



Cambridge O Level

PHYSICS

5054/21

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.

This document consists of **11** printed pages.

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.

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.

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.

Question	Answer	Marks
1(a)	78 m	B1
1(b)	(starting to) apply the brakes	B1
1(c)(i)	time taken to think / react is the same (and speed is the same)	B1
1(c)(ii)	friction is lower or less backwards / resistant force or car slides or skids / tyres do not grip road / car aquaplanes	B1
	takes longer time to stop or acceleration is less	B1

Question	Answer	Marks
2(a)	Hang card from pin / nail through hole and wait until stationary	B1
	using plumb line from hole mark line (on card)	B1
	repeat with another hole	B1
2(b)(i)	centre of mass / C falls outside base	B1
	weight creates moment / turning effect	B1
2(b)(ii)	lower centre of gravity or wider / longer base	C1

Question	Answer	Marks
3(a)	straight line	B1
	through the origin	B1
3(b)	add loads above 8 N	B1
	increase in length same increase in load is different or graph does not continue as a straight line	B1
3(c)	(force of) 4(.0 N) seen	C1
	(a =) F/m in any form algebraic or numerical	C1
	0.8(0) m/s ²	A1

Question	Answer	Marks
4(a)	glass molecules vibrate	B1
	molecules pass on energy / vibration from one to another	B1
	contains <u>many / more</u> free electrons / electrons that can move	B1
	electrons collide with atoms / molecules (and gain / lose energy)	B1
4(b)(i)	glass warms up (before water) or glass expands first	B1
	water expands more than glass	B1
4(b)(ii)	convection or hot water rises	B1
	convection <u>current</u> formed or hot water rises and cold water falls or density of water falls (as it heats)	B1

Question	Answer	Marks
5(a)	pressure = force / area	B1
	sharp knife has small(er) area and large(r) pressure or blunt knife has large(r) area and small(er) pressure	B1
5(b)(i)	temperature	B1
	mass of gas or number of molecules	B1
5(b)(ii)	molecules hit sides of container	B1
	twice as many molecules per second hit (unit area) or molecules hit twice as frequently	B1

Question	Answer	Marks
6(a)	behind the mirror or on the opposite side (of mirror) to object	B1
	same distance as object (from mirror)	B1
6(b)(i)	image marked at correct position by eye	B1
6(b)(ii)	ray from tooth to mirror and ray from mirror to eye	M1
	angles of incidence and reflection equal (by eye)	A1
6(c)	virtual or same size (as object) or laterally inverted	B1

Question	Answer	Marks
7(a)	emission of (at least one of) alpha, beta and gamma (particles / rays)	B1
	from the nucleus or at random	B1
7(b)	carbon-12 6, 6	B1
	carbon-14 6, 8, 6	B1
7(c)(i)	<u>beta</u> (particles)	B1
7(c)(ii)	(does not emit) gamma	B1
	gamma passes through thick container / 6 mm (aluminium)	B1

Question	Answer	Marks
8(a)(i)	electrical in first box	B1
	heat	B1
	light	B1
8(a)(ii)	energy output / energy input	C1
	<u>useful</u> output energy / <u>total</u> energy input	A1
8(b)	two decrease	C1
	all three decrease	A1
8(c)(i)	(R =) V / I in any form numerical or algebraic	C1
	total current = 2.5 A or both resistances 24 (Ω) and 6(.0 Ω)	C1
	4.8 Ω	A1

Question	Answer	Marks
8(c)(ii)	smaller area / diameter / radius	B1
8(d)	current in the coil	B1
	coil / core becomes magnetised	B1
	attracts iron armature	B1
	armature turns and contacts close	B1

Question	Answer	Marks
9(a)(i)	(sound that) cannot be heard	C1
	(sound with) frequency above 20 kHz	A1
9(a)(ii)	(some) reflect	B1
	(some) pass into new material or (some) absorbed by material	B1
9(a)(iii)	(d =) $s \times t$ in any form numerical or algebraic	C1
	$1500 \times 0.03 (\times 10^{-3} / 2)$	C1
	0.022 m or 0.023 m	A1
9(a)(iv)	gases 150 – 1000 m/s	B1
	solids 2000 – 8000 m/s	B1

Question	Answer	Marks
9(b)(i)	(more) X-rays make the image black(er)	B1
	X-rays absorbed by bone or do not reach detector through bone	B1
	<u>some</u> X-rays pass through tissue or tissue absorbs <u>some</u> X-rays	B1
9(b)(ii)	$(f =) v / \lambda$ in any form numerical or algebraic	C1
	1.5×10^{17} Hz	A1
9(b)(iii)	(X-rays) cause mutation / cancer / kill cells / ionisation	B1

Question	Answer	Marks
10(a)(i)	ammeter in series connecting switch with motor	B1
	voltmeter across motor or battery	B1
10(a)(ii)	$(E =) VI$ in any form numerical or algebraic or $P = VI$ and $P = E / t$ in any form	C1
	48 J	A1
10(a)(iii)	$(E = mgh)$ in any form numerical or algebraic	C1
	$0.15 \times 0.8(0) \times 10$	C1
	1.2 J	A1
10(a)(iv)	ANY two of <ul style="list-style-type: none"> • motor / mass has kinetic energy • heat generated in motor / wires • heat generated in air due to drag / resistance • <u>work done</u> to lift string 	B2

Question	Answer	Marks
10(b)(i)	mention of magnetic field (between N and S poles)	B1
	coil cuts lines of magnetic flux / magnetic field lines or flux / field in coil changes	B1
	induction	B1
10(b)(ii)	statement of Lenz's law , e.g. (induced) current flows in a direction to oppose the change producing it	B1
	coil becomes a magnet or current flowing in coil produces force in field	M1
	poles of coil attracted to opposite poles on magnet or force up on a side as side moves down	A1