CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the May/June 2013 series

0625 PHYSICS

0625/32 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 should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

Cambridge will not enter into discussions about these mark schemes.

Cambridge is publishing the mark schemes for the May/June 2013 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

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NOTES ABOUT MARK SCHEME SYMBOLS & OTHER MATTERS

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.

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

A marks In general A marks are awarded for final answers to numerical questions.
If a final numerical answer, eligible for A marks, is correct, with the correct unit and an acceptable number of significant figures, all the marks for that question are normally awarded.
It is very occasionally possible to arrive at a correct answer by an entirely wrong approach. In these rare circumstances, do not award the A marks, but award C marks on their merits. However, correct numerical answers with no working shown gain all the marks available.

C marks are compensatory marks in general applicable to numerical questions. These can be scored even if the point to which they refer are not written down by the candidate, **provided subsequent working gives evidence that they must have known it.** For example, if an equation carries a C mark and the candidate does not write down the actual equation but does correct substitution or working which shows he knew the equation, then the C mark is scored. A C mark is not awarded if a candidate makes two points which contradict each other. Points which are wrong but irrelevant are ignored.

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.

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

o.w.t.t.e. means 'or words to that effect'.

Spelling Be generous about spelling and use of English. If an answer can be understood to mean what we want, give credit. However, beware of and do not allow ambiguities, accidental or deliberate: e.g. spelling which suggests confusion between reflection / refraction / diffraction / thermistor / transistor / transformer.

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.

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

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e.c.f. meaning 'error carried forward' is mainly applicable to numerical questions, but may in particular circumstances be applied in non-numerical questions.
This indicates that if a candidate has made an earlier mistake and has carried an incorrect value forward to subsequent stages of working, marks indicated by e.c.f. may be awarded, provided the subsequent working is correct, bearing in mind the earlier mistake. This prevents a candidate being penalised more than once for a particular mistake, but **only** applies to marks annotated e.c.f.

Significant Figures
Answers are normally acceptable to any number of significant figures ù 2. Accept answers that round to give the correct answer to 2 s.f. Any exceptions to this general rule will be specified in the mark scheme.

Units Deduct one mark for each incorrect or missing unit from a final answer that would otherwise gain all the marks available for that answer: maximum 1 per question.

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

Transcription errors
Deduct one mark if the only error in arriving at a final answer is because given or previously calculated data has clearly been misread but used correctly.

Fractions e.g. ½, ¼, 1/10 etc. are only acceptable where specified.

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1 **(a)** $V = W \times L \times D$ in any form words, symbols or numbers C1
use of $M = \rho V$ in any form OR ρV words, symbols or numbers C1
($M = 51 \times 20 \times 11 \times 1030 = 11\,556\,600$ =) 1.2×10^7 kg A1 [3]

(b) $p = \rho g(\Delta)h$ in any form words, symbols or numbers C1
($\Delta h = 60\,000 / (1030 \times 10)$ =) 5.8(25) m A1 [2]

(c) use of $F = pA$ in any form or pA words, symbols or numbers C1
($F = 60\,000 \times 32.8 \times 8.3 = 60\,000 \times 272.2$ =) $1.6(33) \times 10^7$ N A1 [2]
e.c.f. from **(b)**

[Total: 7]

2 **(a)** **(i)** Hooke's Law B1 [1]

(ii) straight line (graph) / constant gradient B1
through origin/(0,0) B1 [2]
ignore through zero
ignore extension proportional to load

(b) curved extension to graph with increasing gradient, condone decreasing
NOT if any part of curve is vertical/horizontal or has negative gradient B1 [1]

[Total: 4]

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3 **(a)** any two from:
at surface / not within liquid (if other way round must be explicit) B1
at any temperature / not at boiling point (if other way round must be explicit) B1 [2]
(evaporation) causes cooling
boiling requires a heat source
bubbles rising

(b) **(i)** viable heat source clearly described e.g. electrical/immersion heater B1
appropriate readings e.g. V, I, t or P & t or joulemeter readings B1 [2]
OR
combustion heater but only with some mention of amount of fuel used B1
correct measurement of amount of fuel used B1

(ii) viable mass measuring device clearly described B1
e.g. (top pan) balance/scales
appropriate readings B1 [2]
e.g. mass of water before and after / change of mass of water
OR
measuring cylinder B1
volume of water before and after / change of volume of water B1

[Total: 6]

4 **(a)** suitable scales (more than half each scale used, no products of 3 s, 7 s etc.) B1
2 straight line sections, continuous 0 to 120 s, 1st section positive gradient,
2nd section negative gradient B1
section 1 straight line, from(0, 0) to (30, 900) B1
section 2 straight line from end of section 1 to (120, 0) B1 [4]

(b) **(i)** use of $a = \Delta v / t$ or $\Delta v / t$ in any form words, symbols or numbers C1
(a = 900 / 30 =) 30 m / s^2 A1 [2]
e.c.f. from graph

(ii) use of s = area under graph (accept valid equation(s)) C1
(distance = 0.5 × 900 × 120 =) 54 000 m A1 [2]
e.c.f. from continuous graph, if curves working must be clear
no e.c.f. from graph if it's a single rectangle

[Total: 8]

