Cambridge O Level

Cambridge Assessment International Education
Cambridge Ordinary Level

PHYSICS **5054/21**

Paper 2 Theory **October/November 2018**

MARK SCHEME

Maximum Mark: 75

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)	(F =) ma **or** 35×2.6	**C1**
	91 N	**A1**
1(b)(i)	straight line from origin to dashed line / t_1	**B1**
	gradually decreasing gradient until the line is horizontal	**B1**
1(b)(ii)	area under the line **or** area between line and x-axis	**B1**

Question	Answer	Marks
2(a)(i)	(p =) ρgh **or** $940 \times 10 \times 3.3$	**C1**
	3.1×10^4 Pa	**A1**
2(a)(ii)	atmospheric pressure acts at both ends of crack	**B1**
2(b)	(surface) level decreases / drops	**B1**
	pressure (at level of crack) decreases	**B1**

Question	Answer	Marks
3(a)	line continues from (7.0, 0.19) **and** curves upwards	**B1**
3(b)	(extension =) 8.5 (cm)	**C1**
	3.1–3.2 N	**A1**
3(c)	(limit of proportionality is) not reached **and** load shared / distributed equally **or** tension in each spring 4.5 N **or** limit of proportionality now 14 N	**B1**
	or tension in each spring halved **or** tension in each spring < 7.0 N	**B1**

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Question	Answer	Marks
4(a)	(kinetic energy =) $\frac{1}{2}mv^2$ **and** m is the mass of the object	**B1**
4(b)(i)	(ΔQ =) $mc\Delta T$ **or** $0.60 \times 560 \times 25$	**C1**
	8.4×10^3 J	**A1**
4(b)(ii)	$v^2 = 2\Delta Q / m$ **or** $8.4 \times 10^3 = \frac{1}{2} \times 0.60 \times v^2$ **or** (v^2 =) 2.8×10^4 (m^2 / s^2)	**C1**
	167 m / s	**A1**
4(b)(iii)	some internal / thermal energy lost (to ground / air) **or** work done to shatter rock **or** rock bounces **or** energy used to compress ground **or** rock melts	**B1**
5(a)(i)	1 difference between maximum and minimum marked temperatures	**B1**
	2 distance moved by (end of) thread per unit temperature rise	**B1**

Question	Answer	Marks
5(a)(ii)	large bulb / quantity of mercury greater increase in volume **or** narrow bore greater distance / difference (for a given increase in volume)	**M1A1**
5(b)	traps the liquid above the constriction (so that the reading is maintained)	**B1**
5(c)	they / molecules gain <u>kinetic</u> energy / move faster	**B1**
	move apart **or** push each other apart	**B1**
	mercury expands (up the tube)	**B1**

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Question	Answer	Marks
6(a)	(hard) steel	**B1**
6(b)	(place compass near to a pole and) mark a dot at further end of needle	**B1**
	move compass so the first end coincides with the dot **and** mark second dot	**B1**
	repeat (many times) **and** join up dots	**B1**
6(c)	magnetism induced in iron bar **or** poles induced on iron bar	**B1**
	end P becomes an N-pole	**B1**
	unlike poles attract **or** (force of) attraction greater than friction / repulsion	**B1**

Question	Answer	Marks
7(a)(i)	$1 / R_T = 1 / R_1 + 1 / R_2$ **or** $1 / R_T = 1 / 3.6 + 1 / 1.8$ **or** $(R_T =) R_1 R_2 / (R_1 + R_2)$ **or** $1.8 \times 3.6 / (1.8 + 3.6)$	**C1**
	1.2 (Ω)	**C1**
	4.0 Ω	**A1**
7(a)(ii)	$(I =) V / R$ **or** 6.0 / 4.0	**C1**
	1.5 (A)	**A1**
7(b)(i)	work done / energy (released) per unit charge (passed through component)	**B1**
7(b)(ii)	voltmeter symbol **and** across 2.8 Ω resistor	**B1**

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Question	Answer	Marks
7(b)(iii)	total resistance increases **or** resistance of circuit / parallel combination increases	**B1**
	current (in 2.8 Ω resistor) decreases	**B1**

