



General Certificate of Secondary Education

Science B 4462 / Physics 4451

PHY1H Unit Physics 1

Mark Scheme

2007 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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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 / ; e.g. 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.

3.8 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

Question 1

question	answers	extra information	mark
(a)(i)	as a source of thermal <u>radiation</u>	accept heat for thermal radiation accept to act as the Sun do not accept sunlight alone	1
(ii)	any one from: <ul style="list-style-type: none"> • volume of water • distance between lamp and boiling tube • initial / starting temperature of water • same room temperature 	accept amount for volume do not accept time or same insulation material	1
(iii)	any one from: <ul style="list-style-type: none"> • greater sensitivity / precision • could link to a computer for (automatic) data analysis • could take more frequent readings • reduces instrument reading error 	do not accept more reliable (negates mark) accept more accurate do not accept easier to use on its own	1
(b)(i)	acts as a control	accept to be able to make a comparison accept to see the difference do not accept 'to make it a fair test' OWTTE on its own	1
(ii)	(plastic) <u>foam</u> and aluminium foil		1

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question	answers	extra information	mark
(iii)	(aluminium) <u>foil</u> is a <u>poor</u> absorber of thermal radiation or (aluminium) <u>foil</u> is a (good) reflector of thermal radiation (plastic) <u>foam</u> traps air which is a (good) insulator	accept heat / infra red for thermal radiation do not accept 'reflects sunlight' on its own accept (plastic) foam is a poor conductor / (good) insulator do not accept 'the material' is a good insulator / poor conductor	1 1
(c)	particles vibrate with a bigger / stronger amplitude / faster / with more (kinetic) energy energy transferred by <u>collisions</u> with other particles	accept particles vibrate more do not accept <u>start</u> to vibrate only do not accept answers in terms of free/mobile electrons	1 1
total		9	

Question 2

question	answers	extra information	mark
(a)	ultraviolet	accept UV	1
(b)(i)	360 (minutes) / 6 <u>hours</u>	unit if given must be consistent with numerical answer	1
(ii)	any one from: <ul style="list-style-type: none"> • sunscreen not applied thickly enough • sunscreen not applied often enough • sunscreen not applied before sunbathing • water reduces the protection factor • intensity of Sun depends on time of day or cloud cover • intensity of Sun depends on where you are 	do not accept answer in terms of different types of skin alone accept any answer that would lead to a reduction in protection factor accept any answer to do with differences in the intensity	1
(iii)	more UV / radiation absorbed by dark skin	accept darker skin has more melanin / pigment	1
	less UV penetrates deep to <u>damage</u> (living) cells / tissue	do not accept sunlight or heat for ultraviolet	1
(c)	so people can make up their own minds about the potential risk to their health	accept 'so people know to take precautions' do not accept 'might get skin cancer' on its own	1
total			6

Question 3

question	answers	extra information	mark
(a)	line shifts towards red end of spectrum	do not accept reference to 'red light'	1
		do not accept 'red shift' as a stand alone response	
	wavelength (appears) to increase		1
(a)	<u>galaxy</u> is moving away (from the Earth)	do not accept universe expanding	1
	or <u>galaxy</u> moving away from initial point	do not accept planet on its own	
(b)(i)	light from A has a greater red shift	accept light from A is more red do not accept reference to blue light	1
(ii)	3600 (million light years)	allow 1 mark for showing that the line could be extended or allow 1 mark for the correct use of a point on the line	2
(c)	Earth's <u>atmosphere</u> / <u>clouds</u> does not distort / block signals / light	accept converse	1
	Space telescopes more sensitive to weak signal / light		1
total			8

Question 4

question	answers	extra information	mark
(a)(i)	alpha		1
(ii)	damages them / changes DNA	accept kills them / destroys accept causes cancer accept causes cell mutations do not accept they ionise cells on its own	1
(b)	count is (roughly) the same gamma is not affected by magnetic field or alpha and beta are deflected by a magnetic field (1) count would go down significantly (1)	accept magnet for magnetic field	1 1
(c)	time taken for number of nuclei to halve or time taken for count rate to fall to half (its initial value)	do not accept time for radioactivity to halve do not accept time for nuclei to halve	1
(d)	not enough time to take measurements / make observations before level of radiation became insignificant		1 1
total			7

Question 5

question	answers	extra information	mark
(a)(i)	all <u>electromagnetic</u> waves travel at the same speed through a <u>vacuum</u> , (so assume same speed in air)	accept 'all parts of spectrum' for electromagnetic waves	1
(ii)	1500 (m)	allow 1 mark for correct transformation and substitution allow 1 mark for using 200 000 Hz answers 1 500 000 = 1 mark	2
(iii)	line drawn at correct position	anywhere between 1000 and next section (10 000) accept their value for (a)(ii) drawn in the correct position	1
(b)(i)	a signal that varies continually	accept variable amplitude / frequency accept a correctly drawn diagram do not accept signal loses quality when amplified	1
(ii)	any one from: <ul style="list-style-type: none"> • better quality signal / sound (received) • less interference to signal / sound • can be processed by computer / ipod 	accept (received) signal can be restored accept distortion / noise for interference do not accept no interference	1

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question	answers	extra information	mark
(c)	any two from: <ul style="list-style-type: none">• energy not usefully transformed is wasted e.g. not listened to• (wasted and useful) energy transferred to surroundings• (energy spreads out) and is difficult to use usefully for further energy transformations	accept specific examples of energy wasted by any named appliances do not accept machines not 100% efficient on its own	2
total			8

Question 6

question	answers	extra information	mark
(a)	<p>only accept answers in terms of the argument of the nuclear power scientist</p> <p>any three from:</p> <ul style="list-style-type: none"> • produces a lot of energy for a small mass of fuel or is a concentrated energy source • it is reliable or it can generate all of the time • produces no pollutant <u>gases</u> • produces only a small volume of (solid) waste • advances in technology will make fuel reserves last much longer 	<p>accept amount for mass</p> <p>accept named gas or greenhouse gases do not accept no pollution</p> <p>accept amount for volume</p> <p>accept an argument in terms of supply and demand</p>	3
(b)	<p>any one from:</p> <ul style="list-style-type: none"> • may leak into the ground / environment • geological changes • may get into the food chain • over time if location not correctly recorded it may be excavated 	<p>accept earthquakes etc</p> <p>do not accept answers in terms of property prices or ‘damages the environment’</p>	1
(c)	<p>any three from:</p> <ul style="list-style-type: none"> • overall add no carbon dioxide to the environment • power companies can sell electricity at a higher price • opportunity to grow new type crop • more jobs • more land cultivated or different types of land utilised 	<p>accept do not add to global warming accept they are carbon neutral</p> <p>accept power companies make more profit</p> <p>accept specific examples e.g. growing plants in swamps</p> <p>accept extends the life of fossil fuel reserve</p>	3
total			7