

Cambridge IGCSE™

PHYSICS**0625/32**

Paper 3 Theory (Core)

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MARK SCHEME

Maximum Mark: 80

Published

This mark scheme contains the instructions and marking guidance that our examiners used to mark candidate responses for this component.

Before they start marking, examiners complete a standardisation process. They review a range of candidate responses and discuss the mark scheme in detail to agree which answers can and cannot be accepted. Examiners award marks where it is clear that candidate responses have met the requirements of the mark scheme. These requirements may vary between different components or different versions of the same component, depending on the exact requirements of the question and the candidate responses seen during the standardisation process.

Sometimes, our mark schemes may allow marks to be awarded to responses which contain elements that are factually incorrect or for content not covered by the syllabus. We do this in response to the demands of a specific question to support candidates and make sure that our assessments are fair. However, these allowances should not be used as a guide for teaching and learning.

We cannot discuss the mark scheme with schools, and we recommend that schools read the mark scheme together with the assessment material and the Principal Examiner Report for Teachers.

This document consists of **18** printed pages.

General marking principles

All examiners must apply these marking principles when marking candidate responses.

1	Examiners must award marks for each response in line with: - the specific content defined in the mark scheme - the specific skills defined in the mark scheme or in the level descriptions - the standard of response required as exemplified by the standardisation scripts.
2	Examiners must award whole marks (not half marks, or other fractions).
3	Examiners must award marks positively . This means that: - marks are not deducted for errors or omissions - marks are awarded for correct/valid answers as defined in the mark scheme and also for other valid answers which go beyond the scope of the syllabus and mark scheme referring to your team leader as appropriate - the quality of spelling, punctuation and grammar are judged only when the mark scheme indicates that these features are specifically assessed in the question. However, the meaning of all responses must be unambiguous.
4	Examiners must consistently apply the requirements of the mark scheme and any rules for what to do when candidates have not followed instructions correctly.
5	Examiners must use the full range of marks defined in the mark scheme, unless limited by the quality of the candidate responses seen.
6	Examiners must award marks according to the mark scheme and must not award marks with grade thresholds or grade descriptions 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 <i>n</i> responses (e.g. State two reasons ...): • The response should be read as continuous prose, even when numbered answer spaces are provided. • Any response marked <i>ignore</i> in the mark scheme should not count towards <i>n</i>. • Incorrect responses should not be awarded credit but will still count towards <i>n</i>. • 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 <i>n</i> 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
	correct point or mark awarded
	incorrect point or mark not awarded
	information missing or insufficient for credit
	allow or accept
	evaluation attempted
	incorrect or insufficient point ignored while marking the rest of the response
	contradiction in response, mark not awarded
	benefit of the doubt given
	error carried forward applied
	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.
<u>Underlining</u>	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 or I	Indicates either an incorrect or irrelevant point which may be disregarded, i.e., <u>not</u> treated as contradictory.
insufficient	an answer not worthy of credit <u>on its own</u> .
CON	An incorrect point which contradicts any correct point and means the mark cannot be scored.
cao	correct answer only

Question	Answer	Marks	Guidance
1(a)(i)	4.5 (m/s)	B1	accept 4.4 (m/s)–4.6 (m/s) inc. ignore values that roundup to 4.4 e.g. 4.38 or down to 4.6 e.g. 4.62
1(a)(ii)	1 constant/uniform (speed)	B1	accept <u>moving with</u> no acceleration condone constant / uniform motion condone <u>9(.0) m/s</u> CON at rest / stationary
	2 (speed) decreasing / reducing owtte	B1	accept (constant) deceleration or (constant) <u>negative acceleration</u> condone decreasing motion condone <u>9(.0) to 0 m/s</u> condone increasing / decreasing / changing deceleration ignore speed / velocity changing TV NOT unqualified or increasing / decreasing / changing acceleration
1(a)(iii)	54 (m)	A3	
	$6(.0) \times 9(.0)$	C2	condone $\frac{1}{2} \times 6(.0) \times 9(.0)$ or 27
	(distance =) area under graph	C1	condone (distance =) (a) speed $\times$ (a) time e.g. $2(.0) \times 8(.0)$ or $b \times h$ condone $\frac{1}{2} \times b \times h$ ignore $s = d \div t$ or $v = s \div t$

