Cambridge O Level

Cambridge Assessment International Education
Cambridge Ordinary Level

PHYSICS **5054/21**

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)(i)	pressure due to mercury (in tube) is greater than pressure due to atmosphere (+ small height of mercury)	**B1**
	(resultant) force downwards and mercury flows out of tube	**B1**
1(a)(ii)	vacuum **or** nothing **or** mercury vapour	**B1**
1(b)	height of mercury column mentioned	**C1**
	height of mercury column above level in dish measured	**A1**
	candidate suggests use of $p = h \rho g$ **and** h in metres (m)	**B1**

Question	Answer	Marks
2(a)	mgh **and** $\frac{1}{2} mv^2$	**B1**
2(b)	$\frac{1}{2} mv^2 = mgh$ **or** $v^2 = 2gh$ **or** $v^2 = 2 \times 10 \times 380$ **or** $v^2 = 7600$	**C1**
	$(v =) \sqrt{2gh}$ **or** $\sqrt{2 \times 10 \times 380}$	**C1**
	87 m / s	**A1**
2(c)(i)	both the g.p.e. and the k.e. are proportional to mass **or** mass cancels out in the equation **or** they accelerate at the same rate / g	**B1**
2(c)(ii)	air resistance (force) is a smaller proportion of weight (for heavier coin)	**B1**
	acceleration of heavier coin greater / less affected by air resistance	**B1**

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Question	Answer	Marks
3(a)	any **three** from: molecules / they are further apart forces between molecules / them smaller molecules / they move in straight lines (between collisions) potential energy of molecules / them greater gas molecules move freely/randomly but liquid molecules slide over each other	**B3**
3(b)	(molecules separated against) intermolecular forces / bonds	**B1**
	work is done as molecules separate **or** bonds broken **or** latent heat supplied	**B1**

Question	Answer	Marks
4(a)	(A:) ultraviolet (radiation) (B:) infra-red (radiation) (C:) microwaves any **two** correct	**C1**
	all **three** correct	**A1**
4(b)	gamma-rays **and** gamma-rays	**B1**
4(c)	X-rays pass through flesh **and** not (to the same extent) through bone	**B1**
	X-rays detected photographically **or** (digital) detector behind bone	**B1**
	no / less exposure / detection reveals bone **or** exposure / detection reveals break	**B1**

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Question	Answer	Marks
5	two pairs of results from the line **and** separated by $\geqslant 50\ cm^3$	**B1**
	or $(\rho) = m / V$ use of results to obtain gradient **or** any mass / corresponding volume	**C1**
	$W = mg$ **or** $(\rho =)$ gradient / g **or** $0.00881\ (N / cm^3) \leqslant \rho \leqslant 0.00895\ (N / cm^3)$	**C1**
	$0.000881\ kg / cm^3 \leqslant \rho \leqslant 0.000895\ kg / cm^3$ **or** $0.881\ g / cm^3 \leqslant \rho \leqslant 0.895\ g / cm^3$	**A1**

Question	Answer	Marks
6(a)(i)	$(I =) P / V$ **or** $60 / 240$	**C1**
	0.25 A	**A1**
6(a)(ii)	$(R =) V / I$ **or** $240 / 0.25$	**C1**
	960 Ω	**A1**
6(b)(i)	3.0 V	**B1**
6(b)(ii)	resistance is smaller	**B1**
	(filament at a) lower temperature	**B1**
6(b)(iii)	current surge (due to lower resistance when cold)	**B1**

Question	Answer	Marks
7(a)(i)	(atomic particle) Q	**B1**
7(a)(ii)	$+1.6 \times 10^{-19}$ C	**B1**
7(b)	(atomic particle) Q **and** (atomic particle) S	**B1**
7(c)(i)	(atomic particle) R	**B1**

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Question	Answer	Marks
7(c)(ii)	(atomic particle) S	**B1**
7(c)(iii)	beta-(particle) emission	**B1**
7(c)(iv)	99 / 33 **or** 3 half-lives	**C1**
	$1 / 2^3$ **or** 1 / 8 (remain)	**C1**
	7 / 8	**A1**

Question	Answer	Marks
8(a)	surround the component with a box **or** use of iron mentioned	**B1**
	surround the component with (a box of) iron	**B1**
8(b)(i)	solenoid **and** d.c. power supply **and** switch	**B1**
	core	**B1**
	iron core	**B1**
8(b)(ii)	named or described use	**B1**
	what happens when electromagnet is switched on	**B1**
	current causes magnetisation **or** description of what happens when electromagnet is switched off	**B1**

Question	Answer	Marks
8(c)(i)	ammeters deflects / shows a reading	**B1**
	magnetic field lines cut by solenoid **or** changing magnetic field in coil	**B1**
	e.m.f. / voltage induced	**B1**
8(c)(ii)	no deflection **and** no (magnetic) field lines cut **or** constant field	**B1**
8(c)(iii)	larg(er) deflection	**B1**
	opposite deflection	**B1**
	field lines cut in opposite sense or opposite change in (magnetic) field **or** field lines cut faster	**B1**

Question	Answer	Marks
9(a)	it is less dense (than the cooler water)	**B1**
	it floats on the cooler water / cooler water cannot move up / cooler water remains on the bottom	**B1**
9(b)(i)	copper / metal is a good (thermal) conductor	**B1**
9(b)(ii)	vibrating atoms / ions / particles / molecules **or** electrons gain energy	**B1**
	atoms / ions / particles / molecules hit the electrons **or** electrons travel (a long distance through the copper)	**B1**
	electrons hit / transfer energy to (distant) atoms / ions / particles / molecules	**B1**

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Question	Answer	Marks
9(b)(iii)	it contracts **or** its density increases	**B1**
	it sinks	**B1**
	less dense / warmer water rises **or** sets up a convection current	**B1**
9(c)	14(°C) **or** 0.25 (kg) **or** 250 / 1000 (kg) seen	**C1**
	(Q =) $mc\Delta t$ **or** $0.25 \times 4200 \times (21 - 7)$ **or** $0.25 \times 4200 \times 14$	**C1**
	14 700 J **or** 15 000 J	**A1**
9(d)(i)	any **two** from: molecules / they move in clusters	**B1**
	slide over each other molecules / they move throughout the liquid	**B1**
9(d)(ii)	average speed / <u>kinetic</u> energy decreases	**B1**

Question	Answer	Marks
10(a)	3.0×10^8 m / s	**B1**
10(b)	red orange yellow green blue indigo violet (any order)	**B1**
10(c)(i)	(–)6.(0) cm	**B1**

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Question	Answer	Marks
10(c)(ii)	any **two** rays drawn from: paraxial ray that refracts and seems to come from F_1 ray through the optical centre of lens ray that aims for F_2 but refracts and emerges paraxially	**B2**
	rays traced back to point	**B1**
	(point) labelled I **and** rest of image drawn down to the principal axis	**B1**
10(c)(iii)	1.7–1.9 cm	**B1**
10(c)(iv)	candidate's **10(c)(iii)** / 3.0 evaluated	**B1**
10(c)(v)	any **two** from: a real image can be projected on to a screen light actually passes through a real image on same side (of lens) as object **or** on opposite side of mirror to object	**B2**
10(c)(vi)	correction of short-sight / myopia	**B1**
10(d)	light travels more slowly in glass **or** light changes speed	**B1**
	one side / left-hand side of wavefront slows down first	**B1**
	wavelength decreases **or** wavefront travels a shorter distance in the same time	**B1**

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