Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/43**

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 & OTHER MATTERS

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.

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.

Underlining 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.

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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 ≥ 2. Any figures 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.

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 errors 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)	force / vector has size / magnitude **and** direction	**B1**
1(b)(i)	35 N	**B1**
1(b)(ii)	(a =)$F \div m$ **or** 35 ÷ 14 (e.c.f.**(i)**)	**C1**
	2.5 m / s^2 (e.c.f.**(i)**)	**A1**
1(c)	both vectors to scale **and** correct angle (by eye)	**B1**
	resultant **and** parallelogram / two correct sides of triangle	**B1**
	value between 0.83–0.87 m / s (and angle between 88° and 92°)	**B1**

Question	Answer	Marks
2(a)	(p =)mv **or** 2000 × 18	**C1**
	36 000 kg m / s (**or** N s)	**A1**
2(b)(i)	15 000 kg m / s (**or** N s)	**B1**
2(b)(ii)	15 000 kg m / s (**or** N s) (e.c.f.**(i)**)	**B1**
2(b)(iii)	(F =)$p \div t$ **or** $mv \div t$ **or** 15 000 ÷ 0.20 (e.c.f.**(i)**/**(ii)**)	**C1**
	75 000 N	**A1**
2(c)	(increased time causes) decreased rate of: change of momentum / acceleration / deceleration / impulse ÷ time	**B1**
	smaller forces on people / less injury	**B1**

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Question	Answer	Marks
3(a)	any two from: • molecules in regular positions / regular structure / fixed shape • molecules unable to move around / fixed positions / vibrate • (average) separation of molecules less / closely packed • more intermolecular bonds / stronger bonds / greater forces	**B2**
3(b)	work done against forces **or** work done separating molecules **or** energy to break bonds **or** potential energy of molecules increases	**B1**
3(c)(i)	57 °C	**B1**
3(c)(ii)	7.0 (minutes) (Q =)ml **or** 50 × 210 **or** 10 500 (J) $ml \div t$ **or** 50 × 210 ÷ 7500 **or** $ml \div t$ **or** 50 × 210 ÷ 7 1500 (J / min)	**C1** **C1** **C1** **A1**

Question	Answer	Marks
4(a)(i)	inverse proportion **or** pV = const **or** $p \propto 1 / V$ greater volume **and** molecules more spread out / less concentrated / more space greater volume / more spread out **and** less frequent collisions <u>with walls</u>	**B1** **B1** **B1**
4(a)(ii)	a p value multiplied by a V value **or** 2.0×10^5 $2.0\,m^3$	**C1** **A1**
4(b)(i)	(they) slow down	**B1**
4(b)(ii)	(pressure) decreases	**B1**

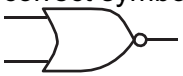
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Question	Answer	Marks
5(a)(i)	(a sound wave with a) frequency above the frequency audible by humans **or** inaudible (to humans)	**B1**
	20 000 Hz	**B1**
5(a)(ii)	visible light **and** radio	**B1**
	ultrasound	**B1**
5(b)	(d =)vt ÷ 2 **or** (d =)vt **or** 0.0369 (m)	**C1**
	(d =)4100 × 9.0 × 10 – 6 ÷ 2	**C1**
	0.018(45) m	**A1**

Question	Answer	Marks
6(a)(i)	(n =)sin i ÷ sin r **or** 61(°) **and** 33(°) seen	**C1**
	(n =)sin 61(°) ÷ sin 33(°)	**C1**
	1.6 / 1.61 / 1.60587	**A1**
6(a)(ii)	(c =)sin–1(1 / n) **or** sin–1(1 / 1.6) (e.c.f.**(i)**)	**C1**
	38.39°–38.7° (e.c.f.**(i)**)	**A1**
6(b)	one appropriate use	**B1**
	diagram of optical fibre **and** ray of light undergoing TIR at least twice	**B1**
	other relevant apparatus / detail	**B1**

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Question	Answer	Marks
7(a)	positive (charge)	**B1**
	electrons repelled (to earth)	**B1**
7(b)(i)	(I =)$Q \div t$ **or** $0.84 \div 3.5 \times 10^{-5}$	**C1**
	2.4×10^{4} A	**A1**
7(b)(ii)	current off scale / damages the meter / time too small	**B1**
7(c)	it/resistance decreases	**B1**

Question	Answer	Marks
8(a)(i)	correct symbol 	**B1**
8(a)(ii)	0, 1, 1, 1 i.e. exactly reversed (values for OR gate)	**C1**
	1, 0, 0, 0	**A1**
8(b)(i)	X variable resistor / rheostat	**B1**
	Y thermistor **cao** **ignore** temperature dependent resistor	**B1**
8(b)(ii)	resistance of thermistor decreases	**B1**
	current increases **or** smaller proportion of total resistance	**B1**
	p.d. (across LED) decreases **or** light goes out	**B1**
8(c)	LED lights up (as the temperature rises)	**B1**
	any sensible use (e.g. warns if the fuel is too hot) **or** LED emits light whenever the fuel is warm enough	**B1**

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Question	Answer	Marks
9(a)(i)	any two from: • velocity (of rod) • length of rod / angle between field and rod • magnetic field strength / separation of poles	**B2**
9(a)(ii)	any one from: • resistance (of circuit / rod / meter) • length • diameter / radius / cross-section / area • resistivity / material of rod • temperature of rod	**B1**
9(a)(iii)	(magnitude becomes) zero **or** no e.m.f. no field lines cut **or** rod slides between field lines	**B1** **B1**
9(b)(i)	horizontal sinusoidal wave two complete cycles	**M1** **A1**
9(b)(ii)	T marked where e.m.f. is maximum (i.e. crest) or minimum (i.e. trough)	**B1**

Question	Answer	Marks
10(a)(i)	(X =)234 (Y =)91	**B1** **B1**
10(a)(ii)	U (number 234 required in correct position) U (number 92 required in correct position)	**B1** **B1**
10(b)(i)	any two lines from: rocks (buildings / earth / ground / wood / stone / minerals) space (Sun / stars / galaxies / cosmic rays) air (radon)	**B2**

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Question	Answer	Marks
10(b)(ii)	1200 ÷ 400 **or** 3 (half-lives)	**C1**
	544 – 32 **or** 512 **or** evidence of 3 halvings	**C1**
	1/8(th) **or** 64 **or** 68	**C1**
	96 counts / minute	**A1**
10(b)(iii)	<u>random</u> fluctuations / variation	**B1**
		[Total: 80]

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