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General Certificate of Secondary Education

Science A 4405 / Physics 4403

PH1HP Unit Physics P1

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.

Quality of Written Communication and levels marking

In Question 2(b) students are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Students will be required to:

- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: basic

- Knowledge of basic information
- Simple understanding
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail
- The spelling, punctuation and grammar are very weak.

Level 2: clear

- Knowledge of accurate information
- Clear understanding
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: detailed

- Knowledge of accurate information appropriately contextualised
- Detailed understanding, supported by relevant evidence and examples
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

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Question 1

question	answers	extra information	mark
1(a) E	**B**	no mark for **B** - marks are for the explanation first two mark points can score even if **A** is chosen	
	draught increases (the rate of) evaporation	accept more evaporation happens accept draught removes (evaporated) particles faster do **not** accept answers in terms of particles gaining energy from the fan / draught	1
	evaporation has a cooling effect	accept (average) <u>kinetic</u> energy of (remaining) particles decreases	1
	so temperature will fall faster / further		1
1(b) E	larger surface area		1
	increasing the (rate of) evaporation **or** for water to evaporate from	accept more / faster evaporation accept easier for particles to evaporate accept more particles can evaporate accept water / particles which have evaporated are trapped (in the bag) answers in terms of exposure to the Sun are insufficient	1
Total			**5**

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Question 2

question	answers	extra information	mark
2(a) E	increases the voltage (across the cables) **or** decreases the current (through the cables)		1
	reducing energy losses (in cables) **or** increases efficiency of (electricity / energy) transmission	accept heat for energy do **not** accept electricity for energy do **not** accept no energy loss accept wires do not get as hot ignore reference to travel faster	1

2(b) E — 6

Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 4, and apply a 'best-fit' approach to the marking.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content	There is a brief description of one advantage or disadvantage of using either overhead or underground cables.	There is a description of some of the advantages **and / or** disadvantages for both overhead and underground cables, with a minimum of three points made. There must be at least **one** point for each type of cable.	There is a clear and detailed description of the advantages **and** disadvantages of overhead and underground cables, with a minimum of five points made. At least one advantage and one disadvantage for each type of cable.

Question 2 continues on the next page . . .

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Question 2 continued . . .

question	answers	extra information	mark
	examples of the points made in the response	**extra information** marks may be gained by linking an advantage for one type of cable with a disadvantage for the other type of cable eg eg overhead cables are easy to repair = 1 mark overhead cables are easier to repair = 1 mark overhead cables are easier to repair than underground cables = 2 marks	
	Overhead Advantages: • (relatively) quick / easy to repair / maintain / access • less expensive to install / repair / maintain • cables cooled by the air • air acts as <u>electrical</u> insulator • can use thinner cables Disadvantages: • spoil the landscape • greater risk of (fatal) electric shock • damaged / affected by (severe) weather • hazard to low flying aircraft / helicopters	easy to install is insufficient do **not** accept easy to spot / see a fault less expensive is insufficient accept thermal energy / heat removed by the air accept there is no need for electrical insulation (around the cables) difficult to reach is insufficient land beneath cables can still be used is insufficient accept specific examples eg high winds, ice more maintenance is insufficient kites / fishing lines can touch them is insufficient hazard to aircraft is insufficient	

Question 2 continues on the next page . . .

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Question 2 continued . . .

question	answers	extra information	mark
	Underground Advantages: • cannot be seen • no hazard to aircraft / helicopters • unlikely to be / not damaged / affected by (severe) weather (normally) no / reduced shock hazard Disadvantages: • repairs take longer / are more expensive • (more) difficult to access (cables) • (very) expensive to install • thicker cables required • need cooling systems • need layers of <u>electrical</u> insulation • land disruption (to lay cables) **or** cannot use land either side of cable path	less maintenance is insufficient installed in urban areas is insufficient accept harder to repair / maintain have to dig up for repairs is insufficient hard to locate (cables) is insufficient faults hard to find is insufficient accept damage to environment / habitat(s) accept restricted land use	

Question 2 continues on the next page . . .

