Cambridge Assessment International Education

Cambridge O Level

PHYSICS **5054/22**

Paper 2 Theory **May/June 2020**

MARK SCHEME

Maximum Mark: 75

Published

Students did not sit exam papers in the June 2020 series due to the Covid-19 global pandemic.

This mark scheme is published to support teachers and students and should be read together with the question paper. It shows the requirements of the exam. The answer column of the mark scheme shows the proposed basis on which Examiners would award marks for this exam. Where appropriate, this column also provides the most likely acceptable alternative responses expected from students. Examiners usually review the mark scheme after they have seen student responses and update the mark scheme if appropriate. In the June series, Examiners were unable to consider the acceptability of alternative responses, as there were no student responses to consider.

Mark schemes should usually be read together with the Principal Examiner Report for Teachers. However, because students did not sit exam papers, there is no Principal Examiner Report for Teachers for the June 2020 series.

Cambridge International will not enter into discussions about these mark schemes.

Cambridge International is publishing the mark schemes for the June 2020 series for most Cambridge IGCSE™ and Cambridge International A & AS Level components, and some Cambridge O Level components.

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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.

Science-Specific Marking Principles

1	Examiners should consider the context and scientific use of any keywords when awarding marks. Although keywords may be present, marks should not be awarded if the keywords are used incorrectly.
2	The examiner should not choose between contradictory statements given in the same question part, and credit should not be awarded for any correct statement that is contradicted within the same question part. Wrong science that is irrelevant to the question should be ignored.
3	Although spellings do not have to be correct, spellings of syllabus terms must allow for clear and unambiguous separation from other syllabus terms with which they may be confused (e.g. ethane / ethene, glucagon / glycogen, refraction / reflection).
4	The error carried forward (ecf) principle should be applied, where appropriate. If an incorrect answer is subsequently used in a scientifically correct way, the candidate should be awarded these subsequent marking points. Further guidance will be included in the mark scheme where necessary and any exceptions to this general principle will be noted.

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5 ‘List rule’ guidance (see examples below)

For questions that require ***n*** responses (e.g. State **two** reasons …):

- The response should be read as continuous prose, even when numbered answer spaces are provided
- Any response marked *ignore* in the mark scheme should not count towards ***n***
- Incorrect responses should not be awarded credit but will still count towards ***n***
- Read the entire response to check for any responses that contradict those that would otherwise be credited. Credit should **not** be awarded for any responses that are contradicted within the rest of the response. Where two responses contradict one another, this should be treated as a single incorrect response
- Non-contradictory responses after the first ***n*** responses may be ignored even if they include incorrect science.

6 Calculation specific guidance

Correct answers to calculations should be given full credit even if there is no working or incorrect working, **unless** the question states ‘show your working’.

For questions in which the number of significant figures required is not stated, credit should be awarded for correct answers when rounded by the examiner to the number of significant figures given in the mark scheme. This may not apply to measured values.

For answers given in standard form, (e.g. $a \times 10^n$) in which the convention of restricting the value of the coefficient (a) to a value between 1 and 10 is not followed, credit may still be awarded if the answer can be converted to the answer given in the mark scheme.

Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

7 Guidance for chemical equations

Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.

State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.

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For every question with more than 2 marks, place a tick at the first place in the answer where each mark is earned.

Preamble

M marks are method marks upon which further marks depend. For an M mark to be scored, the point to which it refers **must** be seen in a candidate's answer. If a candidate fails to score a particular M mark, then none of the A marks that follow can be scored.

B marks: are independent marks, which do not depend on other marks. For a B mark to scored, the point to which it refers must be seen specifically in the candidate's answers.

A marks In general A marks are awarded for final answers to numerical questions. If a final numerical answer, eligible for A marks, is correct, with the correct unit and an acceptable number of significant figures, all the marks for that question are normally awarded. It is very occasionally possible to arrive at a correct answer by an entirely wrong approach. In these rare circumstances, do not award the A marks, but award C marks on their merits. However, correct numerical answers with no working shown gain all the marks available.

C marks are compensatory marks. These can be scored even if the point to which they refer are not written down by the candidate, **provided subsequent working gives evidence that they must have known it.** For example, if an equation carries a C mark and the candidate does not write down the actual equation but does correct substitution or working which shows he knew the equation, then the C mark is scored.

brackets ( ) around words or units in the mark scheme are intended to indicate wording used to clarify the mark scheme, but the marks do not depend on seeing the words or units in brackets e.g. 10 (J) means that the mark is scored for 10, regardless of the unit given.

bold indicates that this must be seen in the answer offered, or something very similar.

