CAMBRIDGE
International Education

Cambridge IGCSE™ (9–1)

PHYSICS (9–1) **0972/42**

Paper 4 Theory (Extended) **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.

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	<u>'List rule' guidance</u> 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	<u>Calculation specific guidance</u> 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	<u>Guidance for chemical equations</u> 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
✓	correct point or mark awarded
✗	incorrect point or mark not awarded
^	information missing or insufficient for credit
A	allow or accept
AE	evaluation attempted
I	incorrect or insufficient point ignored while marking the rest of the response
CON	contradiction in response, mark not awarded
BOD	benefit of the doubt given
ECF	error carried forward applied
NAQ	response has not answered question

Annotation	Meaning
RE	rounding error
SEEN	point has been noted, but no credit has been given or blank page seen
SF	error in number of significant figures
TE	transcription error
TV	response is too vague or there is insufficient detail in response
T	answer outside the tolerance of the mark scheme
	used to highlight parts of an extended response
	used to highlight parts of an extended response
MO	mandatory mark not awarded
SC	special case

Acronyms and shorthand in the mark scheme

Acronym / shorthand	**Explanation**
A mark	Final answer mark which is awarded for fully correct final answers including the unit.
C mark	Compensatory mark which may be scored when the final answer (A) mark for a question has not been awarded.
B mark	Independent mark which does not depend on any other mark.
M mark	Method mark which must be scored before any subsequent final answer (A) mark can be scored.
Brackets ( )	Words not explicitly needed in an answer, however if a contradictory word / phrase / unit to that in the brackets is seen the mark is not awarded.
Underlining	The underlined word (or a synonym) must be present for the mark to be scored. If the word is a technical scientific term, the word must be there.
/ or **OR**	Alternative answers any one of which gains the credit for that mark.
owtte	Or words to that effect.
ignore	Indicates either an incorrect or irrelevant point which may be disregarded, i.e., not treated as contradictory.
insufficient	An answer not worthy of credit on its own.
CON	An incorrect point which contradicts any correct point and means the mark cannot be scored.
ecf [question part]	Indicates that a candidate using an erroneous value from the stated question part must be given credit here if the erroneous value is used correctly here.
cao	Correct answer only.
ORA	Or reverse argument.

Question	Answer	Marks
1(a)	constant speed **OR** uniform speed	**B1**
1(b)	33 m	**A2**
	(distance =) area under graph **OR** *bh* **OR** speed × time **OR** 11 × 3	C1
1(c)(i)	(rate of) decrease of velocity **OR** decrease in velocity (per unit time) **OR** negative acceleration	**B1**
1(c)(ii)	tangent drawn at 9.0 s on graph	**M1**
	0.50–0.70 m / s^2	**A2**
	correct method of gradient calculation using any two correct pairs of co-ordinates (± ½ a small square) from their tangent	C1

Question	Answer	Marks
2(a)	(moment =) force × <u>perpendicular</u> distance (from the pivot)	**B1**
2(b)	X **AND** 50 cm labelled to the right of the pivot **AND** left of 80 cm	**B1**
2(c)(i)	sum of clockwise moments = sum of anticlockwise moments	**B1**
	$\{mg \times 8\} + \{0.12 \times 38\} = \{0.34 \times 32\}$	**B1**
	any **one** from: • $mg = [\{0.34 \times 32\} – \{0.12 \times 38\}] \div 8$ • $mg = \{10.88 – 4.56\} \div 8$ • $mg = 6.32 \div 8$ • $mg = 0.79$ • (mass =) $0.79 \div 9.8$	**B1**
2(c)(ii)	520 kg / m^3	**A2**
	(density =) mass ÷ volume **OR** $0.081 \div \{1(.0) \times 2.6 \times 10^{-2} \times 6(.0) \times 10^{-3}\}$	C1

Question	Answer	Marks
3(a)	(momentum =) mass × velocity **OR** (p =) mv	**B1**
3(b)	(velocity =) 0.19 m / s **AND** (direction) to the right	**A4**
	(momentum before collision) = {0.45 × 0.34} – {0.21 × 0.12} **OR** 0.1278	C1
	(momentum after collision) = 0.66 × v	C1
	momentum before collision = momentum after collision **OR** {0.45 × 0.34} – {0.21 × 0.12} = 0.66 × v **OR** 0.153 – 0.0252 = 0.66 × v	C1
3(c)	(–) 0.12 N	**A2**
	$F\Delta t = \Delta\{mv\}$ **OR** (F =) $\Delta p \div (\Delta)t$ **OR** (F =) $\Delta\{mv\} \div (\Delta)t$ **OR** (F =) 0.26 ÷ 2.1	C1

Question	Answer	Marks
4(a)(i)	container A or container with (dull) black (surface) **AND** (dull) black (surfaces) are better emitters of infrared / radiation (than shiny white surfaces)	**A2**
	container A or container with (dull) black (surface) **AND** (dull) black (surfaces) are better emitters (than shiny white surfaces)	C1
4(a)(ii)	rate of transfer of energy from the container is equal to rate of transfer of energy to the container	**B1**
4(a)(iii)	convection	**B1**
4(b)	any **three** from: • metal is a good / better (thermal) conductor **OR** wood is a poor conductor **OR** wood is a (thermal) insulator • metal contains free / delocalised <u>electrons</u> **OR** wood does not contain free / delocalised <u>electrons</u> • <u>electrons</u> carry (thermal) energy through metal **OR** <u>electrons</u> collide with (distant) ions • wood only transfers (thermal) energy by lattice vibrations	**B3**

