Cambridge IGCSE

Cambridge Assessment International Education
Cambridge International General Certificate of Secondary Education (9–1)

PHYSICS (9–1) **0972/41**

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.

Cambridge International is publishing the mark schemes for the May/June 2018 series for most Cambridge IGCSE™, Cambridge International A and AS Level and Cambridge Pre-U components, and some Cambridge O Level components.

Cambridge Assessment International Education

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)	Mention of gradient of graph at t = 30 s **OR** tangent drawn at t = 30 s and triangle drawn	**1**
	Acceleration in range 0.30 to 0.45 m / s^2	**1**
1(b)	Acceleration less/at a slower rate	**1**
	Less driving force **OR** greater resistive force/friction/air resistance/drag	**1**
	Resultant force less	**1**
1(c)	Area under graph	**1**
	Distance = (20 × 40) + (½ × 40 × 10) **OR** ½ × (30 + 20) × 40	**1**
	1000 m	**1**

Question	Answer	Marks
2(a)	Chemical (potential energy)	**1**
2(b)(i)	(E =) m × g × h **OR** 32 × 10 × 2.5	**1**
	800 J	**1**
2(b)(ii)	Output power = E ÷ t **OR** 800 ÷ 5.4 **OR** 148.148 (W)	**1**
	Eff. = output (power) ÷ input (power) **OR** $P_{out} \div P_{in}$ **OR** $E_{out} \div E_{in}$ **OR** output power ÷ 0.65 **OR** 148.148 ÷ 0.65 **OR** 800 ÷ 0.65	**1**
	= 230 W	**1**
2(c)	Advantage: not dependent on weather/wind blowing **OR** always available	**1**
	Disadvantage: polluting **OR** CO_2/SO_2/greenhouse gases emitted **OR** leads to global warming **OR** oil must be transported **OR** not renewable **OR** oil will run out/be used up	**1**

Question	Answer	Marks
3(a)(i)	W = (4.8 × 10 =) 48 N	**1**
3(a)(ii)	(P =) F ÷ A OR 48 ÷ (0.12 × 0.16)	**1**
	2500 Pa	**1**
3(b)	Atmospheric pressure (in addition to liquid pressure)	**1**
3(c)	P = hdg or in words OR (d =) P ÷ hg OR 2500 ÷ (0.32 × 10)	**1**
	780 kg / m^3	**1**
	OR d = M ÷ V = 4.8 ÷ (0.12 × 0.16 × 0.32)	**(1)**
	780 kg / m^3	**(1)**

Question	Answer	Marks
4(a)(i)	(Molecules) vibrate	**1**
4(a)(ii)	random/haphazard/in all directions	**1**
	Any **one** of: with high speed freely zig-zag in straight lines	**1**
4(b)	(Molecules) collide with walls (of box) **OR** (Molecules) rebound from walls (of box)	**1**
	Change of momentum (occurs)	**1**
	force (on walls) = (total) change of momentum per second	**1**
	Pressure = (total) force ÷ (total) area (of walls)	**1**

Question	Answer	Marks
5(a)(i)	Refraction **OR** reflection	**1**
5(a)(ii)	If refraction in **(i)** Change or increase or decrease in speed of wave **OR** change of refractive index **OR**	**1**
	If reflection in **(i)** Mention of surface or boundary	**(1)**
5(b)(i)	2 points both labelled F at 3.5 cm either side of optical centre of lens	**1**
5(b)(ii)	Any **two** of: Paraxial ray from tip of O refracted through farther F/3.5 cm Undeviated ray from tip of O through optical centre of lens Ray from tip of O through nearer F refracted paraxially	**2**
	Image/I drawn from intersection of rays to principal axis with indication that image is inverted	**1**
5(b)(iii)	In range 3.6 to 4.1 cm	**1**
5(b)(iv)	(Image is) real **<u>and</u>** light passes through it **OR** can be projected/seen on a screen **OR** refracted rays cross/meet	**1**