Spelling Be generous about spelling and English usage. Credit answers that can be understood to mean what we want.

not Indicates that an incorrect answer is not to be disregarded, and indeed may cancel another otherwise correct alternative offered by the candidate i.e. right plus wrong penalty applies.

Ignore Indicates this is something which is not correct but is to be disregarded and does not cause a right plus wrong penalty.

ecf meaning "error carried forward" is mainly applicable to numerical questions, but may in particular circumstances, but rarely, be applied in non-numerical questions. This indicates that if a candidate has made an earlier mistake and has carried an incorrect value forward to subsequent stages of working, marks indicated by ecf may be awarded, provided the subsequent working is correct, bearing in mind the earlier mistake. ecf applies from one marked section to another not within a section and should be applied except where specifically stated.

Sig. Figs Answers are normally acceptable to any number of significant figures $\geqslant 2$. Any exceptions to this general rule will be specified in the mark scheme. Any answer which when rounded to the number of sig. figs in the answer gives the answer in the scheme should be accepted.

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Units	Deduct one mark for each incorrect or missing unit from **an answer that would otherwise gain all the marks available for that answer: only 1 mark can be lost per question** even for different units. No deduction is incurred if the unit is missing from the final answer but is shown correctly in the working.
ae	meaning “arithmetic error”. Deduct one mark if the **only** error in arriving at a final answer is clearly an arithmetic error. This deduction is for the last mark in a series (e.g. C1, A1), a missing unit does not involve further penalty.
Transcription	Deduct one mark if the **only** error in arriving at a final answer is because the candidate clearly made an error in copying a given numerical value or one previously calculated, e.g. by transposing two digits. (**Note:** A further penalty would apply if there was also an arithmetic error.)
Fractions	e.g. ½, ¼, 1/10 are only acceptable where specified.
Crossed out	Work which has been crossed out **and not replaced but can easily be read,** should be marked as if it had not been crossed out. Look to see if it has been replaced by work on a blank page or nearby.
Use of **NR**	(# key on the keyboard) Use this if the answer space for a question is completely blank or contains no readable words, figures or symbols.

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Question	Answer	Marks
1(a)	constant gradient	**B1**
1(b)	use of area (under graph) **or** $\frac{1}{2}$vt **or** average speed 4.5 (m/s)	**C1**
	9(.0) m	**A1**
1(c)	line of decreasing slope after 2 s	**B1**
	horizontal line at 12 m/s from 5.5 to 8 s	**B1**
	line, curved or straight, from (8, 12) to (11,10)	**B1**

Question	Answer	Marks
2(a)	96 m	**B1**
2(b)(i)	increases	**B1**
	time unchanged but speed faster	**B1**
2(b)(ii)	decreases	**B1**
	(force of) friction larger	**B1**

Question	Answer	Marks
3(a)(i)	force × distance	**C1**
	force × perpendicular distance	**A1**
3(a)(ii)	smaller distance to pivot (than from P to pivot)	**B1**

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Question	Answer	Marks
3(b)	same / equal pressure on piston P and piston Q	**B1**
	larger area of piston Q (than piston P)	**B1**
3(c)(i)	(W = Fd) numerical or algebraic	**C1**
	12 J	**A1**
3(c)(ii)	(efficiency) = work output / work input numerical or algebraic, e.g. $400 \times 0.02 / 12$	**C1**
	0.67 or 67%	**A1**

Question	Answer	Marks
4(a)(i)	60°	**B1**
4(a)(ii)	0(°)	**B1**
4(a)(iii)	back along the initial path	**B1**
4(b)	Any three of • same size (as object) • same distance (from mirror as object) • upright • virtual • laterally inverted	**B3**

Question	Answer	Marks
5(a)	microwaves → satellite television	**B1**
	ultraviolet → sunbeds	**B1**
5(b)(i)	(microwaves) must pass through **or** not be absorbed (by container) **or** not reflected	**B1**

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Question	Answer	Marks
5(b)(ii)	convection **and/or** conduction named	**B1**
	(convection involves) hot liquid rises (cold liquid falls)	**B1**
	(conduction involves) energy passes from molecule to molecule	**B1**

Question	Answer	Marks
6(a)	worn insulation → visual check loose wire in live → earth wire cable too hot → circuit breaker ALL three correct B2 one or two correct B1	**B2**
6(b)(i)	energy used by (a device of power) 1 kW for 1 hour	**B1**
6(b)(ii)	(number of kW h =) $1.2 \times 20 / 60$ **or** 0.4 seen	**C1**
	8 c	**A1**

