

Cambridge IGCSE™

PHYSICS**0625/43**

Paper 4 Theory (Extended)

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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 **15** 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.
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.
ORA	Or reverse argument.
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)	constant speed OR constant velocity	B1	TV zero acceleration A steady speed OR stable speed
	(constant) deceleration	B1	A (constant) negative acceleration
1(a)(ii)	4500 (m)	A3	SC for 2 marks 5100 (m)
	area under graph OR one area calculated	C1	
	$\{92 \times 45\} + \frac{1}{2} \{18 \times 45\}$ OR $4140 + 405$	C1	
1(a)(iii)	2.5 (m/s ²)	A2	
	$(a =) \Delta v / (\Delta)t$ OR 45 / 18	C1	A s for v
1(b)	1.5×10^6 (J)	A2	
	$(E_k =) \frac{1}{2} m v^2$ OR $\frac{1}{2} \times 820 \times 60^2$	C1	

Question	Answer	Marks	Guidance
2(a)	(moment =) force $\times$ perpendicular distance (from pivot) = 14×19.6 (= 274 N cm)	B1	must be in words or symbols A (moment =) force $\times$ distance A 14×19.6
2(b)	3.8 (cm)	A2	
	$(d =) \{14 \times 19.6\} / 72$ OR $274 / 72$ OR $270 / 72$	C1	A $14 \times 19.6 = 72 \times d$ A anticlockwise moment = clockwise moment
2(c)	8.6×10^{-4} (m ²)	A2	
	$(A =) F / p$ OR $72 / 8.4 \times 10^4$	C1	A $14 / 8.4 \times 10^4$

Question	Answer	Marks	Guidance
3(a)	any two from: - particles move (fast) OR particles have (high) kinetic energy OR particles have (large) momentum - particles <u>collide with the walls</u> of the balloon - pressure is (total) force (due to collisions) per unit area	B2	A atoms or molecules <i>for</i> particles I particles move faster / gain kinetic energy / gain momentum A particles <u>collide</u> with balloon A $p = F / A$
	collisions cause force on walls of the balloon OR particles have change of momentum on collision with walls owtte	B1	A collision with walls produces an impulse I force = rate of change of momentum
3(b)(i)	25 (m ³)	A2	
	$pV = \text{constant}$ OR $p_1V_1 = p_2V_2$	C1	A $V_2 = \{110 \times 12\} / 52$ A 2.5×10^N
3(b)(ii)	4900 (m)	A3	A 4800 (m) if use of g as 10 clearly shown in working
	$(\Delta h =) E_p / mg$ OR $120\,000 / \{9.8 \times 2.5\}$	C1	A $\{120 \times 10^N\} / \{9.8 \times 2.5\}$ A use of g as 10 if equation given in symbols first
	conversion of 120 (kJ) to 120 000 (J) OR 4.9×10^N	C1	

Question	Answer	Marks	Guidance
4(a)(i)	$(\Delta E =) mc\Delta\theta$	M1	must be in words or symbols A T for θ I t for θ I Q for E
	$200 \times 4.2 \times 58$ OR 48 720 (J)	A1	A $200 \times 4.2 \times (80 - 22)$ A $0.2 \times 4200 \times 58$ TV $0.2 \times 4.2 \times 58$
4(a)(ii)	1200 (W)	A2	
	$(P =) (\Delta)E/t$ OR 49 000 / 41 OR 48 720 / 41 OR 1.2×10^N	C1	A W for E I T for t I Q for E I $W = (\Delta)E/t$
4(a)(iii)	any one from: some energy is transferred to the pan / air / surroundings not 100% efficient transfer from hotplate to pan / water	B1	A heat <i>for</i> energy A energy dissipates to the surroundings A energy is used for evaporation TV some energy is transferred to the hotplate
4(b)	any two from: (gas particles are) further apart OR (particles) fill the container (gas particles have) greater kinetic energy no/less force between (gas) particles	B2	A atoms or molecules <i>for</i> particles TV particles are not in contact TV particles have more space to move CON take the shape of the container A higher speed / fast A no / weak bonds between particles I collide less frequently / with less force I collide rather than slide pass each other A clear reverse argument throughout

