Cambridge IGCSE

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/42**

Paper 4 Extended Theory **May/June 2018**

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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This syllabus is approved for use in England, Wales and Northern Ireland as a Cambridge International Level 1/Level 2 Certificate.

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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.

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.

Question	Answer	Marks
1(a)(i)	**1** straight line from (0,0) to (10,50)	**1**
	2 gradient/slope	**1**
1(a)(ii)	$a = \Delta v \div \Delta t$ in any form **OR** (a=) $\Delta v \div \Delta t$ **OR** (a =) (9–5) ÷ 10 **OR** 4 ÷ 10	**1**
	(a =) 0.40 m / s^2	**1**
1(b)(i)	straight line down from any point on y-axis to any speed at 100 s	**1**
	from (0,50) to (100,15)	**1**
1(b)(ii)	uses area <u>under</u> graph **OR** av speed × time **OR** $s = ut + ½ at^2$ **OR** $v^2 = u^2 + 2as$	**1**
	100 × (50 + 15) ÷ 2 **OR** 100 × 15 + ½ (100 × 35) **OR** 5000 – ½ × 0.35 × 100^2	**1**
	3300 m	**1**

Question	Answer	Marks
2(a)	average/overall/combined density (of the metal and air contained) less (than density of sea water)	**1**
2(b)	(P =) $h \times \rho \times g$ **OR** (V=) $A \times l$ in any form	**1**
	(P= 1.2 × 1020 × 10 =) 12 000 (Pa) **OR** (V= 0.8 × 1.2 =) 0.96 (m^3)	**1**
	$P = F \div A$ **OR** (F =) $P \times A$ **OR** (W =) $V \times \rho \times g$	**1**
	(F = 12240 × 0.80 =) 9800 N **OR** (F = W =) 9800 N	**1**
2(c)	same numerical answer as **(b)**	**1**
	resultant/net (vertical) force = 0 **OR** downward force = upward force **OR** forces are balanced	**1**

Question	Answer	Marks
3(a)	(KE =) $\frac{1}{2} \times m \times v^2$	**1**
	(KE =) ½ × 9500 × 75^2	**1**
	(KE =) 2.7 × 10^7 J	**1**
3(b)	$KE = F \times l$ **OR** (F =)$KE \div l$ **OR** (F =) 2.671875 × 10^7 × 150 **OR** $v^2 - u^2 = 2ax$ **OR** (a =) $v^2 - u^2 \div (2 \times x)$ **OR** (a =) $75^2 \div (2 \times 150) = 18.75$	**1**
	(F =) 1.8 × 10^5 N **OR** ((F =) $m \times a$ = 9500 × 18.75) = 1.8 × 10^5 N	**1**

Question	Answer	Marks
4(a)(i)	atoms drawn close to each other and in rows	**1**
4(a)(ii)	atoms drawn far apart and randomly positioned	**1**
4(b)(i)	(atoms) vibrate/oscillate	**1**
4(b)(ii)	attractive forces between atoms/molecules (in the rock) **OR** energy/work to separate atoms/molecules	**1**
	force (applied must be large enough) to overcome forces between atoms/molecules **OR** work/energy (large) enough to separate atoms/molecules	**1**
4(c)	helium spreads/diffuses/moves freely/collides with air (molecules)	**1**
	the helium atoms travel in all directions/randomly/at high speed	**1**
	OR helium rises	**(1)**
	helium has low density **OR** He atoms high speed	**(1)**

Question	Answer	Marks
5	<u>diagram</u> shows cans placed near heater	**1**
	put thermometers in <u>water</u> **AND** observe readings	**1**
	good detail e.g. cans equal distances from heater same water volumes/levels thermometers same positions in cans	**1**
	higher thermometer reading in black (painted) can **OR** black (surface) good/best/better absorber	**1**

Question	Answer	Marks
6(a)	frequency 35 000 Hz ringed	**1**
	longitudinal ringed	**1**
6(b)	$v = f\lambda$ **OR** (λ =) $v \div f$	**1**
	(λ=) $3 \times 10^{8} \div 1.3 \times 10^{17}$	**1**
	(λ =) 2.3×10^{-9} m	**1**
6(c)	X-rays ionising/harmful/dangerous (to humans)	**1**
	Any **one** from: patient rarely exposed low total dose on patient meaningful comment about benefit outweighs danger dentist frequently exposed total dose on dentist would be high if stayed in room	**1**
6(d)	microwaves harmful/dangerous (to humans)	**1**
	microwaves would pass through open door	**1**

