Cambridge O Level

Cambridge Assessment International Education
Cambridge Ordinary Level

PHYSICS **5054/22**

Paper 2 Theory **October/November 2019**

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)	weight is directly proportional to mass **or** $W = mg$	**B1**
	a larger force acts on the more massive body **or** $a = F / m$ **or** $a = W / m$	**B1**
	mass cancels **or** acceleration inversely proportional to mass	**B1**
1(b)(i)	$(\Delta v =)\ at$ **or** 1.6×1.5	**C1**
	2.4 m / s	**A1**
1(b)(ii)	2.4 marked on *y*-axis **and** straight line from (0, 0) to (1.5, 2.4)	**B1**
1(b)(iii)	$\frac{1}{2} \times 2.4 \times 1.5$ **or** area under the graph mentioned / attempted	**C1**
	1.8 m	**A1**

Question	Answer	Marks
2(a)(i)	$(F =)\ pA$ or $3.8 \times 10^5 \times 6.1 \times 10^{-4}$	**C1**
	230 N	**A1**
2(a)(ii)	force on other side of piston due to air / atmospheric pressure **or** pressure of trapped air decreases as valve opens (and air enters the tyre)	**B1**
2(b)	molecules collide with walls / piston / pump / surface	**B1**
	number of molecules per unit volume increases (as volume decreases)	**B1**
	more collisions per unit area **or** more frequent collisions / collide more often	**B1**

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Question	Answer	Marks
3(a)(i)	(nuclear) fusion (reactions) **or** nuclei fuse	**B1**
	small nuclei / hydrogen nuclei joining together (and release energy) **or** larger nucleus produced	**B1**
3(a)(ii)	infra-red (radiation) **or** ultraviolet (radiation) **or** (visible) light	**B1**
3(b)	black surfaces are (good) absorbers	**M1**
	of (infra-red) radiation / heat / (visible) light / thermal energy	**A1**

Question	Answer	Marks
4(a)	any **two** from: only occurs at the surface / no bubbles produced occurs at any temperature produces cooling	**B2**
4(b)	molecules escape (from liquid)	**B1**
	fast(est) molecules / molecules with great(est kinetic) energy escape **or** slow(est) molecules / molecules with small(est kinetic) energy remain **or** (average) speed of remaining molecules decreases **or** molecules gain (kinetic) energy and escape	**B1**
4(c)(i)	rate of evaporation increases (with increasing area)	**B1**
4(c)(ii)	rate of evaporation decreases with decreasing temperature **or** takes too much time	**B1**

Question	Answer	Marks
5(a)	vibration / oscillation of particles **or** energy transfer **or** compressions and rarefactions	**B1**
	vibration / oscillation (of particles) parallel to energy travel direction / propagation direction	**B1**

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Question	Answer	Marks
5(b)(i)	(λ =) v / f **or** 1500 / 42 000	**C1**
	0.036 m **or** 3.6 cm	**A1**
5(b)(ii)	(ultrasound) vibrates (the cleaning fluid / jewellery)	**B1**
	dirt shaken off	**B1**

Question	Answer	Marks
6(a)(i)	4.0 V **c.a.o.**	**B1**
6(a)(ii)	(V =) 12 – 4.0 **or** 8.0 **or** 4.0 / 700 **or** 5.7×10^{-3}	**C1**
	(R =) V / I **or** 8.0 × 1 / (4.0 / 700) **or** 700 × (8.0 / 4.0) **or** 12 / (4.0 / 700) **or** 2100 (Ω)	**C1**
	1400 Ω	**A1**
6(b)	resistance of LDR decreases	**B1**
	current increases **or** p.d. across 700 Ω resistor / oscilloscope increases **or** p.d. across LDR decreases	**M1**
	trace moves up the screen	**A1**

Question	Answer	Marks
7(a)(i)	current **and** magnetic field / magnetic flux (experiences a force) **or** the two magnetic fields interact	**B1**
7(a)(ii)	three separate approaches **I** / **II** / **III**	
7(a)(ii)**I**	B to A	**B1**
	left-hand rule mentioned / described	**B1**
	or	

