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# General Certificate of Secondary Education

*Science A 4405 / Physics 4403*

**PH1FP 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 8(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)**<br>A | normal | | 1 |
| **1(b)**<br>A | be halved | | 1 |
| **1(c)**<br>A | upright<br>virtual | | 1<br>1 |
| **Total** | | | **4** |

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**Question 2**

| question | answers | extra information | mark |
|---|---|---|---|
| **2(a)(i)**<br>G | X-ray(s) | | 1 |
| **2(a)(ii)**<br>A | gamma rays | | 1 |
| **2(a)(iii)**<br>A | infrared | | 1 |
| **2(b)**<br>A | the same speed as | | 1 |
| **2(c)(i)**<br>E | horizontal arrow drawn pointing to the right | judge by eye<br>accept drawn anywhere on diagram | 1 |
| **2(c)(ii)**<br>A | **Y** | | 1 |
| **2(c)(iii)**<br>E | any **one** from:<br>• any type of electromagnetic wave<br>• water (wave)<br>• (earthquake / seismic) S waves | accept electromagnetic wave(s)<br>do **not** accept seismic waves<br>do **not** accept P waves<br>do **not** accept earthquakes | 1 |

**Question 2 continues on the next page . . .**

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**Question 2 continued . . .**

| question | answers | extra information | mark |
|---|---|---|---|
| **2(d)(i)**<br>E<br>clip with 2(d)(ii) | 3 | | 1 |
| **2(d)(ii)**<br>E<br>clip with 2(d)(i) | 3.6<br>**or**<br>their (d)(i) × 1.2 correctly calculated | $v = f \times \lambda$<br>allow **1** mark for correct substitution<br>ie 3 or their (d)(i) × 1.2<br>provided that no subsequent step is shown | 2 |
| **Total** | | | **10** |

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**Question 3**

| question | answers | extra information | mark |
|---|---|---|---|
| **3(a)(i)**<br>G | light (energy) | this answer only | 1 |
| **3(a)(ii)**<br>E | raises its temperature | accept warms / heats it<br><br>accept air molecules / particles gain energy / move faster<br><br>do **not** accept heat<br><br>do **not** accept pollution | 1 |
| **3(a)(iii)**<br>E | 20 % or 0.2 | efficiency =<br><br>$\frac{\text{useful energy out}}{\text{total energy in}}$ (×100%)<br><br>allow **1** mark for correct substitution<br>ie $\frac{4}{20}$<br>provided that no subsequent step is shown<br><br>20 without % scores 1 mark, 20 **or** 0.2 with a unit scores 1 mark | 2 |
| **3(a)(iv)**<br>E | mercury can be recovered / reused / recycled<br>**or**<br>mercury (vapour) does not get into the atmosphere / environment / air | accept to stop mercury poisoning the land / getting into the food chain / water supply<br><br>accept poisonous gas for mercury (vapour)<br><br>do **not** accept general poisoning<br><br>cause harm to the environment is insufficient | 1 |

**Question 3 continues on the next page . . .**

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**Question 3 continued . . .**

| question | answers | extra information | mark |
|---|---|---|---|
| **3(b)**<br>A | a smaller | | 1 |
| **3(c)**<br>E | reaches full brightness faster | accept brighter / switches on faster accept it does not get as hot<br>accept it will not burn someone who touches it<br>accept stays cool<br>accept temperature does not increase as much<br>accept temperature only goes to 24 (°C)<br>accept contains no mercury<br>do **not** accept wastes less energy | 1 |
| **3(d)**<br>A | top two boxes both ticked<br>The number of hours each bulb lasts before needing to be replaced.<br>The power of each bulb in watts. | | 1 |
| **Total** | | | **8** |

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**Question 4**

| question | answers | extra information | mark |
|---|---|---|---|
| **4(a)(i)** E | correct data point identified (4, 0.96) | | 1 |
| **4(a)(ii)** A | a decrease in | | 1 |
| **4(b)(i)** E | no / less atmospheric pollution | accept specific examples eg no $CO_2$ / greenhouse gases produced<br>accept no harmful gases / fumes<br>accept reduced pollution from transportation (of coal)<br>accept does not contribute to global warming<br>it / they refers to solar cells<br>do **not** accept no / less pollution<br>does not harm the environment is insufficient<br>it is a renewable energy source is insufficient | 1 |
| **4(b)(ii)** E | 8 | allow **1** mark for showing correct method ie $\frac{7600}{950}$<br>provided that no subsequent step is shown | 2 |

