CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2013 series

0625 PHYSICS

0625/33 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 October/November 2013 series for most IGCSE, GCE Advanced Level and Advanced Subsidiary Level components and some Ordinary Level components.

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 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".

c.a.o. — correct answer only

Spelling — Be generous about spelling and use of English. However, do not allow ambiguities e.g. spelling which suggests confusion between reflection/refraction/diffraction or 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.

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 ≥ 2. Any exceptions to this general rule will be specified in the mark scheme.

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.

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 Only accept these where specified in the mark scheme.

1 (a) (i) (metals/they are) (good) conductors (of heat) B1 [1]

(ii) (at hot end) molecules vibrate (more)
or electrons identified as mechanism of conduction B1

molecules collide with their neighbours
or electrons move faster/have more energy B1

energy/vibration passed on
or electrons pass on energy/reach far end/free to move B1 [3]

(b) determine mass of spoon (condone weigh provided word mass is used in answer) B1
immerse spoon in water/liquid B1
determine increase in volume/overflow B1
$\rho = m/V$ **or** density = mass/volume B1 [4]

[Total: 8]

2 (a) ($W =$) mg **or** 0.25 × 10 **or** 250 × 10 **or** 2500 C1
2.5 N A1 [2]

(b) (i) limit of proportionality **or** (the point where) proportionality between force and extension stops **or** Hooke's Law no longer obeyed (condone elastic limit) B1 [1]

(ii) gradient **or** numbers from graph divided e.g. 4.5 ÷ 10 C1
0.45 N / cm **or** 45 N / m A1 [2]

(c) (i) 0 (N) **or** zero **or** no net force etc. (ignore absent unit; wrong unit loses mark) B1 [1]

(ii) 1. 0.9 N (accept 0.8 N < value < 1.0 N) B1 [1]
2. (a =) F/m **or** 0.90/0.12 (e.c.f. from **2(c)(i)**) C1
7.5 m / s^2 (e.c.f. from **2(c)(i)**) A1 [2]

[Total: 9]

3 (a) (W.D. =) $F \times d$ **or** 640 × 3.5 C1
2240 J to 2 or more sig. figs. A1 [2]

(b) (i) ($E =$) VIt **or** 75 × 25 × 4.0 **or** 75 × 100 (accept ($E =$) VQ and $Q = It$) C1
7500 J A1 [2]

(ii) (efficiency =) $\frac{\text{(useful) energy output}}{\text{energy input}}$ (× 100%) **or** 2240/7500
(accept power for energy) (e.c.f. from **3(a)(i)** or **3(b)(i)**) C1
0.3 or 0.30 or 0.299 or 30 % or 29.9 % (e.c.f. from **3(a)(i)** or **3(b)(i)**) A1

(c) any **two** from:
electrical heating
friction
W.D. lifting supports
sound — B2 [2]

[Total: 8]

4 **(a)** **(i)** (GPE =) *mgh* **or** 0.40 × 10 × 8.5 (accept 9.8 for 10) — C1
34 J — A1 [2]

(ii) KE = GPE in any form **or** ½*mv*^{2} **or** 2*gh*
or 2 × 10 × 8.5 (e.c.f. from **4(a)(i)**) — C1
(*v*^{2} =) 170 **or** (*v* =)√170
(e.c.f. from **4(a)(i)**) — C1
13 m / s e.c.f. from **4(a)(i)** — A1 [3]

(b) drag **or** air resistance **or** friction with air (ignore wind for air) — B1
WD **or** energy lost as heat **or** more KE needed to overcome drag etc. — B1 [2]

(c) transformed to thermal energy/heat **or** friction/air resistance slows parachutist down **or** lost to air particles
(**not** KE (accept KE of air), **not** GPE → KE → heat; ignore sound) — B1 [1]

[Total: 8]

5 **(a)** (nuclear) fusion — B1 [1]

(b) **(i)** smaller (surface) area
(accept thinner, narrower(at top), ignore reference to lid) — B1 [1]

(ii) apparatus: black object, white object, thermometer(s)/ball-bearing with wax/level of water in vessel — B1

source of heat e.g. Sun/radiant heater (condone light bulb/Bunsen burner) — B1

action: (fill cans with water and) measure temperature rise **or** wax melts **or** compare volumes of water — B1

observation: water in black can (better absorber) has greater temperature increase / wax melts first / less water
note: emission experiment gains max. 2 — B1 [4]