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Question 2 continued . . .

question	answers	extra information	mark
2(c) E	examples of acceptable responses: • closest to cables field from underground is stronger • field from overhead cables stronger after 5 metres • field from underground cables drops rapidly • field from overhead cables does not drop much until after 20 metres • overhead field drops to zero at / after 50 metres • underground field drops to zero at / after 30 metres • (strength of) field decreases with distance for <u>both</u> types of cable	allow **1** mark for each correct point accept values between 20 and 30 inclusive if suitably amplified this may score both marks	2
2(d) A	ethical		1
Total			**11**

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Question 3

question	answers	extra information	mark
3(a) E	91 (p)	$E = P \times t$ an answer £0.91 gains 3 marks an answer 0.91 gains 2 marks allow **2** marks for energy transferred = 18.2 (kWh) **or** substitution into 2 equations combined, ie $2.6 \times 7 \times 5$ allow **1** mark for correct substitution into $E = P \times t$, ie $E = 2.6 \times 7$ **or** allow **1** mark for multiplying and correctly calculating an incorrect energy transfer value by 5	3
3(b) E	answers should be in terms of supply exceeding demand	accept there is a surplus / excess of electricity (at night)	1
3(c) E	reduce (rate of) energy transfer (from ceramic bricks)	accept heat for energy do **not** accept no energy / heat escapes do **not** accept answers in terms of lost / losing heat if this implies heat is wasted energy	1
	so keeping the (ceramic) bricks hot for longer **or** to stop the casing getting too hot	accept increase time that energy is transferred to the room accept keep room warm for longer accept so you do not get burnt (on the casing)	1

Question 3 continues on the next page . . .

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Question 3 continued . . .

question	answers	extra information	mark
3(d) E	120	$E = m \times c \times \theta$ allow **1** mark for correct substitution ie $9\,000\,000 = m \times 750 \times 100$	2
Total			**8**

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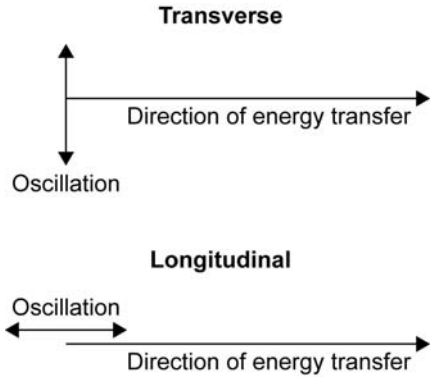
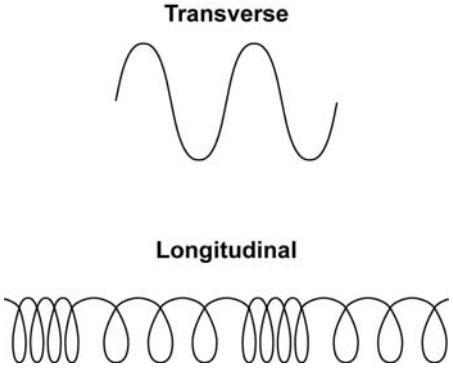
Question 4

question	answers	extra information	mark
4(a)(i) E	the oscillation / vibration (causing the wave)	a movement causes the wave is insufficient	1
	for a transverse wave is perpendicular to the direction of <u>energy</u> transfer	answers given in terms of direction of wave travel and not energy transfer for both types of wave, score **1** mark for these **two** mark points	1
	and for a longitudinal wave is parallel to the direction of <u>energy</u> transfer		1
		the marks may be scored by the drawing of two <u>correctly labelled</u> diagrams ie  	
		two labelled diagrams showing the general form of a transverse and longitudinal wave gain **1** mark if no other mark has been awarded eg  	

Question 4 continues on the next page . . .

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Question 4 continued . . .

question	answers	extra information	mark
4(a)(ii) E	mechanical wave	accept specific examples, eg waves on a spring / slinky / seismic / earthquake waves accept water waves do **not** accept shock waves	1
4(b) E	semicircular waves drawn	judged by eye do not need to be full semicircles ignore any rays	1
4(c) E	sound (waves) will <u>diffract</u> (towards the person) **or** light (waves) do not diffract (towards the person) (because) width of door way similar to / less than wavelength of sound (waves) **or** (because) width of doorway much greater than wavelength of light (waves)	a general statement that waves (only) <u>diffract</u> when the width of a gap is similar to the wavelength of the waves can be awarded **1** mark	1 1
Total			**7**

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Question 5

question	answers	extra information	mark
5(a)(i) G	refraction	accept refracted reflection, diffraction and dispersion are incorrect	1
5(a)(ii) E	to check rise in temperature (of other thermometers) was due to the (different wavelengths of) light	accept as a control / comparison to measure room temperature is insufficient	1
5(a)(iii) E	any **two** from three: • different colours produce different heating effects / (rises in) temperatures • red light produces the greatest heating effect / (rise in) temperature **or** • violet produces the least heating effect / (rise in) temperature • all colours produce a greater heating effect than outside the spectrum	an answer the longer the <u>wavelength</u> the greater the (rise in) temperature **or** the lower the <u>frequency</u> the greater the (rise in) temperature gains both marks	2
5(b) E	move a thermometer into the infrared region / just beyond the red light the temperature increases beyond 24(°C)	allow use an infrared camera / infrared sensor accept temperature higher than for the red light	1 1

Question 5 continues on the next page . . .

