CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2014 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.

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NOTES ABOUT MARK SCHEME SYMBOLS AND OTHER MATTERS

B marks — 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 answer.

M marks — 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 — 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.

A marks — 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. A marks are commonly 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. An A mark following an M mark is a dependent mark.

Brackets ( ) — 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.

<u>Underlining</u> — Underlining indicates that this **must** be seen in the answer offered, or something very similar.

OR / or — This indicates alternative answers, any one of which is satisfactory for scoring the marks.

e.e.o.o. — This means "each error or omission".

o.w.t.t.e. — This means "or words to that effect".

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

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

Not / NOT — This 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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ecf 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 ecf may be awarded, provided the subsequent working is correct, bearing in mind the earlier mistake. This prevents a candidate from being penalised more than once for a particular mistake, but **only** applies to marks annotated ecf.

Sig. figs. Answers are normally acceptable to any number of significant figures ≥ 2. Any exceptions to this general rule will be specified in the mark scheme. Rounding errors in the second or third significant figure will be penalised.

Arithmetic errors

Deduct one mark if the **only** error in arriving at a final answer is clearly an arithmetic one. Regard a power-of-ten error as an arithmetic error.

Transcription errors

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

Fractions Allow fractions only where specified in the mark scheme.

Units Deduct one mark for an incorrect or missing unit, but only if the answer would otherwise have gained all the marks available for that answer. Maximum one unit penalty per question.

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1 (a) (i) (gradient =) 10 (m / s^2) B1

(ii) any linking of gradient to acceleration of freefall **OR** gravitational field strength B1

(b) gradient decreases B1

(c) speed / velocity stays constant **OR** terminal velocity / speed B1
no resultant force **OR** forces cancel / balance B1

(d) initially gradient steeper B1
graph lower in second half of BC B1
horizontal final section **and** lower than CD B1

[Total: 8]

2 (a) (i) 180 N B1

(ii) (P =) $F \div A$ **OR** $180 \div (0.30 \times 0.04)$ C1
15 000 Pa A1

(b) (i) arrow (labelled W) from / to correct centre of mass B1

(ii) **1.** force × (perpendicular) distance **OR** 40×0.60 **OR** 180×0.15 in **2.** C1
24 N m A1

2. 27 N m e.c.f. from **(a)(i)** A1

(iii) slab topples / rotates (about point D) **OR** corner C lifts from ground **OR** falls over B1

moment of force at B becomes bigger than moment of weight / W
OR anticlockwise moment becomes bigger than clockwise moment
OR weight/centre of mass outside base B1

[Total: 9]

3 (a) (i) (g.p.e. =) mgh **OR** $0.15 \times 10 \times 1.8$ C1
2.7 J ignore minus sign A1

(ii) (k.e. **OR** 2.7 =) $\frac{1}{2}mv^2$ **OR** $\frac{1}{2} \times 0.15v^2$ C1
(v^2 =) 36 C1
6.0 m / s A1

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(b) (i) initial temperature (of metal) **OR** final temperature (of metal)
OR temperature change (of metal) B1

(ii) thermal energy transferred to something specific e.g. air / tube / stopper / thermometer / surroundings / environment
OR small spheres lost before / after weighing
OR not all the spheres fall the same distance B1

(iii) higher temperature increase **OR** calculate mean of (100) readings M1
small measurements less accurate owtte A1

[Total: 9]

4 (a) pV = constant **OR** $p_1V_1 = p_2V_2$ **OR** p_1V_1 / V_2 or $1.0 \times 10^5 \times 100 \div 40$ C1
2.5×10^5 Pa A1

(b) (i) (the particles move) randomly B1

(the particles move) slowly **OR** through small distances **OR** disappear **OR** zigzag **OR** directions change **OR** erratic **OR** straight lines between collisions B1

(ii) air molecules / particles collide with smoke particles (at high speed) B1
fast(er) air molecules **OR** move randomly **OR** many collisions B1

