UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2009 question paper

for the guidance of teachers

0625 PHYSICS

0625/31   Paper 31 (Extended Theory), maximum raw mark 80

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

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NOTES ABOUT MARK SCHEME SYMBOLS AND OTHER MATTERS

B marks   are independent marks, which do not depend on any other marks. For a B mark to be scored, the point to which it refers must actually be seen in the candidate's answer.

M marks   are method marks upon which accuracy marks (A marks) later depend. For an M mark to be scored, the point to which it refers **must** be seen in a candidate's answer. If a candidate fails to score a particular M mark, then none of the dependent A marks can be scored.

C marks   are compensatory method marks which can be scored even if the points to which they refer are not written down by the candidate, provided subsequent working gives evidence that they must have known it. e.g. if an equation carries a C mark and the candidate does not write down the actual equation but does correct working which shows he knew the equation, then the C mark is scored.

A marks   are accuracy or answer marks which either depend on an M mark, or which are one of the ways which allow a C mark to be scored.

c.a.o.   means "correct answer only".

e.c.f.   means "error carried forward". This indicates that if a candidate has made an earlier mistake and has carried his incorrect value forward to subsequent stages of working, he may be given marks indicated by e.c.f. provided his subsequent working is correct, bearing in mind his earlier mistake. This prevents a candidate being penalised more than once for a particular mistake, but **only** applies to marks annotated "e.c.f."

e.e.o.o.   means "each error or omission".

brackets ( ) around words or units in the mark scheme are intended to indicate wording used to clarify the mark scheme, but the marks do not depend on seeing the words or units in brackets.
e.g. 10 (J) means that the mark is scored for 10, regardless of the unit given.

underlining   indicates that this must be seen in the answer offered, or something very similar.

OR/or   indicates alternative answers, any one of which is satisfactory for scoring the marks.

Spelling   Be generous about spelling and use of English. If an answer can be understood to mean what we want, give credit.

Significant   Answers are acceptable to any number of significant figures ≥ 2, except if specified
  Figures   otherwise, or if only 1 sig.fig. is appropriate.

Units   It is expected that all final answers will have correct units. Deduct one unit penalty for each incorrect or missing unit, maximum 1 per question. No unit penalty if unit is missing from final answer but is shown correctly in the working. No unit penalty for incorrect answer.

Fractions These are only acceptable where specified.

Extras   Ignore extras in answers if they are irrelevant; if they contradict an otherwise correct response or are forbidden by mark scheme, use right + wrong = 0

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Ignore   Indicates that something which is not correct is disregarded and does not cause a right plus wrong penalty.

Not/NOT   Indicates that an incorrect answer is not to be disregarded, but cancels another otherwise correct alternative offered by the candidate i.e. right plus wrong penalty applies.

Work which has been crossed out, but not replaced, should be marked as if it had not been crossed out.

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1 (a) micrometer OR screw gauge OR vernier scale NOT vernier callipers   B1

(b) 2.73 mm   B1

(c) check/set zero   )
close instrument on to paper   )
not too tight/use ratchet   )   any 3   B1 × 3
take reading of both scales   )
use several sheets   )
divide reading by no. of sheets   )

                                                                                                    [5]

2 (a) measuring cylinder with liquid   B1
immerse statue   B1
volume from difference of readings from measuring cylinder   B1
OR
displacement can/equivalent/beaker, <u>filled to overflowing</u> with liquid   (B1)
immerse statue   (B1)
measure volume displaced <u>with measuring cylinder</u>   (B1)

(b) (D =) M/V   OR   600/65   B1
9.23 g/cm^3 (minimum 2 s.f.) N.B. unit penalty applies   B1
OR
(For gold) (M =) V × D OR 65 × 19   (B1)
1235 g   (minimum 2 s.f.)   N.B. unit penalty applies   (B1)
OR
(For gold) (V =) M / D OR 600/19   (B1)
31.6 cm^3 (minimum 2 s.f.)   N.B. unit penalty applies   (B1)

'NO' ticked if justified by previous work in **(a)** or **(b)**.
e.c.f from wrong values above   B1

                                                                                                    [6]

3 (a) 5 points correctly plotted ±½ small square –1 e.e.o.o. (ignore 0,0)   B2

(b) 3 N one, however identified OR 3rd value OR 4th value   B1

(c) good straight line through origin and candidate's remaining points   B1

(d) straight line / constant gradient   M1
does obey Hooke's Law   A1
OR
special case: obeys Hooke's law because force ∝ extension or wtte   B1

(e) graph becomes non-linear / curves / bends   B1
    Ignore reference to direction of curve or bend.

(f) will have exceeded / reached proportional / elastic limit
    OR permanently deformed or equiv OR staightened
    OR will have broken   OR   no longer elastic or wtte   B1

                                                                                                            [8]

4 **(a)** in direction of the force Do not accept forward on is own.   B1

(b) changes direction / causes acceleration / stops straight line motion / keeps object
    from leaving circle / keeps path circular / pulls object into circle   B1

(c) **(i)** 1. 600 N   B1
           2. same as his 1. accept 600 N if no value given in **(c) (i)** 1.   B1

    (ii) ma OR 60 × 2.5   C1
            150 N   A1

    (iii) 750 N e.c.f. from **(c) (i)** 2 and/or **(c) (ii)**   B1

    (iv) same as his **(c) (i)** 2 accept 600 N if no value given in **(c) (i)** 2.   B1

                                                                                                            [8]

5 **(a)** (P.E.) = mgh   C1
    12 × 10 × 3   Accept g = 9.8 or 9.81   C1
    360 J   g = 9.8 gives 352.8 J (minimum 2 s.f.)   A1
                  g = 9.81 gives 353.16 J (minimum 2 s.f.)

