CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the October/November 2014 series

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 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)** A increasing speed
B constant speed
C stationary B2
Note: one mark lost for e.e.o.o.

(b) D increasing acceleration
E constant acceleration
F constant speed B2
Note: one mark lost for e.e.o.o.

(c) **(i)** (a =) $\Delta v / t$ **OR** $(v–u)/t$ **OR** 10.5 / 1.5 C1
= 7.0 m / s^2 A1

(ii) (a =) 0 (m / s^2) B1

(iii) upward and downward forces equal **OR** no resultant force
OR forces equal and opposite **OR** forces balanced
OR weight (of body) = tension (in rope) B1

[Total: 8]

2 **(a)** **(i)** (increase in g.p.e. = mgh **OR** 65 × 10 × 8 =) 5200 J B1

(ii) **EITHER**
k.e. gained = g.p.e. lost C1
½ mv^2 = 5200 in any form C1
v^2 = 5200 / (0.5 × 65) **OR** 160 C1
v = 12.6 m / s e.c.f. **(a)(i)** A1
OR
$v^2 = u^2 + 2as$ / $v^2 = 2gh$ (C1)
v^2 = 2 × 10 × 8 (C1)
v^2 = 160 (C1)
v = 12.6 m / s e.c.f. **(a)(i)** (A1)

(b) speed is the same B1
EITHER
loss in g.p.e. is the same B1
k.e. gained is the same B1
OR
acceleration is the same (B1)
distance fallen is the same (B1)

[Total: 8]

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3 **(a)** **(i)** force / pressure greater on outside surface owtte B1

(ii) $p = F/A$ in any form **OR** $(F =)\ pA$ C1
$= (1.0 \times 10^5 - 6000) \times 0.12$ C1
11280 N to at least 2 sig. figs. A1

(b) **(i)** pressure of oil = pressure of water B1

(ii) **1.** $(p =)\ h\rho g$ C1
$(= 0.25 \times 1000 \times 10 =)$ 2500 Pa A1

2. $h\rho g = 2500$ C1
$(\rho = 2500/(0.32 \times 10) =)$ 781 kg / m^3 to at least 2 sig. figs. A1

[Total: 9]

4 **(a)** mass of block m B1
initial temperature θ_1 and final temperature θ_2 B1
time of heating t B1
voltage / p.d. V AND current I B1

(b) $(c =)\ VIt \div [m\ (\theta_2 - \theta_1)]$
OR $Pt \div [m\ (\theta_2 - \theta_1)]$ **OR** $E \div [m\ (\theta_2 - \theta_1)]$ as appropriate to symbols defined in **(a)**
numerator correct B1
denominator correct B1

(c) (more) thermal energy / heat lost (to surroundings) so temperature rise is less
OR more thermal energy / heat input required for same temperature rise B1

[Total: 7]

5 **(a)** **(i)** longitudinal: oscillations/vibration of particles/molecules in direction of travel (of wave) B1
transverse: oscillation / vibrations of particles/molecules perpendicular to direction of travel (of wave) B1

(ii) **1.** e.g. sound wave / compression wave on a spring B1
2. e.g. any named electromagnetic wave / ripples / water wave / wave on a stretched rope B1

(b) use of $v = f\lambda$ in any form **OR** $(\lambda =)\ v/f$ **OR** 7200 / 30 **OR** 7.2 / 30 C1
240 m / 0.24 km A1

(c) no sound heard / quieter sound B1
medium/air required to transmit sound
OR sound does not travel through a vacuum B1

[Total: 8]

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6 **(a)** **(i)** **1.** one normal to mirror drawn B1
2. angle of incidence, labelled X B1

(ii) **1.** both reflected rays drawn B1
2. construction lines to locate image, marked I B1

(b) **(i)** dot marked C in correct position B1

(ii) two circular arcs each joining correct points on barrier B1
spacing of arcs same as spacing of incident waves B1

[Total: 7]

7 **(a)** **(i)** diagram showing:
molecules widely spaced B1
molecules randomly positioned B1

(ii) (attractive) forces (much) smaller between gas molecules B1
gas molecules (much) farther apart B1

(b) **(i)** pV = constant **OR** $p_1V_1 = p_2V_2$ **OR** (V_2 =) p_1V_1/p_2
OR (V_2 =) $2.75 \times 10^6 \times 6 \times 10^{-3} / 1.1 \times 10^5$ C1
= $0.15\,m^3$ C1
(no. of balloons = $(0.15 - 6 \times 10^{-3}) / 3 \times 10^{-3}$ =) 48 A1

(ii) pressure of air in balloon increases B1
molecules move faster **OR** hit balloon surface harder / more often
OR larger force rips / breaks rubber **OR** balloon expands B1

[Total: 9]

8 **(a)** **(i)** rectifier / diode B1

(ii) frequency (of A.C. supply) B1

(b) **(i)** (P =) IV **OR** 0.5×5.3 **OR** 500×5.3 C1
2.6 W **OR** 2600 mW A1

(ii) (E =) Pt **OR** IVt **OR** $2.65 \times 1.5 \times 3600$ **OR** $0.5 \times 5.3 \times 1.5 \times 3600$ C1
14000 J A1

(c) energy only underlined B1

[Total: 7]

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9 **(a)** background (radiation) **OR** a specific source of background radiation e.g. rocks / building materials / radon gas / cosmic rays B1

(b) any three from:
low count rate due to background radiation only
slightly less reading due to random nature of radioactivity
very high reading due to α-particles OR emission from source
sudden increase of count rate at limit of range of α-particles B3

(c) **(i)** downward curve B1

(ii) (count rate) decreases / background only B1
deviation starts at start of plates B1

[Total: 7]

10 **(a)** (lamps) stay on / have same brightness as before / nothing happens B1
(lamps) still connected to supply / have same voltage as before / are connected in parallel B1

(b) **(i)** line 1: on line 2: off line 3: off line 4: on B2
deduct one mark for e.e.o.e.

(ii) when either switch is operated, the state of the lamp changes. B1

[Total: 5]

11 **(a)** **(i)** electromagnetic induction B1

(b) **(i)** pointer deflects B1
pointer returns to zero B1

(ii) greater deflection (of pointer) B1
pointer deflects in opposite direction and returns to zero
OR deflects for shorter time B1

[Total: 5]

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