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# **GCE A LEVEL MARKING SCHEME**

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**SUMMER 2018**

**A LEVEL (NEW)  
PHYSICS - UNIT 5  
1420U50-1**

## **INTRODUCTION**

This marking scheme was used by WJEC for the 2018 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

## A2 UNIT 5 MARK SCHEME

### GENERAL INSTRUCTIONS

#### Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (except for the extended response question).

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

#### Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

#### Extended response question

A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statement.

### Marking abbreviations

The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao = correct answer only  
ecf = error carried forward  
bod = benefit of doubt

## PRACTICAL ANALYSIS TASK

| Question |     | Marking details  | Marks available |          |          |          | Maths    | Prac     |
|----------|-----|--|-----------------|----------|----------|----------|----------|----------|
|          |     |  | AO1             | AO2      | AO3      | Total    |          |          |
| 1        | (a) | Ratio of both sets of readings determined / 1.6(0) and 2.2(9) / 0.625 and 0.438 [ignore s.f.] (1) or equiv. e.g. Ratio of drop = $\frac{1.20}{0.80} = 1.5$ ; ratio of bounce = $\frac{0.75}{0.35} = 2.1$ <b>or</b> reciprocals of both<br><br>Constant (of proportionality) / ratio different - stated (1)<br><b>Not</b> proportional (1) [Independent mark] |                 | 3        |          | 3        | 1        | 3        |
|          | (b) | Freeze frame photography / slow motion camera / release mechanism / use of assistant or equiv.<br><br>[Not greater resolution]<br>[Allow a neutral and a correct answer]   |                 | 1        |          | 1        |          | 1        |
|          |     | <b>Question 1 total</b>  | <b>0</b>        | <b>4</b> | <b>0</b> | <b>4</b> | <b>1</b> | <b>4</b> |

| Question  |     | Marking details  |   |                         |                           |                         | Marks available             |             |        |       |       |      |   |
|---|-----|--|---|-------------------------|---------------------------|-------------------------|-----------------------------|-------------|--------|-------|-------|------|---|
|   |     |  |   |                         |                           |                         | AO1                         | AO2         | AO3    | Total | Maths | Prac |   |
| 2   | (a) | Load /N $\pm$ 5%   | Uncertainty load (N)  | Depression loading (cm) | Depression unloading (cm) | Mean depression, y (cm) | Uncertainty depression (cm) | 3           | 3      | 3     | 3     |      |   |
|   |     | 2.0  | 0.1/0.10  | 8.1                     | 8.3                       | 8.2                     | 0.1/0.10                    |             |        |       |       |      |   |
|   |     | 3.0  | 0.2/0.15  | 11.4                    | 11.4                      | 11.4                    | 0.1/0.10                    |             |        |       |       |      |   |
|   |     | 4.0  | 0.2/0.20  | 14.5                    | 14.6                      | 14.6                    | 0.1/0.10                    |             |        |       |       |      |   |
|   |     | 5.0  | 0.3/0.25  | 17.5                    | 17.3                      | 17.4                    | 0.1/0.10                    |             |        |       |       |      |   |
|   |     | 6.0  | 0.3/0.30  | 20.7                    | 21.0                      | 20.9                    | 0.2/0.15                    |             |        |       |       |      |   |
|   |     | (1)  |   | (1)                     | (1)                       |                         |                             |             |        |       |       |      |   |
| 1 mark for each correct column – with consistent s.f. |     |  |   |                         |                           |                         |                             |             |        |       |       |      |   |
|   | (b) | <p>Both axes labelled [could be <math>y</math> and <math>W</math>] and units included – correct orientation allow <b>ecf</b> (1)</p> <p>Suitable scales chosen so that the data points occupy at least <math>\frac{1}{2}</math> of each axis and not involving awkward factors, e.g. 3 (1)</p> <p>[Allow axis break but must be labelled unless 0 missing on <math>y</math> axis]</p> <p>All points plotted correctly to within <math>\pm \frac{1}{2}</math> small square division <b>ecf</b> (1)</p> <p>All <math>x</math>-axis error bars plotted correctly [<b>ecf</b> from (a)] (1)</p> <p>Correct steepest and least steep lines consistent with the <math>x</math>-axis error bars (1)</p> |   |                         |                           |                         | 1                           | 1<br>1<br>1 |        | 5     | 5     | 5    |   |
|   | (c) | (i)  | <p>Large triangles used (should be close to the extremities of the lines) or two suitable points clearly shown on each graph or clearly implied by calculation [see below] (1)</p> <p>Minimum gradient correctly calculated (<b>ecf</b>) (1)</p> <p>Maximum gradient correctly calculated (<b>ecf</b>) (1)</p> <p><b>Note:</b> ignore units [allow cm for <math>y</math>] and number of significant figures in this part of the question. Allow <b>ecf</b> for incorrect max/min lines.</p> |                         |                           |                         |                             | 1           | 1<br>1 |       | 3     | 2    | 3 |