[Total: 6]

6 **(a)** (Q/E =) Pt **or** 2400 × 50 C1
1.2×10^5 (J) C1
(c =) $Q/m\Delta T$ **or** $1.2 \times 10^5/(1.5 \times 32)$ (condone 2400/(1.5 × 32))
(allow e.c.f. from candidate's $Q = 1.2 \times 10^5$) C1
2.5×10^3 J/(kg °C) **or** 2.5 J/(g °C) (condone missing brackets)
(allow e.c.f. from candidate's $Q = 1.2 \times 10^5$) A1 [4]

(b) (student's value) too large **and** heat lost to surroundings/kettle/evaporation B1 [1]

[Total: 5]

7 **(a)** n = sin i/sin r **or** n = sin r/sin i **or** (sin i =) 1.5 sin 40(°) i **or** (sin r =) 1.5 sin 40(°)
or 25° C1
0.9641 C1
75/74.6 ° to 2 or more sig. figs. A1 [3]

(b) **(i)** (v =) $f\lambda$ **or** $3.8 \times 10^{14} \times 5.3 \times 10^{-7}$ C1
2.01×10^8 m / s to 2 or more sig. figs. A1 [2]

(ii) (c =) nv **or** 1.5 × 2.0/2.01/2.014 × 10^8 (e.c.f. from **7(b)(i)**) C1
3.02×10^8 m / s (accept 3 or 3.0×10^8 m / s only with working)
(e.c.f. from **7(b)(i)**) A1 [2]

(c) wave(front) hits/enters the plastic at the same time **or** incident ray perpendicular
along normal/at 90° **or** i = 0° (condone it doesn't hit at an angle) B1
wave(front) all slows down at the same time **or** refracted ray perpendicular normal/at
90° **or** r = 0° by calculation B1 [2]

[Total: 9]

8 **(a)** **(i)** half-wave rectified trace (ignore horizontal lines) M1
horizontal lines and wavelength same and amplitude same/slightly reduced
(≥ ¾A_0 by eye) A1 [2]

(ii) rectifier **or** suitable device **or** produce d.c. (from a.c. for electronic circuits)
(condone flashing lamp of some sort) B1 [1]

(b) (lamp becomes) dimmer/less bright/flashes on and off B1
less (thermal)energy/heat/power **or** (thermal) energy etc. for less time **or** current
becomes zero B1 [2]

[Total: 5]

9 **(a)** (alternating current causes alternating/changing) magnetic field (in core) B1
alternating/changing magnetic field in secondary coil B1
voltage/e.m.f. induced (in secondary coil) B1
more turns (on secondary) so greater output B1 [4]

(b) **(i)** resistance increases (with/is proportional to length (of cable)) B1
(energy losses) due to resistance (of cables)/heating in cables/electrical working (in cables)/I^2R B1 [2]

(ii) reduced resistance **or** less heat loss B1
more metal **or** cables heavier **or** more pylons **or** more costly to construct B1 [2]

[Total: 8]

10 **(a)** **(i)** at least two lines (one left, one right) outside the coil of correct shape **or** at least two vertical lines inside the coil **or** two diverging and one central line at top and bottom C1
at least four lines (two left, two right) outside the coil of correct shape **or** at least two lines (one left, one right) outside the coil of correct shape) and at least two vertical lines inside the coil
(crossing or complete loops outside coil gains maximum of 1) A1 [2]

(ii) lines closer where field is stronger o.w.t.t.e. **or** vice versa **or** spacing of lines B1 [1]

(b) reduces (strength of) field B1
(increasing the resistance) reduces the current B1 [2]

(c) **(i)** curved path upwards (might curve back to the left) B1
well-drawn curved path (no straight section and circular by eye) B1 [2]

(ii) curves in opposite direction to **(c)(i)** B1
magnetic field reversed B1 [2]

[Total: 9]

11 **(a)** 12 counts / min B1 [1]

(b) **(i)** 72 counts / min (e.c.f. from **11(a)**) B1

(ii) 9 counts / min (note: if background not subtracted, **(i)** 84 and **(ii)** 21 gains 1 compensatory mark) B1 [2]

(c) 9/72 **or** 1/8 **or** 3 (half-lives)
or (e.c.f.) 21/84 **or** 1/4 **or** 2 (half-lives) C1
3.0 minutes **or** 4.5 minutes (i.e. background not subtracted but otherwise correct) A1 [2]

[Total: 5]