CAMBRIDGE
International Education

Cambridge IGCSE™

PHYSICS **0625/41**

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.

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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 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.

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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.
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.

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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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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

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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

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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.

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Question	Answer	Marks
1(a)	(only) acceleration **AND** velocity circled	**B1**
1(b)(i)	56 m / s braille: 55 m / s	**B1**
1(b)(ii)	accelerates **OR** speed increases **AND** (then) constant speed **AND** (then) decelerates **OR** speed decreases	**B1**
	constant acceleration **OR** constant deceleration	**B1**
1(b)(iii)	26 000 m **OR** 26 km braille: 26 125 m	**A3**
	(distance =) area under the speed–time graph **OR** (distance =) average speed × time taken	C1
	$0.5 \times 80 \times 56$ **AND** 56×400 **AND** $0.5 \times 50 \times 56$ **OR** $\frac{1}{2} \times \{400 + 530\} \times 56$ braille: 0.5 × 100 × 55 **AND** 55 × 400 **AND** 0.5 × 50 × 55 **OR** $\frac{1}{2} \times \{400 + 550\} \times 55$	C1
1(b)(iv)	any **one** from: • lower acceleration **OR** less acceleration • lower deceleration **OR** less deceleration • lower maximum speed **OR** lower average speed **OR** lower constant speed	**B1**

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Question	Answer	Marks
2(a)(i)	direction (changes)	**B1**
	any **one** from: • magnitude of the velocity (changes) • speed (changes) • (there is) acceleration	**B1**
2(a)(ii)	any **one** from: • (change) size • (change) shape	**B1**
2(b)	1 place (the centre of) the metre ruler on the pivot owtte **OR** (labelled) diagram showing metre ruler on a pivot	**B1**
	2 add mass on one side (of pivot) and then add mass on other side to balance the ruler owtte	**B1**
	3 (moment =) force × <u>perpendicular</u> distance (from pivot)	**B1**
	4 sum of clockwise moments = sum of anticlockwise moments (when in equilibrium)	**B1**

Question	Answer	Marks
3(a)	<u>gravitational</u> potential to kinetic to gravitational potential	**B1**
	to thermal (store) **OR** to internal (store)	**B1**
3(b)(i)	1800 J	**A2**
	(W =) Fd **OR** (W =) $65 \times 9.8 \times 2.8$	C1

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Question	Answer	Marks
3(b)(ii)	$F = \Delta p \div (\Delta)t$ **AND** Δp is change in momentum, $(\Delta)t$ is time (taken) **OR** $F = \Delta\{mv\} \div (\Delta)t$ **AND** $\Delta\{mv\}$ is change in momentum, $(\Delta)t$ is time (taken) **OR** force = rate of change in momentum **OR** force = change in momentum divided by time (taken)	**A2**
	$F = \Delta p \div (\Delta)t$ **OR** $F = \Delta\{mv\} \div (\Delta)t$ **OR** $F = I \div (\Delta)t$	C1

Question	Answer	Marks
4(a)(i)	convection	**B1**
4(a)(ii)	warm air rises **OR** less dense air rises	**B1**
	warm air is less dense (than cool air) ORA	**B1**
	any **one** from: • cold air replaces warm air • cold air falls and the process repeats owtte • there is a convection current owtte	**B1**
4(b)(i)	$P = IV$ **OR** $(I =)\ P \div V$	**B1**
	2.0 kW = 2000 W **OR** $2000 \div 230$	**B1**

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Question	Answer	Marks
4(b)(ii)	10 (A) **AND** any **one** from: • smaller fuse melts in normal use (of the heater) owtte • smaller fuse stops the heater working (at all) • larger fuse allows too much current (without melting) • larger fuse may not melt before the circuit is damaged • fuse (rating) must be higher than the (normal) current • the fuse will melt if current goes too high owtte	**A2**
	any **one** from: • 10 (A) • 13 (A) **AND** fuse (rating) must be higher than (normal) current • 13 (A) **AND** 3 A / 5 A fuse melts in normal use owtte	C1

Question	Answer	Marks
5(a)	(refractive index is) the ratio of the speed of light in two different regions owtte **OR** (refractive index =) $\frac{\text{speed of light in air}}{\text{speed of light in (soap) film}}$	**B1**
5(b)(i)	$n = \frac{\sin i}{\sin r}$ **OR** $(r =) \sin^{-1}\left\{\frac{\sin i}{n}\right\}$ **OR** $1.28 = \frac{\sin 60}{\sin r}$	**B1**
	$i = 60$ (°)	**B1**
5(b)(ii)	normal drawn (at the point incident ray meets film)	**M1**
	refracted ray drawn (refraction towards normal in film) and angle of refraction labelled braille: angle identified but not labelled	**A1**
5(c)(i)	(light of) a single frequency	**B1**