|     |       |  |          |           |          |           |           |           |
|-----|-------|--|----------|-----------|----------|-----------|-----------|-----------|
|     | (ii)  | Mean gradient correct [expect $\sim 3.2 \times 10^{-2} \text{ [N m}^{-1}\text{]}]$ (1)<br>Percentage uncertainty correct and expressed to 1 or 2 sig fig.<br>ecf [no unit penalty] (1) [expect $\sim 11\%$ ]   |          | 2         |          | 2         | 2         | 2         |
| (d) | (i)   | Correct use of gradient, e.g. $E = \frac{4l^3}{\text{gradient} \times bd^3}$ quoted (or equiv)<br>or substitution of gradient (1)<br>$E$ calculated correctly with units Pa / $\text{N m}^{-2}$ (1)[accept $\text{N cm}^{-2}$ or<br>$\text{N mm}^{-2}$ [expect $\sim 1(.4) \times 10^{10} \text{ Pa}$ ] – no s.f. penalty<br>$p_l = 0.1\%$ ; $p_b = 4(.3)\%$ ; $p_d = 7.7\%$ (or $8\%$ ) [or by implication] (1) –<br>ignore s.f.<br>$p_l \times 3$ and $p_d \times 3$ (1)<br>Absolute uncertainty calculated from $p_{\text{tot}}$ expressed to 1 or 2 s.f.<br>N.B. $p_{\text{tot}}$ expect 27(.6) [or 28] + (c)(ii)( $p_{\text{grad}}$ ) [ $\sim 40\%$ ] |          |           |          | 5         | 5         | 5         |
|     | (ii)  | Biggest (fractional / %) uncertainty in $d$ [and it is cubed] (1)<br>Use a more accurate named instrument e.g. digital / Vernier<br>callipers or micrometer or better resolution instrument (1) [allow<br>appropriate answer relating to first mark]   |          |           |          | 2         | 2         | 2         |
|     | (iii) | <u>Mass/weight</u> of ruler not taken into account or equiv (e.g. there is<br>a deflection with no added load because of the <u>weight</u> of the<br>ruler)  |          |           |          | 1         | 1         | 1         |
|     |       | <b>Question 2 total</b>  | <b>2</b> | <b>11</b> | <b>8</b> | <b>21</b> | <b>17</b> | <b>21</b> |

| Question     | AO1      | AO2       | AO3      | TOTAL MARK | MATHS     | PRAC      |
|--------------|----------|-----------|----------|------------|-----------|-----------|
| 1            | 0        | 4         | 0        | 4          | 1         | 4         |
| 2            | 2        | 11        | 8        | 21         | 17        | 21        |
| <b>TOTAL</b> | <b>2</b> | <b>15</b> | <b>8</b> | <b>25</b>  | <b>18</b> | <b>25</b> |



|     |   |          |          |           |           |           |           |           |           |
|-----|---|----------|----------|-----------|-----------|-----------|-----------|-----------|-----------|
| (b) | <p>Clear table with headings [variable names of symbols] and correct units (1) [If repeats done – setting out correct]</p> <p>All values of <math>P</math>, <math>\ln P</math> (<math>R</math>, <math>\ln R</math> in Test 2) and <math>\ln V</math> correct (with no units) (accept <math>\ln(V/V)</math>) and <math>(\ln(P/W))</math> (Test 2: <math>\ln(R/(\Omega))</math>) (1)</p> <p>2/3 s.f. [or d.p.] for all <math>\ln V</math> and <math>\ln P</math> values (<math>\ln R</math> in Test 2) (1)</p> <p>Correct instrument resolutions quoted (1)</p> | 1        | 1        |           |           | 4         | 2         | 4         |           |
| (c) | <p>Axes labelled correctly – and no units (or alternative; see part (b)) <b>ecf</b> from part (a) (1)</p> <p>Suitable scale so that data points occupy half of each axis and not involving awkward factors e.g. 3 (1)</p> <p>All points plotted correctly to within <math>\pm 1/2</math> small square division (1)</p> <p>Good line of best fit consistent with data (1)</p>  | 1        | 1        |           |           | 4         | 3         | 4         |           |
| (d) | <p>Large triangle (should be close to extremities of the line of best fit i.e. over half the line used) or 2 equivalent points clearly indicated (1)</p> <p>Gradient calculated correctly (1)</p> <p>Intercept determined correctly (1)</p> <p><math>k</math> calculated correctly (1)</p>  |          |          |           |           | 4         | 4         | 3         | 4         |
| (e) | <p>Equation written correctly with values of <math>n</math> and <math>k</math> to 2 or 3 sig figs with <b>ecf</b> from part (d): <math>n</math> to within <math>\pm 0.1</math> of centre value</p>  |          | 1        |           |           | 1         | 1         | 1         | 1         |
| (f) | <p>Current for the circuit will have different value / resistance decreased / (acts as) resistors in parallel (1)</p> <p>Hence <math>k</math> has a different value [or by impl. e.g. intercept is different] (1)</p> <p><math>k</math> will double (Test 1) / halve (Test 2) [implies 2nd mark] (1)</p> <p><math>n</math> stays the same (Tests 1 and 2) (1)</p>   |          |          |           |           | 4         | 4         |           | 4         |
|     | <b>Question Total</b>   | <b>6</b> | <b>8</b> | <b>11</b> | <b>25</b> | <b>11</b> | <b>25</b> | <b>11</b> | <b>25</b> |

**A2 UNIT 5: PRACTICAL EXAMINATION****SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES**

| <b>Question</b>         | <b>AO1</b> | <b>AO2</b> | <b>AO3</b> | <b>TOTAL MARK</b> | <b>MATHS</b> | <b>PRAC</b> |
|-------------------------|------------|------------|------------|-------------------|--------------|-------------|
| Practical Analysis Task | <b>2</b>   | <b>15</b>  | <b>8</b>   | <b>25</b>         | <b>18</b>    | <b>25</b>   |
| Experimental Task       | <b>6</b>   | <b>8</b>   | <b>11</b>  | <b>25</b>         | <b>11</b>    | <b>25</b>   |
| <b>TOTAL</b>            | <b>8</b>   | <b>23</b>  | <b>19</b>  | <b>50</b>         | <b>29</b>    | <b>50</b>   |