(c) diagram showing:
molecules touching each other B1
molecules positioned in an ordered structure B1

[Total: 8]

5 (a) (n =) sin i / sin r **OR** sin 62 / sin 36 C1
1.5(02) C1
(v_g =) c / n **OR** $3.0 \times 10^8 / 1.5$ C1
2.0 / 2.00 / 1.997×10^8 m / s A1

(b) (infra-red / light) encoded **OR** (sent as) pulses **OR** multiplexing **OR** many messages **OR** signal **OR** information **OR** data **OR** internet B1
(optical fibre transmits) light / infra-red (pulse) B1
total internal reflection / TIR (prevents escape) B1

[Total: 7]

6 (a) mark **(i)** and **(ii)** together:
mention of free electrons B1
(current is) flow/movement of free electrons B1
insulators contain no free electrons / metals contain many free electrons B1

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(b) (i) chemical (energy) to electrical (energy) (**IGNORE** heat) B1

(ii) (energy =) VIt **OR** $120 \times 96 \times 10$ (**OR** $\times 60$ **OR** $\times 10 \times 60$)
OR $11\,520 \times 10$ (**OR** $\times 60$ **OR** $\times 10 \times 60$) C1
6.9×10^6 J A1

(iii) 96×120 **OR** $1.2 / 1.15(2) \times 10^4$ **OR** $12\,000 / 11\,500 / 11\,520$ C1
1.0×10^4 W A1

[Total: 8]

7 (a) 1500 m / s underlined / indicated B1

(b) compression: closer together **AND** rarefaction: further apart B1

compression: particles / molecules / wavefronts closer together / low pressure
AND rarefaction: particles / molecules / wavefronts further apart / high pressure B1

(c) (i) (t =) d / v used **OR** $t = 2d / v$ **OR** $12 / 1500$ **OR** 0.008 (s) C1
(t =) $2d /$ v used **OR** $24 / 1500$ C1
0.016 s A1

(ii) amplitude: decrease B1
pitch: no change B1

[Total: 8]

8 (a) 6.0 V B1

(b) (i) coulomb (**IGNORE** C) B1

(ii) (Q =) $I t$
OR $0.25 \times 12 \times 60$ **OR** 0.25×720 **OR** 0.25×12 **OR** 3.0 **OR** 0.25×60 **OR** 15 C1
180 (C) A1

(iii) (R =) V / I or 6.0 / 0.25 or 24.0 e.c.f. from **(a)**
OR
(V =) IR **OR** 0.25×16 **OR** 4.0 e.c.f. from **(a)** C1

8.0 Ω A1

(c) $R \propto l$ **OR** 8.0 **OR** $16 / 2$ C1
$R_1R_2 / (R_1 + R_2)$ **OR** $1 / R = 1 / R_1 + 1 / R_2$ **OR** $64 / 16$ **OR** $1 / R = 1 / 8 + 1 / 8$ C1
4.0 Ω A1

[Total: 9]

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9 (a) (i) (magnetic field) lines closer together / denser / more lines B1

(ii) (magnetic field (lines) direction reversed B1

(b) (i) ammeter needle deflects / reading on ammeter B1
(magnetic) field cuts coil **OR** changing (magnetic) field B1
(electromagnetic) induction B1

(ii) deflection / reading on ammeter smaller **OR** lasts longer B1
slower rate of cutting field lines **OR** slower rate of change of field B1

[Total: 7]

10 (a) any one specific source of background radiation
e.g. rocks, ground, building materials, radon, radiation from space, Sun, cosmic rays, nuclear waste B1

(b) (i) electromagnetic radiation **OR** photons B1
(very) high frequency **OR** (very) short wavelength **or** high energy B1

(ii) (count rate) decreases B1

(count rate decreases but) not completely absorbed (by lead)
OR only some γ-rays detected B1

(c) (i) no deflection (last / fifth box ticked) B1

(ii) (γ-rays) are uncharged / neutral (**IGNORE** not affected by magnetic fields) B1

[Total: 7]

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