



General Certificate of Secondary Education

Science B 4462 / Physics 4451

PHY1H 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)(i) G	conduction		1
1(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
1(b)(i) G	5 (°C) to 25 (°C)	either order	1
1(b)(ii) E	a correct example of doubling temperature difference doubling heat transfer eg going from 5 to 10 (°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°C the heat transfer is 30 or for every 5°C increase in temperature difference heat transfer increases by 30 (J/s) no credit for stating they are directly proportional	2

Question 1 continues on the next page . . .

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Question 1 continued . . .

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

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Question 2

question	answers	extra information	mark
2(a) E	Y	accept cannot be X as size is increasing	1
	shows Universe expanding	this scores if Y or Z is chosen accept exploding outwards	1
	from a (very small) point	this only scores if Y is chosen accept from zero (size) answers in terms of planets negate the last two mark points	1
2(b)(i) A	both the 'big bang' and 'steady state' theories		1
2(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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Question 3

question	answers	extra information	mark
3(a)(i) G	food processor hairdryer	both required and no other either order	1
3(a)(ii) G	TV Table lamp Food processor	all required and no other any order	1
3(b) E	any two from: <ul style="list-style-type: none"> • transfers / requires / uses more energy / power • more electricity needs to be generated • more (fossil) fuels (likely) to be burnt 	accept more electricity used accept higher power accept a named fossil fuel	2
3(c)(i) G	precise	this answer only	1
3(c)(ii) E	any three from: <ul style="list-style-type: none"> • can look for trends / patterns • help reduce energy use / consumption • reduce bills • identify appliances which use a lot of energy • replace appliances with more efficient ones • see effect of leaving appliances on (standby) 	accept save money to monitor usage is insufficient answers in terms of environment are insufficient	3
Total			8

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Question 4

question	answers	extra information	mark
<p>4(a) E</p>	<p>any two from:</p> <ul style="list-style-type: none"> • travel at the same speed (through a vacuum) • can travel through a vacuum / space • transfer energy • can be reflected • can be refracted • can be diffracted • can be absorbed • transverse • travel in straight lines 	<p>if a value is given it must be correct accept air for vacuum accept travel at the speed of light</p> <p>do not accept air for vacuum</p> <p>accept any other property common to electromagnetic waves</p> <p>accept travel at the same speed through a vacuum for both marks</p> <p>both radiated from the Sun is insufficient</p>	<p>2</p>
<p>4(b) E</p>	<p>0.19 (0)</p>	<p>accept any answer that rounds to 0.19 accept 0.2 for all 3 marks provided working is shown 0.2 without working gains 2 marks allow 2 marks for a correct substitution and transformation using frequency in hertz ie wavelength = $\frac{300\,000\,000}{1575\,000\,000}$ or allow 1 mark for changing MHz to Hz allow 1 mark for correct substitution using 1575 or incorrectly converted frequency answers 190476 and 190000 gain 2 marks</p>	<p>3</p>

Question 4 continues on the next page . . .

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question	answers	extra information	mark
4(c) E	create an alternating current with the same frequency (as the microwaves / signals / 1575(MHz))	ignore reference to change in temperature	1
Total			6

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Question 5

question	answers	extra information	mark
5(a) E	9	<p>allow 2 marks for power =1400 (kW) if a subsequent calculation is shown award 1 mark only</p> <p>or</p> <p>allow 1 mark for correct substitution and transformation</p> $\text{power} = \frac{5600}{4}$ <p>allow 1 mark for using a clearly incorrect value for power to read a corresponding correct value from the graph</p>	3
5(b)(i) E	system of cables <u>and</u> transformers	both required for the mark ignore reference to pylons inclusion of power stations / consumers negates the mark wire(s) is insufficient	1
5(b)(ii) E	<p>(uses step-up transformer to) increase pd / voltage</p> <p>or</p> <p>(uses step-up transformer to) reduce current</p>	<p>accept (transfers energy / electricity at) high voltage</p> <p>accept (transfers energy / electricity at) low current</p> <p>ignore correct references to step-down transformers</p>	1

Question 5 continues on the next page . . .

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Question 5 continued . . .

question	answers	extra information	mark
<p>5(c) E</p>	<p>build a power station that uses a non-renewable fuel or biofuel</p> <p>or</p> <p>buy (lots of) petrol / diesel generators</p> <p>stockpile supplies of the fuel</p> <p>or</p> <p>fuel provides a reliable source of energy</p>	<p>accept a named fuel eg coal or wood</p> <p>accept fuel does not rely on the weather</p> <p>accept as an alternative answer idea of linking with the National Grid (1) and taking power from that when demand exceeds supply (1)</p> <p>or</p> <p>when other methods fail</p> <p>or</p> <p>when it is needed</p> <p>answers in terms of using other forms of renewables is insufficient</p>	<p>1</p> <p>1</p>
<p>Total</p>			<p>7</p>

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Question 6

question	answers	extra information	mark
6(a) E	B E G	all 3 required and no other any order	1
	same number of / 88 protons (and different numbers of neutrons)	same number of electrons is insufficient	1
6(b)(i) E	222		1
	86		1
6(b)(ii) E	4800	allow 1 mark for obtaining 3 half-lives	2
6(c) E	ethical		1
	deceived / lied to (about safety of working conditions)	accept (women) not warned of the dangers	1
	or value own / scientists lives more than women	given no protection is insufficient	
	or did not treat women humanely		

Question 6 continues on the next page . . .

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Question 6 continued . . .

question	answers	extra information	mark
6(d) E	<p>accept any sensible suggestion eg too many interests in continued use of radium</p> <p>evidence may cause public unrest</p> <p>doctors not want to be blamed for illnesses (caused by radium)</p> <p>doctors thought (possible) benefits outweighed (possible) risks</p>	<p>do not accept not enough evidence</p> <p>accept doctors not wanting to be sued (for harm caused by using radium)</p> <p>do not accept did not know radium could be harmful</p> <p>believe radium could treat illnesses is insufficient</p>	1
Total			9

UMS Conversion Calculator

<http://web.aqa.org.uk/UMS/index.php>