Question	Answer	Marks
7(a)(ii)**II**	B to A	**B1**
	top face of coil attracted to S-pole **or** top face acts as an N-pole	**B1**
	or	
7(a)(ii)**III**	B to A	**B1**
	more field lines under AB **or** fewer lines above AB	**B1**
7(b)	(Γ=) Fx **or** $2 \times 9.6 \times 10^{-3} \times 0.025$ **or** $9.6 \times 10^{-3} \times 0.025$ **or** 2.4×10^{-4} (N m) **or** 0.024 (N cm)	**C1**
	4.8×10^{-4} N m **or** 0.048 N cm	**A1**
7(c)(i)	split-ring commutator **or** (carbon) brushes	**B1**
7(c)(ii)	(soft-)iron core **or** stronger magnet(s) **or** larger current **or** more turns **or** smaller resistance **or** greater electromotive force (e.m.f.)	**B1**

Question	Answer	Marks
8(a)	where / when extension is not directly proportional to load / tension / force (applied)	**C1**
	point where extension stops being directly proportional to load / tension / force (applied)	**A1**
8(b)(i)	the amount matter in a body **or** (a measure of) the inertia of a body	**B1**
8(b)(ii)	force (on a body)	**B1**
	in a gravitational field	**B1**
8(c)(i)	7.0 N **c.a.o.**	**B1**
8(c)(ii)	41 N / m **or** 0.41 N / cm	**B1**

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Question	Answer	Marks
8(d)(i)	two separate approaches **I** / **II**	
8(d)(i)**I**	0.90	**C1**
	41 × 0.90 **or** 37 **or** 3.7 **or** 3.7 – 0.70	**C1**
	3.0 kg	**A1**
	or	
8(d)(i)**II**	1.7 – 0.97 **or** 0.73	**C1**
	41 × (1.7 – 0.97) **or** 41 × 0.73 **or** 30	**C1**
	3.0 kg	**A1**
8(d)(ii)	straight line to marked point	**B1**
	0 < location of *y*-intercept < 1.70 m (intercept need not be labelled)	**B1**
	curve of changing / changed gradient beyond marked point	**B1**
8(e)	from elastic (potential energy) **or** strain (energy)	**B1**
	to kinetic (energy) **or** to gravitational (potential energy)	**B1**

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Question	Answer	Marks
9(a)	temperature	**B1**
	at which a liquid becomes a gas / vapour	**B1**
9(b)	forces (between the molecules of the liquid) / bonds mentioned	**B1**
	move molecules apart **or** overcome forces (between the molecules)	**B1**
	work done against forces **or** gains (molecular) potential energy	**B1**
9(c)	ammeter symbol in series	**B1**
	voltmeter symbol across the heater / power supply	**B1**
9(d)(i)	(P =) VI **or** 6.0×2.0	**C1**
	12 W	**A1**
9(d)(ii)	(E =) Pt **or** 12×60 **or** (E =) VIt **or** $6.0 \times 2.0 \times 60$	**C1**
	720 J	**A1**
9(d)(iii)	(m =) Q / l_v **or** $720 / 9.0 \times 10^5$	**C1**
	8.0×10^{-4} kg **or** 0.80 g	**A1**
9(e)	(it / upward force) does not change	**B1**
	always equal to weight of piston + force due to atmospheric pressure **or** no resultant force **or** piston is not accelerating	**B1**

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Question	Answer	Marks
10(a)	similarity: (same) number of protons	**B1**
	difference: (different) number of neutrons	**B1**
10(b)(i)	(nucleon number =) 222 – 4 **or** 218 **or** 218 – 84	**C1**
	134	**A1**
10(b)(ii)	(proton number =) 84 + 2	**C1**
	86	**A1**
10(b)(iii)	it / helium atom has two electrons (in orbit around the nucleus)	**B1**
10(c)(i)	2.1×10^{10} (alpha-particles)	**B1**
10(c)(ii)	**calculated** value of: 2.8×10^{10} – candidate's **10(c)(i)** (atoms remain) (expected value: 7.0×10^{9})	**B1**
10(c)(iii)	7.0×10^{9} / 2.8×10^{10} **or** 1 / 4	**C1**
	2 (half-lives) **or** 7.6 / 2	**C1**
	3.8 days	**A1**
10(d)	alpha-particles are (very) weakly penetrating	**B1**
10(d)	strongly ionising	**B1**
	(ionisation causes cell) mutations / cancers	**B1**

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