CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2012 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 2012 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 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. 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.

ecf — meaning "error carried forward" is mainly applicable to numerical questions, but may in particular circumstances be applied in non-numerical questions.

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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 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 $\geqslant 2$. Any exceptions to this general rule will be specified in the mark scheme. In general, accept numerical answers, which, if reduced to two significant figures, would be right.

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.** No deduction is incurred if the unit is missing from the final answer but is shown correctly in the working.

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.

Crossed out work Work which has been crossed out **and not replaced but can easily be read,** should be marked as if it had not been crossed out.

Use of **NR** (# key on the keyboard) Use this if the answer space for a question is completely blank or contains no readable words, figures or symbols.

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1	(a)	(i)	a time from 12.5 – 14.9 s **or** 15.1 – 16.0 s *Unit penalty applies		B1	
		(ii)	a time from 0 – 2.5 s **or** 14.9 – 15.1 s *Unit penalty applies		B1	
		(iii)	a time from 2.5 – 12.5 s *Unit penalty applies		B1	
	(b)		(initially) weight/force of gravity **and** air friction/resistance act		B1	
			it speeds up/accelerates **and** (air) friction/resistance increases		B1	
			reaches terminal/constant velocity		B1	
			(air) friction/resistance = weight **or** no resultant (force) **or** forces in equilibrium		B1	
	(c)		upwards		B1	**[8]**
	*Apply unit penalty once only					
2	(a)		54 N *Unit penalty applies		B1	
	(b)	(i)	(the point where) proportionality between force/weight and extension/Hooke's Law stops		B1	
		(ii)	35 – 20 **or** 15 (cm) **or** 25 – 20 **or** 5 (cm)		C1	
			(F =) k*x* **or** 54/15 × 5 **or** 54/15 **or** 5/15	ecf from **2(a)**	C1	
			18 N *Unit penalty applies	ecf from **2(a)**	A1	
			54 – 18 **or** 36 **or** 5.4 – 1.8	ecf from **2(b)(ii)1.**	C1	
			3.6 kg *Unit penalty applies	ecf from **2(b)(ii)1.**	A1	
		(iii)	(ρ =)m/V **or** 3.6/0.0045	ecf from **2(b)(ii)2.**	C1	
			800 kg/m^3 *Unit penalty applies	ecf from **2(b)(ii)2.**	A1	
	(c)		air molecules further apart **or** oil molecules closer together		B1	**[10]**
	*Apply unit penalty once only					
3	(a)	(i)	(a =) v/t **or** 65/26		C1	
			2.5 m/s^2 *Unit penalty applies		A1	
		(ii)	(F =)ma **or** 3.4 × 10^5 × 2.5	ecf from **3(a)(i)**	C1	
			8.5 × 10^5 N *Unit penalty applies	ecf from **3(a)(i)**	A1	
	(b)	(i)	any two of: KE **or** GPE **or** heat/internal energy/thermal energy		B2	
		(ii)	chemical energy **not** heat		B1	
		(iii)	thermal energy/sound is lost (to the atmosphere) **or** KE of air		B1	

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(c) perpendicular to path **or** towards centre of circle **or** centripetal B1 **[9]**

*Apply unit penalty once only

4 (a) (i) atoms/molecules/particles move **or** collide (ignore with each other) B1
atoms/molecules/particles collide with (inside) surface/wall M1
force (exerted) on wall etc. **or** force/unit area **or** force spread-out A1

(ii) fewer atoms/molecules/particles **and** fewer collisions (with wall) B1

(b) (P =) hρg **or** $25 \times 1.0 \times 10^3 \times 10$ C1
$h\rho g + p_{atm}$ **or** $25 \times 1.0 \times 10^3 \times 10 + 10^5$ **or** 2.5×10^5 C1
3.5×10^5 Pa *Unit penalty applies A1 **[7]**

