UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2010 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.

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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.

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1 **(a)** decreases / braking / decelerating)
constant / steady / nothing) all 3 B1
increases / accelerate)

(b) speed x time in any form, symbols, numbers or words
OR any area under graph used or stated C1
13 (m/s) OR 24 (s) seen or used in correct context C1
312 m A1

(c) rate of change of speed OR gradient of graph OR 18/12 C1

18 (m/s) OR 12 (s) seen or used in correct context C1
1.5 m/s^2 A1

(d) <u>same</u> gradient / slope OR equal speed changes in equal times OR allow graph symmetrical B1 [8]

2 **(a)** $½mv^2$ OR ½ × 900 x 30^2 C1
405 000 J A1

(b) force x distance OR 2000 x 30 C1
60 000 J OR 60 kJ A1

(c) 60 000 W OR 60 000 J/s OR 60kW OR 60 kJ/s ecf from (b) B1

(d) chemical B1

(e) idea of energy loss / heat / sound / inefficiency / energy used within car / possibility of increase in P.E. Ignore work done against against friction B1 [7]

3 **(a)** 2^{nd} statement re-written to include force in first gap and <u>inversely</u> proportional to mass in second gap. NOT indirectly proportional B1

(b) F = ma OR in words in any correct arrangement B1

(c) **(i)** nothing OR continues as before OR same / constant velocity OR same / constant speed & direction OR no acceleration B1

(ii) idea of retardation. Ignore stop. Ignore brakes. Ignore goes in opposite direction B1

(iii) moves in (arc of a) circle or curve OR deflected OR turns OR changes direction B1 [5]

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4 **(a)** matt black B1

(b) **(i)** L down and R up, equal amounts (by eye) B1

(ii) on black side or on left (more) energy / heat absorbed OR greater temp rise OR heats up quicker B1

on black side or on left greater expansion of air / greater pressure of air B1 [4]

5 **(a)** <u>energy</u> / <u>heat</u> required to change state / phase / any example of change of state / phase M1

with no change in temperature / at a specified temperature A1
OR energy to break bonds between molecules /atoms M1
with no change in K.E. A1

(b) any time or range of time between 1.6 (min) and 14.0 (min) inclusive [no UP] B1

(c) turns substance to gas / vapour OR causes evaporation OR escape from liquid C1

energy to break bonds/separate molecules/overcome intermolecular forces
Ignore move faster / PE increases A1

(d) **(i)** Pt / 2 × 4 / 2000 × 4 / 2 × 240 / 2000 × 240 / 8 / 8000 / 480 / 480000 C1
480 000 J OR 480 kJ A1

(ii) (θ =) 43 (°C) seen anywhere C1
Q = mcθ OR 480000 = m x 1760 × 43 in any form ecf. from **(i)** C1
6.34 kg or 6.3 kg ecf. A1 [10]

6 **(a)** **(i)** same / unchanged / nothing B1

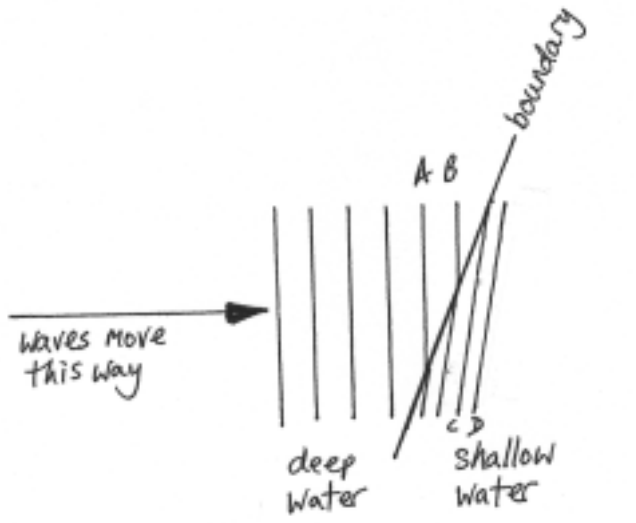
(ii) reduced / slows down B1

(iii) reduced B1

(b) v = fλ in any form or in words [not numbers]
OR f =1/T in any form or in words [not numbers] B1
0.12 = f × 0.08 OR T = 0.08 / 0.12 C1
1.5 Hz / cycles per sec / c.p.s. / per s
[only 2 marks if B1 mark above not scored] A1