Question	Answer	Marks
7(a)(i)	T and Q **or** U and R	**B1**
7(a)(ii)	different number of neutrons (in nucleus)	**B1**
7(b)(i)	time when decay occurs / particle emitted is not known / not constant **or** direction in which particle is emitted is not known / can be at any angle / direction	**B1**

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Question	Answer	Marks
7(b)(ii)	$^{218}_{84}Po$	**B1**
	$^{4}_{2}\alpha$ $^{4}_{2}He$ or	**B1**
7(c)(i)	electron or beta particle	**B1**
7(c)(ii)	(R gains or S has) one more proton	**B1**
	(R loses or S has) one less neutron	**B1**

Question	Answer	Marks
8(a)(i)	resistance decreases as temperature increases	**B1**
	current increases (and voltage constant) as temperature increases	**B1**
8(a)(ii)	volume (of liquid/gas), expansion (of solid/liquid or gas), length (of solid), pressure (of gas) length (of bimetallic strip), e.m.f. (of thermocouple), colour (of liquid crystals or very hot objects)	**B1**
8(b)(i)	<u>temperature</u> of melting ice **or** freezing water	**B1**
8(b)(ii)	<u>temperature</u> of boiling water (at 1 atmosphere)	**B1**
8(c)(i)	work done / energy change ÷ charge (passed through a component)	**B1**
8(c)(ii)	(R =) V / I in any form	**C1**
	(I =) 0.014(0) (A)	**C1**
	260 Ω	**A1**

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Question	Answer	Marks
8(c)(iii)	(V across R =) 25-3.6 **or** 21(.4 V) **OR** (total resistance =) 25 / 0.0014	**C1**
	15 000 Ω	**A1**
8(d)(i)	(a thermometer where the quantity) changes a lot per unit temperature rise / °C / same temperature rise	**B1**
8(d)(ii)	at high temperatures	**B1**
	large(r) change in current / meter deflection for unit temperature rise / °C / same temperature rise **or** large(r) gradient	**B1**
8(e)	heat (thermal energy) produced in the thermistor / resistor	**B1**

Question	Answer	Marks
9(a)(i)	core becomes magnetised (due to current in coil)	**B1**
	iron armature attracted to core	**B1**
	contacts touch	**B1**
9(a)(ii)	steel is a permanent magnet **or** iron is a temporary magnet	**B1**
	with a steel core motor stays on or contacts stay closed (if switch S is opened)	**B1**
9(a)(iii)	(with relay) safer **or** switch S connected to low voltage **or** switch only handles low currents	**B1**

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Question	Answer	Marks
9(b)(i)	at least two lines inside coil and horizontal near centre and covering at least six wires of coil	**B1**
	correct shape of lines fanning out at ends of coil	**B1**
	at least two lines passing outside the coil from one end to the other	**B1**
	correct direction of field lines on at least one line and none wrong	**B1**
9(b)(ii)	N-pole on right hand side	**B1**
9(c)(i)	move magnet into / near coil **or** move coil	**C1**
	move magnet / coil quickly **or** move strong magnet	**A1**
9(c)(ii)	lines of magnetic field cut the coil **or** flux in coil changes	**B1**
	induced e.m.f. / voltage produced (in complete circuit)	**B1**

Question	Answer	Marks
10(a)(i)	filament is hot / heated	**B1**
10(a)(ii)	attracted by a positive potential **or** repelled by filament **or** filament is negative	**B1**
10(a)(iii)	$2000 \times 1.6 \times 10^{-19}$	**C1**
	3.2×10^{-16} J	**A1**
10(b)(i)	two divisions	**C1**
	6(.0) V	**A1**
10(b)(ii)	40 ms	**B1**
10(c)(i)	longitudinal	**B1**

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Question	Answer	Marks
10(c)(ii)	oscillation described, e.g. back and forth	**B1**
	in direction of travel (of wave / energy) **or** compressions and rarefactions stated or described	**B1**
10(c)(iii)	more waves seen on screen	**B1**
	higher frequency (of sound) **or** more waves per second **or** time for one wave less	**B1**
10(d)(i)	diode passes current in only one direction **or** current only flows for half the cycle / oscillation **or** current is d.c. / direct	**B1**
10(d)(ii)	at least one top half and no bottom half **or** one bottom half and no top half	**C1**
	three top halves of the wave and flat sections along mid line **or** two bottom halves of the wave and flat sections along mid line	**A1**

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