Question	Answer	Marks
5(a)	echo method (outside): 1 method of producing short, loud sound (e.g. clap / shout / cry out / bang 2 pieces of wood together) 2 measuring tape or trundle wheel, stopwatch and wall 3 (person) starts stopwatch when clap etc heard and stops it when echo heard 4 speed = 2 × measured distance ÷ time	B4
	OR	
	direct method outside: 1 method of producing short, loud sound (e.g. fire gun) 2 measuring tape or trundle wheel, stopwatch 3 (student at one end) starts stopwatch when smoke seen from gun and stops it when sound heard 4 speed = distance ÷ time	B4
	OR	
	direct method (using digital): 1 method of producing short sound e.g. clap or hammer striking block 2 measuring tape or metre ruler, digital timer and microphones 3 digital timer starts when sound reaches first microphone and stops when sound reaches second microphone. Time difference is recorded on digital timer owtte 4 speed = distance ÷ time for direct method	B4

Question	Answer	Marks
5(b)(i)	radio waves	**B1**
5(b)(ii)	$3(.0) \times 10^8$ m / s	**B1**
5(b)(iii)	0.12 m	**A3**
	$v = f\lambda$ **OR** (λ =) $v \div f$ **OR** (λ =) $\{3(.0) \times 10^8\} \div \{2.48 \times 10^9\}$	C1
	(λ =) $\{3(.0) \times 10^8\} \div \{2.48 \times 10^9\}$ **OR** (λ =) 1.2×10^N	C1

Question	Answer	Marks
6(a)(i)	**two** points labelled F on principal axis, both 3.0 cm from the centre of the lens	**B1**
6(a)(ii)	method 1 **two** correct rays from: • ray from top of I through the centre of the lens • ray from top of I parallel to principal axis to the left of the lens, to centre of lens and then through RH focus • ray from top of I through LH focus to lens, to centre of lens and then parallel to principal axis on the right of the lens	**M2**
	OR	
	method 2 **two** correct rays from: • ray from top of I through the centre of the lens • ray from top of I through RH focus of lens and extended back, from centre of lens, parallel to principal axis on the left of the lens • ray from top of I parallel to principal axis to the left of the lens, and extended back, from the centre of the lens, through the LH focus	**M2**
	object, labelled O, at the intersection of rays to the RH of the lens for method 1 object, labelled O, at the intersection of rays to the LH of the lens for method 2	**A1**
6(a)(iii)	real **OR** inverted	**B1**
6(b)(i)	rays meeting behind the retina **OR** would meet behind retina if extended	**B1**
6(b)(ii)	any converging lens	**B1**

Question	Answer	Marks
7(a)	(region) where a(n electric) charge experiences a force **OR** (region) where a force acts on a(n electric) charge	**B1**
7(b)(i)	any **two** from: • friction (between cloth and rod causes electrons to gain energy) • electrons move • (electrons move) from cloth / to plastic (making plastic negative and cloth positive)	**B2**
7(b)(ii)	moves away (from the charged plastic rod)	**A2**
	moves / experiences a force / repels	C1
7(c)(i)	energy transferred in one hour at a rate of transfer of 1 kW	**B1**
7(c)(ii)	1 5.5 (kW h)	**A2**
	$P = (\Delta)E \div t$ **OR** $(\Delta E =) Pt$ **OR** $(\Delta E =)\ 0.025 \times 220$ **OR** 25×220	C1
	2 $0.11 \times$ A	**A2**
	$P = VI$ **OR** $(I =)\ P \div V$ **OR** $(I =)\ 25 \div 230$	C1

Question	Answer	Marks
8(a)(i)	P and Q: <u>slip</u> rings	**B1**
	X and Y: brushes	**B1**
8(a)(ii)	coil cuts magnetic field	**B1**
8(a)(iii)	any **one** from: • increase strength of magnetic field • increase speed of rotation of coil • increase number of turns (of coil)	**B1**
8(b)(i)	1.2 A	**B1**
	(total) resistance of two (identical) resistors in series is added / doubled	**B1**
8(b)(ii)	6(.0) A	**B1**
8(b)(iii)	2.1 Ω	**A2**
	$V = IR$ **OR** (R =) $V \div I$ **OR** (R =) 5(.0) ÷ 2.4	C1

Question	Answer	Marks
9(a)(i)	radiation (always) present in the environment **OR** radiation from natural sources	**B1**
9(a)(ii)	any **one** from: • radon gas • rocks **OR** buildings • food **OR** drink • cosmic rays	**B1**
9(b)(i)	${}^{219}_{86}Rn$	**B1**
	${}^{4}_{2}\alpha$	**B1**
9(b)(ii)	alpha (particles) would be absorbed / stopped by the skin owtte	**B1**
9(c)(i)	gamma / radiation needs to pass out of the body (to detector)	**B1**
9(c)(ii)	after a few days / some time, little radiation is emitted owtte	**B1**

Question	Answer	Marks
10(a)(i)	planet B	**B1**
	high(est) (surface) temperature	**B1**
10(a)(ii)	–180 (°C)	**B1**
10(a)(iii)	planet A	**B1**
	gravitational field strength is highest so acceleration (due to gravity) is greater **OR** gravitational field strength is highest so greater (downward) force on the object	**B1**
10(b)(i)	red supergiant	**B1**
	(new) heavier elements **OR** hydrogen	**B1**
	any **two** from: • neutron star • black hole • new stars (with orbiting planets)	**B2**
10(b)(ii)	distance (from Earth) to galaxy	**B1**