



Cambridge IGCSE™

SUBJECT

Paper 4 Theory (Extended)

MARK SCHEME

Maximum Mark: 80

0625/42

March 2024

Pre-standardisation

This document consists of **20** printed pages.

PRE-STANDARDISATION**Cambridge Assessment International Education – 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 descriptions for the question
- the specific skills defined in the mark scheme or in the generic level descriptions 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 descriptions.

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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 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 'List rule' guidance

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.

PRE-STANDARDISATION**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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Specific Instructions for Marking 0625/Paper 4

Preparation for Marking

Instructions and handbooks, for markers using RM Assessor 3 can be found at [RM support portal](#).

Marking

M1. Blank pages, additional objects and marking outside the question zone.

Blank pages will be attached to the first part of Q1 and should be annotated with SEEN on all scripts.

Annotate any blank Additional Objects with SEEN.

Link any other additional objects to the question or questions applicable.

Examiners must ensure that they view the whole exam paper for each candidate. This will sometimes mean scrolling through a large zone to ensure that no working relevant to either the current or any other question is missed.

Where a candidate's answer extends beyond the marking zone, examiners must view the whole page (or link to other pages) to annotate and mark the whole answer. To view the whole page, deselect any annotation tool from the mouse, then click in the bottom right-hand corner of the marking zone where "view whole page" appears. For instructions to link to other pages see above.

M2. Use of Annotation tools.

Examiners annotate scripts to explain their reasons for awarding or not awarding marks, noting:

- for **all** questions with **two** or **more** marks, it is **mandatory** to annotate with ticks placed to indicate where each mark is awarded. In a calculation where the final answer (A) mark is awarded all the ticks should be placed near to the final answer.
- annotations and comments must never suggest or imply that a mark has been deducted e.g. -1
- for questions with only one mark maximum, examiners' ticks to show the mark is awarded are not mandatory
- SF and ECF annotations must be used when appropriate (see table of annotation tools)

annotation tool	use of annotation tool on scripts
tick	mark awarded (a tally is shown next to the annotation tool so you can check the mark you enter agrees with number of ticks placed)
cross	incorrect / not creditworthy
SEEN	this page/item has been considered by the examiner (see M1)
BOD	benefit of doubt given
NBOD	no benefit of doubt given

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text box	allows a comment written by the examiner to be included on the script
ECF	error carried forward (ecf) has been applied
^	omission mark
Highlighter and zig-zag lines	used to highlight a particular point
CON	contradiction (to a correct point in the answer)
NAQ	The answer provided is not an answer to the question asked. (NB Do not use this annotation where no response has been made and the mark NR awarded.)
SF	error in the number of significant figures of a final answer
TV	too vague
I	ignore
SC	special case

M3. 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	Indicates either an incorrect or irrelevant point which may be disregarded, i.e., <u>not</u> treated as contradictory.

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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.
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

M4. Miscellaneous

Equations and formulae. Where a C, B or M mark is available for quoting a formula or equation this can be done in any form and in words, symbols or numbers unless the mark scheme specifies otherwise.

Use of ecf. The mark scheme notes where ecf is applicable, in the guidance section of the final answer mark. However, it should be applied for all relevant C marks as well. **Always annotate ecf if applied.** See Science specific Marking point 4 above.

Units.

- A numerically correct final answer without a unit is awarded the final answer (A) mark if the unit is shown correctly in the candidate's working.
- A numerically correct answer with a missing or incorrect unit is not awarded the final answer (A) mark. C (B or M) marks are awarded from the candidate's working.
- Accept units with incorrect use of upper-case and lower-case symbols, e.g. pA for Pa.
- Unless the mark scheme for a specific question part states otherwise, the only permitted derived units are:

unit	permitted derived units
W	J/s or Nm/s
Pa	N/m ²
momentum	Ns or kgm/s
impulse	Ns or kgm/s
J	Nm

- NB J is **not** permitted as the unit for moments.

Significant Figures.

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- Unless otherwise indicated in the mark scheme final answers expressed to two or more significant figures receive the final answer (**A**) mark if the candidate's answer rounds to the mark scheme answer.
- A final answer expressed to one significant figure is only awarded the final answer (**A**) mark where the final answer is exact to one sig. fig. (This applies to all answers, including answers using ecf.)
- A correct numerical answer, quoted with fewer significant figures than required by the mark scheme (even if in the working it has the required number of significant figures), is not awarded the final answer (**A**) marks. **C** (B or M) marks are awarded as appropriate.

