CAMBRIDGE INTERNATIONAL EXAMINATIONS

Cambridge International General Certificate of Secondary Education

MARK SCHEME for the March 2015 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.

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NOTES ABOUT MARK SCHEME SYMBOLS & OTHER MATTERS

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 — 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 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 <u>must</u> 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.

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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.
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.
Significant figures	Answers are normally acceptable to any number of significant figures $\geqslant 2$. 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. Regard a power-of-ten error as an arithmetic error.
Fractions	Allow these only where specified in the mark scheme.

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1 (a) (i) $a = (v - u) \div t$ OR $a = \Delta v \div t$ in any form OR in words in any form
AND with correct numbers substituted B1

(ii) Straight line from origin to point (3.2 s, 32 m / s) B1

(iii) Area under graph OR $\frac{1}{2} \times 3.2 \times 32$
OR $s = \frac{1}{2} at^2$ OR $\frac{1}{2} \times 10 \times 3.2^2$ C1
51 m A1

(b) (i) Air resistance increases B1

(ii) Graph line Y under graph line X B1
Graph has decreasing gradient B1
Graph extends to value of t greater than 3.5 s and greater than X B1

[Total: 8]

2 (a) (i) ($W = mg = 2.8 \times 10^6 \times 10 =$) 2.8×10^7 N B1

(ii) $3.2 \times 10^7 - 2.8 \times 10^7$ C1
4.0×10^6 OR 0.4×10^7 N A1

(iii) $F = ma$ in any form OR ($a =$) $F \div m$ OR $4.0 \times 10^6 \div (2.8 \times 10^6)$ C1
1.4 m / s^2 A1

(b) Mass of rocket decreases (as fuel is used up)
OR
Value of g/gravitational force on rocket decreases as rocket rises B1
OR
Air resistance decreases

[Total: 6]

3 (a) Note: answers in either order
Resultant/net/total force B1
Resultant/net/ total turning effect/moment/torque/couple B1

(b) (i) 1. ($240 \times 1.2 =$) 290 (N m) B1
2. $F \times 3.2$ B1

(ii) $F \times 3.2 = 288$ C1
90 N A1

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(iii) To balance the weight B1
OR to make resultant (vertical) force zero
OR to make resultant moment zero
OR to keep the ladder in (vertical) equilibrium
OR because there is a downward force
OR because the ladder is pressing on the ground
OR otherwise the ladder would fall / sink (into the ground)

[Total: 7]

4 (a) (i) kinetic B1

(ii) (GPE =) mgh OR $1.0 \times 10 \times 300$ C1
3000 J A1

(iii) $Q = mc\Delta\theta$ in any form OR $Q \div mc$ OR $3000 \div [(1.0 \times) 4200]$ C1
0.71 °C A1

(iv) Energy used to heat air (via air resistance) / Heat lost to surroundings B1
OR Energy retained as KE of water (at bottom of waterfall)
OR Sound (energy) produced

(b) Temperature change/difference is (very) small B1

[Total: 7]

5 (a) (i) X-rays B1

(ii) Infra-red B1

(b) (i) $v = f\lambda$ in any form OR $v \div$ f OR $3.0 \times 10^8 \div (2.45 \times 10^9)$ C1
0.12 m A1

(ii) (Q =) ml OR 150×330 C1
49 000 (J) OR 49 000 (J) OR 50 000 (J) C1

$P = Q/t$ in any form OR (t =) Q/P OR (0.65×1100) OR 715 C1
69 s A1

[Total: 8]

6 (a) (i) Normal at Q drawn AND refracted ray drawn with r less than i B1
(ii) Emerging ray drawn parallel to PQ AND normal drawn B1
(iii) Two equal angles, marked X, between rays and normal B1

(b) (i) $n = \sin i \div \sin r$ in any form OR $1.62 = \sin 65 \div \sin r$ in any form C1
OR $\sin r = \sin 65 \div 1.62$

$r = 34°$ A1

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(ii) n = speed (of light) in air ÷ speed (of light) in glass in any form C1
OR $1.62 = 3.0 \times 10^8 \div$ speed in glass in any form
(speed in glass = $3.0 \times 10^8 \div 1.62$) = 1.8 OR 1.9×10^8 m/s A1

(c) Dispersion B1

[Total: 8]

7 (a) (i) A region in which a force acts upon an (electric) charge/charged object B1

(ii) At least 4 radial straight lines with lines evenly spaced B1
Arrows on lines pointing away from + charge B1

(b) Use positively charged rod B1

Place rod close to surface of sphere B1

Touch sphere (briefly) with finger OR Connect sphere to earth and remove earth connection OR Briefly connect sphere to earth B1

Remove charged rod B1

[Total: 7]

8 (a) (i) diode B1

(ii) **1.** 0.7 V B1
2. $I = V \div R$ in any form OR (I =) $V \div R$ OR 11.3÷4 C1
2.8 A A1

(b) (i) **1.** (12÷8 =) 1.5 A B1
2. (1.5 + 2.825 =) 4.3 A ecf **(a)(ii)2.** and **(b)(i)1.** B1

(ii) 1.5 A ecf **(b)(i)1.** B1

[Total: 7]

9 (a) (i) Upper box: (split-ring) commutator OR split-ring B1
Lower box: brush(es) OR contact(s) B1

(ii) X (is the N pole) B1

(b) (i) Any two from: B2
Greater current (through coil) OR battery with greater <u>voltage</u>
More turns in coil OR coil with greater area
Use stronger magnet OR soft-iron core in coil OR bring magnetic poles closer to coil

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(ii) Coil rotates in opposite direction
OR rotates anticlockwise
OR rotation reversed — B1

(c) Magnetic field is cut (by the wires of the coil) — B1

Electromagnetic induction takes place
OR Voltage/e.m.f. is induced/produced (causing current in the coil)
OR Current is induced (in the coil) — B1

[Total: 8]

10 (a) (i) 1. to heat the cathode/filament
OR produces thermionic/electron emission — B1

2. cathode / negative terminal — B1

3. anode / positive terminal — B1

(ii) So that electrons are not obstructed/stopped/deflected (by (air/gas) molecules/particles)
OR so filament does not burn out/melt — B1

(b) (i) Y-plates OR Voltage applied to Y-plates / Y inputs / Y terminals — B1
Alternating voltage/A.C. applied to Y-plates/Y inputs/Y terminals — B1

(ii) X-plates OR time-base switched on — B1

(iii) Reduce voltage/input/charge/current/field — B1
OR Suggestion of change in V / cm setting/gain

[Total: 8]

11 (a) Both have positive/same charge — B1

(b) A continues along original line — B1
B deflected by any angle up to 135° (by eye) — B1
C returns along same line OR deflected more than 135° (by eye) — B1

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(c) Any two from: B2

Atom is mostly empty space OR Nucleus is (very) much smaller than the atom OR Nucleus is very small

Charge of nucleus is (very) concentrated / (very) dense
OR Nucleus contains all the positive charge of the atom
OR Nucleus has positive charge

Nucleus contains most of the mass of the atom
OR Nucleus is (very) massive OR Nucleus is (very) dense

[Total: 6]

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