**Question 4 continues on the next page . . .**

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**Question 4 continued . . .**

| question | answers | extra information | mark |
|---|---|---|---|
| **4(b)(iii)**<br>A | increase | | 1 |
| **4(b)(iv)**<br>E<br>view with 4(b)(iii) | less / no electricity generated | **these marks can score even if (b)(iii) is wrong**<br>accept energy for electricity<br>accept reduced power / voltage output | 1 |
| | (because) lower light intensity (hitting solar panel / cell)<br>**or**<br>so decreases money paid / gained (from selling electricity) | allow less light / sun (hitting solar panel / cell) | 1 |
| **Total** | | | **8** |

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**Question 5**

| question | answers | extra information | mark |
|---|---|---|---|
| **5(a)(i)** E | random distribution of circles in the box with at least 50 % of circles touching | | 1 |
| | random distribution of circles occupies more than 50 % of the space | judged by eye | 1 |
| **5(a)(ii)** E | (large) gaps between particles | accept particles do not touch<br>accept particles are spread out | 1 |
| | (so) easy to push particles closer (together)<br>**or**<br>forces between particles are negligible / none | an answer in terms of number of particles is insufficient | 1 |
| **5(b)(i)** E | (both are) random | accept a correct description of random eg unpredictable or move around freely or in all directions<br>they take up all the space is insufficient<br>they are spread out is insufficient<br>they move in straight lines is insufficient | 1 |
| **5(b)(ii)** E | (speed also) increases | | 1 |
| **Total** | | | **6** |

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**Question 6**

| question | answers | extra information | mark |
|---|---|---|---|
| **6(a)(i)**<br>G | conduction<br>convection | correct order only | 1<br>1 |
| **6(a)(ii)**<br>A | to keep the ceramic bricks hot for a longer time | | 1 |
| **6(b)(i)**<br>E<br>clip with 6(b)(ii) | 18.2 | $E = P \times t$<br>allow **1** mark for correct substitution ie $2.6 \times 7$ provided that no subsequent step is shown | 2 |
| **6(b)(ii)**<br>E<br>clip with 6(b)(i) | 91 (p)<br>**or** their (b)(i) $\times$ 5 correctly calculated | accept £0.91<br>do **not** accept 0.91 without £ sign | 1 |
| **6(c)**<br>E | 2 250 000 | $E = m \times c \times \theta$<br>allow **1** mark for correct substitution ie $120 \times 750 \times 25$ provided that no subsequent step is shown<br>answers 2250 kJ or 2.25 MJ gain both marks | 2 |
| **Total** | | | **8** |

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**Question 7**

| question | answers | extra information | mark |
|---|---|---|---|
| **7(a)** E | **B** | no mark for **B** - marks are for the explanation<br>first two mark points can score even if **A** is chosen | |
| | draught increases (the rate of) evaporation | accept more evaporation happens<br>accept draught removes (evaporated) particles faster<br>do **not** accept answers in terms of particles gaining energy from the fan / draught | 1 |
| | evaporation has a cooling effect | accept (average) kinetic energy of (remaining) particles decreases | 1 |
| | so temperature will fall faster / further | | 1 |
| **7(b)** E | larger surface area | | 1 |
| | increasing the (rate of) evaporation<br>**or**<br>for water to evaporate from | accept more / faster evaporation<br>accept easier for particles to evaporate<br>accept more particles can evaporate<br>accept water / particles which have evaporated are trapped (in the bag)<br>answers in terms of exposure to the Sun are insufficient | 1 |
| **Total** | | | **5** |

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**Question 8**

| question | answers | extra information | mark |
|---|---|---|---|
| **8(a)** E | increases the voltage (across the cables)<br>**or**<br>decreases the current (through the cables) | | 1 |
| | reducing energy losses (in cables)<br><br>**or**<br>increases efficiency of (electricity / energy) transmission | accept heat for energy<br>do **not** accept electricity for energy<br>do **not** accept no energy loss<br>accept wires do not get as hot<br><br>ignore reference to travel faster | 1 |

| **8(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.<br>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.<br>At least one advantage and one disadvantage for each type of cable. |

**Question 8 continues on the next page . . .**

**PH1FP**

**Question 8 continued . . .**

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

**Question 8 continues on the next page . . .**

**PH1FP**

**Question 8 continued . . .**

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

**Question 8 continues on the next page . . .**

**PH1FP**

**Question 8 continued . . .**

| question | answers | extra information | mark |
|---|---|---|---|
| **8(c)** E | examples of acceptable responses:<br>• closest to cables field from underground is stronger<br>• field from overhead cables stronger after 5 metres<br>• field from underground cables drops rapidly<br>• field from overhead cables does not drop much until after 20 metres<br>• overhead field drops to zero at / after 50 metres<br>• underground field drops to zero at / after 30 metres<br>• (strength of) field decreases with distance for <u>both</u> types of cable | allow **1** mark for each correct point<br><br>accept values between 20 and 30 inclusive<br><br>if suitably amplified this may score both marks | 2 |
| **8(d)** A | ethical | | 1 |
| **Total** | | | **11** |

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