Question	Answer	Marks
8(a)	substance **or** matter	**B1**
	rest **or** motion	**B1**
8(b)(i)	(a region of space) where a mass experiences a force (due to gravitational attraction)	**B1**
8(b)(ii)	(m =) ρV **or** $1000 \times 2.4 \times 10^{-2}$ **or** 24 (kg)	**C1**
	25 (kg) **or** 240 (N)	**C1**
	250 N	**A1**
8(c)(i)	(Γ =) Fx **or** 250×0.12	**C1**
	30 N m	**A1**
8(c)(ii)	75 N	**B1**
8(d)(i)	any **two** from: friction (between axle and cylinder) weight of rope force not perpendicular (to radius) rope wraps over itself (and increases moment)	**B2**

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Question	Answer	Marks
8(d)(ii)	from chemical (energy) **or** chemical (energy) as first term	**B1**
	to gravitational potential (energy) **or** to thermal / heat (energy) as last term	**B1**
	to thermal / internal (energy) / heat **and** thermal / internal (energy) / heat	**B1**
8(e)	no resultant force **or** forces balance / cancel **or** tension equals weight (of bucket) **or** upwards force equals downward force	**B1**

Question	Answer	Marks
9(a)	the vibration direction is parallel to the wave / energy travel direction **or** longitudinal waves have compressions and rarefactions **or** transverse waves have crests and troughs **or** longitudinal waves cannot be polarised	**B1**
9(b)(i)	(f =) v / λ **or** 0.17 / 0.019	**C1**
	8.9 Hz	**A1**
9(b)(ii)	(frequency) stays constant **or** does not change	**B1**
9(b)(iii)	(speed) decreases	**B1**
	(Fig. 9.1 shows that) wavelength decreases **or** refraction is towards normal **or** $i > r$ **or** top of wave (in shaded region) lags behind bottom of wave	**B1**
9(c)(i)	electromagnetic **and** transverse underlined	**B1**
9(c)(ii)	$n = \sin(i) / \sin(r)$ **or** (r =) $\sin^{-1}(\sin(i) / n)$ **or** (r =) $\sin^{-1}(\sin(60°) / 1.6)$	**C1**
	33(°)	**A1**

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Question	Answer	Marks
9(c)(iii)	1 $n = 1 / \sin(c)$ **or** $(c =) \sin^{-1}(1 / n)$ **or** $\sin^{-1}(1 / 1.6)$	**C1**
	39°	**A1**
	2 total internal reflection	**B1**
	$\theta > c$ **or** 57(°) > 39(°) **or** angle of incidence greater than the critical angle	**B1**
	3 reflected ray at P (correct angle by eye)	**B1**
	light in air at 30° (by eye) to vertical surface	**B1**

Question	Answer	Marks
10(a)(i)	same number of protons **or** same number of electrons	**B1**
10(a)(ii)	different number of neutrons	**B1**
10(b)(i)	${}^{4}_{2}\alpha$	**B1**
	${}^{\cdots\cdots}_{92}\mathrm{U}$	**B1**
	${}^{235}_{\cdots\cdots}\mathrm{U}$	**B1**
10(b)(ii)	(no. of half-lives =) $1.2 \times 10^5 / 2.4 \times 10^4$ **or** 5 (half-lives)	**C1**
	relevant halving **or** $1 / 2^5$ **or** 1 / 32 **or** 6400 / 32	**C1**
	200 counts / second	**A1**

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Question	Answer	Marks
10(b)(iii)	1 curving (only) downwards with correct curvature	**M1**
	no straight section (by eye) anywhere in magnetic field	**A1**
	2 (Fleming's) left-hand rule **or** motor rule **or** rule described **or** moving charge is a current	**B1**
10(c)(i)	splitting of a nucleus	**B1**
10(c)(ii)	neutron fired at a plutonium nucleus **or** plutonium nucleus absorbs neutron	**B1**
10(c)(iii)	1 no CO_2 / SO_2 / nitrogen oxides / greenhouse gases emitted **or** do not contribute to global warming / acid rain	**B1**
	2 reliable / not intermittent **or** smaller land area	**B1**

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