UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

International General Certificate of Secondary Education

MARK SCHEME for the October/November 2011 question paper for the guidance of teachers

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.

Mark schemes must be read in conjunction with the question papers and the report on the examination.

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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".

Spelling — Be generous about spelling and use of English. If an answer can be understood to mean what we want, give credit.

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. 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 ≥ 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	These are only acceptable where specified.

1	(a)	Δh = 0.068 m		C1	
		use of mgh		C1	
		0.054 J/Nm		A1	[3]
	(b)	$\frac{1}{2}mv^2$ = candidate's **(a)**		C1	
		1.2 m/s ecf from **(a)**		A1	[2]
	(c)	(i)	use of distance ÷ time	C1	
			= 1.1 m/s	A1	
		(ii)	air or wind resistance / friction / heat / thermal energy OR correct mention of experimental error e.g. width of cylinder	B1	[3]
2	(a)	(i)	use of $a = \Delta v/t$ in any form	C1	
			23.3 m/s^2 ignore sign	A1	[2]
	(b)	(i)	336 000 J	B1	[1]
		(ii)	use of power × time	C1	
			= 180 000 J	A1	[2]
		(iii)	54% OR 0.54 ecf from **(i)** and **(ii)** accept (= 180 000/840 000) 21% OR 0.21	B1	[1]
	(c)		anything sensible for a moving vehicle, e.g. flywheel / capacitor / battery	M1	
			appropriate change for this device, for example: flywheel: speed or kinetic energy capacitor: voltage or charge or electrical energy battery: voltage or charge or electrical or chemical energy	A1	[2]
3	(a)		ρgh in symbols, words or numbers	C1	
			700 Pa or N/m^2	A1	[2]
	(b)		use of $F = pA$	C1	
			14.7 N ecf from **(a)**	A1	[2]
	(c)		(30.9 – 14.7 =)16.2 N OR evidence of calculation of resultant	C1	
			use of $a = F/m$	C1	
			5.24 m/s^2	A1	[3]

4 **(a)** molecules/atoms move more slowly B1
fewer collisions OR less hard collisions with walls / balloon B1
lower pressure B1 [3]

(b) larger surface area of walls OR atoms further apart OR atoms travel further B1
fewer collisions with walls/balloon (only penalise missing walls once in **(a)** or **(b)**) B1
lower pressure B1 [3]

5 **(a)** conduction rod / target / anode B1
copper / thickness of rod B1
good conductor / increases amount of conduction (of thermal energy) B1 [3]

(b) convection fins B1
large surface area / number of fins / spaces between fins B1
large contact with air / allows air to rise between fins B1 [3]

(c) radiation fins / black surface / end of rod B1
black surface / large surface area B1
good emitter / large radiating surface ignore absorber B1 [3]

6 **(a)** incident ray correct at 59° B1 [1]

(b) **(i)** use of $n = \sin i / \sin r$ C1
$(r = \sin^{-1}(\sin 59/1.33)) = 40.1°$ condone no unit
only accept 40° if working shown e.g. sin 59/1.33 A1 [2]

(ii) ray from A to B AND angle of refraction = 40° B1 [1]

(c) reflected ray at B, correct by eye B1 [1]

(d) emerging ray refracted away from normal B1 [1]

7 **(a)** **(i)** 320-350 m/s condone 100 – 999 m/s B1

(ii) 3×10^8 m/s condone $2 – 4 \times 10^8$ m/s B1 [2]

(b) use of $v = f\lambda$ C1
correct evaluation of candidate's **(a)(i)**/1.2
(330 m/s gives 275 Hz) A1 [2]

(c) **(i)** correct evaluation of candidate's **(a)(i)** × 4.8
(330 m/s gives 1584m) B1

(ii) clear statement that light travels instantaneously o.w.t.t.e.
OR distance of thunderstorm same as distance travelled by sound
OR thunder and lightning caused by same event
OR negligible wind — B1 [2]

8 **(a)** compression — B1
rarefaction — B1 [2]

(b) cone moves forward / in direction of travel of wave
OR cone pushes air particles closer o.w.t.t.e. — B1
cone moves backwards / away from direction of travel of wave
OR cone causes empty spaces o.w.t.t.e. — B1 [2]

(c) **(i)** loudness increases AND pitch same — B1

(ii) loudness same AND pitch increases — B1 [2]

9 **(a)** **(i)** $1/R_p = 1/R_1 + 1/R_2$ OR $(R_p =)\ R_1R_2/(R_1 + R_{2)}$ in any form — B1

(ii) 1.5 Ω — B1 [2]

(b) **(i)** correct position, allow across ammeter as well — B1

(ii) use of $V = IR$ in any form — C1
2.4 V OR 1.6 × candidate's R_p V — A1 [3]

(c) reduced accept current decreases — B1 [1]

10 **(a)** decreases / low / very low / zero — B1 [1]

(b) **(i)** ecf from **(a)**, both answers must be consistent with candidate's **(a)** — B1

e.g.	decreases / low / very low / zero					increases / high / v. high / > 5V				
	light	high	OR	1		light	low	OR	0	
AND	dark	low	OR	0	AND	dark	high	OR	1	

(ii)

	switch position P	high	OR	1
AND	switch position Q	low	OR	0

B1 [2]

(c) AND gate — B1 [1]

(d) transistor — B1 [1]

(e) any 2 of:
(input) A high
(input) B high
C high
transistor switches on/works M1
yes / it would work A1 [2]

11 **(a)** magnetic flux changes / rod cuts magnetic field B1
emf / voltage induced ignore current induced B1 [2]

(b) Mark **(i)** & **(ii)** together
deflection increases/to R in **(i)** B1
deflection increases/to R in **(ii)** B1
correct reason in **(i)** or **(ii)** AND consistent with deflection:
in **(i)** or **(ii)** rate of change of flux (linkage) increases
in **(i)** more (magnetic) field lines cut/stronger (magnetic) field cut
in **(ii)** rod moves faster/field lines cut faster B1

(iii) no deflection AND no (magnetic) field lines cut/no change of flux (linkage) B1 [4]

12 **(a)** **(i)** $x = 88$
AND $y = 38$ B1

(ii) 50 B1

(iii) 38 B1 [3]

(b) different numbers of neutrons / nucleons NOT different no of protons / electrons C1
(strontium-90 has) 52 neutrons / 90 nucleons OR 2 more neutrons / nucleons A1 [2]