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General Certificate of Secondary Education

Science B 4462 / Physics 4451

PHY1F Unit Physics 1

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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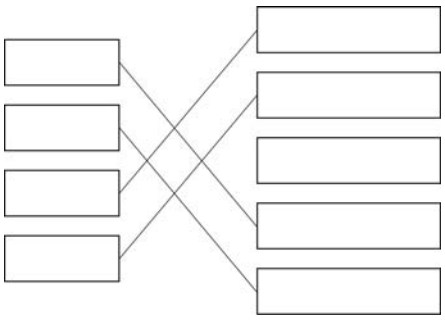
Question 1

question	answers	extra information	mark
1(a) G	all 4 lines correct 	allow **1** mark for each correct line if 2 or more lines are drawn from any box in **List A** then all those lines are incorrect	4
1(b)(i) A	The distance between the UV lamp and the bacteria.		1
1(b)(ii) E	longer the exposure / time smaller % living	accept number for % accept longer the exposure / time larger % / number killed allow negative correlation do **not** accept inversely proportional	1
1(b)(iii) E	only 1 type of bacteria tested **or** not tested all types of bacteria	accept some bacteria not affected by UV only one set of data / results is insufficient did not repeat experiment is insufficient not enough evidence to support conclusion is insufficient	1
Total			**7**

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Question 2

question	answers	extra information	mark
2(a)(i) G	TV		1
2(a)(ii) G	hairdryer and sandwich toaster	both required either order but no others	1
2(b)(i) E Clip with 2(b)(ii)	1.2	allow **1** mark for correct substitution ie 0.4 × 3 provided that no subsequent step is shown	2
2(b)(ii) E Clip with 2(b)(i)	18 **or** their (b)(i) × 15 correctly calculated	accept £0.18 for both marks an answer 0.18 scores **1** mark allow **1** mark for correct substitution ie 1.2 or their (b)(i) × 15 provided that no subsequent step is shown	2
2(c)(i) G	precise	accept any correct indication	1

Question 2 continues on the next page . . .

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Question 2 continued . . .

question	answers	extra information	mark
2(c)(ii) E	any **two** from: • less electricity needs to be generated • less fuels needed • less air / atmospheric pollution • (non-renewable) energy sources last longer • slows global warming / greenhouse effect	 accept a named fuel used in any type of power station accept named pollutant eg CO_2 accept reduces carbon / carbon dioxide emissions accept reduces radioactive waste accept running out of fossil fuels / a named fossil fuel do **not** accept stops global warming environmentally friendly is insufficient less pollution is insufficient	2
Total			**9**

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Question 3

question	answers	extra information	mark
3(a)(i) E	any **one** from: • produces no (air / atmospheric) pollution • energy (source) is free	 accept named pollutant eg CO_2 accept no harmful gases accept produces no emissions accept does not add to global warming environmentally friendly is insufficient accept no fuel costs accept the wind / it is free	1
3(a)(ii) E	any **one** from: • waves • tides • <u>falling</u> water • solar • geothermal • biofuel / biomass	 accept hydroelectric do **not** accept water (flow) accept Sun / sunlight accept solar panels / cells accept a named biofuel	1
3(b)(i) G	3000 (kilowatts)	accept 3 <u>megawatts / MW</u> accept 3 000 000 <u>watts / W</u>	1

Question 3 continues on the next page . . .

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Question 3 continued . . .

question	answers	extra information	mark
3(b)(ii) E	(average) wind speed below 6 m/s	answers giving a wind speed greater than 3 but less than 6 m/s gain both marks allow **1** mark for calculating the output as 500 kW (maximum) and allow **1** mark for wind speed too low or wind not strong enough do **not** accept wind above 25 m/s do **not** accept the turbines are frozen	2
3(b)(iii) A	A small amount of nuclear fuel generates a large amount of electricity. Nuclear power stations do not depend on the weather to generate electricity.	both required	1
Total			**6**

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Question 4

question	answers	extra information	mark
4(a) G	nucleus	do **not** accept core / centre / middle	1
4(b) E	radiation damages our cells	accept radiation is dangerous / poisonous / harmful / toxic accept radiation can cause cancer / kills cells / change DNA / cause mutations / harm health accept so precautions can be taken accept so they know they may be exposed to / harmed by radiation it refers to radiation (source) to stop people being harmed is insufficient	1
4(c) A	**C**		1
4(d) E	gamma gamma will pass through the <u>lead</u> **or** alpha <u>and</u> beta will not pass through <u>lead</u>	 reason only scores if gamma chosen accept correct symbols for alpha, beta and gamma	1 1

Question 4 continues on the next page . . .

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Question 4 continued . . .

question	answers	extra information	mark
4(e)(i) E	range of alpha too short **or** alpha absorbed whether box is full or empty	accept alpha would not reach detector accept alpha (always) absorbed by box / card accept alpha will not pass through the box / card alphas cannot pass through objects / solids is insufficient alpha not strong enough is insufficient	1
4(e)(ii) E	**M** less radiation / beta (particles) absorbed **or** more radiation absorbed by full boxes	 reason only scores if **M** chosen accept more radiation / beta particles pass through accept reading is higher	1 1
Total			**8**

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Question 5

question	answers	extra information	mark
5(a)(i) G	conduction		1
5(a)(ii) E	atoms gain (kinetic) energy **or** atoms vibrate with a bigger amplitude **or** atoms collide with neighbouring atoms	accept particles / molecules for atoms do **not** accept electrons for atoms accept vibrate faster / more do **not** accept start to vibrate	1
	transferring energy to (neighbouring / other) atoms **or** making these other atoms vibrate with a bigger amplitude	do **not** accept heat for energy accept faster / more for bigger amplitude mention of (free) electrons moving and passing on energy negates this mark	1
5(b)(i) G	5 (^{o}C) to 25 (^{o}C)	either order	1
5(b)(ii) E	a correct example of doubling temperature difference doubling heat transfer eg going from 5 to 10 (^{o}C) difference doubles heat transfer from 30 to 60 (J/s)	 accept for heat transfer number of joules / it allow **1** mark for correctly reading 1 set of data eg at 5 ^{o}C the heat transfer is 30 **or** for every 5^{o}C increase in temperature difference heat transfer increases by 30 (J/s) no credit for stating they are directly proportional	2

Question 5 continues on the next page . . .

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Question 5 continued . . .

question	answers	extra information	mark
5(b)(iii) E	1800	allow **1** mark for obtaining heat transfer value = 120	2
5(c) E	payback time calculated as 33 years this is greater than lifetime of windows **or** total savings (over 30 years) = £4800 (1) this is less than cost of windows (1) **or** $\frac{5280}{30}$ = 176 (1) this is more than the yearly savings (1)	calculations must be correct to score the first mark point explanations must relate to it not being cost effective	1 1
Total			**10**

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Question 6

question	answers	extra information	mark
6(a) E	**Y** shows Universe expanding from a (very small) point	accept cannot be **X** as size is increasing this scores if **Y** or **Z** is chosen accept exploding outwards this only scores if **Y** is chosen accept from zero (size) answers in terms of planets negate the last two mark points	1 1 1
6(b)(i) A	both the 'big bang' and 'steady state' theories		1
6(b)(ii) E	(new) evidence that supports / disproves a theory **or** (new) evidence not supported by current theory	accept proves for supports accept there may be more evidence supporting one (theory) than the other (theory) accept new evidence specific to this question eg measurement of CBR **or** some types of star only found in distant parts of Universe (steady state suggests should be same throughout Universe)	1
Total			**5**

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