UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2010 question paper

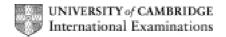# for the guidance of teachers

0625 PHYSICS

0625/31   Paper 3 (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 & OTHER MATTERS

Points applicable to all answers

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 further marks 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 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.

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.

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

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.

Points applicable to numerically worked answers only

Final answers If the final answer to a numerically worked question is correct, with the correct unit and an acceptable number of significant figures, all the marks for that question are awarded. The points which could have gained C marks need not be examined, even if wrong.

Ecf 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 ecf. provided his subsequent working is correct, bearing in mind any earlier mistake. This prevents a candidate being penalised more than once for a particular mistake, but **only** applies to marks annotated ecf.

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

Units Deduct one mark for each incorrect or missing unit from **an answer that would otherwise gain all the marks available for that answer: maximum 1 per question.** No deduction is incurred if the unit is missing from the final answer but is shown correctly in the working.

Arithmetic errors Deduct one mark if the **only** error in arriving at a final answer is an arithmetic one.

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 the mark scheme, use right + wrong = 0

1 **(a)** (parallelogram or triangle may have any orientation)
NOT a copy of Fig. 1.1
two sides at right angles, by eye   B1
one side longer than the other   B1
diagonal or completion of triangle drawn **and** labelled "resultant" OR R
Ignore numerical values. Condone arrows in wrong direction   B1

(b) 98 N – 102 N   B1
(accept value found by calculation)

(c) (vertically) up/opposite to W NOT North   B1

(d) his **(b)** OR correct value calculated   B1
ignore mass

[Total: 6]

2 **(a)** constant velocity must be in a straight line/direction of motion is changing   B1

(b) **(i)** if no force, then constant velocity in straight line OR force is needed
to change direction   B1

body moving in circle is changing direction/velocity/accelerating
so force is needed   B1

(ii) towards centre (of circle)/at right angles to motion/inwards   B1

(iii) friction between tyres and road/reaction from banking of track   B1

[Total: 5]

3 **(a)** **(i)** (P =) F/A in any form   OR   1000/0.01   C1
100 000 Pa   accept N/m^2 A1

(ii) multiplication of either force or area by 4   C1
0.08 × his **(i)**   OR   0.02 × his **(i)**   C1
8000 N   e.c.f. from **(i)**   A1
(2000 N gets C0, C1, A1)

(b) his **(ii)** – 2000 correctly evaluated   C1
600 kg e.c.f.   A1

[Total: 7]

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4 (a) heat/energy to raise/change temperature   M1
of 1 kg/1g/unit mass through 1°C/1K   A1
(mention of change of state scores zero)

(b) $Q = mc\theta$ (for θ accept t, T, $\Delta\theta$, Δt, or ΔT)   B1
$23800 = 0.93 \times c \times (41.3 - 13.1)$ C1
907.5 or 907 or 908 or 910 J/(kg °C) or J/(kg K) at least 2 sig. figs   A1
(for unit in **(b)** and **(c)(i)** condone no brackets and extra solidus)

(c) (i) 1212.9 or 1200 or 1210 or 1213 or 1214 J/(kg °C) or J/(kg K)   B1

    (ii) more energy lost (to surroundings)   B1
        (average) temperature is higher/initial temperature higher/no cooling
        time allowed/temperature rise is lower/time of heating may be longer/
        rate of heating may be lower   B1

(d) insulate block/provide lid/cover with shiny foil   )
    start & finish same amount below & above room temperature)   any 2   B1 + B1
    get heater up to temperature before inserting   )
    put oil in gap between heater & block   )

                                                                              [Total: 10]

5 (a) (i) (speed =) distance/time in any form, words, letters, numbers   C1
        0.15 m/s or 15 cm/s   A1
        (if answer only, 1 mark for either if no units)

    (ii) (PE =) mgh OR mgh OR Wh symbols, words or numbers   C1
        100 J OR 98.1 J OR 98 J   A1

    (iii) his **(ii)**/40 OR his **(ii)**/4   C1
        2.5 W OR 2.45 W e.c.f. from **(ii)**   A1

(b) (input) greater/output less NOT a numerical factor   B1

                                                                              [Total: 7]

6 (a) incident ray in (more) dense medium   )
    angle of incidence greater than critical angle/42°   )   any 3   B1 × 3
    no light refracted   )
    reflected with $i = r$)

(b) reflection at Q only, no further reflections   B2
    (allow B1 only, if there is one further reflection at <u>lower</u> surface)
    (give B0 for more than one further reflection)   **[Total: 5]**

7 **(a)** **(i)** sound B1

(ii) particle OR mechanical OR compression OR longitudinal
OR matter wave B1

(iii) ultra violet/uv B1

(b) $v = f\lambda$ OR $\lambda = v/f$ B1
$3.0 \times 10^8 / 2.5 \times 10^8$ OR $3.0 \times 10^8 = 2.5 \times 10^8 \lambda$ C1
1.2 m A1

[Total: 6]

8 **(a)** capacitor/capacitance/condenser B1

(b) **(i)** 5 Ω B1

(ii) 5 and 20 both used OR 25 C1

$1/R = 1/R_1 + 1/R_2$ OR $(R =) \dfrac{R_1 R_2}{R_1 + R_2}$ seen or used C1

4 Ω A1

(c) EITHER | OR
ammeter reading falls (to zero) | no current/reading M1

as capacitor charges | P already charged/does not conduct d.c. A1

(d) Formula for calculation of I ($I = V/R$) OR P ($P = V^2/R$) C1
Use of energy = power × time in any form C1
400 s A1

[Total: 10]

9 **(a)** **(i)** negative at LH end **and** positive at RH end B1

(ii) (+ve) charge on A attracts electrons/-ve charges/-ve ions
OR unlike charges attract (ignore reference to + charges) B1
<u>electrons</u> move to end X/towards A B1
(unbalanced) +ve charges (left) at end Y NOT repelled to Y B1

(iii) idea that each electron leaves behind an equal unbalanced proton
in nucleus/B has no net charge/B is neutral/idea that B has not
gained or lost any charges B1

(b) **(i)** nothing OR nothing implied B1

(ii) +ve charge cancelled/neutralised B1
by electrons/negative charges <u>flowing up from earth</u> B1

[Total: 8]

10 (a) idea of background radiation   M1
        random/different at different times   NOT places   A1

    (b) A   nothing   OR   background   M1
               reading doesn't change (when source removed)   A1

          B   gamma   OR   γ   M1
               gamma undeflected (by magnetic field)   A1
               uncharged/neutral   OR   electromagnetic radiation   A1

          C   beta   OR   β   B1
               deflection is big/more deflection than alpha   B1
               low mass/much smaller than alpha   B1

               OR

               beta   OR   β   B1
               negative   B1
               deflects according to left-hand rule   B1

                                                         [Total: 10]

11 battery   horizontal line across at least 4 squares   M1
                               above or below horizontal centre line   A1

    a.c. supply   alternating trace, any shape one or more cycles, at least
                               4 squares wide   M1
                               above and below centre line, need not be symmetrical   A1

    a.c. supply   only humps or only troughs seen, minimum 2 humps or troughs
    + diode   M1

                               horizontal lines, approximately same width as humps or troughs,
                               separating humps or troughs   A1

                                                         [Total: 6]