Version 1.0 21/07/2009

ASSESSMENT and QUALIFICATIONS ALLIANCE

## General Certificate of Secondary Education

# Additional Science 4463/ Physics 4451

## PHY2F Unit Physics 2

# Mark Scheme

*2009 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.

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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 / ; 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

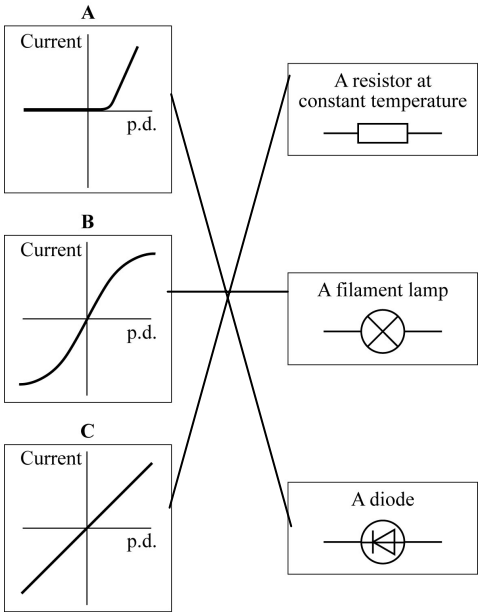
The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

### 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) | **three** lines drawn correctly<br>  <br> | allow **1** mark for 1 correct line<br>if more than one line goes from a graph, both are incorrect | 2 |
| **1**(b) | **J** | | 1 |
| **Total** | | | **3** |

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**Question 2**

| question | answers | extra information | mark |
|---|---|---|---|
| **2**(a) | **Y** | accept the one in the middle<br>accept 90 | 1 |
| | has the biggest mass | reason does not score if X or Z is chosen<br>accept weight for mass<br>accept weighs the most<br>accept they are the heaviest<br>accept has a larger mass<br>do **not** accept weighs 90kg's on its own<br><br>biggest/larger on its own is not sufficient | 1 |
| **2**(b) | increases | | 1 |
| **Total** | | | **3** |

**PHY2F**

**Question 3**

| question | answers | extra information | mark |
|---|---|---|---|
| **3**(a) | shallowest slope/ gradient | accept smallest distance in biggest time<br>accept longest time to travel the same distance<br>accept the line is not as steep<br>accept it is a less steep line<br>do **not** accept the line is not steep | 1 |
| **3**(b) | **A – B** | If 2or 3 boxes are ticked no mark | 1 |
| **3**(c)(i) | 200 m | | 1 |
| **3**(c)(ii) | 20 s | allow **1** mark for correctly identifying 60 s or 40 s from the graph | 2 |
| **3**(d)(i) | straight line starting at origin<br>passing through t = 200 and d = 500 | accept within one small square of the origin | 1<br>1 |
| **3**(d)(ii) | 166 | accept any value between 162 and 168<br>accept where their line intersects given graph line correctly read ± 3 s | 1 |
| **Total** | | | **8** |

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**Question 4**

| question | answers | extra information | mark |
|---|---|---|---|
| **4**(a)(i) | 6 | | 1 |
| **4**(a)(ii) | 6 (volts) | accept their (a)(i)<br>ignore any units | 1 |
| **4**(b) | 0.30 | accept 0.3 | 1 |
| **4**(c) | smaller(than) | accept correct alternatives to smaller than e.g. less than | 1 |
| | a bigger current flows through the lamp | only accept if 'smaller than' is given<br>accept converse<br>accept a correct calculation<br>accept resistance is half of 60<br>accept resistance = 30 (Ω)<br>do **not** accept answers in terms of p.d | 1 |
| **Total** | | | **5** |

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**Question 5**

| question | answers | extra information | mark |
|---|---|---|---|
| **5**(a)(i) | 50 (N) | ignore any units | 1 |
| **5**(a)(ii) | resultant force | | 1 |
| **5**(a)(iii) | 4000 | accept their (a)(i) × 80 correctly calculated for **2** marks<br><br>allow **1** mark for correct substitution i.e. 50 × 80 or their (a)(i) × 80<br><br>ignore any units | 2 |
| **5**(b)(i) | joule | | 1 |
| **5**(b)(ii) | heat | | 1 |
| **Total** | | | **6** |

