Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/42**

Paper 4 Extended Theory **May/June 2016**

MARK SCHEME

Maximum Mark: 80

Published

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 — 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. **Always annotate ecf if applied.**
c.a.o.	correct answer only
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. No deduction is incurred if the unit is missing from the final answer but is shown correctly in the working. Condone wrong use of upper and lower case symbols, e.g. pA for Pa. Derived units are acceptable e.g. N/m^2 for Pa, even $kg\,m/s^2$ for N
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 these only where specified in the mark scheme.
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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Question	Answer	Marks
1(a)	accelerate / speed up } any decelerate / slow down / } two come to rest / stop } from change direction / path curves } four	B2
1(b)(i)	a = (v–u) / t in any form or (v–u) / t	C1
	{(60 – 0) / 16 or 60 / 16 = } 3.8 m / s^2	A1
1(b)(ii)	(average speed) = (tot) dist / (tot) time	C1
	(100 / 1.85 =) 54 m / s	A1
1(b)(iii)	to reduce (air) resistance / drag OR to lower centre of mass	B1
	to increase acceleration / speed / resultant force OR smaller (frontal) area / better aero(dynamic) shape OR to improve stability / balance	B1
		Total: 8

Question	Answer	Marks
2(a)	momentum = mv	C1
	(=) 30 000 kg m / s OR N s	A1
2(b)(i)	impulse same as momentum change	C1
	27 000 kg m / s OR N s	A1
2(b)(ii)	F= impulse(mom ch) / t in any form OR impulse(mom ch) / t	C1
	(F=27 000 / 0.6 =) 45 000 N	A1

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Question	Answer	Marks
2(b)(iii)	momentum loss truck A same as momentum gain truck B / impulse	C1
	(final mom truck A=) candidate's **(a)** – candidate's **(b)(i)**	C1
	(v= 3000/6000 =) 0.50 m/s	A1
		Total: 9

Question	Answer	Marks
3(a)	internal energy of surroundings Box 4 internal energy of wires of motor Box 5	B1 B1
3(b)	(change of g.p.e. =) mgh	C1
	(800 × 10 × 50 =) 400 000 J OR 400 kJ	A1
3(c)	electrical energy generated } any sensible use of electrical energy } three } } sensible economic comment } from } sensible environmental comment } four	B3
		Total: 7

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Question	Answer	Marks
4(a)(i)	P = hρg in any form or hρg	C1
	(15 × 1020 × 10 =) 150 000 Pa / 150 kPa	A1
4(a)(ii)	250 000 Pa / 250 kPa	B1
4(a)(iii)	use of P = F / A in any form or PA	C1
	(253 000 × 1.2 × 0.8 =) 240 000 N	A1
4(b)	weight of lid } any (there is a) pressure inside box } OR upthrust on lid } two moment of force changes } from friction (of hinge) } five drag of water }	B2
		Total: 7

Question	Answer	Marks
5(a)	larger saucepan AND greater area	B1
5(b)	bubbles form } any boiling occurs throughout the liquid } one not influenced by surface area / humidity / draught } from boiling occurs at one temp } five boiling requires heat }	B1
5(c)(i)	molecules move apart / separate / escape NOT move faster / more KE	B1
	(intermolecular) forces / bonds broken / overcome	B1

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Question	Answer	Marks
5(c)(ii)	m = E / l_v in any form or E / l_v	C1
	920 × 300 / 2.3 × 10^6	C1
	0.12 kg OR 120 g	A1
		Total: 7

Question	Answer	Marks
6(a)(i)	35°	B1
6(a)(ii)	sin i / sin r = n OR sin i / sin r = 1 / n in any form	C1
	sin r = 1.56 × sin 35 OR (sin 35) / 1.56	C1
	r = 63°	A1
6(b)(i)	<u>angle of incidence</u> when angle of refraction = 90°	B1
6(b)(ii)	sin c = 1 / n in any form	C1
	c = 40°	A1
6(c)(i)	refraction	B1
6(c)(ii)	frequency Box 2 only	B1
		Total: 9

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Question	Answer	Marks
7(a)	appropriate use, accept from diagram	M1
	sensible diagram of: X-ray machine and package, luggage etc.	A1
	good extra detail	A1
7(b)	radio waves in air to Box 4 only	B1
	ultrasound in air to Box 1 only	B1
	X-rays in vacuum to Box 4 only	B1
		Total: 6

Question	Answer	Marks
8(a)	connect <u>d.c.</u> supply (to terminals / circuit)	B1
	switch on	B1
	connect <u>a.c</u>. supply (to terminals / circuit)	M1
	withdraw rod from solenoid / reduce current	A1
8(b)	$I_pV_p = I_sV_s$ OR $(I_s =) I_pV_p / V_s$	C1
	$(0.2 \times 240 / 12 =) 4.0$ (A)	A1
	fuse blows / does not blow	B1
		Total: 7

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Question	Answer	Marks
9(a)	ball gets –ve charge (from –ve plate)	**B1**
	–ve(ly charged ball) attracted to +ve / repelled from –ve	**B1**
9(b)	electrons	**B1**
	from L to R	**B1**
9(c)	Q = It in any form or Q / t	**C1**
	correct use of f = 4 Hz or T = 0.25 s	**C1**
	(I =) 3.4×10^{-9} A	**A1**
		Total: 7

Question	Answer	Marks
10(a)	$P=V^2/R$ in any form or V^2/P	**B1**
	$(240^2/1000 =)$ 58 Ω	**B1**
10(b)	$(120^2/1000 =)$ 14 Ω	**B1**
10(c)	P=V I in any form or P / V	**B1**
	(2000 / 240 =) 8.3 A	**B1**
		Total: 5

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Question	Answer	Marks
11(a)	86 protons (in nucleus)	**B1**
	134 neutrons (in nucleus)	**B1**
	86 electrons (surrounding nucleus / in orbit)	**B1**
11(b)	$^{4}_{2}\alpha$	**B1**
	$^{\ldots}_{84}Po$	**B1**
	$^{216}_{\ldots}Po$	**B1**
11(c)	220 / 55 **or** 4 (half-lives) **or** 720 / 16	**C1**
	45 counts / s	**A1**
		Total: 8

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