



General Certificate of Secondary Education

**Additional Science 4463/
Physics 4451**

PHY2F Unit Physics 2

Mark Scheme

2010 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.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

Copyright © **2010**. AQA and its licensors. All rights reserved.

COPYRIGHT

AQA retains the copyright on all its publications. However, registered centres for AQA are permitted to copy material from this booklet for their own internal use, with the following important exception: AQA cannot give permission to centres to photocopy any material that is acknowledged to a third party even for internal use within the centre.

Set and published by the Assessment and Qualifications Alliance.

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.

PHY2F**Question 1**

| question | answers | extra information | mark |
|-----------------|-----------------|-----------------------------|-------------|
| 1(a) | switch | allow answer circled in box | 1 |
| 1(b) | 24 | | 1 |
| 1(c) | equal to 0.25 A | | 1 |
| 1(d) | 4 | | 1 |
| Total | | | 4 |

PHY2F**Question 2**

| question | answers | extra information | mark |
|-----------------|---|--|-------------|
| 2(a) | repel | correct order only | 1 |
| | opposite | | 1 |
| | attract | | 1 |
| 2(b) | refuelling an aircraft | reason cannot score if refuelling aircraft is not chosen | 1 |
| | a spark may cause an explosion / fire / ignite the fuel | accept the static for a spark accept named fuel there must be a consequence of having a spark do not accept answers in terms of people getting a shock or electrocuted | 1 |
| Total | | | 5 |

PHY2F**Question 3**

| question | answers | extra information | mark |
|-----------------|--|--|-------------|
| 3(a) | R | reason cannot score if R is not chosen | 1 |
| | has the <u>greatest</u> speed / velocity | accept it is going at 28 m/s answer should be comparative | 1 |
| 3(b)(i) | 3250 | allow 1 mark for correct substitution of 130 and 25 ie 130×25 accept 2600 or 3640 for 1 mark | 2 |
| 3(b)(ii) | kg m/s | accept answer given in (b)(i) if no answer given here | 1 |
| 3(c)(i) | increase it | accept make it slower accept slow it down accept make it longer accept (reactions) would be slower do not accept if the answer clearly refers to distance comparative answers expected | 1 |
| 3(c)(ii) | increase it | accept make it longer do not accept if the answer clearly refers to time comparative answers expected | 1 |
| Total | | | 7 |

PHY2F

Question 4

| question | answers | extra information | mark | | | | | | |
|---------------------|---|--|------------|---------------------|---|--------------------|---|---|---|
| 4(a)(i) | all correct <table border="1" data-bbox="341 461 778 667"> <tr> <td>Number of protons</td> <td>3</td> </tr> <tr> <td>Number of electrons</td> <td>3</td> </tr> <tr> <td>Number of neutrons</td> <td>4</td> </tr> </table> | Number of protons | 3 | Number of electrons | 3 | Number of neutrons | 4 | accept presented as a tally chart allow 1 mark for 1 correct | 2 |
| Number of protons | 3 | | | | | | | | |
| Number of electrons | 3 | | | | | | | | |
| Number of neutrons | 4 | | | | | | | | |
| 4(a)(ii) | 7 number of protons and neutrons | reason may score even if 7 not chosen accept number of particles in the nucleus accept number of nucleons do not accept number of electrons and neutrons | 1 1 | | | | | | |
| 4(b) | an ion | | 1 | | | | | | |
| 4(c)(i) | smaller than | | 1 | | | | | | |
| 4(c)(ii) | radon loses an alpha (particle) or radon loses an (alpha) particle or (mass of) polonium plus an alpha = (mass) radon or radon loses 2 protons and 2 neutrons (to become polonium) | accept radon has less protons and neutrons | 1 | | | | | | |
| Total | | | 7 | | | | | | |

PHY2F**Question 5**

| question | answers | extra information | mark |
|-----------------|---|--|-------------|
| 5(a) | a light-dependent resistor | | 1 |
| 5(b) | any three from: <ul style="list-style-type: none"> • resistance starts at 500 (kilohms) • (resistance) falls rapidly as intensity increases from 0 • (resistance) halves between 10 and 20 lux • (resistance) falls slightly between 20 and 50 lux or • (resistance) almost constant / levels out between 20 and 50 lux • at 50 lux, resistance = 10 (kilohms) | for full credit the word resistance must be used correctly at least once accept resistance falls accept brightness for intensity an answer resistance falls as intensity increases gains 2 marks - this may be combined with one of the bullet point marks for full credit | 3 |
| 5(c)(i) | decrease | | 1 |
| 5(c)(ii) | resistance increases | this can score without (c)(i) | 1 |

Question 5 continues on the next page . . .

PHY2F**Question 5 continued . . .**

| question | answers | extra information | mark |
|-----------------|---|--------------------------|-------------|
| 5(d) | A circuit to switch on security lighting when it gets dark. | | 1 |
| Total | | | 7 |

PHY2F**Question 6**

| question | answers | extra information | mark |
|------------------|---|---|-------------|
| 6(a) | 96 | allow 1 mark for correct substitution ie 80×1.2 | 2 |
| | newton or N | allow Newton do not allow n | 1 |
| 6(b)(i) | direction | | 1 |
| 6(b)(ii) | velocity <u>and</u> time are continuous (variables) | answers must refer to both variables accept the variables are continuous / not categoric accept the data / 'it' is continuous accept the data / 'it' is not categoric | 1 |
| 6(b)(iii) | C velocity is not changing | the 2 marks for reason may be scored even if A or B are chosen accept speed for velocity accept speed is constant (9 m/s) accept not decelerating accept not accelerating accept reached terminal velocity | 1 1 |
| | forces must be balanced or resultant force is zero | accept forces are equal accept arrows are the same length / size do not accept the arrows are equal | 1 |
| Total | | | 8 |

PHY2F

Question 7

| question | answers | extra information | mark |
|----------|--|--|------------|
| 7(a)(i) | (two) <u>nuclei</u> (of light elements) join forming a larger / heavier nucleus / one | accept <u>hydrogen atoms</u> for nuclei accept comparative term equivalent to larger accept forms a helium (nucleus / atom) this mark only scores if fusion is in terms of hydrogen atoms | 1 1 |
| 7(a)(ii) | stars | accept a named star e.g. the Sun accept nebula mention of planets negates answer | 1 |
| 7(b)(i) | any one from: <ul style="list-style-type: none"> • (currently) only experimental • <u>reaction</u> does not last long enough • use more energy than they produce | allow difficult to control do not allow inefficient on its own | 1 |
| 7(b)(ii) | any one from: <ul style="list-style-type: none"> • will give another source of energy • unlimited fuel supplies / energy • would not produce any radioactive waste • want to show that it can be done | do not accept answers only in terms of fossil fuels or carbon dioxide accept unlimited hydrogen accept less radioactive waste accept nuclear for radioactive do not accept toxic waste accept any sensible suggestion | 1 |

Question 7 continues on the next page . . .

