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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2011 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.

- Cambridge will not enter into discussions or correspondence in connection with these mark schemes.

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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.

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.**

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

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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1 **(a)** all points correctly plotted ±½ small square
straight line of best fit for candidate's points — B

(b) **(i)** candidate's correct value with unit (± 0.2), (expect 1.2 N) — B1

(ii) remains stationary / nothing happens / no acceleration NOT constant speed — B1

(c) Correct data from candidates graph for ΔF and Δm, used in ΔF/Δm — B1

(d) **(i)** $F = ma$ in any form, letters, words — B1

(ii) gradient = F/a OR gradient = m ignore $m=F/a$ — C1
candidate's **(c)** with correct unit — A1

(e) straight line of positive gradient — B1 [9]

2 **(a)** distance/height AND tape measure/(metre) rule(r) — B1
weight OR load OR force
AND balance/scale(s) OR newton-meter/spring balance/force meter — B1
time AND watch/clock/timer — B1

(b) power = work/time OR energy/time in any form
OR Pt words or numbers seen anywhere e.g. 528 x 5 — C1
(work =) force × distance in any form — C1
11 — A1

(c) efficiency = E_{out}/E_{in} OR P_{out}/P_{in} seen anywhere, clearly identified
OR 520 × (20/11) × 5
OR (work done =) 800 × 20 × 0.3 OR 800 × 20 × 30 OR 4800 (J) OR 720 (J) — C1
(energy used =) 32,000 J — A1 [8]

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3 **(a)** **(i)** smaller because <u>area</u> smaller

(ii) smaller because depth/height smaller ignore less water B1

(b) **(i)** $h\rho g$ OR $12 \times 1000 \times 10$ C1
1.2×10^5 Pa OR 1.1772×10^5 Pa OR 1.176×10^5 Pa accept N/m^2 A1

(ii) candidate's **(i)** + 1.0×10^5 Pa correctly evaluated with unit (correct value 2.2×10^5) B1

(iii) $p_1V_1 = p_2V_2$ in any form C1
$1.1\ cm^3$
OR 0.5 × candidate's **(ii)**/10^5 correctly evaluated A1

(iv) value in **(iii)** too small OR volume larger o.w.t.t.e. B1 [8]

4 **(a)** rheostat/<u>variable</u> resistor AND control/vary/change/ limit current /resistance/power/voltage <u>across heater</u> B1

(b) **(i)** $P = VI$ in any form OR (I=) P/V C1
1.25 A A1

(ii) (R =) V/I in any form words or numbers C1
(voltage across X =) 2.4 (V) OR 6 - 3.6 (V) C1
1.92 Ω e.c.f. from **(b) (i)** A1

(c) battery running down/going flat/energy <u>of battery</u> used up OR V or e.m.f. less OR more/increasing resistance (of heater) NOT resistance of X increases B1

(d) **(i)** transformer condone step-up OR potential divider/potentiometer NOT extras B1

(ii) diode OR rectifier OR L.E.D. NOT extras B1 [9]

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5 **(a)** **(i)** potential difference OR e.m.f. OR voltage ignore volts

(ii) frequency accept cycles/s ignore waves/s } all 3 B1

(iii) power accept energy/s

(b) **(i)** case/frame/outside/base/parts that can be touched ignore metal parts B1

(ii) electric shock/electrocution/death by electricity o.w.t.t.e. ignore anything else B1
live wire touches case B1

(c) heaters in parallel with any supply
(M0 if no supply, clear break in circuit, short across supply or heater) M1
one switch controlling both heaters and one switch controlling one heater
OR one switch in series with each element A1

special case: heaters in series with supply and one switch shorting out one resistor AND another switch in series with supply B2 [6]

6 **(a)** A and C B1

(b) **(i)** 4.2×10^{10} years B1

(ii) idea of decay OR changes proton/neutron/nucleon number
OR change into another nuclide/isotope/element/type of atom
OR emits α/β particle (ignore γ / radiation) B1

