CAMBRIDGE
International Education

Cambridge IGCSE™

PHYSICS **0625/42**

Paper 4 Extended Theory **February/March 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 February/March 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.

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 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.

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

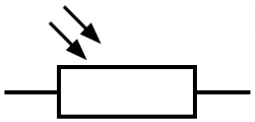
Question	Answer	Marks
1(a)	50 000 N / m **OR** 5.0×10^4 N / m	**A2**
	(k =) $F \div x$ **OR** k is (determined from) the gradient (of the line in Fig. 1.1)	C1
1(b)	Any one from: • The graph is a straight line (through the origin) • The slope / gradient is constant • The graph / line does not curve	**B1**
1(c)	1300 N	**B1**
	any negative number **OR** indication that force is in opposite direction	**B1**
1(d)	(Force is a) vector quantity. Forces have (both magnitude / size and) direction	**B1**

Question	Answer	Marks
2(a)	(statement momentum is) zero / 0 **AND** (explanation) momentum is mass $\times$ velocity **OR** the velocity (of B) is zero	**B1**
2(b)	1.1 kg	**A3**
	Conservation of momentum **OR** momentum after (collision) = momentum before (collision) **OR** $\{0.75 \times 0.44\} = \{0.75 + m\} \times 0.18$	C1
	momentum before collision = 0.75 × 0.44 (+ m $\times$0 = 0.33) **OR** momentum after collision = (0.75 + m) $\times$ 0.18	C1
2(c)(i)	0.13 N	**A2**
	(F =) $\Delta p \div (\Delta)t$ **OR** (0.75 + 1.1) $\times$ 0.18 $\div$ 2.6 **OR** (F =) 0.33 $\div$ 2.6 $(F =)\{0.75 + \textbf{2(b)}\} \times 0.18 \div 2.6$	C1

Question	Answer	Marks
2(c)(ii)	(time taken) Increases **AND** use of $F(\Delta)t = \Delta\{mv\}$ **OR** $F \propto 1 / (\Delta)t$ **OR** same momentum change required	**B1**

Question	Answer	Marks
3(a)	infrared	**B1**
3(b)	shiny surface / it is a good reflector of radiation	**A2**
	Any **one** from: • it is a good reflector • it reflects radiation	C1
3(c)	*Any one from*: • prevents (electric) shock (if live wire touches the metal casing) owtte • if live wire touches the metal casing the current goes to earth	**B1**
3(d)(i)	2.6 A	**A2**
	$R = V / I$ **OR** $(I=)\ V/R$ **OR** $(I=)$ 230 / 89	C1
3(d)(ii)	$P = IV$	**B1**
	$(I =)$ 5.2 (A) **OR** $(P =)$ 2 × power of one element **OR**	**B1**
3(d)(iii)	68 000 J **OR** 68 kJ	**A3**
	$E = Pt$ **OR** $(E =)\ Pt$ **OR** $(E =)$ 1200 × 60	C1
	efficiency = useful energy out / total energy (in) **OR** $95 \div 100 \times E$ **(power output of heater =)** 95% × 1200	C1

Question	Answer	Marks
4(a)(i)	(acceleration is) rate of change in velocity **OR** (acceleration is) change in velocity per unit time **OR** (acceleration is) change in velocity per second	**B1**
4(a)(ii)	200 km = 200 000 m **OR** × 1000 seen	**B1**
	division by {60 × 60} seen **OR** division by 3600 seen	**B1**
4(a)(iii)	80 s **OR** 79 s	**A2**
	(t =) $\Delta v / a$ OR 56 / 0.7(0)	C1
4(b)(i)	310 000 N **OR** 3.1×10^5 N	**A2**
	$F = ma$ OR $440000\times0.7(0)$	C1
4(b)(ii)	(statement:) reduces acceleration **OR** lower (maximum) velocity **AND** (explanation:) resultant/net force decreases	**B1**

Question	Answer	Marks
5(a)	y-axis labelled resistance **AND** x-axis labelled light intensity	**B1**
	Straight line / smooth curve with negative gradient	**B1**
5(b)(i)	 Correct symbol drawn to complete circuit.	**B1**

Question	Answer	Marks
5(b)(ii)	in the dark, V_{LDR} is a bigger proportion of e.m.f **OR** when R_{LDR} is high V_{LDR} is a bigger proportion of e.m.f. **OR** when V_{LDR} is high V_{LDR} is a bigger proportion of e.m.f.	**A2**
	In the dark, V_{LDR} is high **OR** when R_{LDR} high, V_{LDR} is high	C1
	Any **one** from: • emf shared (between fixed resistor and LDR) **OR** emf is constant • $V_{LDR} = V_{LAMP}$ **OR** p.d. is the same across components in parallel	**B1**

Question	Answer	Marks
6(a)(i)	Horizontal axis labelled P	**B1**
6(a)(ii)	X on horizontal axis 3.0 cm to the left of centre of L **OR** X on horizontal axis 3.0 cm to the right of centre of L	**B1**
6(a)(iii)	Any **two** from: • Straight line from a point on O, passing through centre of L (and beyond) • Horizontal line from same point on O to L, refracted through F (on RH side of L) • Straight line from same point on O through F (on LH side of L) to L, refracted parallel to principal axis	**M1**
	both rays extended until they intersect	**A1**