Question	Answer	Marks	Guidance																
5(a)(i)	parallel	B1																	
5(a)(ii)	sound (waves) OR (seismic) P-waves OR (seismic) primary waves	B1	• A ultrasound • TV waves in a spring • TV seismic • TV water waves • CON S / secondary (waves)																
5(b)(i)	7.5 Hz	A2																	
	(f =) v / λ OR 0.12 / 0.016 OR Hz	C1	A s for v																
5(b)(ii)	<table><tr><th>wave property</th><th>decreases</th><th>stays the same</th><th>increases</th></tr><tr><td>wavelength</td><td></td><td></td><td>✓</td></tr><tr><td>frequency</td><td></td><td>✓</td><td></td></tr><tr><td>speed</td><td></td><td></td><td>✓</td></tr></table>	wave property	decreases	stays the same	increases	wavelength			✓	frequency		✓		speed			✓	B2	CON more than 1 tick per row
	wave property	decreases	stays the same	increases															
	wavelength			✓															
	frequency		✓																
	speed			✓															
1 mark for each correct row																			
5(c)(i)	diffraction	B1																	
5(c)(ii)	decrease size of gap	B1	A gap size similar to wavelength																
	increase wavelength	B1	A decrease frequency A use deeper water																

Question	Answer	Marks	Guidance
6(a)(i)	correct location indicated (and labelled I)	B1	
6(a)(ii)	ray from O reflected at the mirror and goes to eye	B1	I arrow direction
	angle of reflection = angle of incidence	B1	A mark intent approximately equal angles
6(b)(i)	0.9(0)	A2	
	$(n =) \sin i / \sin r$ OR $\sin 25 / \sin 28$	C1	A $n_1 \sin_1 = n_2 \sin_2$
6(b)(ii)	correct angle indicated and labelled c	B1	
6(b)(iii)	ray reflected in glass	B1	I arrow direction CON any ray leaving the glass

Question	Answer	Marks	Guidance
7(a)	electron(s)	B1	
7(b)(i)	light-dependent resistor / LDR	B1	
7(b)(ii)	4.5 (V)	A3	
	$R = V / I$ OR $(I =) 12 / 640$ OR $(I =) 0.01875$	C1	A $(V_2 =) V_s R_2 / \{R_1 + R_2\}$
	$(V =) 0.01875 \times 240$	C1	A $\{12 \times 240\} / \{240 + 400\}$
7(c)	decreases decreases	A2	
	(current) decreases	C1	

Question	Answer	Marks	Guidance
8(a)	current	B1	A voltage / p.d. A flow of charge / moving electrons I electricity
	magnetised OR an electromagnet	B1	TV magnet TV magnetic TV ferromagnetic CON electromagnetic
	completes owtte	B1	A e.g. switches on
8(b)(i)	27 (V)	A2	
	$(V_s =) \{V_p \times N_s\} / N_p$ OR $\{240 / V_s\} = \{360 / 40\}$	C1	A $\{40 / 360\} \times 240$
8(b)(ii)	d.c. does not produce the changing magnetic field needed for electromagnetic induction OR a.c. required to produce changing magnetic field needed for electromagnetic induction	A2	
	there is no changing magnetic field	C1	

Question	Answer	Marks	Guidance
9(a)(i)	arrow indicating clockwise direction	B1	
9(a)(ii)	poles consistent with current direction	B1	clockwise expect X – S / south and Y – N / north anticlockwise expect X – N / north and Y – S / south if 9(a)(i) blank or current direction other than clockwise or anticlockwise accept X – S / south and Y – N / north CON positive / negative
9(a)(iii)	increase current increase magnetic field strength	B2	A increase voltage (across cylinder) A decrease gap between poles A stronger magnet
9(b)(i)	(allows) <u>current</u> in the coil to change direction (reverses the current) every half turn / 180 degrees OR when the coil is vertical/at right angles to the magnetic field	B2	
9(b)(ii)	any one from: transfer <u>current</u> to the coil (from circuit) provide continuous contact (between split ring commutator and circuit) owtte prevent wires tangling	B1	

Question	Answer	Marks	Guidance
10(a)	similarity: (same) number of protons	B1	A proton number I atomic number CON number of electrons
	difference: three (more) neutrons	B1	A three (more) nucleons I mass number
10(b)(i)	${}^{14}_7\text{N}$	B1	
	${}^0_{-1}\beta$	B1	A e for β
10(b)(ii)	a neutron changes into a proton (plus an electron)	B1	A nucleus loses a neutron and gains a proton
10(c)	17 000 (years)	A2	
	3 half-lives	C1	

Question	Answer	Marks	Guidance
11(a)	(nuclear) fusion	B1	CON fission
	hydrogen <u>nuclei</u> join	B1	A combine / fuse <i>for</i> join I atoms / molecules
	(into / to form) helium	B1	I atoms / molecules
11(b)	ultraviolet	B1	A uv
	electromagnetic	B1	A e.m.
11(c)	1.3 (A)	A2	
	$(I =) Q / t$ OR 240 / 180	C1	