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General Certificate of Secondary Education

Science B 4462 / Physics 4451

PHY1H Unit Physics 1

Mark Scheme

2011 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 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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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 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)	higher frequency **or** shorter wavelength **or** greater energy	general properties / uses are neutral do **not** accept different frequency / wavelength / energy	1
1(b)	the same (speed)	accept they travel at the speed of light	1
1(c)	pass through / transmitted by the plastic / casing <u>reflected</u> by the metal / plates	 do **not** accept bounce / deflected etc for reflected if neither marking point scores an answer reflected (back to boat / from the device) scores **1** mark	1 1
1(d)(i)	waves are not <u>reflected</u> from the walls **or** only waves (reflected) from the device are detected	accept microwaves / radar for waves do **not** accept bounce / deflected etc for reflected accept to stop reflected waves affecting results	1

Question 1 continues on the next page . . .

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Question 1 continued . . .

question	answers	extra information	mark
1(d)(ii)	different types (of device) can be compared	fair test is insufficient accept idea that only one variable is then changed	1
1(d)(iii)	so (measurements / results / scientists) are not biased towards one type / manufacturer of device/s	accept to avoid bias accept so they are not biased	1
1(e)(i)	any **two** from: • (for any angle) **A** values < **B** values • **A** values increase with (increasing) angle • **B** values decrease with (increasing) angle • **A** values do not vary as much (as **B** values)	if temperature is mentioned rather than angle a maximum of **1** mark can be scored **or** converse eg **B** values are higher / better / stronger accept weakest at 0^o strongest at 15^o values go up is insufficient accept strongest at 0^o weakest at 15^o values go down is insufficient	2
1(e)(ii)	**D** values are always over 2(.0)	mark is for the reason reason cannot score if **D** is not chosen	1
Total			**10**

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Question 2

question	answers	extra information	mark
2(a)	frequency / pitch decreases	accept wavelength increases accept it / the note becomes deeper / lower it / the note decreases is insufficient quieter is neutral	1
2(b)(i)	Models can help to explain an effect or theory.		1
2(b)(ii)	(moving) loudspeaker represents the (moving) galaxy the decrease in frequency of the sound is like red-shift	accept sound waves represent light waves accept increase in frequency is like blue-shift accept answers in terms of wavelength change accept sound going away from you is like red-shift accept red-shift happens when galaxies / stars move away (from Earth) this accept only scores if first marking point scores	1 1
2(c)	big bang		1
Total			**5**

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Question 3

question	answers	extra information	mark
3(a)		marks are awarded only for the reason but must match the ringed answer for both marks a **MAYBE** answer should include a **YES** and **NO** response answers in terms of the sources being renewable or non-renewable are insufficient	2
	any **two** from: **YES** answers may include:		
	• wind produces no pollutant gases	accept wind burns no fuel accept CO_2 / SO_2 / oxides of nitrogen / greenhouse gas for pollutant gases	
	• nuclear produces no pollutant gases	accept nuclear burns no fuel	
	• (burning) gas does not produce SO_2	accept gas does not cause acid rain do **not** accept they don't / none produce pollutant gases	
	NO answers may include: • nuclear produces <u>radioactive</u> waste		
	• (burning) gas produces CO_2 / pollutant gases / air pollution	accept contributes to global warming / greenhouse effect	

Question 3 continues on the next page . . .

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Question 3 continued . . .

question	answers	extra information	mark
3(b)	nuclear power stations use a non-renewable fuel	accept uranium / plutonium is non-renewable do **not** accept some are unrenewable	1
Total			**3**

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Question 4

question	answers	extra information	mark
4(a)(i)	kinetic	accept KE do **not** accept movement	1
4(a)(ii)	0.75 **or** 75 %	allow **1** mark for correct substitution ie $\frac{60\,000}{80\,000}$ an answer 0.75 % **or** 0.75 with a unit gains **1** mark only an answer 75 with or without a unit gains **1** mark only	2
4(b)	any **one** from: • large areas of land are flooded • peoples homes may be destroyed • habitat (of animals and plants) lost / damaged	 uses large areas of land / takes up large areas of land is insufficient construct is neutral very noisy is neutral	1

Question 4 continues on the next page . . .

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Question 4 continued . . .

question	answers	extra information	mark
4(c)(i)	system of cables <u>and</u> transformers	both required for the mark accept power lines / wires for cables ignore reference to pylons inclusions of power stations / consumers negates answer	1
4(c)(ii)	less energy loss / wasted (in the cables) as the cables are shorter	accept heat for energy do **not** accept no energy loss do **not** accept electricity for energy	1 1
Total			**7**

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Question 5

question	answers	extra information	mark
5(a)(i)	conduction		1
5(a)(ii)	free / mobile electrons gain (kinetic) energy free electrons collide with other (free) electrons / ions / atoms / particles	accept free / mobile electrons move faster an answer in terms of atoms / particles gaining (kinetic) energy (and) colliding with / vibrating and passing energy to other atoms / particles gains **1** mark only answers in terms of heat particles negate	1 1
5(a)(iii)	convection		1
5(b)(i)	**A** and **C** **or** **B** and **D** only one (independent) variable **or** different shapes but the same colour	this mark only scores if a correct pair is chosen **and** a correct reason given both required and none other both required and none other accept only the shape changes	1

Question 5 continues on the next page . . .

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Question 5 continued . . .

question	answers	extra information	mark
5(b)(ii)	**B** radiates heat faster **or** **B** is a better emitter (of heat) but **B** has a smaller (surface) area **or** **B** has a smaller (surface) area: volume ratio	converse answer in terms of **A** gains full marks allow **2** marks for both lose the same quantity / amount of heat in the same time **or** both have same rate of heat loss allow **1** mark for both lose the same quantity / amount of heat	1 1
5(b)(iii)	any **one** from: • transfer a lot of heat (too rapidly) • water temperature drops too rapidly • water too cold for the next radiator	accept (significantly) more heat will be lost from the first radiator mention of absorption of heat negates mark	1
Total			**8**

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Question 6

question	answers	extra information	mark
6(a)	total saving shown for each method ie: cavity wall £325 jacket £163 central heating £90	allow **1** mark for one correctly calculated value **or** allow **1** mark for showing energy bill savings for each method over 5 years ie: cavity wall £575 jacket £175 central heating £400 there are no marks for calculation of payback time	2
6(b)	energy cannot be destroyed	accept energy is conserved ignore reference to created	1
6(c)	4 (hours)	allow **1** mark for obtaining number of kWh = 10 **or** energy transferred = 10	2
Total			**5**

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Question 7

question	answers	extra information	mark
7(a)	beta		1
	alpha: would not pass through (the aluminium / foil)		1
	gamma: no change in count rate when thickness changes	must be a connection between detection / count rate / passing through and change in thickness	1
7(b)	foil thickness increases then decreases (then back to normal / correct thickness)	a description of count rate changes is insufficient	1
	gap between rollers decreases, then increases (then back to correct size) **or** pressure from rollers increases then decreases	accept tightness for pressure answers may link change in thickness and gap width for full credit ie: foil thickness increases so gap between rollers decreases (1) foil thickness decreases so gap between rollers increases (1)	1

Question 7 continues on the next page . . .

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Question 7 continued . . .

question	answers	extra information	mark
7(c)	56 (years)	accept any value between 55-57 inclusive allow **1** mark for correct calculation of mass remaining as 1.5 (micrograms) allow **1** mark for a mass of 4.5 micrograms plus correct use of graph with an answer of 12 maximum of **1** compensation mark can be awarded	2
Total			**7**