

Cambridge O Level

PHYSICS**5054/22**

Paper 2 Theory

May/June 2025

MARK SCHEME

Maximum Mark: 80

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.

Cambridge International is publishing the mark schemes for the May/June 2025 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

PUBLISHED**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 descriptions 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

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.

Annotations guidance for centres

Examiners use a system of annotations as a shorthand for communicating their marking decisions to one another. Examiners are trained during the standardisation process on how and when to use annotations. The purpose of annotations is to inform the standardisation and monitoring processes and guide the supervising examiners when they are checking the work of examiners within their team. The meaning of annotations and how they are used is specific to each component and is understood by all examiners who mark the component.

We publish annotations in our mark schemes to help centres understand the annotations they may see on copies of scripts. Note that there may not be a direct correlation between the number of annotations on a script and the mark awarded. Similarly, the use of an annotation may not be an indication of the quality of the response.

The annotations listed below were available to examiners marking this component in this series.

Annotations

Annotation	Meaning
	information missing or insufficient for credit
	used to highlight parts of an extended response
	evaluation attempted
	benefit of the doubt given
	contradiction in response, mark not awarded
	incorrect point or mark not awarded
	error carried forward applied
	incorrect or insufficient point ignored while marking the rest of the response
	two statements are linked
	mandatory mark not awarded
	benefit of doubt was considered, but the response was decided to not be sufficiently close for benefit of doubt to be applied.

Annotation	Meaning
POT	power of ten error
SEEN	point has been noted, but no credit has been given or blank page seen
SF	error in number of significant figures
TV	response is too vague or there is insufficient detail in response
	correct point or mark awarded
U	Incorrect unit

Question	Answer	Marks
1(a)(i)	points plotted to within $\frac{1}{2}$ a small square	B1
	smooth curve drawn	B1
1(a)(ii)	(average speed =) d / t in any form	C1
	195 (cm / s)	A1
1(a)(iii)	draw a tangent (at $t = 0.40$ s)	B1
	find the gradient / slope (of the graph) or the gradient of the tangent	B1
1(b)(i)	mention of air resistance / resistive force	B1
	resultant force decreases or air resistance / upwards force increases (as speed increases) / becomes high(er)	B1
	(eventually) air resistance = weight (and acceleration is zero) or air resistance balances / cancels weight	B1
1(b)(ii)	straight line (of positive) or (line of) constant gradient / slope	B1

Question	Answer	Marks
2(a)	work done or energy per unit time	B1
2(b)	(input power =) power output / efficiency in any form	C1
	860 (W)	A1
2(c)(i)	(work =) force $\times$ distance or mgh	C1
	1100 (J)	A1
2(c)(ii)	(time =) work $\div$ (output) power	C1
	1.9 or 1.8 s	A1
2(d)	<i>Any one of:</i> - friction / air resistance - electrical heating	B1

Question	Answer	Marks
3(a)(i)	(P =) force / area in any form	C1
	1.9×10^5 (Pa)	A1
3(a)(ii)	(increasing pressure) decreases the area	B1
3(b)(i)	mass (of the particle) $\times$ velocity (of the particle)	B1
3(b)(ii)	<i>on collision</i> : change of momentum / direction / velocity or <i>on collision</i> : momentum transferred to wall	B1
	force related to change in momentum $\div$ time or force of equal size on tyre / wall and on particle (Newton's 3rd law)	B1
3(c)	(particles have) high(er) speed / velocity / momentum / <u>kinetic</u> energy	B1
	more collisions per second or hit (wall) hard(er) or larger change in momentum per sec	B1

Question	Answer	Marks
4(a)	<i>motion of particles:</i> backwards and forwards / to and fro / closer and further apart	B1
	(oscillation) in the direction of travel of the wave / to the right / in direction of microphone / longitudinal / horizontal / parallel to vibrations of tuning fork or mention of compressions and rarefactions	B1
4(b)(i)	number of oscillations per second or number of wave(length)s (passing a point) per second	B1
4(b)(ii)	2.5 (waves) seen or (1 wave takes) 0.02 (s) or ($f = 1 / T$ or (number of) waves / time	C1
	50 (Hz)	A1
4(b)(iii)	quieter / less volume	B1
4(b)(iv)	half frequency shown and at least one complete oscillation seen	B1
4(c)(i)	(at least) three correctly curved wavefronts centered on gap	B1
	same wavelength as on left and some curving in correct direction	B1
4(c)(ii)	diffraction	B1