Fractions. An answer expressed as a fraction is not a numerically correct final answer unless the fraction is explicitly stated in the mark scheme.

Crossed out work. When only part of an answer is crossed out the crossed-out work must be ignored. However, work which has been **wholly** crossed out and not replaced and can easily be read, should be marked as if it had not been crossed out. Look to see if it has been replaced on a blank page or another part of the same page before attempting to mark the crossed-out work.

Marking diagrams on-screen. Differences in magnification and/or individual computer screen settings can alter the appearance of diagrams. If it is necessary to check line lengths or angles use the ruler and protractor tools provided within RM Assessor 3 to ensure consistency across all examiners.

NR. (# or / key on the keyboard). Use this (instead of giving 0 marks) if the answer space for a question is completely blank or contains no readable words, figures or symbols.

Question	Answer	Marks	Guidance
1(a)	constant speed	B1	
	constant deceleration	B1	accept constant negative acceleration (discuss at STM – AB question)
	stationary	B1	accept not moving/ zero speed
1(b)(i)	710 000J OR 710kJ	A2	712 890
	$E_k = \frac{1}{2}mv^2$ in any form OR $\frac{1}{2} \times 18\,000 \times (8.9)^2$	C1	words, symbols, or numbers
1(b)(ii)	31 000N OR 31 kN	A3	ecf from (b)(i) throughout this part
	$W = Fd$ in any form	C1	words, symbols or numbers
	$F = 710\,000/23$	C1	accept other valid methods e.g. use of $F=ma$ and $a = (v^2-u^2)/2s$ (discuss at STM)

Question	Answer	Marks	Guidance
2(a)	(Impulse =) force x time (for which force acts)	B1	words or symbols accept change of momentum CON rate of change of momentum
(b)(i)	$(F =) \Delta(mv)/\Delta t$	B1	words or symbols accept $F=ma$ and $a=\Delta v/\Delta t$
	$2800 \times 1400 = 3\,920\,000 \text{ N}$	B1	
(b)(ii)	$4.0 \times 10^5 \text{ kg}$	A3	accept $4 \times 10^5 \text{ kg}$
	$F - \text{weight of rocket} = 0$ OR $F - mg = 0$ in any form	C1	words, symbols or numbers
	$(m =) F/g$ OR $3.9 \times 10^6 / 9.8$ OR 4.0×10^5	C1	accept 4×10^5 accept 4.0×10^N ? STM to consider POT errors without working

Question	Answer	Marks	Guidance
3(a)(i)	2.0 x 10 ⁵ Pa / 200 kPa	A2	Original value of 2.0 Pa corrected by PM on advice of reviser.
	($P =$) F/A in any form OR 13 000/(0.016 x4)	C1	words, symbols or numbers accept 13 000/0.016 for this mark
3(a)(ii)	particles (of air) in tyre move faster	B1	Mp1 is gain KE acceptable? (Vetter) accept particles gain KE
	particles (of air) collide harder with the walls of the tyre OR particles (of air) collide more frequently with the walls of the tyre	B1	
	any two from <ul style="list-style-type: none"> temperature of the air in the tyre increases friction between road and tyre force on the tyre wall increases (and hence the pressure in the tyre increases) 	B2	Possibly accept alternative marks for answer in terms of mechanical work done on gas, particles increase speed or KE, collisions on tyre wall increase in frequency and/or with greater momentum (change), increasing force (per unit area) Discuss at STM whether to make it any 4 from or hold out for the two specific points.

