Version 1.0: 0707

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science B 4462 / Physics 4451

PHY1H Unit Physics 1

Mark Scheme

2007 examination - June 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.

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.

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.

PHY1H Question 1

	answers	extra information	mark
(a)(i)	electromagnetic (wave / radiation)	accept em (wave / radiation) ignore reference to frequency	1
(ii)	gamma can penetrate the crate / box / packaging	accept converse (but must relate to both alpha and beta) ignore just gamma radiation kills bacteria accept can get through to food	1
(iii)	neutrons		1
(b)(i)	absorb gamma / radiation	accept it stops / reduces the radiation	1
(ii)	any **one** from: • slow down the conveyor belt • food does more than one circuit • stay on the conveyor belt longer • food closer to the source / radiation	ignore larger doses / use more of the source ignore thinner packaging	1

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Question 1 continued

	answers	extra information	mark
(c)(i)	idea of testing food on humans / animals		1
	no (measured) ill effects **or** monitor their health	accept monitor people that have eaten the food accept a measurement / comparison for **1** mark eg measure the amount of radiation in treated food comparison plus a reason for the comparison would get **2** marks eg idea of measuring level of radiation in treated food **with** no measurable increase in level = **2** marks **or** comparing it to untreated food = **2** marks	1
(ii)	so can make own decision about eating or not eating treated food	accept may be against their religious / moral views accept some people prefer food that hasn't been tampered with ignore in case they don't like the idea of eating treated food accept don't want to eat treated food ignore might be allergic to the food eg think it will give them cancer = **0** marks think it will give you cancer so I need to know so that I can choose = **1** mark	1
total			8

PHY1H Question 2

	answers	extra information	mark
(a)	the outside colour of the cans		1
(b)(i)	18 (°C) **or** 88 to 70	ignore negative sign	1
(ii)	8 (°C) **or** 70 to 62	ignore negative sign	1
(c)	greater temperature difference between water and surroundings (at start)	must mention temperature difference ignore just water hotter accept energy used to heat cans initially	1
(d)	black		1
	temperature falls the fastest (in L)	accept (can L) loses more heat / cools quicker accept heat for temperature	1
	black is a good / the best / better emitter (of heat / radiation)	accept converse ignore black is best absorber	1
total			7

PHY1H Question 3

	answers	extra information	mark
(a)(i)	national grid		1
(ii)	increases voltage / potential difference	accept decrease current accept step-up / boosts the voltage do **not** accept increases energy / power / current ignore reference to voltage going through	1
(iii)	any **two** from: • reduce current • reduces energy loss / power loss (from cables) • increases efficiency (of distribution)	ignore increased voltage / pd accept reduces heat loss do **not** accept stops energy loss	2
(b)	any **one** from: • produces pollutant gases • produces solid waste / ash / smoke	accept produces carbon dioxide / sulfur dioxide / nitrogen oxides accept global warming / greenhouse effect / carbon emissions / air pollution / acid rain ignore ozone layer do **not** accept carbon monoxide accept global dimming ignore produces pollution	1

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Question 3 continued

	answers	extra information	mark
(c)(i)	any **two** from: • using renewable energy • make non-renewable fuels last longer • non-renewable fuels can be used for other processes • no pollutant gases produced • land can still be used for farming	any two valid points gains the marks accept don't use up non-renewable / fossil fuels accept named fuels accept the opposite of (b) ignore no pollution ignore economic issues	2
(ii)	any **two** from: • cause <u>noise</u> pollution • cause <u>visual</u> pollution • may interfere with TV / radio / mobile phone signals • need to put in new infrastructure • not reliable owtte • dangerous to birds • lots of concrete needed for the bases **or** producing cement is environmentally damaging	accept spoils the landscape accept sunlight flicker accept new roads needed accept reduces house prices ignore any references to cost / jobs / number required ignore takes up a lot of land accept reference to obstruction of shipping etc. if clear reference to offshore wind farm	2
total			9

PHY1H Question 4

	answers	extra information	mark
(a)	wavelength increases	accept the crests are further apart ignore waves are further apart	1
	frequency decreases	accept pitch decreases ignore references to amplitude	1
(b)	stars / galaxies / sources emit all / different types of electromagnetic waves / radiation	accept two or more named electromagnetic waves accept answers in terms of frequencies / wavelengths	1
(c)(i)	wavelength (of light) increases **or** light moves to red end of spectrum	accept frequency decreases accept redder but do **not** accept red alone	1
(ii)	it is the star (detected) <u>furthest</u> from the Earth **or** it is moving <u>away</u> the fast<u>est</u>	accept galaxy for stars ignore reference to universe expanding	1
(d)(i)	all matter compressed to / starts at / comes from a single point	do **not** accept increasing gravitational pull accept everything / the universe for all matter	1
	(massive) <u>explosion</u> sends matter outwards	accept <u>explosion</u> causes universe to expand ignore explosion creates the universe **or** further reference to star / Earth formation	1

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Question 4 continued

(ii)	check validity / reliability of the evidence **or** change the theory to match the new evidence	accept comparison of new and old evidence	1
total			8

PHY1H Question 5

	answers	extra information	mark
(a)(i)	a signal that has only two states / only discrete states	accept can only be on or off accept made up of 1 and 0 only accept high and low accept diagram with all amplitudes equal	1
(ii)	400 000 000 **or** correct equivalent	allow **1** mark for correct transformation **and** substitution (of 75) answer 4 000 000 gains **1** mark only	2

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Question 5 continued

	answers	extra information	mark
(b)(i)		any mention of alpha, beta, gamma waves scores **0** marks	
	emit / uses / transmit / receive microwaves	accept radiation for microwaves throughout ignore radio waves	1
	some microwave / energy absorbed by / enters the body	ecf for their given electromagnetic wave do **not** accept goes through the body	1
	raises temperature of (body) cells / tissue / water	accept reference to water molecules vibrating faster accept it could cause mutation / harm / kill cells do **not** accept answers in terms of ionisation ignore references to cancer	1
(ii)	any **two** from: • research (may be) biased **or** may have been misled in the past • some research suggests a link • long-term effect not proven / studied • residents may not have seen the research	accept not independent **or** may be lying accept not studied for long enough	2
total			8

PHY1H Question 6

	answers	extra information	mark
(a)	four calculations correctly shown	$200 \times 10 - 1800 = £200$ $100 \times 10 - 2400 = -£1400$ $50 \times 10 - 600 = -£100$ $20 \times 10 - 75 = 125$ accept four final answers only **or** obvious rejection of solar water heater and underfloor heating, with other two calculations completed any 1 complete calculation correctly shown **or** showing each saving × 10 of all four calculations = **1** mark answers in terms of savings as a percentage of installation cost **may** score savings mark only	2
	hot water boiler	correct answers only	1
(b)	less electricity / energy to be generated / needed from power stations	accept less demand	1
	reduction in (fossil) fuels being burnt	accept correctly named fuel accept answer in terms of: fewer light bulbs required because they last longer (1 mark) less energy used / fuels burnt in production / transport etc. (1 mark) ignore reference to CO_2 or global warming ignore reference to conservation of energy	1
total			5