Question	Answer	Marks
6(a)(i)	At least 3 circular wavefronts centred on gap extending to at least half of semicircle	**1**
	Same spacing as incident wavefronts	**1**
6(a)(ii)	At least 3 straight, parallel, wavefronts, approximately same length as width of gap	**1**
	Ends of straight lines curving towards but not reaching barrier	**1**
6(b)	Any **four** of: Diagram to show: labelled barrier, incident straight or curved waves Diagram shows appropriately reflected waves Water surface e.g. tank of water/ripple tank/pond/acceptable alternative How waves are produced: e.g., moving end or length of solid rod dipping into surface **OR** small solid object thrown in. Detail of barrier: made of metal, glass or wood fixed in position How observed: by eye, video, film, stroboscope	**4**

Question	Answer	Marks
7(a)	(Metals) contain free/mobile electrons/delocalised electrons	**1**
7(b)(i)	$R \propto L$ **and** $R \propto 1 \div A$ **OR** $R \propto L \div A$ **OR** $R = 16 \times ½ \div 2$ **OR** $R = 16 \div 4$	**1**
	4.0 Ω	**1**
7(b)(ii)	$1 \div R = (1 \div R_1) + (1 \div R_2)$ **OR** $R = (R_1 \times R_2) \div (R_1 + R_2)$ **OR** $(1 \div R) = (1 \div 4) + (1 \div 16)$ **OR** $(4 \times 16) \div (4 + 16)$	**1**
	3.2 Ω	**1**
7(c)(i)	3E or $3 \times E$	**1**
7(c)(ii)	$I_B > I_2 > I_1$ (6th box ticked)	**1**

Question	Answer	Marks
8(a)	(Q =) $mc\Delta\theta$ **OR** $200 \times 4.2 \times 22$	**1**
	18000 J	**1**
8(b)	Q = m × L **OR** (L =) Q ÷ m **OR** 18 480 ÷ 60	**1**
	310 J / g	**1**
8(c)	(Thermal) energy/heat transfers from surroundings **OR** into water	**1**

Question	Answer	Marks
9(a)	Would not be effective **OR** No	**1**
	With current on **OR** the (alternating) current should not be switched off	**1**
	Magnet should be withdrawn from the coil	**1**
	OR Magnet would be alternately magnetised in different directions	**(1)**
	Would remain magnetised in the direction occurring at the moment of switching off	**(1)**
9(b)(i)	Coil turns	**1**
	Clockwise/continuously	**1**
	Current (in coil) reverses every half turn/when coil is in vertical position **OR** force on current in a magnetic field	**1**
9(b)(ii)	**1** × (4 × T)	**1**
	2 × (2 × T)	**1**
	3 × (T ÷ 2)	**1**

Question	Answer	Marks
10(a)	To produce an alternating/changing magnetic field	**1**
	so that current/voltage is <u>induced</u> (continuously) in the <u>secondary</u> coil **OR** <u>secondary</u> circuit	**1**
10(b)(i)	$N_s \div N_p = V_s \div V_p$ in any form **OR** $(N_s =)\ N_p \times V_s \div V_p$ **OR** $8000 \times 6 \div 240$	**1**
	200	**1**
10(b)(ii)	$I_pV_p = I_sV_s$ in any form **OR** $(I_p =)\ I_s \times V_s \div V_p$ **OR** $2.0 \times 6 \div 240$	**1**
	0.050 A	**1**
10(b)(iii)	(Number of lamps =) $2 \div 0.05 = 40$	**1**

Question	Answer	Marks
11(a)	Number of protons = 86 and number of electrons = 86	**1**
	Number of neutrons = 136	**1**
11(b)	$^{218}_{84}\text{Po}$	**1**
	$+\ ^{4}_{2}\alpha$	**1**
11(c)	7.6 days = 2 half-lives or evidence of two halvings	**1**
	(number of Rn atoms left = $6.4 \times 10^6 \div 4$ =) 1.6×10^6	**1**
	number of α-particles emitted = ($6.4 \times 10^6 - 1.6 \times 10^6$ =) 4.8×10^6	**1**