General Certificate of Secondary Education

Physics 4451

PHY3H Unit Physics 3

Mark Scheme

2012 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 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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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 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	Neptune, Mars, Moon	1
2	Neptune, 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.

Quality of Written Communication and levels marking

In Question 8 students are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Students will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: Basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: Clear

- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: Detailed

- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

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Question 1

question	answers	extra information	mark
1(a)(i)	towards the centre of the circle	accept inwards accept a correct description 'along the string' is insufficient	1
1(a)(ii)	tension (in the string) **or** weight (on the end of the string)	accept pull of the string 'the string' is insufficient 'the student' is insufficient 'turning action' is insufficient	1
1(b)(i)	each may (also) affect the speed so only one independent variable	accept results for speed accept only one variable affects dependent variable 'fair test' is insufficient 'they are control variables' is insufficient	1 1
1(b)(ii)	continuous dependent	both required	1
1(b)(iii)	reduces (absolute) timing error (for one rotation) **or** increases / improves reliability / accuracy (for one rotation)	accept too fast to time one ignore checking for anomalous results to work out an average is insufficient	1
1(c)	speed increases with centripetal force	accept positive correlation do **not** accept proportional	1
1(d)(i)	gravitational pull (of the Earth)	accept gravity	1

Question 1 continues on the next page

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Question 1 continued

question	answers	extra information	mark
1(d)(ii)	**No** geostationary orbits once every 24 hours	both parts required – however this may have been subsumed within the reason accept a correct comparative description	1
Total			**9**

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Question 2

question	answers	extra information	mark
2(a)	method of suspending card through one hole	eg supported pin / nail through hole	1
	use of plumb line suspended from same point as card	term plumb line is not essential	1
	repeating for a second hole		1
		mark points can be scored from labelled diagram(s)	
		unlabelled diagram(s) alone score(s)a maximum of **1** mark	
2(b)	suspended card and plumb line from third hole and mark (new) line	accept repeat experiment using the third hole	1
	if accurate 3 lines cross at same point		1
	or		
	place card on finger (tip) (1)	accept alternatives eg pin	
		accept suspend card from point where lines cross	
	balances where lines cross (1)	accept 'centre of mass' for where lines cross	
		'card balances' is insufficient	
Total			**5**

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Question 3

question	answers	extra information	mark
3(a)(i)	same frequency / wavelength / amplitude / loudness	accept (time) period do **not** accept volume	1
3(a)(ii)	quality	accept timbre do **not** credit descriptions of wave shapes	1
3(b)(i)	amplitude	accept energy ignore volume	1
3(b)(ii)	sound reflected (from concert hall walls)	accept sound echoes (from concert hall walls) accept closer to speakers	1
3(c)(i)	(minimum) hearing level is above normal conversational level talking loudly increases sound level / loudness above (minimum) hearing level of person	 accept 58-60 dB inclusive for hearing level	1 1
3(c)(ii)	all crosses to be between 0 and 20 inclusive	minimum of two crosses	1
3(c)(iii)	can make an (informed) choice about listening to loud music using earbuds / accepting risk (to hearing) **or** more likely to take steps to reduce risk	 accept a sensible specific suggestion eg reduce volume on mp3 player / change type of earphone	1
Total			**8**

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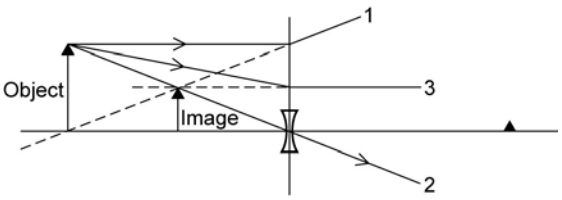
Question 4

question	answers	extra information	mark
4(a)	diverging	accept concave accept bi-concave accept double concave do **not** accept plano-concave	1
4(b)(i)	any **two** from: 1. ray parallel to principal axis from the top of the object, diverges through lens, traced back through **F** 2. ray passing through centre of lens 3. ray heading to focus on right of lens, diverges through lens parallel to principal axis, traced back parallel to principal axis arrow(s) showing correct direction  	if three rays or more are drawn apply the list rule this mark only scores if all rays drawn are shown refracted only required once but any contradictory arrows negate this mark ignore arrows on construction lines – construction lines may be solid	2 1
4(b)(ii)	0.5 or 1/2 **or** answer obtained from their correctly drawn diagram	to gain both marks there must be a correctly drawn diagram with or without image shown for an incorrect diagram allow **1** mark for the image clearly shown and the size measured accurately ignore any units	2

Question 4 continues on the next

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Question 4 continued

question	answers	extra information	mark
4(b)(iii)	image formed by the intersection of virtual / imaginary ray(s) (and real ray)	accept the image is on the same side (of the lens) as the object accept (real) rays do not cross do **not** accept answers in terms of image in front or behind lens do **not** credit answers in terms of cannot be projected onto screen	1
Total			**7**

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Question 5

question	answers	extra information	mark
5(a)(i)	step-up more turns on the secondary / output (coil)	both parts required do **not** accept coils for turns 'secondary output is greater than primary input' is insufficient	1
5(a)(ii)	(easily) magnetised (and demagnetised)	accept (it's) magnetic it's a conductor negates answer	1
5(b)	60	allow **1** mark for correct substitution ie $\frac{230}{15} = \frac{920}{N_s}$	2
Total			**4**

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Question 6

question	answers	extra information	mark
6(a)(i) E	current produces a magnetic field (around XY) (creating) a force (acting) on XY / wire / upwards	accept current (in XY) is perpendicular to the (permanent) magnetic field reference to Flemings left hand rule insufficient	1 1
6(a)(ii) G	motor (effect)		1
6(a)(iii) E	vibrate / move up and down 5 times a second	 only scores if first mark point scores allow for **1** mark only an answer 'changes direction 5 times a second'	1 1
6(b) E	0.005	 allow **1** mark for calculating moment of the weight as 0.04 (Ncm) and allow **1** mark for correctly stating principle of moments **or** allow **2** marks for correct substitution ie F x 8 = 2 x 0.02 **or** F x 8 = 0.04	3
Total			**8**

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Question 7

question	answers	extra information	mark
7(a) E	runs out of hydrogen (in its core)	accept nuclear fusion slows down do **not** accept fuel for hydrogen do **not** accept nuclear fusion stops ignore reference to radiation pressure / unbalanced forces	1
7(b) E	temperature decreases / (relative) luminosity increases as it changes to a red giant temperature increases / (relative) luminosity decreases as it changes to a white dwarf correct change in temperature **and** (relative) luminosity as Sun changes to a red giant and then to a white dwarf	if both temperature and luminosity are given both must be correct if both temperature and luminosity are given both must be correct an answer changes to a red giant and then white dwarf with no mention or an incorrect mention of temperature or (relative) luminosity change gains **1** mark only if no other marks awarded ignore correct or incorrect stages given beyond white dwarf	1 1 1
Total			**4**

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