Question	Answer	Marks
6(a)(iv)	<table><tr><td>diminished</td><td></td></tr><tr><td>enlarged</td><td>✔</td></tr><tr><td>inverted</td><td>✔</td></tr><tr><td>real</td><td>✔</td></tr><tr><td>same size</td><td></td></tr><tr><td>upright</td><td></td></tr><tr><td>virtual</td><td></td></tr></table>	**B3**
6(b)	(image is now) virtual	**B1**
	(image is now) upright	**B1**

Question	Answer	Marks
7(a)(i)	diffraction	**B1**
7(a)(ii)	4.8×10^{-7} m **OR** 480 nm	**A2**
	One wavelength marked on Fig. 6.1 **OR** 1.2 seen	C1
7(a)(iii)	at least two curved wavefronts	**B1**
	three semi-circular wavefronts centred on (centre of) gap	**B1**
	wavelength is unchanged	**B1**

Question	Answer	Marks
7(b)(i)	$v = f\lambda$	**M1**
	$(\lambda =)$ 330 / 380 **OR** $(\lambda =)$ 0.87 (m)	**A1**
7(b)(ii)	7.6 s	**A2**
	$v = s / t$ **OR** (t =) s / v **OR** (t =) 2500 / 330	C1

Question	Answer	Marks
8(a)	(direction of force) down(wards)	**B1**
	magnetic field direction, current direction and force are mutually perpendicular	**B1**
	magnetic field is from N to S / left to right **AND** current flows from positive to negative / anticlockwise / into paper	**B1**
8(b)	(direction of force) reverses / changes by 180°	**B1**

Question	Answer	Marks
8(c)	(J carbon brushes) Any **one** from: • connect cell / circuit to coil / wire / split ring(s) / commutator • maintains (continuous) connection • prevent wires from tangling (as motor rotates)	**B1**
	(K coil) Any **one** from: • rotates / turns • conducts / has a current in it	**B1**
	(L axle) Any **one** from: • allows the coil to rotate / turn • allows motor to turn / spin	**B1**
	(M split ring commutator) Any **one** from: • keeps motor turning in the same direction owtte • reverses the connections to the coil (every half-turn) owtte • prevents wires from tangling (as the motor rotates)	**B1**

Question	Answer	Marks
9(a)(i)	(isotopes are) forms of an element with the same number of protons but a different number of neutrons (in the nucleus) **OR** (isotopes are) the same element with a different number of neutrons	**B1**

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td rowspan="2">9(a)(ii)</td><td>
<table>
<tr><td>particle</td><td>number in each atom of strontium</td><td>location</td></tr>
<tr><td>electron</td><td>38</td><td>outside nucleus</td></tr>
<tr><td>neutron</td><td></td><td></td></tr>
<tr><td>proton</td><td>38</td><td>Inside nucleus</td></tr>
</table>
</td><td>B1</td></tr>
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<table>
<tr><td>particle</td><td>number in each atom of strontium</td><td>location</td></tr>
<tr><td></td><td>38</td><td>outside nucleus</td></tr>
<tr><td>neutron</td><td>52</td><td>Inside nucleus</td></tr>
<tr><td></td><td>38</td><td>Inside nucleus</td></tr>
</table>
</td><td>B1</td></tr>
<tr><td rowspan="2">9(b)(i)</td><td>(there is a) different count rate with different thicknesses of metal OR number of β-particles detected varies with thickness</td><td>A2</td></tr>
<tr><td>(beta (β) particles) can penetrate thin / 0.75mm metal OR (beta (β) particles) are stopped by thick metal</td><td>C1</td></tr>
<tr><td rowspan="2">9(b)(ii)</td><td>(approximate) percentage of source remaining (after 15 years) stated AND in range 63–70%
(approximate) percentage of sample lost (after 15 years) stated AND in range 30–37%</td><td>B1</td></tr>
<tr><td>Any one from:
• count rate / activity (too) low (to detect differences in thickness) owtte
• detector needs high activity (to detect differences in thickness) owtte
• count rate / activity too close to background owtte
• less difference in activity for different thicknesses owtte</td><td>B1</td></tr>
</table>

Question	Answer	Marks
10(a)	(number of days =) 91	**B1**
	(statement F to G) is ¼ of (a complete) orbit **OR** a whole year is 365 days	**B1**
10(b)(i)	F	**B1**
10(b)(ii)	H	**B1**
10(c)	1.5×10^{11} m	**A3**
	$v = 2\pi r/T$ **OR** (r =) $vT/(2\pi)$ **OR** $(r =) 3.0 \times 10^4 \times 365 \times 24 \times 60 \times 60 / 2\pi$	C1
	(T =) 365 × 24 × 60 × 60 **OR** (T =) 31 536 000 **OR** (r =) 3.0 × 10^4 × T / (2π) **OR** correct rearrangement of and substitution into formula using candidate's value of T	C1
10(d)	Any **one** from: • minor planets • asteroids **OR** meteoroids • moons (that orbit planets) • comets • natural satellites	**B1**