AQA

ASSESSMENT and
QUALIFICATIONS
ALLIANCE

GCE

Physics A

Unit PHA5–9/P

Units 5–9 : Practical

Instructions to examiners

1   Give due credit to alternative treatments which are correct. Give marks for what is correct; do not deduct marks because the attempt falls short of some ideal answer. Where marks are to be deducted for particular errors specific instructions are given in the marking scheme.

2   Do not deduct marks for poor written communication. Refer the script to the Awards meeting if poor presentation forbids a proper assessment. In each paper candidates may be awarded up to two marks for the Quality of Written Communication in cases of required explanation or description. Use the following criteria to award marks:

   2 marks: Candidates write legibly with accurate spelling, grammar and punctuation; the answer containing information that bears some relevance to the question and being organised clearly and coherently. The vocabulary should be appropriate to the topic being examined.

   1 mark: Candidates write with reasonably accurate spelling, grammar and punctuation; the answer containing some information that bears some relevance to the question and being reasonably well organised. Some of the vocabulary should be appropriate to the topic being examined.

   0 marks: Candidates who fail to reach the threshold for the award of one mark.

3   An arithmetical error in an answer should be marked AE thus causing the candidate to lose one mark. The candidate's incorrect value should be carried through all subsequent calculations for the question and, if there are no subsequent errors, the candidate can score all remaining marks (indicated by ticks). These subsequent ticks should be marked CE (consequential error).

4   With regard to incorrect use of significant figures, normally two, three or four significant figures will be acceptable. Exceptions to this rule occur if the data in the question is given to, for example, five significant figures as in values of wavelength or frequency in questions dealing with the Doppler effect, or in atomic data. In these cases up to two further significant figures will be acceptable. The maximum penalty for an error in significant figures is **one mark per paper**. When the penalty is imposed, indicate the error in the script by SF and, in addition, write SF opposite the mark for that question on the front cover of the paper to obviate imposing the penalty more than once per paper.

5   No penalties should be imposed for incorrect or omitted units at intermediate stages in a calculation or which are contained in brackets in the marking scheme. Penalties for unit errors (incorrect or omitted units) are imposed only at the stage when the final answer to a calculation is considered. The maximum penalty is **one mark per question**.

6   All other procedures, including the entering of marks, transferring marks to the front cover and referrals of scripts (other than those mentioned above) will be clarified at the standardising meeting of examiners.

1 *planning*
measurements:
(to measure <u>depth</u> in lower container)
use <u>ruler</u> or millimetere scale (scale to be specified)   ✓
(if 'volume' measured, must have uniform cross-sectional area)
(to measure/monitor the time) use stopwatch   ✓
(use of two containers, one draining into the other, continuously <u>or not</u>,
or measurement mark not accepted)

strategy:
allow water to drain from upper into lower container, then into a sink: ✓
(process <u>must</u> be continuous and containers must have uniform cross-
sectional area or zero marks for strategy)
arrangement takes account of need for *half-life* of Y > *half-life* of X   ✓
(can be shown in diagram, e.g. lower container has smaller outlet or
larger cross-sectional area: different outlet sizes must have same
cross-section, different cross-sections must have same outlet size)
measure how depth [volume or mass] of water in the <u>lower</u> container
changes at regular intervals   ✓
illustrate how depth changes with time by plotting graph of depth of
water in <u>lower</u> container against time   ✓
(for 'measure time to reach certain depths', strategy mark = $_{max}3$)

control:
containers used must have uniform (not 'same') cross-sectional area
or ensure that all the water initially in upper container drains <u>through</u>
the middle container ['avoid splashing/spillage' accepted]
or ensure that lower container is empty at start   ✓✓

difficulties:
(*difficulty + how overcome* = 2)

any **two** of the following:
reduce uncertainty in depth (not 'volume') of water
by making cross-sectional area small (to increase depth measurement)
[or by using transparent container]
('use large volume' or 'add dye to liquid' not accepted)

improve resolution of graph
by increasing frequency of readings when depth is changing most rapidly

increase time in which to record data [increase amount of data]
by reducing flow rate by making outlet(s) small

reduce difficulty in taking measurements
by marking container and measuring (accurately) later   ✓✓✓   <u>(8)</u>
                                                                                     <u>(8)</u>

2   *implementing*

(a)   *accuracy* c, y_1 and y_2 <u>all</u> recorded to nearest mm   ✓

                   M to nearest g, from $\dfrac{100y_1}{y_2}$ ✓

                   M correct to SV±5 g   ✓

(b)   *tabulation* m/g nT T/s   ✓✓

        readings: 5 sets of m (including 20 g and 100 g) and nT ✓
                   (mark deducted for any missing or
                   if any nT where n or Σn<20)

        significant   all nT to 0.1 s or better, all T to 0.01 s   ✓
        figures

(c)   *quality*   at least four points to ±2 mm of smooth curve
                   of positive decreasing gradient
                   (providing suitably- scaled graph drawn)   ✓   *(8)*

3   *applying evidence and drawing conclusions*
       processing

(c)   *axes*   marked m/g, T/s   ✓✓
                   (deduct ½ for each missing, rounding down)
        scale   suitable (e.g. 8×8)   ✓✓
                   [5×5, 2×8, 8×2 ✓]
        points   five points plotted correctly   ✓
                   with smooth best-fit line of positive, decreasing gradient

       deductions

(d)(i) G to 3 s.f. from suitable Δ (e.g. 8×8)   ✓
   (ii) T' read correctly from graph $\pm$ 1 grid square (allow incorrect M)   ✓
   (iii) $\dfrac{2MG}{T'}$, no unit (or C.E.) in range 0.10(0) to 0.17(0)   ✓   *(8)*

4 *evaluating evidence and procedures*

(e)(i)   sketch: (line on) fiducial mark must be aligned with pivot   ✓

pivot

edge of bench
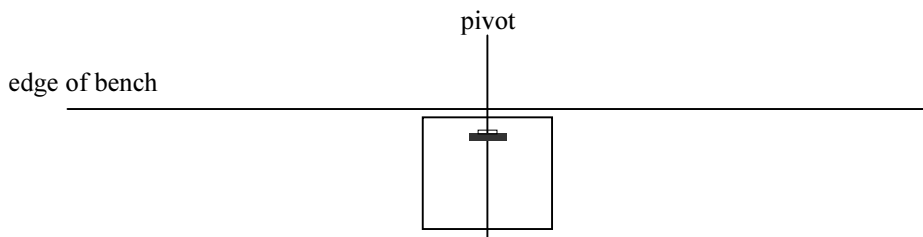
positioned at centre of oscillation because transit time is least   ✓

(e)(ii)   draw tangent to curve   ✓
          suitable sketch or reasonable explanation explaining correct use of
          plane mirror to determine either the normal or the tangent to the curve,   ✓

          e.g. to find normal to curve
          look for line on page and line in
          reflection to be continuous
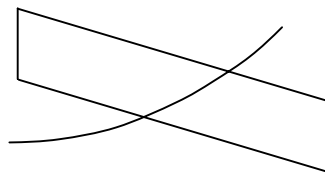
(e)(iii) student A reduces <u>random</u>
          [human/percentage] error (not 'the error')   ✓
          student B can detect <u>systematic</u> error [anomalies]
          ('less likely to lose count' or 'through averaging accounts
          for/eliminates anomalies' not acceptable)   ✓   <u>(6)</u>
                                                                                  <u>(22)</u>