Question	Answer	Marks
7(a)	(speed/it) decreases	**1**
	refractive index > 1.0 **OR** sin (*i*) > sin (*r*) **OR** $i > r$ **OR** refraction/bends towards normal **OR** $n_p > n_w$ **OR** sin (*i*) ÷ sin (*r*) = $c_w \div c_p$	**1**
7(b)(i)	paraxial ray refracts through F_2	**1**
	other ray continues undeviated	**1**
7(b)(ii)	candidate's rays from **(b)(i)** traced <u>back</u> to intersection	**1**
	image marked from intersection of candidate's rays to axis	**1**
7(b)(iii)	in range 2.7 cm to 3.3 cm **AND** rays converge to the left of the object	**1**
7(b)(iv)	virtual **AND** light does not pass through image/cannot be projected on to a screen **OR** object distance < f **OR** on left of object	**1**

Question	Answer	Marks
8(a)(i)	variable resistor **OR** rheostat	**1**
8(a)(ii)	voltmeter symbol correctly connected across 20 Ω resistor	**1**
8(b)	$(I =) V \div R$ **OR** 6.0 ÷ 20 **OR** (any value < 6.0) ÷ 20	**1**
	correct calculation of I for V>0 accept point on graph with correct co-ordinates, apart from the origin	**1**
	straight line from (0,0) to (6.0,0.30) tolerance within ½ small square	**1**
8(c)(i)	(combined resistance) less (than the resistance of either/smaller resistor)	**1**
8(c)(ii)	steeper **OR** gradient greater **OR** description of how the line differs (e.g. reaches 0.40 A before V reaches 6.0 V) ignore 2nd line above 1st line	**1**

Question	Answer	Marks
9(a)(i)	forces on AB and CD in opposite (vertical) directions	**1**
9(a)(ii)	Column 2 increased by factor 3 Box 6	**1**
	Column 3 increased by factor 3 Box 6	**1**
	Column 4 decreased by factor 2 Box 3	**1**
9(b)(i)	deflects **OR** shows I/V/p.d.	**1**
	returns to zero	**1**
9(b)(ii)	produces/changes magnetic field	**1**
	S pole at bottom **OR** magnetic field opposes motion/(magnetic) field of magnet	**1**

Question	Answer	Marks
10(a)(i)	electrons/–ve charges (in metal) move o.w.t.t.e. to top half/move up	**1**
10(a)(ii)	more –ve charges in top half than bottom **OR** more +ve charges in bottom half than top NOT if contradiction e.g. more +ve in top and more –ve in top	**1**
10(a)(iii)	helps (keep plastic sheet in place)/yes	**1**
	unlike charges attract **OR** attractive force between metal plate and plastic sheet	**1**
10(b)	**1** both threads angled away from other ball	**1**
	2 like/same/positive charges repel	**1**

Question	Answer	Marks
11(a)	^{231}Th	**1**
	$_{90}Th$	**1**
11(b)(i)	splitting of a nucleus into (2) parts/light(er)nucleus	**1**
11(b)(ii)	(fission involves production of) ionising radiation **OR** radiation dangerous/harmful (to humans)	**1**
	(thick concrete walls) absorb/stop the radiation (and so protect workers)	**1**
11(b)(iii)	no CO_2/SO_2/greenhouse gases/acid rain	**1**
	nuclear waste (disposal) **OR** leaks of radioactive material **OR** risk of radiation in case of accident	**1**
11(c)	(52 hours =) 2 half-lives **OR** evidence of 2 halvings	**1**
	(after 52 hours number of thorium atoms left = $4.8 \times 10^9 \div 4$ =) 1.2×10^9 **OR** (number of thorium atoms decayed =) $\frac{3}{4} \times 4.8 \times 10^9$	**1**
	(number of atoms decayed = $4.8 \times 10^9 - 1.2 \times 10^9$) = 3.6×10^9	**1**