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.

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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.

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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

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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, Δθ, 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 lower surface)
(give B0 for more than one further reflection) **[Total: 5]**

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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 $(R =) \frac{R_1 R_2}{R_1 + R_2}$ 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
electrons 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 flowing up from earth B1

[Total: 8]

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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 + diode only humps or only troughs seen, minimum 2 humps or troughs M1
horizontal lines, approximately same width as humps or troughs, separating humps or troughs A1

[Total: 6]

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