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General Certificate of Secondary Education

Science B 4462/ Physics 4451

PHY1H Unit Physics 1

Mark Scheme

2010 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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Registered address: AQA, Devas Street, Manchester M15 6EX *Dr Michael Cresswell Director General*

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)	radiation		1
1(a)(ii)	traps (small pockets of) air	do **not** accept it's an insulator do **not** accept reduces conduction and / or convection do **not** allow it doesn't allow heat to escape	1
1(b)(i)	bigger temperature difference (between the water and surroundings) at the start (than at the end)	do **not** accept water is hotter	1
1(b)(ii)	starting temperature (of the water)	accept thickness of fleece do **not** accept same amount of fleece do **not** accept thermometer / can do **not** accept time is the same	1
1(b)(iii)	18 (°C)	correct answer only	1
1(b)(iv)	**M** smallest temperature drop (after 20 mins)	 cannot score if **M** is not chosen accept it's the best insulator accept smallest loss in heat accept keeps heat / warmth in for longer	1 1
Total			**7**

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Question 2

question	answers	extra information	mark
2(a)(i)	kinetic	do **not** accept movement	1
2(a)(ii)	thermal sound	accept heat for thermal do **not** accept noise for sound both answers required in either order	1
2(b)	transferred to surroundings / surrounding molecules / atmosphere **or** becomes dissipated / spread out	'it escapes' is insufficient accept warms the surroundings accept degraded / diluted accept a correct description for surroundings eg to the washing machine do **not** accept transformed into heat on its own	1
2(c)	a smaller <u>proportion / percentage</u> of the energy supplied is wasted	owtte accept a statement such as 'less energy is wasted' for **1** mark do **not** accept costs less to run ignore references to uses less energy	2
2(d)(i)	2.4 (p)	accept 2 p if it is clear from the working out this is rounded from 2.4 p allow **1** mark for correct substitution of correct values ie 0.2 × 12 allow **1** mark for calculating cost at 40 °C (13.2 p) **or** cost at 30 °C (10.8 p)	2

Question 2 continues on the next page . . .

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Question 2 continued . . .

question	answers	extra information	mark
2(d)(ii)	any **one** from: • less electricity needed • fewer power stations needed • less fuel is <u>burned</u>	ignore answers in terms of the washing machine releasing less energy an answer in terms of the washing machine releasing CO_2 negates the mark do **not** accept less energy is produced accept a correctly named fuel do **not** accept less fuel is needed	1
Total			**8**

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Question 3

question	answers	extra information	mark
3(a)(i)	microwaves		1
3(a)(ii)	can pass through the ionosphere	accept travels in a straight line accept atmosphere for ionosphere do **not** accept air for ionosphere	1
3(b)	any **two** from: • analogue is continuously varying • digital has only discrete values • digital is less prone to interference (than analogue) • digital can be processed more easily (than analogue) by a computer	 do **not** accept analogue has many values accept digital is on or off accept digital is 1 or 0 accept digital is binary accept digital is easier to restore	2
3(c)	higher the frequency, further the wave travels (into the atmosphere before reflection)		1
3(d)	15 000	allow **1** mark for correct transformation and substitution ie $\frac{300\,000\,000}{20}$ an answer of 15 000 000 only gains **1** mark allow both marks for an answer of 15 MHz (unit must be changed) an answer of 15 gains no credit	2
Total			**7**

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Question 4

question	answers	extra information	mark
4(a)(i)	alpha (particle)		1
4(a)(ii)	(unstable) nucleus	accept (unstable) nuclei do **not** accept middle do **not** accept helium nucleus	1
4(a)(iii)	same number of protons	accept same number of electrons accept same atomic / proton number accept they both have 92 protons same number of neutrons negates answer	1
4(b)(i)	4500 million years	do **not** accept 4500 years	1
4(b)(ii)	curve starting at 100 000 with a correct general shape passing through (4500, 50 000) and (9000, 25 000)	 allow **1** mark for points plotted **or** line passing through (4500, 50 000) and (9000, 25 000)	1 1
Total			**6**

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Question 5

question	answers	extra information	mark
5(a)(i)	(dismantle and) remove radioactive waste / materials / fuels	accept nuclear for radioactive do **not** accept knock down / shut down	1
5(a)(ii)	increases it	do **not** accept it has a negative effect	1
5(b)(i)		if efficiency is not mentioned it must be implied answers in terms of energy generated only gains no credit	
	K most efficient **or** **M** least efficient	accept **K** and / or **L** are more efficient than **M**	1
	(efficiency) of **K** and **L** increases, (efficiency) of **M** (almost) constant / slightly reduced	all 3 power stations must be mentioned to get this mark	1
5(b)(ii)	any **two** from: • do not know how many (nuclear) power stations there will be • power stations may continue to increase in efficiency • do not know what type of power station new ones will be • do not know future energy / electricity demands • may be new uses for uranium	accept new methods may be found to generate electricity / energy accept other ways of generating energy may be expanded accept we may become more energy efficient	2
Total			**6**

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Question 6

question	answers	extra information	mark
6(a)(i)	Universe began at a (very) small (initial) point	'it' refers to Universe	1
	'explosion' sent matter outwards **or** 'explosion' causing Universe to expand	accept gas / dust for matter accept rapid expansion for explosion	1
6(a)(ii)	light shows a red shift	owtte the term red shift on its own does not score a mark	1
	galaxies moving away (from the Earth)	'it' refers to light 'they' refers to galaxies accept star for galaxy do **not** accept planet for galaxy	1
6(b)	check reliability / validity of data	accept check data accept collect more data	1
	amend theory **or** discount the data	accept replace old theory with new theory	1
6(c)	answer involves (religious) belief **or** no / insufficient evidence	accept it cannot be tested	1
Total			**7**

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Question 7

question	answers	extra information	mark
7(a)(i)	0.75	allow **1** mark for correct transformation and substitution ie 0.15 × 5	2
7(a)(ii)	2	accept 1.5 ÷ their (a)(i) correctly calculated	1
7(b)	any **one** from: • seasonal <u>changes</u> • cloud cover	accept specific <u>changes</u> in conditions eg shorter hours of daylight in winter accept idea of <u>change</u> must be stated or unambiguously implied eg demand for water will not (always) match supply of solar energy do **not** accept figures are average on its own do **not** accept solar panels are in the shade	1
Total			**4**