(iii) idea of insignificant change in activity during stated time up to 5×10^{9} years
OR experiment time insignificant c.f. 1.4×10^{10} years OR long half life
OR long time to decay B1 [4]

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7 **(a)** idea of fine ray/beam shone into (glass) block / pins appropriately placed shown in diagram or described B1
angles *i* & *r* or *C* measured OR correct *i* & *r* or *C* marked on diagram B1
sin*i*/sin*r* OR sin*r*/sin*i* OR 1/sin*C* OR sin*C* B1
n = speed in air/speed in glass OR *c*/*v* = sin*i*/sin*r* OR *n* = 1/sin*C* OR *c*/*v* = 1/sin*C* B1

(b) **(i)** $v = f\lambda$ OR $240/1.9 \times 10^5$ OR $T=d/s$ AND $f=1/T$ B1
0.00126 Hz OR 0.0013 Hz NOT 0.0012 Hz
ignore more than 3 s.f. accept s^{-1} A1

(ii) distance = speed × time in any form accept $s = 2d/t$ C1
(time for tremor =) 240 (s) or 4 mins also gives first C1 C1
(time for tsunami =) 2500 (s) or 41 mins 40 s also gives first C1 C1
(warning time =) 2260 (s) or 37 mins 40 s A1 [10]

8 **(a)** **(i)** total (internal) reflection OR reflection but no refraction/doesn't emerge B1
angle (of incidence} > critical angle B1

(ii) initial reflection + 0 or 1 further reflection only, not at lower surface
must be straight and reach within 1cm of end B1

(b) **(i)** bends easily/less likely to break (ignore stronger) OR smaller pixels/
more detail/greater resolution/see smaller objects/wider field of view B1

(ii) light travels down/along/through fibres B1

(iii) light/image returns up/along/through fibres ignore cameras B1 [6]

9 **(a)** **(i)** down
down OR anti-clockwise } both B1

(ii) BC is parallel to the field/doesn't cut field or vice-versa/not at angle to field
ignore BC not perpendicular to field B1

(b) continues moving/turning NOT reverse/other direction M1
idea of moving things continue moving OR reference to Newton's Laws
OR reference to momentum/KE/inertia NOT reference to force still acting A1

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(c) more turns/several coils
iron core
increase current/voltage
stronger magnet
smaller air gap
curved poles
more efficient brushes
poles closer
use split-ring commutator
} any 1 B1 [5]

10 (a) release of electrons due to heating/high temperature/heater B1

(b) X- and Y-plates labelled B1
anodes either order, labelled, either plates/cylinders with holes B1
closed tube of sensible shape
AND cathode AND anode(s) AND X- & Y- plates, all three features in correct order
labels not needed for last mark but if given must be correct B1

(c) change current in filament/cathode/heater IGNORE limit
OR change temperature/heat/power/energy of filament/cathode/heater
OR change cathode-anode p.d./voltage
OR change charge/voltage of grid B1

(d) (i) (I=)Q/t in any form C1
0.0019 A OR 1.9×10^{-3} A OR 1.9 mA A1

(ii) (E=) VIt OR VQ in any form, words, symbols, numbers (accept t=5s) C1
190 J OR candidate's $I \times 100\,000$ correctly evaluated A1 [9]

11 (a) Pt OR $1.2 \times 10^4 \times 9$ OR $1.2 \times 10^4 \times (11 - 2)$ C1
(l=) E/m OR $E/0.36$ OR Pt/m OR $Pt/0.36$ C1
3×10^5 J/kg A1

(b) (i) liquid ignore vapour/gas/water A1

(ii) move around more rapidly / faster / more KE
ignore **start to** vibrate etc but accept starts to vibrate faster
move further apart / spreads out (NOT molecules expand)
break free / evaporate / overcome bonds / overcome forces of attraction /escape / change state (accept boils)
convection (current)
} any 2 B1 [6]