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General Certificate of Secondary Education

Physics 4451

PHY3H Unit Physics 3

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)	aluminium cannot be magnetised	accept aluminium is not magnetic "it" refers to aluminium do **not** accept aluminium is not easily magnetised reference to conduction and aluminium negates mark iron can be magnetised is insufficient	1
1(b)(i)	10 to 50	either order	1
1(b)(ii)	(data is) anomalous	accept does **not** fit the pattern it is an error is insufficient	1
1(b)(iii)	21	accept 22 do **not** accept any fraction of a turn ie 20.1	1
	secondary p.d. (just) larger than primary p.d. **or** there must be more turns on the secondary coil than primary coil	accept output (just) larger than input/2V do **not** accept coil for turns	1
1(c)	to reduce/step-down the (input) p.d./voltage	mains p.d. is too high is insufficient step-down transformer is insufficient answers in terms of changing/ stepping-up current **or** fuse blowing **or** not working with 230 volts are insufficient any mention of step-up negates mark stepping down both voltage/p.d. **and** current negates mark	1
Total			**6**

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Question 2

question	answers	extra information	mark
2(a)(i)	ellipse/elliptical	accept oval/ovoid egg shape is insufficient	1
2(a)(ii)	gravitational attraction (between the Sun and the planet)	allow (force of) gravity allow force due to mass of the planet **and** mass of the Sun the Sun is insufficient do **not** accept references to weight	1
2(a)(iii)	arrow drawn from planet pointing towards the Sun		1
2(a)(iv)	any **two** from: • mass of the planet • distance between the planet and Sun • mass of the Sun • speed of planet	 size of the planet insufficient do **not** accept references to weight accept radius of orbit size of Sun insufficient	2
2(b)(i)	YES equal/close to the actual/true distances	no mark for this, mark is for reason does not score if NO is chosen accept (calculated) data is (generally) accurate	1

Question 2 continues on the next page . . .

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Question 2 continued . . .

question	answers	extra information	mark
2(b)(ii)	Ceres/discovery agrees/supports prediction **or** Ceres in predicted position accept Bode's Law **or** (now) think it's important	"it" refers to Ceres/discovery	1 1
2(b)(iii)	idea of new evidence not supporting/being in agreement with existing law	accept the idea of needing to modify the law to take account of the new data do **not** accept the universe is expanding so (Bode's) data is invalid answers in terms of new technology are insufficient answers in terms of making the law better/more reliable are insufficient	1
Total			**9**

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Question 3

question	answers	extra information	mark
3(a)		accept throughout wire/turns for coil provided the meaning is clear	
	magnetic field (lines) cut by coil	magnet cuts the coil is insufficient	1
		current induced in coil is insufficient	
	p.d. induced across (ends of)/in coil		1
	coil is part of a complete circuit		1
3(b)	it is not moving		1
	p.d. is zero **or** magnetic field lines not being cut (by coil)	reason only scores if first marking point awarded	1
3(c)(i)	smallest change (in value) instrument can measure	accept smallest vibration that can be detected do **not** accept it is the smallest value that can be measured	1
3(c)(ii)	any **two** from:		2
	• stronger/more powerful magnet	accept (use a) heavier magnet bigger magnet is insufficient	
	• more turns (on the coil) **or** turns (of coil) pushed closer together	bigger coil is insufficient do **not** accept more coils of wire	
	• less stiff spring	accept weaker spring do **not** accept smaller/looser spring	
Total			**8**

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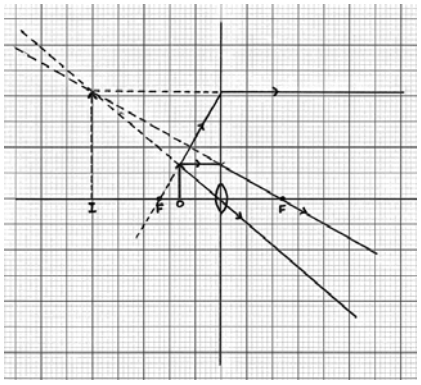
Question 4

question	answers	extra information	mark
4(a)(i)	**two** correct rays drawn • ray parallel to axis from top of object **and** refracted through focus **and** traced back beyond object • ray through centre of lens **and** traced back beyond object • ray joining top of object to focus on left of lens taken to the lens refracted parallel to axis **and** traced back parallel to axis beyond object an arrow showing the position **and** correct orientation of the image for their rays	**1** mark for each correct ray  to gain this mark, the arrow must go from the intersection of the traced-back rays to the axis **and** the image must be on the same side of the lens as the object and above the axis	2 1
4(a)(ii)	(x) 3.0 **or** $\frac{\text{their image height}}{\text{object height}}$ correctly calculated	accept 3.0 to 3.5 inclusive allow **1** mark for correct substitution into equation using their figures ignore any units	2
4(b)	any **two** from: in a camera the image is: • real not virtual • inverted and not upright • diminished and not magnified	 both parts of each marking point are required accept upside down for inverted accept smaller and bigger accept converse answers but it must be clear the direction of the comparison	2
Total			**7**

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Question 5

question	answers	extra information	mark
5(a)(i)	3		1
5(a)(ii)	30 000 **or** 10 000 × their (a)(i) correctly calculated		1
5(a)(iii)	any **two** from: • frequency is above 20 000 (Hz) • frequency is above the upper limit of audible range • upper limit of audible range equals 20 000 (Hz) • it is ultrasound/ultrasonic	 accept the frequency is 30 000 ignore reference to lower limit 	2
5(b)(i)	wave (partially) reflected at crack to produce **A** and end of bolt to produce **B**	 accept at both ends of the crack	1 1
5(b)(ii)	0.075 (m)	allow **2** marks for time = 0.0000125 allow **1** mark for time = 0.000025 answers 0.15 **or** 0.015 **or** 0.09 gain **2** marks answers 0.18 **or** 0.03 gain **1** mark the unit is not required but if given must be consistent with numerical answer for the available marks	3
Total			**9**

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Question 6

question	answers	extra information	mark
6(a)	960 (Nm)		1
	see-saw is in equilibrium	accept see-saw is balanced see-saw is stationary is insufficient	1
	(total) clockwise moments = anticlockwise moment	accept no resultant moment forces are balanced is insufficient an answer clockwise moments balance the anticlockwise moments gains **2** marks	1
6(b)(i)	600 (Nm)		1
6(b)(ii)	375 (N) **or** their (b)(i) ÷ 1.6 correctly calculated	do **not** credit if (b)(i) is larger than 960 allow **1** mark for correct substitution **and** transformation ie $\frac{600}{1.6}$ **or** $\frac{\text{their (b)(i)}}{1.6}$	2
Total			**6**

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