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Question	Answer	Marks	Guidance
3(b)	(maximum number =) 34	A3	c.a.o What would 34.6 score, 2 marks? (Vetter) "can be filled" probably needs the word "completely" if we want to hold out for 34 cao. Otherwise then I think we are pushing ESL candidates too far since some over half the air for the 35 th will go in and rounding up would be mathematically appropriate.
	$(V_2 =) p_1 V_1 / p_2$ in any form OR $pV = \text{constant}$ OR $(2.0 \times 10^6 \times 0.026) / 1.0 \times 10^5$	C1	words, symbols or numbers
	$V_2 = 0.52 \text{ (m}^3\text{)}$	C1	

Question	Answer	Marks	Guidance
4(a)	(thermal) energy to raise the temperature of unit mass by 1°C	A2	accept heat for (thermal) energy accept 1kg or 1g for unit mass
	(thermal) energy to raise the temperature by 1°C	C1	
4(b)(i)	(m=) 2.2 kg	A2	2.184
	$m = \rho V$ in any form OR 910×0.0024	C1	
4(b)(ii)	700 000 J	A2	704 000 698 880 J (from $m = 2.184 \text{ kg}$) ecf (b)(i) accept $7 \times 10^5 \text{ J}$

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Question	Answer	Marks	Guidance
	$(E =) mc\Delta\theta$ in any form OR $2.2 \times 2000 \times 160$ OR $2.184 \times 2000 \times 160$	C1	words, symbols or numbers Allow use of 20 or 180 for the temperature in mp2? (Vetter) No
4(b)(iii)	1700 W	A2	ecf from (b)(ii)
	$(P =) E / t$ in any form OR $700\,000 / 7 \times 60$ OR $704\,000 / 7 \times 60$ OR $698\,880 / 7 \times 60$	C1	words, symbols or numbers accept use of t as 7 for this mark

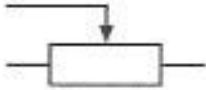
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Question	Answer	Marks	Guidance														
5(a)(i)	<table border="1"> <tr> <td>application</td> <td>region of electromagnetic spectrum</td> </tr> <tr> <td>cancer treatment</td> <td>gamma rays</td> </tr> <tr> <td>bluetooth</td> <td>radio waves</td> </tr> <tr> <td>optical fibres</td> <td>infrared</td> </tr> <tr> <td>security marking</td> <td>ultraviolet</td> </tr> <tr> <td>sterilising food</td> <td>gamma rays</td> </tr> <tr> <td>wireless internet</td> <td>Microwaves</td> </tr> </table>	application	region of electromagnetic spectrum	cancer treatment	gamma rays	bluetooth	radio waves	optical fibres	infrared	security marking	ultraviolet	sterilising food	gamma rays	wireless internet	Microwaves	B3	<p>3 marks: all correct 2 marks: 4 correct 1 mark 2 or 3 correct</p> <p>STM to consider acceptable alternatives e.g. microwaves for Bluetooth and/or wireless internet??</p> <p>Microwaves for Bluetooth? UV for sterilising food (found this on internet and discussed in MCQ migration meetings)? (Vetter comment although PM feels that ultraviolet only good for liquids due to absorption at surface if food has thickness) Research needed. UV used on surface of fruit to prevent importation of insects on fruit.</p>
application	region of electromagnetic spectrum																
cancer treatment	gamma rays																
bluetooth	radio waves																
optical fibres	infrared																
security marking	ultraviolet																
sterilising food	gamma rays																
wireless internet	Microwaves																
5(a)(ii)	$3(.0) \times 10^8 \text{ m/s}$	B1	<p>CAO Alternative answers acceptable if correct unit offered (i.e. $3(.0) \times 10^5 \text{ km/s}$ but not in miles per hour or miles per second or any other non-metric unit).(I don't think this caveat is necessary EMB) Could add unit on answer line?</p>														
5(b)(i)	crests parallel to the barrier	B1	NOT drawn freehand														
	same wavelength as wave after the gap	B1	<p>By eye assessment advised as use of a ruler scale is not indicated and there is no answer space for a wavelength value. PM Ruler tool across two wavelengths is a tolerance used effectively before.</p>														

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Question	Answer	Marks	Guidance
5(b)(ii)	crests parallel to the barrier (with slightly curved edges)	B1	must have a central, straight (linear) portion on all waves drawn to right of barrier ignore crests to left of the barrier
	same wavelength as in (i)	B1	By eye assessment advised as use of a ruler scale is not indicated and there is no answer space for a wavelength value. Ruler tool as before.

