Cambridge International Examinations
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/43**

Paper 4 Extended Theory **October/November 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

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. 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.

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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 $\geqslant 2$. 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 Deduct one mark if the only error in arriving at a final answer is because given or errors 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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Question	Answer	Marks
1(a)	(a =)$\Delta v / t$ **or** gradient 0.50/2.0 0.25 m / s^2	**C1** **C1** **A1**
1(b)(i)	decreasing gradient from gradient zero at end **and** joins first part smoothly	**B1** **B1**
1(b)(ii)	deceleration **or** retardation	**B1**
	Total	**6**

Question	Answer	Marks
2(a)	(moment =)$F \times x_{\perp r}$ **or** $F \times x$ **or** 400 × 1.2 **or** 500 × 1.2 **or** 480 **or** 600 600 **and** 480 120 N m anticlockwise	**C1** **C1** **A1** **B1**
2(b)(i)	1080 / 1100 N m	**B1**
2(b)(ii)	100 N	**B1**
	Total	**6**

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Question	Answer	Marks
3(a)(i)	a vector quantity / it has **direction**	**B1**
3(a)(ii)	vector **and** has direction/is related to velocity	**B1**
3(b)(i)	(p =)mv **or** 35×1200 4.2×10^4 kg m / s (**or** N s)	**C1** **A1**
3(b)(ii)	(K.E. =)½mv^2 **or** ½ $\times$ 35 $\times$ 1200^2 2.5(2) $\times 10^7$ J	**C1** **A1**
3(c)(i)	constant / unchanged / conserved	**B1**
3(c)(ii)	increases chemical / fuel energy transformed to kinetic energy	**B1** **B1**
	Total	**9**

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Question	Answer	Marks
4(a)(i)	(p =)$h\rho g$ **or** $0.36 \times 840 \times 10$ $3.0(24) \times 10^3$ Pa	**C1** **A1**
4(a)(ii)	$1.0(2024) \times 10^5$ Pa (**allow** 1.0×10^5 Pa **with evidence of addition**)	**B1**
4(b)(i)	left level not as low right level not as high **or** one level higher **and** one level lower smaller *h* / height (difference)	**B1** **B1**
4(b)(ii)	both / liquid levels higher same / 0.36 m *h* / height (difference)	**B1** **B1**
	Total	**5**

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Question	Answer	Marks
5(a)(i)	speed increases **or** kinetic energy increases	**B1**
5(a)(ii)	effect: density / it increases explanation: (separation) decreases **and** less (kinetic) energy / vibrate less / smaller volume	**B1** **B1**
5(b)(i)	(Q =) ml **or** $0.12 \times 3.3 \times 10^5$ $3.96 / 4.0 \times 10^4$ (P =) Q / t **or** ml / t **or** $3.96 \times 10^4 / 220$ **ign.** WD / t 180 W	**C1** **C1** **C1** **A1**
5(b)(ii)	thermal energy lost to something specific (air, road, surroundings) **or** thermal radiation reflected	**B1**
	Total	**8**

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Question	Answer	Marks
6(a)(i)	same wavelengths (as original) **and** three crests (or more) sensible curvature at top and bottom (not touching wall) straight line section in middle	**B1** **B1** **B1**
6(a)(ii)	Innermost curve beyond guidelines **and** same wavelength	**B1**
6(b)	type of wave / longitudinal wave / transverse wave electromagnetic wave: ✓ (transverse wave) — **B1** P-wave: ✓ (longitudinal wave) S-wave: ✓ (transverse wave) — **B1** sound wave: ✓ (longitudinal wave) ultrasound wave: ✓ (longitudinal wave) — **B1**	
	Total	**7**

Question	Answer	Marks
7(a)(i)	3.0×10^8 m / s	**B1**
7(a)(ii)	radio (waves)	**B1**
7(a)(iii)	infra-red (radiation) X-rays **or** Röntgen rays	**B1** **B1**
7(b)(i)	less energy wasted **or** danger (to people nearby)/harmful	**B1**
7(b)(ii)	satellite communication / television **or** mobile / cell telephones **or** other sensible use (e.g. radar)	**B1**
	Total	**6**

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Question	Answer	Marks
8(a)	(c =)$\sin^{-1}(1/n)$ **or** $\sin^{-1}(1/1.5)$ **or** $\sin^{-1}(0.6667)$ **or** n = 1/sin(c) 42(41.8103)°	**C1** **A1**
8(b)(i)	(all of the) same / one frequency / wavelength	**B1**
8(b)(ii)	(r =)$\sin^{-1}(\sin(i)/n)$ **or** $\sin^{-1}(\sin(45(°))/1.5)$ n = sin (i) / sin(r) **or** 1.5 = sin(45°) / sin(r) **or** sin(r) = 0.47(140) 28(.1255057)° **or** 28°/27.63930015°	**C1** **A1**
8(b)(iii)	reflected ray **and** refracted ray at correct angles	**B1**
	Total	**6**

Question	Answer	Marks
9(a)	6 (cells)	**B1**
9(b)(i)	48 Ω	**B1**
9(b)(ii)	$1/R = 1/R_1 + 1/R_2$ **or** 1 / 48 + 1 / 24 **or** (R =)$R_1R_2/R_1 + R_2$ **or** 24 × 48 / 72 16 Ω	**C1** **A1**
9(c)(i)	(I =)V/R **or** 12 / 48 0.25 A	**C1** **A1**
9(c)(ii)	(Q =) / t **or** 0.25 × 6.0 **or** 0.25 × 6.0 × 60 **or** 1.5 90 C	**C1** **A1**
	Total	**8**

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Question	Answer	Marks
10(a)(i)	experiences force to left or right **or** moves to left or right moves to right **or** bows out to right	**C1** **A1**
10(a)(ii)	vibrates (to left and right) **or** moves left and right repeatedly	**B1**
10(b)(i)	(magnetic) field (lines) cut e.m.f. induced	**B1** **B1**
10(b)(ii)	opposite deflection **or** current reversed same size deflection / current	**B1** **B1**
10(b)(iii)	small(er) deflection / current (in same direction)	**B1**
	Total	**8**

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Question	Answer	Marks
11(a)(i)	$^{56}_{26}Fe$; **both** numbers correct and in correct position	**B1**
11(a)(ii)	$^{196}_{78}Pt$; 78 **and** Pt correct position 196 in correct position	**B1** **B1**
11(b)(i)	($^{238}_{94}Pu \rightarrow$) $^{234}_{92}U + {}^{4}_{2}\alpha$; 4 **and** 2 in correct position by the α 92 in correct position by the U 234 in correct position by the U	**B1** **B1** **B1**
11(b)(ii)	270/90 half-lives **or** 3 half-lives **or** 1 / 8 1.2×10^{10} **or** $9.6 \times 10^{10} - 1.2 \times 10^{10}$ **or** 7 / 8 8.4×10^{10}	**C1** **C1** **A1**
	Total	**9**
		80

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