Question	Answer	Marks	Guidance
1(b)	3.3 (m/s)	A4	accept 3.3 (m/s) rounded to > 2 sf accept 3 (m/s) for 4 marks
	$400 \div 120$	C3	accept 200 (m/s)
	(average speed =) (total) distance $\div$ time (taken)	C1	accept $400 \div 2(.0)$ for 2 marks note: (speed =) distance $\div$ time or ($s =$) $d \div t$ or <u>$v = s \div t$</u> in this form only
	(time =) $\{2 \times 60\}$ (s) or 120 (s)	C1	

Question	Answer	Marks	Guidance
2(a)(i)	780	A3	accept <u>0.78 kJ</u> for 4 marks
	650×1.2	C2	accept in any form, words or symbols accept Nm condone mN accept kJ if answer incorrect / missing
	(work done =) force $\times$ distance	C1	
	J / joule	B1	
2(a)(ii)	66 (kg)	A3	accept any rounding of 66.3265 > 2 sf
	$650 \div 9.8$	C2	
	(mass =) weight / gravitational field strength or W/g or $W/9.8$ in any form	C1	accept words or symbols or $W = m \times g$ note: 65 (kg) or 650/10 or $W/10$ scores 1 mark

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Question	Answer	Marks	Guidance
2(b)	2200 (N/m ²)	A4	accept any rounding of 2201.89... > 2 sf note: 650 ÷ {their area} if seen or evaluated scores 2 marks
	650 ÷ {0.82 × 0.36} or 650 ÷ 0.2952 or 650 ÷ 0.3(0)	C3	
	(pressure =) force / area	C1	accept in any form, words or symbols
	(area =) 0.82 × 0.36 or 0.2952 (m ²) or 0.3(0) (m ²) seen or used	C1	

Question	Answer	Marks	Guidance
3(a)	(electric electronic / top-pan / digital) balance	B1	accept (weighing) scales ignore electronic scale ignore scale ignore weighing machine ignore measuring scale

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Question	Answer	Marks	Guidance
3(b)	method 1 any three from: measuring cylinder measures volume measuring cylinder (partially) filled with water owtte (initial) volume / reading measured / noted pebble (submerged) in water owtte (new / 2nd) volume / reading (of pebble and water) measured	B3	accept pour (some) water into measuring cylinder accept water level for volume accept V_1 / to a certain amount / level / volume / {say} 50 cm ³ owtte
	(volume of pebble =) difference in volumes i.e. $V_2 - V_1$	B1	accept idea of difference in readings/measurements
		B4	alternative displacement can method 2: (no mix and match) • pour water into displacement can until overflows • pebble (submerged) in water / can • overflow of water in measuring cylinder • the reading / measurement = volume of pebble
3(c)	2.3 (g / cm ³)	A3	accept any rounding of 2.30769... > 2 sf
	120 ÷ 52	C2	accept in any form, words or symbols
	(ρ =) $m \div V$	C1	

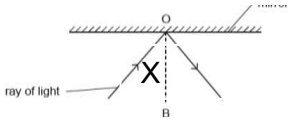
Question	Answer	Marks	Guidance
4(a)(i)	melting	B1	ignore fusing / liquifying
4(a)(ii)	any three from: (about particles) regular/uniform (arrangement) closely/tightly packed vibrate fixed (position) }	B3	ignore solids have a fixed shape accept lattice or (in a) pattern or in order accept touching (each other) or idea that closer than liquids condone packed together ignore compact or close TV note: vibrate at a fixed position owtte (often seen <i>vibrate about / in <u>their</u> positions/places</i>) scores 2 marks accept not free to move around / change position condone they do not move (freely) ignore limited motion TV
4(b)(i)	<u>absolute zero</u>	B1	cao
4(b)(ii)	−273 (°C)	B1	accept −273.1(5) (°C) or −273.2 (°C)

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Question	Answer	Marks	Guidance
5(a)(i)	infrared or radiation (through space and atmosphere)	B1	accept <u>heat rays</u> ignore light rays or sunlight
5(a)(ii)	(idea that black surface is) best / good <u>absorber</u>	M1	ignore references to emission or reflection or conduction or convection
	of infrared / radiation	A1	accept thermal energy or heat ignore light / sunlight
5(a)(iii)	conduction (through the copper pipe)	B1	accept copper is a good conductor (of thermal energy) accept description of conduction ignore is absorbed (by the copper)
5(b)	any three from: convection(current) (heated water) expands (becomes) less dense (less dense) water rises	B3	accept reverse argument for cold water sink ignore conduction or radiation/infrared accept in terms of particle/molecules separation accept warm/hot water is less dense than cold water ignore (water becomes) lighter accept hot water rises note: description using air MAX 2

