Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/41**

Paper 4 Extended Theory **October/November 2019**

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.

Cambridge International will not enter into discussions about these mark schemes.

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Generic Marking Principles

These general marking principles must be applied by all examiners when marking candidate answers. They should be applied alongside the specific content of the mark scheme or generic level descriptors for a question. Each question paper and mark scheme will also comply with these marking principles.

GENERIC MARKING PRINCIPLE 1:

Marks must be awarded in line with:

- the specific content of the mark scheme or the generic level descriptors for the question
- the specific skills defined in the mark scheme or in the generic level descriptors for the question
- the standard of response required by a candidate as exemplified by the standardisation scripts.

GENERIC MARKING PRINCIPLE 2:

Marks awarded are always **whole marks** (not half marks, or other fractions).

GENERIC MARKING PRINCIPLE 3:

Marks must be awarded **positively**:

- marks are awarded for correct/valid answers, as defined in the mark scheme. However, credit is given for valid answers which go beyond the scope of the syllabus and mark scheme, referring to your Team Leader as appropriate
- marks are awarded when candidates clearly demonstrate what they know and can do
- marks are not deducted for errors
- marks are not deducted for omissions
- answers should only be judged on the quality of spelling, punctuation and grammar when these features are specifically assessed by the question as indicated by the mark scheme. The meaning, however, should be unambiguous.

GENERIC MARKING PRINCIPLE 4:

Rules must be applied consistently e.g. in situations where candidates have not followed instructions or in the application of generic level descriptors.

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GENERIC MARKING PRINCIPLE 5: Marks should be awarded using the full range of marks defined in the mark scheme for the question (however; the use of the full mark range may be limited according to the quality of the candidate responses seen).
GENERIC MARKING PRINCIPLE 6: Marks awarded are based solely on the requirements as defined in the mark scheme. Marks should not be awarded with grade thresholds or grade descriptors in mind.

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Question	Answer	Marks
1(a)(i)	$a = \Delta v / \Delta t$ **or** $a = (v - u)/t$ in any form words, symbols or numbers **or** ($a =$) $\Delta v / \Delta t$ **or** ($a =$) $(v - u)/t$ **or** $15 (- 0)/5.0$ **or** ($a =$) gradient	**C1**
	$3.0\ m / s^2$	**A1**
1(a)(ii)	($F =$) ma in any form words, symbols or numbers **or** ($F =$) ma **or** 2300×3.0	**C1**
	6900 N	**A1**
1(b)	accelerating **or** speed / velocity increasing	**B1**
	at a decreasing rate **or** acceleration decreasing	**B1**
	gradient (of graph is positive and) decreasing	**B1**
1(c)	air resistance **or** friction mentioned **or** resistive force	**B1**
	air resistance **or** friction **or** resistive force increases (with speed)	**B1**

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Question	Answer	Marks
2(a)	any **two** from: shape size / volume / length / density / any linear dimension direction (of motion) / speed / velocity / momentum / kinetic energy / acceleration	**B2**
2(b)(i)	extension **and** tension / force / load mentioned extension is directly proportional to tension / force / load	**C1** **A1**
2(b)(ii)1.	260 N	**B1**
2(b)(ii)2.	$k = F / x$ in any form words, symbols or numbers **or** (k =) F / x **or** 260 / (0.94 – 0.63) **or** 260 / 0.31 840 N / m	**C1** **A1**
2(b)(iii)	from chemical (potential energy) to elastic (potential) / strain (at end)	**B1** **B1**

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Question	Answer	Marks
3(a)	force × time (for which it acts)	**B1**
3(b)(i)	$v = I/m$ **or** 0.019 / 0.00011 in any form words, symbols or numbers **or** (v =) I/m 170 m / s	**C1** **A1**
3(b)(ii)	$KE = \frac{1}{2}mv^2$ in any form words, symbols or numbers **or** (KE =) $\frac{1}{2}mv^2$ $0.50 \times 0.00011 \times 170^2$ 1.6 J **or** 1.7 J	**C1** **C1** **A1**
3(c)	**accept** reverse comments if clearly about how the molecular structure of a solid differs from that of a liquid (molecules / they) have an irregular arrangement / not ordered / random arrangement (molecules / they) are (slightly) further apart (on average) (molecules / they are) not fixed in place	 **B1** **B1** **B1**

Question	Answer	Marks
4(a)	it / cone vibrates any **two** from: alternating current (a.c.) (in coil / wire) **or** alternating magnetic field (neighbouring) air vibrates **or** vibrations passed on (producing) compressions **and** rarefactions / vibrations parallel to energy transfer vibrating at 15 000 Hz	**B1** **B2**
4(b)	$\lambda = v / f$ in any form words, symbols or numbers **or** ($\lambda =$) v / f **or** 330 / 15 000 0.022 m	**C1** **A1**
4(c)	at least two vertical wavefronts either to left of barrier or in gap at least one wavefront showing some diffraction approximately constant wavelength throughout **and** ~50% of gap width	**B1** **B1** **B1**