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(c)



(ignore length of waves)
waves bending in correct direction (be generous) M1
A and B correct by eye, straight and parallel A1
C and D parallel to A and B by eye A1 [9]

7 **(a)** idea of light travelling (much) faster than sound B1

(b) **(i)** 4.0 (min) B1

(ii) always a (measurable) time difference / never zero time difference
Ignore time would be less B1

(iii) distance/time in any form, symbols, words, numbers OR 1200/3.6 C1
333.3 m/s to 2 or more sig figs A1

(iv) idea of light travelling instantaneously OR no wind
OR idea of lightning at ground level OR no obstruction to sound
Ignore echoes B1

(c)

	light waves	sound waves
longitudinal		✓
transverse	✓	
electromagnetic	✓	
mechanical		✓

–1 e.e.o.o. i.e. 1 mark subtracted from 3 for each error or omission B3 [9]

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8 **(a)** **(i)** $N_1/N_2 = V_1/V_2$ in any form, symbols, words or numbers — C1
12 (turns) [possible unit penalty] — A1

(ii) mention of magnetic / electromagnetic field)
change of flux linkage / magnetism)
OR field lines being cut)
Induced current / emf / voltage) any 3 — B1 x 3
Fewer coils in secondary so smaller emf / voltage
OR larger current)

(iii) heat in either coil / wires)
eddy currents in core / heat in core) any 1 — B1
magnetic leakage from core)
sound from core/coil)

(b) **(i)** 12 V d.c. OR low d.c.voltage — B1

(ii) diode OR rectifier [Ignore extras unless wrong] — B1

(c) $V_1I_1 = V_2I_2$ in any form, or words or numbers
OR power in = power out or equivalent — C1

8 A — A1 [10]

9 **(a)** first finger – field / magnetism / flux)
second finger – current / charge flow (NOT electron flow)) both — B1

(b) **(i)** brush OR contact OR sliding connector — B1
split ring OR commutator NOT slip ring — B1

(ii) clockwise OR right side down OR left side up OR correct arrows on figure NOT turn to the right — B1

(iii) more current / more voltage / "stronger battery" / more power)
more turns on coil / more coils)
stronger magnet Ignore bigger magnets)
closer magnet / magnetic poles) any 2 — B1, B1
more magnets)
iron core) [6]

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10 (a) proton number OR atomic number OR (number of) protons / electrons OR position in periodic table OR chemical properties B1

(b) mass (number) OR nucleon number OR (number of) neutrons / nucleons OR (number of) protons plus (number of) neutrons B1

(c) (i) mass (number) OR nucleon number OR (number of) nucleons OR (number of) protons plus (number of) neutrons B1

(ii) proton number OR atomic number OR (number of) neutrons OR (number of) protons / neutrons / electrons OR position in periodic table OR chemical properties OR a neutron changes into a proton B1 [4]

11 (a) (i) 4 Ω B1

(ii) IVt OR I^2Rt OR V^2t/R in any form or words or numbers
Condone t = 9 if substituted possible ecf from **(i)** C1
540 (s) C1
437.4 J possible ecf if 4 Ω from **(i)** used A1

(b) $R = \rho L/A$ OR $R \propto L/A$ OR $R \propto L$ and $R \propto 1/A$ or $1/d^2$ or $1/r^2$ C1

$A_2 = ¼A_1$ OR $A_2 = 0.25A_1$ C1
$R_2 = (0.45/0.3) \times R_1$ OR $(3/2) \times R_1$ C1
⅜ OR 0.375 OR 37.5 % A1
OR
$R = \rho L/A$ OR $R \propto L/A$ OR $R \propto L$ and $R \propto 1/A$ or $1/d^2$ or $1/r^2$ C1

Resistance of thinner wire with same length as thicker wire = 4 × 4 = 16 Ω C1

Actual resistance of thinner wire = 1.8 /0.3 = 6.0 Ω C1

Ratio: L of thinner wire / L of thicker wire = 6.0 / 16 = 3/8 = 0.375 = 37.5 % A1 [8]

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