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Question	Answer	Marks
5(c)(ii)	4.4×10^{14} Hz	**A3**
	(speed of light / e-m waves is approximately) 3.0×10^{8} m / s (in air)	C1
	$v = f\lambda$ **OR** (f =) $3.0 \times 10^{8} \div 680 \times 10^{-9}$	C1

Question	Answer	Marks
6(a)	any **one** from: • magnetic materials are attracted to magnets • non-magnetic materials are not attracted to magnets • magnetic materials experience a force in magnetic fields • non-magnetic materials don't experience a force in magnetic fields	**B1**
6(b)	any **one** from: • steel as it stays magnetised • steel makes a permanent magnet	**B1**
6(c)	N and S poles correctly labelled braille: north to south owtte	**B1**
6(d)	field lines close(r) indicates strong(er) (magnetic) field owtte ORA	**B1**

Question	Answer	Marks
7(a)(i)	diode	**B1**
	there is only a current (in diode) when the voltage is increased in one direction owtte **OR** only a current in one direction	**B1**
7(a)(ii)	 braille: symbol A identified	**B1**

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Question	Answer	Marks
7(b)(i)	59 Ω	**A2**
	$V = IR$ **OR** $(R =)\ V \div I$ **OR** $(R =)\ 230 \div 3.9$	C1
7(b)(ii)	270 000 J **OR** 2.7×10^5 J	**A3**
	$(E =)\ IVt$	C1
	$(t =)\ 5 \times 60$ seen	C1
7(b)(iii)	7.8 A	**B1**
	any **one** from: • identical heaters (each with p.d. of 230 V) so 3.9 A in each branch • $I = I_1 + I_2$ • $\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2}$ in any form	**B1**

Question	Answer	Marks
8(a)(i)	(A is carbon) brushes	**B1**
	(B is) slip rings	**B1**
8(a)(ii)	strengthens the magnetic field (of the magnet)	**B1**
8(b)	graph is sinusoidal with positive and negative e.m.f.	**B1**
	graph shows minimum of one cycle completed in 0.5 s	**B1**
	e.m.f. is a maximum at 0.00 s, curves to a minimum at 0.25 s and curves to maximum at 0.50 s **OR** e.m.f. is a minimum at 0.00 s and curves to a maximum at 0.25 s and curves to a minimum at 0.50 s braille: e.m.f. starts at time zero at either maximum or minimum value	**B1**

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Question	Answer	Marks
8(c)(i)	**either:** less power loss (for same power transmission) **AND** (because) $P = I^2R$ **OR** low current (for same power transmission) **AND** (allows) thinner / cheaper cables	**A2**
	any **one** from: • less power loss (for same power transmission) • $P = I^2R$ • low current (for same power transmission) • thinner / cheaper cables	C1
8(c)(ii)	5400	**A2**
	$\frac{V_p}{V_s} = \frac{N_p}{N_s}$ **OR** $(N_s =) \frac{N_p V_s}{V_p}$ **OR** $(N_s =) \frac{450 \times 300\,000}{25\,000}$	C1

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Question	Answer	Marks
9(a)(i)	(stable isotope) has fewer neutrons **AND** radioactive isotopes (usually) have an excess of neutrons **OR** (stable isotope) has fewer neutrons AND radioactive isotopes are <u>too</u> heavy	**A2**
	any **one** from: • (stable isotope) has fewer neutrons • radioactive isotopes (usually) have more neutrons • radioactive isotopes are <u>too</u> heavy	C1
9(a)(ii)	$^{90}_{39}Y$	**B1**
	$^{0}_{-1}\beta$	**B1**
9(a)(iii)	<u>ionising</u> radiation is harmful (to humans) **OR** beta particles are <u>ionising</u> and harmful (to humans)	**A2**
	any **one** from: • radiation is / beta particles are harmful • beta particles ionise • it ionises **AND** is harmful	C1
9(b)(i)	72 ⩽ half-life ⩽ 76 (h) braille: 80 h (mark based on candidate choice of halving)	**A3**
	evidence of count rate halved e.g. 48 ÷ 2 = 24	C1
	evidence on graph or in working that Fig. 9.1 is used to find time for count rate to halve	C1
9(b)(ii)	any **one** from: • table includes <u>background</u> radiation owtte • graph does not have <u>background</u> count rate owtte • graph has <u>corrected</u> count rate	**B1**

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Question	Answer	Marks
10(a)	Jupiter is gaseous	**B1**
	Earth is rocky	**B1**
10(b)(i)	(gravitational) force per unit mass **OR** (g =) $\frac{\text{weight}}{\text{mass}}$ in this form	**A2**
	(gravitational) force on a mass **OR** $W = mg$	C1
10(b)(ii)	mass	**B1**
10(c)	(orbital speed of) Jupiter is slower ORA	**B1**
	Jupiter is further from the Sun ORA **OR** orbital speeds of planets decrease as distance from the Sun increases ORA	**B1**
	gravitational field (strength) of Sun decreases with distance (from Sun) ORA	**B1**

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