Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education

PHYSICS **0625/42**

Paper 4 Extended Theory **March 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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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)	Rate of change of velocity OR change of velocity / time OR change of velocity over time OR (v – u)/t	**B1**
1(b)(i)	Straight line from origin to (15, 28)	**B1**
	Horizontal line {from (15, 28)} to (32, 28)	**B1**
	a = (v – u) / t OR (t =) (v – u) / a OR (0 – 28) / 2.0	**C1**
	= 14 (s)	**C1**
	Straight line from (32, 28) to (46, 0)	**A1**
1(b)(ii)	**1** Towards the centre of the circle / inwards	**B1**
	2 Velocity is (continually) changing its direction	**B1**

Question	Answer	Marks
2(a)	(Because g.p.e. is) the work done by the force OR the force × the distance that the object rises OR mgh and height is <u>greater</u>	**B1**
2(b)	mgh OR $80 \times 65 \times 10 \times 1600$	**C1**
	8.3×10^7 J	**A1**
2(c)	<u>Method 1</u>	
	W = Pt OR E = Pt in any form	**C1**
	Work input =$1500 \times 10^3 \times 30 \times 60$ OR 2.7×10^9 J	**C1**
	Efficiency = work output / work input (x 100)	**C1**
	0.031 OR 3.1 %	**A1**
	<u>Method 2</u>	
	P = E/t in any form	**(C1)**
	Power output = $8.3 \times 10^7 / 30 \times 60$	**(C1)**
	Efficiency = power output / power input (× 100)	**(C1)**
	0.031 OR 3.1%	**(A1)**

Question	Answer	Marks
3(a)	...(the) force × its perpendicular distance from pivot / a point	**B1**
3(b)(i)	centre of mass	**B1**
3(b)(ii)	(mass =) 160 / 10 = 16 kg	**B1**
3(b)(iii)	(Not moving up or down because) no resultant (vertical) force OR upward force = downward force	**C1**
	80 N + 80 N = 160 N	**A1**
	(Not rotating because) no resultant moment (about any point) OR (sum of) clockwise moments = (sum of) anticlockwise moments	**C1**
	clockwise moment (about centre) = 80 × 1.2 anticlockwise moment (about centre) = 80 × 1.2	**A1**

Question	Answer	Marks
4(a)	Molecules of hot liquid collide with (surface of) spoon	**B1**
	transfer energy / heat to (molecules of) spoon	**B1**
	(amplitude of) vibration of spoon's molecules increases / is faster (increasing spoon's temperature)	**B1**
4(b)	Molecules of hot liquid (also) transfer energy to (free) electrons in the spoon	**B1**
	These (free) electrons move through the metal	**B1**
4(c)	(Q =) $mc\Delta\theta$	**C1**
	150 × 4.2 × (80 – 56)	**C1**
	15000 J	**A1**

Question	Answer	Marks
5(a)(i)	Sketch showing straight lines with sudden changes of direction	**B1**
5(a)(ii)	Any 3 marks from 4 points:	
	Air molecules move in random / different directions	**B1**
	Smoke particles are hit	**B1**
	by air molecules	**B1**
	Change direction at each collision OR undergo Brownian motion	**B1**
5(b)	F = (mv – mu) / t in any form OR Impulse = mv – mu	**C1**
	= 20 × 4.2 / 60	**C1**
	1.4 N	**A1**

Question	Answer	Marks
6(a)	A: infra-red B: ultra-violet C: X-(rays) D: γ-(rays)	**B2**
6(b)(i)	n = sin i / sin r OR sin r = sin i / n OR sin r = sin 35 / 1.50	**C1**
	r = 22°	**A1**
6(b)(ii)	Refraction at XY drawn with r < i	**B1**
	Refraction at XZ drawn with r > i	**B1**
6(b)(iii)	Blue ray drawn below red ray in prism and drawn with r < i	**M1**
	Ray to right of prism diverging downwards from red ray	**A1**

Question	Answer	Marks
7(a)	n = speed in air / speed in water OR speed in water = 3.0×10^8 / 1.33	**C1**
	2.3×10^8 m / s	**A1**
Answers to **(b)(i)**, **(b)(ii)** and **(b)(iii)** all combined to maximum of 5 marks on same screen		
7(b)(i)	Wavefronts in plastic: meet wavefronts in air	**B1**
	make smaller angle with boundary than wavefronts in air and downwards to the left	**B1**
	parallel to each other	**B1**
7(b)(ii)	Arrow(s) perpendicular to wavefronts in plastic and downwards to right	**B1**
7(b)(iii)	*r* in plastic between refracted wavefront and boundary	**B1**
	OR At a point where refracted wavefront meets boundary, normal to boundary drawn and line perpendicular to wavefront drawn. *r* in plastic between the two lines drawn	**(B1)**

Question	Answer	Marks
8(a)	P = IV OR (I =) 50 / 12	**C1**
	4.2 A	**A1**
8(b)(i)	(E =) QV	**C1**
	(E =) $270 \times 10^3 \times 12$	**C1**
	3.2×10^6 J / 3200 kJ	**A1**
8(b)(ii)	Volume of fuel used = $3.2 \times 10^6 / 3.6 \times 10^4$	**C1**
	89 cm^3 OR 90 cm^3 if 3.24×10^6 used	**A1**

Question	Answer	Marks
9(a)(i)	Resistor: tick in 2nd box	**B1**
9(a)(ii)	Lamp: tick in 1st box	**B1**
9(b)	(R =) V / I OR (R =) 6.0 / 4.4	**C1**
	1.4 Ω	**A1**
9(c)	Current in lamp = 4.4 A Current in resistor = 4.0 A	**C1**
	Current from supply (= 4.0 + 4.4) = 8.4 A	**A1**
	OR (With 6 V p.d.) R_L = 6 / 4.4 = 1.36 Ω R_R = 6 / 4 = 1.5 Ω Combined resistance = (1.36 × 1.5) / 2.86) = 0.71 Ω	**(C1)**
	Current = 6 / 0.71 = 8.4 A	**(A1)**
9(d)	p.d. across lamp = 4.9 V p.d. across resistor = 6.0 V	**C1**
	Total p.d. (= 4.9 + 6.0) = 10.9 V	**A1**
	OR (With 4 A current) R_L = 5 / 4 = 1.25 Ω R_R = 6 / 4 =1.5 Ω Total R = 2.75 Ω	**(C1)**
	Total p.d. = 2.75 × 4 = 11.0 V	**(A1)**

Question	Answer	Marks
10(a)	Strength of magnetic field / magnet	**B1**
	Speed (of movement of wire)	**B1**
	Length of AB / wire (within field)	**B1**
10(b)(i)	$V_p / V_s = N_p / N_s$ OR (N_s =) 8000 × 12 / 240	**C1**
	400 (turns)	**A1**
10(b)(ii)	Circuit connected to A and B with resistor and diode with correct circuit symbols in series	**B1**

Question	Answer	Marks
11(a)(i)	In box / cupboard with lead walls	**B1**
11(a)(ii)	(Handle) with (long) tongs OR remote-controlled device OR wearing lead gloves OR wearing lead suit	**B1**
11(b)	Col 1: gamma / γ (rays) alpha / α (particles) beta / β (particles)	**B1**
	Col 3: – a few cm or up to 10 cm a few m or up to 10 m	**B1**
	Col 4: thick lead or 30 cm lead or very thick concrete or 3 m concrete – thin aluminium or 2 mm aluminium	**B1**
11(c)(i)	alpha / α (particles or rays)	**B1**
11(c)(ii)	beta / β (particles or rays)	**B1**