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5 (a) (i) diffraction B1 [1]

(ii) 1 or 2 parallel waves (and part-circular ends) in outer harbour
NOT part-circular ends going down B1
3 part-circular waves, > 45° each side by eye, in inner harbour
allow flat below gap
centred in gap, allow error up to 1λ vertically B1
wavelength constant throughout, must have 3 extra wavefronts, judged
along line of direction of wave travel in Fig. 5.1 B1 [3]

(b) (i) refraction B1 [1]

(ii) at least 4 parallel, straight waves joined onto original waves B1
at least 3 straight waves, sloping down to the right OR with constant reduced λ B1 [2]

[Total: 7]

6 (a) correct reflection of left ray
AND 22° ≤ angle between right ray and surface ≤ 32°, by protractor B1
rays projected back to form image in correct position B1 [2]

(b) both rays refract down M1
rays projected back to form image somewhere in water to the left of where left ray
strikes surface A1 [2]

(c) $\sin c = 1 / 1.33$ OR $\sin c / \sin r = 1 / 1.33$ C1
OR $\sin^{-1}(1 / 1.33)$ OR $\sin^{-1} 0.75$
($c = 48.8°$ =) 49° A1 [2]

(d) appropriate use, accept diagram
accept 'endoscope', 'in medicine' is not sufficient M1
clear diagram of the above use or t.i.r. diagram for optical fibre A1
one from:
light goes down fibre/into body
illuminates internal organ
light/image returns from body/organ o.w.t.t.e. A1 [3]

[Total: 9]

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7 **(a)** (P_i =) 260 (× 2) × length × breadth (= 260 × 0.1), words, symbols or numbers C1
note: gets this mark if omits factor of 2
(P_i = 2 × 260 × 0.25 × 0.2 =) 26 W A1 [2]

(b) (P_o = 0.95 × 20 =) 19 (W) B1
efficiency = output (energy) / input (energy)
accept power for energy
E = candidate's P_o/candidate's P_i evaluated (= 0.73 or 73%), accept fraction (19/26) C1
0.73% or bald 73 gets unit penalty A1 [3]

(c) A OR B in series with C connected across 20 V M1
parallel combination of A and B only A1 [2]

(d) 1 / R = 1 / R_1 + 1 / R_2 OR R = R_1R_2 / (R_1 + R_2) in any form OR R_1R_2 / (R_1 + R_2) C1
words, symbols or numbers
12 Ω A1 [2]

[Total: 9]

8 **(a)** at least 3 complete circles/ellipses, roughly centred on X M1
spacing greater as radius increases A1
at least 1 arrow to show clockwise field, no contradiction B1 [3]

(b) use of compass/suspended small magnet B1
observe needle/magnet on one field line B1
observe needle/magnet on another field line B1
mark on card OR needle/magnet shows direction of field B1 [4]

OR
(sprinkle) iron filings o.w.t.t.e. M1
tap card A1
direction/alignment of iron filings show field B1
use compass/suspended small magnet to show field direction B1

(c) wire X/Y is in a magnetic field / any reference to magnetic fields
accept description involving poles that clearly implies fields B1
current carrying conductor in field / fields interact/cut/combine/overlap B1 [2]

(d) top box only ticked B1 [1]

[Total: 10]

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9 **(a)** first box only ticked in each line — 2 × B1 [2]

(b) **(i)** output/V/I/power increases — M1
greater (rate of change of) field/flux
OR sensible reference to V_1 / V_2 = N_1 / N_2 OR V_1 proportional to V_2 — A1 [2]

(ii) output/V/I/power zero — M1
accept nothing happens **NOT** no change
field/flux does not change
ignore transformers only work with a.c./don't work with d.c. — A1 [2]
special case for answer about what happens at moment of switching on/off:
correct statement of some output etc. for short time — M1
change of field/flux — A1

[Total: 6]

10 **(a)**

	hydrogen-1	**deuterium**	**tritium**
no.of protons	1	1	1
no. of neutrons	0	1	2
no. of electrons	1	1	1

proton line correct — B1
neutron line correct, do not accept blank for 0 — B1
electron line correct — B1 [3]

(b) ignore any reference to background radiation throughout this part

(i) beta / fast moving electrons — B1 [1]

(ii) any two from:
beta stopped by 5 mm/thick Al / beta not stopped by 0.5 mm/thin Al — B1
alpha stopped by 0.5mm/thin Al
accept stopped by paper — B1 [2]
gamma not stopped by 5 mm or more/thick Al
ignore any reference to range in air

(c) **(i)** fusion / thermonuclear (reaction) — B1 [1]

(ii) (energy) released — B1 [1]

(d) fission — B1 [1]

[Total: 9]

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11 (a) (i) electrons
ignore β

B1 [1]

(ii) to heat cathode or produce thermionic emission o.w.t.t.e.
i.e. any mention of heating/providing energy and production/emission of electrons
NOT heater/filament emits electrons

B1 [1]

(iii) air would stop/weaken (electron) beam OR electrons have no collisions

B1 [1]

(b) X-plates
zero (p.d.)/off NOT zero current

B1

Y-plates
alternating (p.d.) OR description
condone a.c.

B1 [2]

[Total: 5]

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