Question	Answer	Marks	Guidance
6(a)	ray from top of object to base of image	B1	Tip of image might be clearer?
	line labelled L drawn in correct position	B1	credit without label if clear
6(b)	ray from top of O parallel to principal axis to lens AND ray from lens to base of I OR ray from base of I parallel to principal axis to lens AND ray from lens to top of O	B1	
	2.1 cm	B1	tolerance to be discussed at STM
6(c)	virtual	B1	accept image is not real
	upright	B1	accept image is not inverted accept smaller magnification (x2 instead of x2.5)

Question	Answer	Marks	Guidance
7(a)		B1	accept arrow vertically down without right angled bend
7(b)(i)	1.5 V	A2	
	$V_{\text{out}} / V_{\text{R}} = R_{\text{out}} / R$ in any form OR $V_{\text{R}} = 3 V_{\text{out}}$ OR $V_{\text{out}} = 6/4$	C1	words, symbols or numbers
7(b)(ii)	0.51 C	A2	accept 510 mC
	$(Q =) It$ in any form OR $1.7 \times 10^{-3} \times 300$	C1	accept 1.7×300

Question	Answer	Marks	Guidance
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Question	Answer	Marks	Guidance
8(a)(i)	three concentric circles	B1	
	second and third circles further apart than first and second circles	B1	
	direction of arrows clockwise	B1	at least one correct and no incorrect arrows
8(a)(ii)	strength of magnetic field increases	B1	accept field lines closer together
	its direction reverses	B1	
8(b)	power loss = I^2R	B1	STM consider an any 3 from 4 for this.
	(high voltage so) lower current (for same power)	B1	
	thinner wires have (smaller cross-sectional area so) higher resistance but this is less important as there is less power loss	B1	Correct reference to current reduction more significant than resistance increase due to squared term in formula. (PM)

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Question		Marks	Guidance
9(a)(i)	most of the atom is empty space OR mass concentrated in nucleus	B1	
9(a)(ii)	any two from: <ul style="list-style-type: none"> the nucleus is very small mass of gold nucleus is much greater than mass of alpha particle the nucleus is positively charged 	B2	Mark each part as a whole (conclusion and explanation) accept nucleus is charged
	corresponding explanation to conclusion: <ul style="list-style-type: none"> not many alpha particles pass close to the nucleus force (repulsive) between alpha particle and nucleus is large to give large deflections alpha particles are positively charged and force is repulsive (so nucleus is positive) 	B2	explanation referring to momentum conservation may be acceptable here for explanation for second conclusion. (PM)
9(b)(i)	neutron is replaced by a proton	B1	ignore references to electron
9(b)(ii)	22 μg	A3	
	three half lives OR 1/8 remaining OR 25/8 remains	C1	accept 3.125 SEEN?
	(mass decayed \Rightarrow) 25 – 3.125	C1	

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Question		Marks	Guidance
10(a)(i)	position A and/or E	B1	
	position G	B1	
10(a)(ii)	1 month	B1	accept 27, 28 or 30 days
10(b)(i)	110 000 (km/h)	A3	10758...
	$(v =)2\pi r / T$ in any form	C1	words, symbols or numbers Accept 8760 (hours) seen for 1 mark? (Vetter)
	$T = 365 \times 24 \text{ h OR } 2\pi \times 1.5 \times 10^8 / 365 \times 24$	C1	
10(b)(ii)	500 s	A2	
	$(t =) d / v$ in any form OR $1.5 \times 10^{11} / 3.0 \times 10^8$	C1	words, symbols or numbers accept 1.5×10^8 or $N / 3.0 \times 10^8$ OR 5.0×10^N for this mark?

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Question		Marks	Guidance
11(a)	inward force of gravitational attraction is balanced by an outward force (due to high temperature in the centre of the star)	B1	accept forces within protostar are balanced
11(b)(i)	ratio of speed of recession to distance away (from observer)	A2	accept H_0 in equation $v = H_0 d$ where v is the recessional speed of galaxy and d is distance of galaxy from Earth
	ratio of speed (of a galaxy) to distance away (from observer)	C1	accept H_0 in equation $v = H_0 d$
11(b)(ii)	$t (=d / v) = 1 / H_0$	B1	d/v is in brackets and MS indicates t is required – the equation in the syllabus is $d/v = 1/H_0$ but this would not get a mark as MS stands? (Vetter) We need to accept syllabus statement. t should be in brackets really
11(b)(iii)	$4.5(4) \times 10^{17}$ s	B1	CAO? Not 13.8 billion years as this is known from general knowledge and not calculated? (PM)