Question	Answer	Marks
5(a)	swap voltmeter for ammeter	B1
	have cells all facing the same way, e.g. reverse left two cells	B1
5(b)(i)	($R =$) V / I in any form, e.g. $6 / 0.8$	C1
	$7.5 (\Omega)$	A1
5(b)(ii)	shorter and one of: • resistance smaller or resistance proportional to length • larger current (for same voltage) • smaller voltage to produce (an equal) current	B1
5(b)(iii)	6 (.0 cm)	B1

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Question	Answer	Marks
6(a)	$(I) = P / V$ or $2000 / 230$ or 8.7 (A)	M1
	fuse rating <u>13 A</u> underlined or circled	A1
	The fuse rating needs to be the lowest value above / slightly larger than the normal current / 8.7 A or $5 / 8 \text{ A}$ fuse blows under normal operation / 8.7 A or 30 A fuse may not blow / heater or circuit damaged if fault or current larger than normal 8.7 A	B1
6(b)	fuse melts / blows / or cuts off current / circuit	B1
6(c)(i)	0.95 (A)	B1
6(c)(ii)	17	B1
6(d)	Any two from: (trip switches can / are) • be reset / used more than once • faster acting / turns off immediately • more sensitive • be tested without replacement • have an external indication that they are working • can trip on difference in live and neutral currents	B2

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Question	Answer	Marks
7(a)	<i>split ring commutator:</i> to reverse the current (in the coil)	B1
	reverse current / connections every half turn / twice in one turn / every 180° / when coil is vertical	B1
	<i>brushes:</i> to connect coil / commutator or (split) rings to battery / (external) circuit or to provide current to coil, commutator or (split) rings or to avoid wires (to coil) tangling / twisting	B1
7(b)	<i>direction:</i> (from left) to right / from magnet 1 to magnet 2	B1
	<i>explanation:</i> current is from plus to minus / towards front / out of plane / page / outwards / top to bottom of wire / downwards <u>along wire</u> / towards the split ring on the left	B1
	left-hand rule mentioned and explained using two of current, field or motion / force	B1
7(c)	no change	B1
7(d)(i)	(moment =) force $\times$ distance in any form	C1
	0.69	A1
	Nm	B1
7(d)(ii)	(perpendicular) distance between (line of action of) forces decreases or (sides of) coil enter weaker magnetic field or coil leaves magnetic field	B1

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Question	Answer	Marks
8(a)	<i>shielding</i> : protects workers / absorbs radiation	B1
	<i>control rods</i> : controls number of neutrons / absorbs neutrons	B1
	<i>moderator</i> : slows down the neutrons	B1
8(b)	neutron hits / collides U–235 (nucleus)	B1
	nucleus splits / forms daughter nuclei	B1
	emits more neutrons	B1
8(c)(i)	amount of energy / heat needed for a unit rise in temperature	M1
	for unit mass	A1
8(c)(ii)	large (specific heat capacity) and <i>one of</i>: • smaller rise in temperature / temp. stays lower • heats up slower / longer time • less chance of boiling • smaller mass needed (for same temperature rise) / less flow rate / smaller pumps • more energy absorbed <u>for same temp. rise</u> or small(er heat capacity) and larger temperature rise (to heat boiler more efficiently) / heats up faster	B1

Question	Answer	Marks
9(a)	Mercury orbit inside Earth's orbit	B1
	Mars orbit between orbit of Earth and Jupiter	B1
9(b)	the Sun is in the way	B1
9(c)(i)	gravitational (force / attraction from Sun)	B1
9(c)(ii)	all four forces towards Sun by eye	B1
9(c)(iii)	increases (from 1) to 3 and decreases (from 3 to 4)	B1
	explanation of statement in description e.g. (stronger force) because comet is close(r) to <u>Sun</u> (at position 3)	B1
9(d)	speed = $2\pi r / T$ in any form	C1
	time for Jupiter to orbit Sun = 3.8×10^8 (s) or time for Earth to orbit Sun = 3.1×10^7 (s) or distance increases by 7.8 / 1.5 and speed decreases by 30 / 13 or $\frac{7.8 (\times 10^8)}{1.5 (\times 10^8)} \times \frac{30}{13}$	C1
	number of orbits = 12	A1