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**Question 6**

| question | answers | extra information | mark |
|---|---|---|---|
| **6**(a)(i) | the thicker the tile, the greater the*(*fall) height | accept the higher( the fall) the thicker the tile<br>accept there is a positive correlation<br>do **not** accept they are proportional | 1 |
| **6**(a)(ii) | 60( mm) | accept any number or range between 60 and 85 inclusive<br>if units are given must match range | 1 |
| | (minimum thickness*)* needed to <u>reduce risk of injury</u> | reason must match thickness choice<br>do **not** accept to keep child safe<br><br>accept an answer in terms of – the thicker the tile, the less chance there is of a serious injury if the answer given is greater than 60<br><br>accept answers in terms of use of graph e.g. the graph shows that for a 2m fall a thickness of 60mm is needed<br><br>minimum level answer' the graph shows that's what's needed' accept only if 60 is the answer | 1 |
| **6**(b)(i) | the time taken (to stop) | | 1 |
| **6**(b)(ii) | (the) force (on) | | 1 |
| **Total** | | | **5** |

**PHY2F**

**Question 7**

<table>
<tr><th>question</th><th>answers</th><th>extra information</th><th>mark</th></tr>
<tr><td>7(a)</td><td>
<table>
<tr><td>Particle</td><td>Relative Mass</td><td>Relative charge</td></tr>
<tr><td>Proton</td><td>1</td><td></td></tr>
<tr><td>Neutron</td><td></td><td>0</td></tr>
</table>
</td><td>accept one, accept +1<br>do not accept -1<br>accept zero<br>do not accept no charge/ nothing/ neutral unless given with 0</td><td>1<br><br>1</td></tr>
<tr><td>7(b)</td><td>equal numbers/amounts of protons and electrons<br><br>protons and electrons have equal but opposite charge</td><td><br><br>accept protons charge +1 and electron charge -1<br><br>accept (charge) on proton cancels/balances (charge) on electron<br>accept positive (charges) cancel out the negative(charges)<br>neutrons have no charge is neutral<br>do not accept total charge of protons, electrons (and neutrons) is 0 unless qualified</td><td>1<br><br>1</td></tr>
</table>

**Question 7 continues on the next page . . .**

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**Question 7 continued . . .**

| question | answers | extra information | mark |
|---|---|---|---|
| **7**(c)(i) | (3) fewer neutrons | accept lower/ smaller mass number<br><br>do **not** accept different numbers of neutrons<br><br>any mention of fewer/more protons/ electrons negates mark<br><br>accept answers in terms of U-238 providing U-238 is specifically stated i.e. U-238 has (3) more neutrons | 1 |
| **7**(c)(ii) | neutron | | 1 |
| **7**(c)(iii) | (nuclear) fission | accept fision<br><br>do **not** accept any spelling that may be taken as fusion | 1 |
| **Total** | | | **7** |

**PHY2F**

**Question 8**

| question | answers | extra information | mark |
|---|---|---|---|
| **8**(a)(i) | gained electrons | | 1 |
| **8**(a)(ii) | see if it exerts a force on another (charged) object<br><br>**or**<br><br>see if it will pick up (small) pieces of paper | accept repels another negative(ly charged)object<br>accept attracts a positive(ly charged) object<br>accept attracts or repels a charged object<br><br>accept any correct way of showing an electrostatic effect i.e. bend a (slow moving) stream of water (from a tap)<br><br>do **not** accept see if you get an electric shock on its own | 1 |
| **8**(b)(i) | plastic is an insulator<br><br>stop them discharging<br>**or**<br>stop them being earthed | accept plastic is a poor conductor<br>any mention of heat negates this mark<br><br>accept keeps the charge on the person<br>accept stop them being grounded<br>accept electricity cannot go to earth<br>do **not** accept so don't get an electric shock | 1<br><br>1 |
| **8**(b)(ii) | type of clothing could affect (build up of) charge/data | accept it is a variable/ factor (that needs to be controlled)<br>do **not** accept fair test on its own | 1 |
| **8**(b)(iii) | there is a clear pattern<br>**or**<br>enough precision to tell difference (between the materials)<br>**or**<br>accept none of the results are within 0.1kV of the shock line or each other | accept there is a wide range of results | 1 |

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

**PHY2F**

**Question 8 continued . . .**

| question | answers | extra information | mark |
|---|---|---|---|
| **8**(b)(iv) | any **two** from:<br>• the material normally used has a value above the p.d likely to cause a shock<br>• use a material that reduces pd (below 3.6 kV)<br>• so people are less likely to be shocked<br>• can put 'non-shock' seating in adverts<br>• may sell more seats/ cars | accept use a material that reduces charge (on the person)<br>accept so people will not feel a shock<br>owtte | 2 |
| **Total** | | | **8** |