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Question 5 continued . . .

question	answers	extra information	mark
5(c) E	9.4×10^{-6} **or** 0.0000094	$v = f \times \lambda$ accept 9.375×10^{-6} or 9.38×10^{-6} accept 0.000009375 **or** 0.00000938 allow **1** mark for correct substitution ie $3 \times 10^{8} = 3.2 \times 10^{13} \times \lambda$	2
5(d) E	at night the surroundings are cooler **or** at night there is a greater temperature difference between people and surroundings	accept at night the air is colder there is no heat from the Sun is insufficient	1
	(so surroundings) emit less infrared (than in daytime) **or** gives larger difference in infrared emitted (between people and surroundings)	accept camera detects a greater contrast	1
Total			**10**

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Question 6

question	answers	extra information	mark
6(a)(i) E clip with 6(a)(ii)	1.6 (W)	efficiency = useful power out / total power in (×100%) allow **1** mark for correct substitution ie 0.2 / 20/100 = output/8	2
6(a)(ii) E clip with 6(a)(i)	32 (%) / 0.32 **or** their (a)(i) ÷ 5 correctly calculated	efficiency = useful power out / total power in (×100%) ignore any units	1
6(b) E	two output arrows narrower arrow labelled light or useful (energy / output / power) **and** wider arrow labelled waste (energy / output / power)	one arrow should be wider - judged by eye only scores if first mark awarded accept heat ignore numerical values	1 1

Question 6 continues on the next page . . .

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Question 6 continued . . .

question	answers	extra information	mark
6(c)(i) E	any **two** from: • comparison over same period of time of relative numbers of bulbs required eg over 50 000 hours 5 CFL's required to 1 LED • link number of bulbs to cost eg 5 CFL's cheaper than 1 LED • over the same period of time LEDs cost less to operate (than CFLs)	accept an LED lasts 5 times longer an answer in terms of over a period of 50 000 hours CFLs cost £15.50 (to buy), LED costs £29.85 (to buy) so CFLs are cheaper scores both marks an answer in terms of the cost per hour (of lifetime) being cheaper for CFL scores 1 mark if then correctly calculated scores both marks	2
6(c)(ii) E	any **one** from: • price of LED bulbs will drop • less electricity needs to be generated • less CO_2 produced • fewer chips needed (for each LED bulb) • fewer bulbs required (for same brightness / light) • less energy wasted	do **not** accept they become cheaper accept we will use less electricity do **not** accept electricity for energy	1
Total			**8**

PH1HP

Question 7

question	answers	extra information	mark
7(a) E	change in (observed) wavelength / frequency	accept specific change eg increase accept pitch for frequency provided the source is sound	1
	when source of waves / observer moves (relative to each other)	accept specific example of source accept specific example of movement for both marks a specific change in wavelength / frequency must be linked to a correct specific movement of source / observer	1
7(b) E	(observed) increase in wavelength of light (from distant galaxies) **or** (observed) decrease in the frequency of light (from distant galaxies)	accept a correct description eg wavelength(s) of light (from distant galaxies) moves towards red end of spectrum **or** (pattern) of (black) lines in (visible) spectrum move towards red end galaxy looks red negates this first mark point	1
	because the galaxy is moving away from the Earth / us		1
	the bigger the red-shift the faster the galaxy is moving	accept bigger the red-shift the further the galaxy is from the Earth	1
Total			**5**

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Question 8

question	answers	extra information	mark
8(a) E		answers must be in terms of nuclear fuels	
	concentrated source of energy	idea of a small mass of fuel able to generate a lot of electricity	1
	that is able to generate continuously	accept it is reliable **or** can control / increase / decrease electricity generation idea of available all of the time / not dependent on the weather ignore reference to pollutant gases	1
	the energy from (nuclear) <u>fission</u>		1
	is used to heat water to steam to turn turbine linked to a generator		1
8(b) E	<u>carbon dioxide</u> is not released (into the atmosphere)		1
	but is (caught and) stored (in huge natural containers)		1
Total			**6**

UMS Conversion Calculator
http://web.aqa.org.uk/UMS/index.php