angle) y is less than the critical angle eg glass is more (optically) dense than air	1

Question 3 continues on the next page . .

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Question 3 continued . . .

question	answers	extra information	mark
3(d)(i)	ratio of v to y does not give the same answer (in every case) **or** value of v doubles value of y does not double **or** increments for v are the same but increments for y are not the same	allow for **1** mark a calculation but no conclusion eg 30 → 60 19 → 35 (38)	2
3(d)(ii)	as (angle) v increases, angle y increases	accept as the angle of incidence increases, the angle of refraction increases **or** there is a (strong) positive(non-linear) relationship between the variables **or** ratio of sines is constant do **not** accept angle y is not directly proportional to angle v	1
3(d)(iii)	no evidence outside this range **or** when angle y is greater than the critical angle total internal reflection occurs	OWTTE	1
Total			**7**

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Question 4

question	answers	extra information	mark
4(a)(i)	the bigger the masses (of the dust and gases then) the bigger the force / gravity (between them)	accept the converse	1
4(a)(ii)	the greater the distance (between the dust and gases then) the smaller the force / gravity (between them)	accept the converse	1
4(b)	radiation 'pressure' and gravity / gravitational attraction these are balanced / in equilibrium **or** there is sufficient / a lot of hydrogen / fuel to last a very long time	 must be in correct context do **not** accept are equal second mark consequent on first	1 1
4(c)	any **two** from: • hydrogen runs out / is used up • nuclei larger than helium nuclei formed • (star expands to) / become(s) a red giant	 accept bigger atoms are formed however do **not** accept any specific mention of an atom with a mass greater than that of iron	2
Total			**6**

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Question 5

question	answers	extra information	mark
5(a)(i)	same frequency / period / pitch / wavelength	ignore references to amplitude	1
5(a)(ii)	differences in waveform / shape / quality	accept the diagrams are not identical	1
5(b)(i)	20 000 Hz / hertz **or** 20 kHz / kilohertz	in both cases, if the **symbol** rather than the name is used, it must be correct in every detail	1
5(b)(ii)	material(s) / substance(s) (through which sound travels)		1
5(b)(iii)	is absorbed is transmitted	accept (some) sound (energy) is transformed / transferred as heat / thermal energy accept is refracted accept changes speed accept changes velocity do **not** accept is diffracted do **not** accept is diffused do **not** accept is dissipated	1 1
Total			**6**

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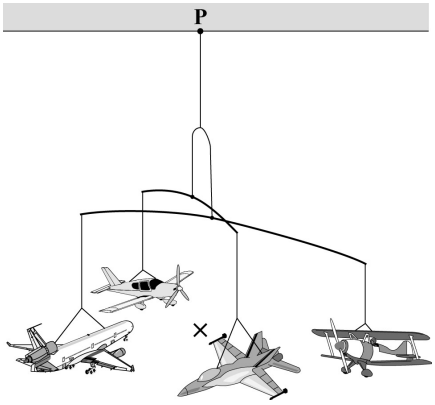
Question 6

question	answers	extra information	mark
6(a)(i)	centre of **X** directly below **P** and between the model aeroplanes	as judged by eye but between centre of propeller of top aeroplane and canopy of bottom aeroplane example  	1
6(a)(ii)	the centre of mass is (vertically) below the point of suspension / P		1
	the centre of mass is in the middle of the aeroplanes	accept the centre of mass is level with the aeroplanes	1

Question 6 continues on the next page . . .

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Question 6 continued . . .

question	answers	extra information	mark
6(b)	centre of mass of the worker and the ladder (and device)		1
	line of action of the weight is inside the base	accept the centre of mass is above / within / inside the base (of the ladder and device)	1
	so there will not be a (resultant) moment **or** it will (only) topple over if the line of action of the weight / the centre of mass is outside the base	accept so he / it / the ladder will not topple even if he leans over accept each point, either on the diagram or in the written explanation, but do **not** accept the point if there is any contradiction between them	1
Total			**6**

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Question 7

question	answers	extra information	mark
7(a)	any **two** from: • to (electrically) connect • stationary and moving parts • without tangling the wires	 accept to complete the circuit accept to allow a current / charge to flow	2
7(b)	current (induced) is reversed / changes in direction / alternates every half turn	accept (induced) p.d. <u>across</u> the coil do **not** accept p.d. <u>in</u> the coil	1 1
7(c)	by rotating / moving a magnetic field / magnet relative to a coil	accept by doing the converse / opposite	1
Total			**5**