*Apply unit penalty once only

5 (a) (i) water molecules hit copper/tank/atoms **or** copper atoms hit air molecules **or** radiation from water/tank/copper **or** describe/mention evaporation B1
vibrating (copper) atoms/molecules/particles hit neighbours pass on energy/vibration **or** vibrating (copper) atoms/molecules/particles hit electrons (through copper) B1
electrons strike copper atoms B1

(ii) smaller temperature difference/thermal gradient (between tank and air) **or** reduced vibrations of copper atoms **or** water molecules slower/less kinetic energy **or** reduced radiation (emitted) **or** less evaporation B1

(b) diagram of suitable vessel(s) (one shiny; one dark) B1
action – e.g. fill with hot water **and** same mass/volume B1
starting temperatures are the same B1
measure final temperature **and** compare drop **or** equivalent B1
allow detailed description of Lesley's cube method **and** measure emission rate (for a maximum of 4 marks) **[8]**

6 (a) (i) $2.0 – 4.0 \times 10^8$ m/s *Unit penalty applies B1

(ii) (f =) v/λ **or** $3.0 \times 10^8 / 4.0 \times 10^{-7}$ ecf from **6(a)(i)** C1
7.5×10^{14} Hz *Unit penalty applies ecf from **6(a)(i)** A1

(b) (i) 55° *Unit penalty applies B1

(ii) sin i/sin r = n **or** sin 55°/1.5 **or** 0.54610 ecf from **6(b)(i)** C1
33° *Unit penalty applies ecf from **6(b)(i)** A1 **[6]**

*Apply unit penalty once only

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7 **(a)** **(i)** any <u>two</u> of these rays from top of object:
paraxial to lens <u>and</u> on through focal point
undeviated to centre of lens
as if from focal point to lens <u>and then paraxial</u> B2

traced back to locate image B1

(ii) any <u>two</u> of: virtual/upright/magnified/further from lens/dimmer B2

(b) **(i)** 3.4 – 3.6 cm *Unit penalty applies B1

(ii) magnifying glass/magnifier (**c.a.o.**) B1 **[7]**

*Apply unit penalty once only

8 **(a)** **(i)** (I =) V/R **or** 230/46 C1
5.0 A *Unit penalty applies A1

(ii) (P =) IV **or** V^2/R **or** I^2R **or** 230 × 5 **or** $230^2/46$ **or** $5^2 \times 46$
ecf from **8(a)(i)** C1
1100/1150/1200 W *Unit penalty applies ecf from **8(a)(i)** A1

(b) same as **8(a)(i)** (**c.a.o.**) *Unit penalty applies B1 **[5]**

*Apply unit penalty once only

9 **(a)** **(i)** <u>changing</u> magnetic field (in coil) **or** field lines cut coil (**or** *vice versa*) B1
e.m.f./current induced B1

(ii) smaller deflection/current/reading/voltage **or** deflection lasts longer (ignore slower) B1
rate of cutting field lines/change of magnetic field reduced B1

(iii) deflection/current in opposite direction B1

(b) alternating/changing current (in primary coil) B1
alternating/changing magnetic field clearly in core B1
field channelled from primary to secondary by core (somehow expressed) **or** core increases effect B1
<u>induced</u> e.m.f. in secondary B1 **[9]**

10 **(a)** **(i)** light-dependent resistor/LDR B1

(ii) (in bright light) resistance of Z/LDR/circuit falls/is low B1
current rises/is large/(starts to) flow/more p.d. across R B1
relay (coil) magnetises/attracts/is magnet B1
switch closes/completes second circuit B1

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(b) thermistor replaces LDR **or** LDR removed **and** thermistor added B1 **[6]**

11 (a) $^{234}(\text{Pa})$ (**c.a.o.**) B1

$_{91}(\text{Pa})$ (**c.a.o.**) B1

$^{0}_{-1}(\beta)$ (**c.a.o.**) B1

(b) (i) correctly curved path upwards (ignore lines not between plates) (**not** in/out **not** if some section is downwards) B1

(ii) attracted by/move towards the positive/opposite plate/charge **or** repelled by the negative/same plate/charge **no** ecf from **(b)(i)** B1 **[5]**

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