(b) (P =) E/t   C1
    360/60   C1
    6 W   352.8 J gives 5.88 W   353.16 J gives 5.886 W (minimum 2 s.f.)   A1

                                                                                                             [6]

6 **(a)** **(i)** increases   B1

    (ii) pV = const in any form   C1
            1.05 (× 10^5) × 860 (× 10^{-6}) = p × 645 (× 10^{-6})   C1
            1.4 × 10^5 Pa   A1

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    (iii)   F = pA in any form   accept weight for F   C1

            EITHER   increase in pressure = 0.35×10^5 (Pa)   C1

                                 $0.35 \times 10^5 \times 5.0 \times 10^{-3}$ C1

                                 175 N   (minimum 2 s.f.) c.a.o.   A1

         OR $1.05 \times 10^5 \times 5.0 \times 10^{-3}$ or 525 N or $1.4 \times 10^5 \times 5.0 \times 10^{-3}$ or 700 N   (C1)

               700 – 525 N e.c.f. from **(a) (ii)**   (C1)

               175 N   (minimum 2 s.f.) c.a.o.   (A1)

   (b) **(i)**   increases   B1

        (ii)   no change   B1

      (iii)   extra weight (on tray/piston)   B1

      (iv)   increases   B1

                                                                [12]

7 **(a)** EITHER   OR

            copper   constantan

            copper   constantan

            constantan   copper   B1

   (b) galvanometer OR <u>milli</u>voltmeter OR <u>milli</u>ammeter OR <u>digital</u> ammeter

       OR <u>digital</u> voltmeter   B1

   (c) rapid response   )

       small area   )

       can measure high / low temperatures   )

       small thermal capacity (idea of)   ) any 1   B1

       remote reading   )

       large range   )

       data logging / continuous monitoring possible)

       takes temperature of a surface   )

       N.B. (very) sensitive not accepted

                                                               [3]

8 **(a)** 2 cm (by eye) vertical object somewhere between F_2 and lens

                                (condone no O, if clear)   B1

   (b) any two standard rays correctly drawn (no extrapolation needed)   B1

       correct rays extrapolated <u>back</u> to intersect   B1

       virtual image drawn at candidate's intersection of extrapolated rays

                              (condone no I, if clear)   B1

                                                             [4]

9 **(a)** (quantity of) heat/energy to raise temp by 1 °C/1degC/1K/unit temp rise   M1
    1 kg OR 1 g OR unit mass   (Mention of change of state gets M0 A0)   A1

(b) long time to heat up/cook   )
    long time to cool down   ) any 1   B1
    expensive to heat   )
    takes a lot of energy to heat up   )

(c) **(i)** 1.8 degC OR 1.8 °C OR 1.8 K
    AND 77.1 degC OR 77.1 °C OR 77.1K   B1

    (ii) (Q =) mcT in any form, seen anywhere   B1
       0.2 × 4200 × 1.8 e.c.f. from **(c) (i)**   C1
       1512 J (minimum 2 s.f.) c.a.o.   A1

    (iii) 1512 = 0.05 × c × 77.1 in any form e.c.f. from **(c) (i)** and/or **(c) (ii)**   C1
        392 J/kg K (N.B. must be to 3 sf ; A0 for wrong s.f.) e.c.f.   A1

    (iv) heat lost during transfer   )
       boiling water not at 100 °C / reason for not boiling
       at 100 °C e.g. water not pure/ not standard pressure   )
       energy lost to cup etc. / surroundings   ) any 1   B1
       thermometer not accurate / sensitive enough   )
       temperature / mass(es) not accurately measured   )

                                                                [10]

10 **(a)** **(i)** <u>step-up</u> transformer   B1

    (ii) less heat/energy/power loss (from lines) / thinner wires (possible)   B1
       OR lower current   NOT more efficient

(b) P = V × I in any form, figures or symbols / (P =) VI   C1
    2.5 A   A1

(c) P = I^2R in any form, figures or symbols / (P =) I^2R   C1
    18.75 W e.c.f. from **(b)**   A1

(d) V = IR in any form, figures or symbols OR (V =) IR OR
    P = V^2 / R in any form, figures or symbols OR (P =) V^2 / R OR V = $(PR)^{1/2}$ C1

    7.5 V e.c.f. from **(b)** or **(c)**   A1

(e) 22,000 – 7.5 – 7.5 OR 22,000 – 7.5 ecf   C1
21,985 V   e.c.f. (minimum 4 s.f.in this case)   A1
OR
55,000 – 37.5 = 54962.5   (C1)
54962.5 / 2.5 = 21985 V (minimum 4 s.f. in this case)   (A1)

             [10]

11 (a) A   NOT or inverter   B1
       B   AND   B1

(b) (accept 1 or ON for HIGH, and 0 or OFF or NOT HIGH for LOW throughout)

    (i) A – HIGH   and   B – LOW (both) no e.c.f.   B1

    (ii) A – HIGH   and   B – HIGH (both) no e.c.f.   B1

    (iii) A – LOW   and   B – LOW (both)   no e.c.f.   B1

(c) (i) B cannot provide enough power / current for lamp, or equiv.
       OR allows remote lamp   B1

    (ii) the second one / dark and warm / HIGH, HIGH e.c.f. from **(b)**   B1

    (iii) warning if temperature in a closed / dark space (e.g. refrigerator, kiln) reaches
       too high a value
       N.B. "to switch on a lamp when it is dark and warm" not accepted   B1

             [8]