Question	Answer	Marks
5(a)	four or more radial arrows / lines outside surface at least one arrow pointing towards (centre of) sphere **and** none wrong	**B1** **B1**
5(b)(i)	positive charges on left **and** negative charges on right of S equal numbers	**M1** **A1**
5(b)(ii)	it moves towards / attracted towards the negatively charged sphere / to the left	**B1**
5(b)(iii)	electrons / negative charges move (along the wire) towards Earth / towards ground / down the wire S becomes positively charged	**B1** **B1**
5(c)	electrons mentioned free (to move) / delocalised / mobile in metals / S **or** fixed in position in plastic / stand	**M1** **A1**

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Question	Answer			Marks
6(a)(i)	$I = P / V$ **or** in any form words, symbols or numbers **or** (I =) P / V **or** 9000 / 230 39 A			**C1** **A1**
6(a)(ii)	40 A **or** any greater integer value (in A) up to and including 60 A			**B1**
6(b)	$E = Pt$ **or** in any form words, symbols or numbers **or** (E =) Pt **or** 9000 × 1.0 **or** 9000 J seen 35 – 16 **or** 19 (°C) seen $m = E /(c\Delta T)$ **or** in any form words, symbols or numbers **or** (m =) $E /(c\Delta T)$ **or** 9000 / (4200 × 19) 0.11 kg			**C1** **C1** **C1** **A1**
6(c)(i)	two different metal wiresjoined at one end **and** voltmeter between free ends	**or**	three metal wires **and** two different joined ABA **and** voltmeter between free ends	**B1** **B1**
6(c)(ii)	any **one** from: quick response / makes measurements fast measures rapidly varying temperatures electrical output small heat capacity robust / rugged			**B1**

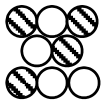
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Question	Answer	Marks
7(a)	7 / 7.6 / 8 / 10 marked towards top of *y*-axis **and** 1(.0) towards right of *x*-axis a straight line of positive gradient from 0, 0 to point 1.0, 7.6	**B1** **B1**
7(b)(i)	energy (transferred) per unit charge energy (transferred) from chemical **or** energy (transferred) to electrical **or** energy (transferred) around / in a (complete) circuit	**B1** **B1**
7(b)(ii)	1. $I = V / R$ **or** in any form words, symbols or numbers **or** (I =) V / R **or** 12 / 7.6 1.6 A	**C1** **A1**
	2. 4.2 V **or** 4.3 V	**B1**
	3. $Q = It$ **or** in any form words, symbols or numbers **or** (Q =) It **or** $1.6 \times 5.5 \times 60$ **or** 1.6×5.5 **or** 8.8 (C) 520 C **or** 530 C	**C1** **A1**

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Question	Answer	Marks
8(a)(i)	n = sin(i) / sin(r) in any form words, symbols or numbers **or** (n =) sin(i) / sin(r) **or** sin(53°) / sin(30°) 1.6	**C1** **A1**
8(a)(ii)	path emerging into air along correct path (by eye) **and** labelled R	**B1**
8(a)(iii)	ratio / division of two identical quantities / speeds / sine functions / (pure) numbers	**B1**
8(b)(i)	path labelled V with two correct refractions **and** below path of red light in glass	**B1**
8(b)(ii)	larger frequency results in smaller speed (in glass) **or** r.a. (reverse argument) **or** inversely related / proportional. any **two** from: more refraction / closer to normal / larger refractive index for larger frequency **or** r.a. violet light has larger frequency **or** o.r.a. violet light has a smaller speed (in glass) **or** o.r.a. violet light has larger refractive index **or** o.r.a.	**B1** **B2**

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Question	Answer	Marks
9(a)(i)	$^{8}_{3}$(Li)	**B1**
9(a)(ii)	 4 × ⊘ 4 × ○ electron	**B1** **B1** **B1**
9(b)(i)	radioactive emission / (background) radiation / decay is random	**B1**
9(b)(ii)	any **one** of: rocks, buildings, soil, Earth, space, cosmic rays, Sun, radon, nuclear waste, weapons testing	**B1**
9(b)(iii)	440 – 24 **or** 416 **or** 52 **or** 55 **or** 79 **or** 3 (half-lives) **or** 45 / 15 **or** 1 / 2^3 **or** 1 / 8 1/2^3 **or** 1/8 **or** 52 **or** 55 **or** 79 76 (counts)	**C1** **C1** **A1**