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Question	Answer	Marks	Guidance
6(a)	gamma / γ (rays / waves)	B1	mark intent for γ symbol but ignore λ (rays) regions interchanged scores 1 mark
	microwaves	B1	
6(b)	wavelength	B1	
6(c)	the same (speed as radio waves)	B1	accept $3(.0) \times 10^8 \text{ m/s}$
6(d)	image of bones or scanning or cancer treatment / detection	B1	any valid use e.g. bone density measurement – check broken bones / bone infection / dislocations – medical scans – dental scans – fluoroscopy – testing welds / locating fractures in metal – space telescopes – crystallography – security scans of luggage / vehicles / container(s)(ships) – checking for (missing) components in packaged goods medical examinations TV astronomy TV security TV
6(e)	infrared visible/light ultraviolet	B2	answers may be in any order all 3 scores 2 marks 1 or 2 scores 1 mark

Question	Answer	Marks	Guidance
7(a)(i)	normal	B1	
7(a)(ii)		B1	accept any clear indication that X marks an angle in correct region
7(a)(iii)	angle of incidence = angle of reflection	B1	accept $i = r$ condone angle of incident = angle of reflection
7(a)(iv)	virtual upright/erect <u>same size</u> }	B2	answers in any order but only mark the first three answers 3 correct scores 2 marks 1 or 2 correct scores 1 mark ignore not real ignore not inverted ignore upwards additional answers: accept laterally inverted accept same distance from mirror owtte ignore unqualified same distance apply CON e.g. virtual real upright scores 1 mark virtual diminished same size scores 1 mark
7(b)(i)	principal axis	B1	accept axis
7(b)(ii)	ray from top of O through centre of lens undeviated	B1	accept a ray from top of O drawn through 'F' on left and then parallel to principal axis CON any incorrect ray(s)
7(b)(iii)	image I drawn as an inverted arrow from principal axis to where rays cross	B1	accept intersection of incorrect rays accept unlabelled image accept a line instead of an arrow (line can be dotted) NOT an upright arrow
7(b)(iv)	principal focus correctly shown	B1	accept F on left hand side if matched in 7(b)(ii)

Question	Answer	Marks	Guidance
8(a)	20 (Ω)	A3	
	$230 \div 11.5$	C2	
	$(R =) V \div I$	C1	accept in any form, words or symbols
8(b)	2600 (W)	A3	accept any rounding of 2645... > 2 sf
	230×11.5	C2	
	$(P =) V \times I$	C1	accept in any form, words or symbols
8(c)	risk of <u>overheating</u> owtte	B1	accept cause fires / burns condone too much heat(ing) or significant amount of heat owtte ignore unqualified heating ignore shocks
8(d)	any two from: a large <u>current</u> fuse / it melts breaks the circuit owtte	B2	condone fuse / it blows / blasts / burns / bursts / explodes
8(e)	13 A	B1	accept 13

Question	Answer			Marks	Guidance
9(a)		nature	charge	B1	accept 2
	alpha (α)	helium nucleus	+2	B1	accept (fast moving) electron or e or e ⁻ ignore E
	beta (β)	electron	-1	B1	
	gamma (γ)	e.m. wave	0		
9(b)(i)	3			B1	NOT -3 NOT -4
9(b)(ii)	4			B1	note: numbers interchanged score 1 mark
9(c)	1 / 8 or 0.125 or <u>12.5%</u> .			A2	accept 0.13 or <u>13%</u>
	3 half-lives or $\frac{1}{2} \times \frac{1}{2} \times \frac{1}{2}$			C1	accept 3 (half-lives) or $33 / 11 = 3$ (half-lives) in any form ignore 11 / 33 condone 3 halving of 223 i.e. $223 - 111(.5) - 56 - 28$

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Question	Answer	Marks	Guidance
10(a)	<u>1 month</u>	B1	accept <u>27–30 days</u> or <u>4 weeks</u>
10(b)	gravitational (force / attraction)	B1	accept gravity condone gravitational field or gravitational field strength ignore centripetal force NOT GPE
10(c)	$3.8 \times 10^8 \text{ (m)}$	A3	accept $3.8(4) \times 10^8 \text{ (m)}$ or 384 000 000 (m)
	$3.0 \times 10^8 \times 1.28$	C2	accept $3.8(4) \times 10^N$
	(distance =) speed $\times$ time	C1	note: (distance =) speed $\times$ time or ($d =$) $s \times t$ or <u>$s = v \times t$</u> in these forms only