CAMBRIDGE
International Education

Cambridge O Level

PHYSICS **5054/22**

Paper 2 Theory **October/November 2025**

MARK SCHEME

Maximum Mark: 75

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 October/November 2025 series for most Cambridge IGCSE, Cambridge International A and AS Level components, and some Cambridge O Level components.

PUBLISHED

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.

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 standard isation 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
	unclear response
	information missing or insufficient for credit
	evaluation attempted
	benefit of the doubt given
	contradiction in response or mark not awarded
	incorrect point or mark not awarded
	error carried forward applied
	used to highlight parts of an extended response
	highlight
	incorrect or insufficient point ignored while marking the rest of the response

Annotation	Meaning
LNK	two statements are linked
MO	mandatory mark not awarded
POT	power of ten error
RE	rounding error
SC	special case
SEEN	point has been noted, but no credit has been given or blank page seen
SF	error in number of significant figures
T	answer outside the tolerance of the mark scheme
TV	response is too vague or there is insufficient detail in response
	correct point or mark awarded
	used to highlight parts of an extended response
U	incorrect unit

Mark Scheme Abbreviations:

;	separates marking points
/	alternative responses for the same marking point
R	reject the response
A	accept the response
I	ignore the response
ecf	error carried forward
AVP	any valid point
ora	or reverse argument
AW	alternative wording
underline	actual word given must be used by candidate (grammatical variants excepted)
( )	the word / phrase in brackets is not required but sets the context
max	indicates the maximum number of marks that can be given
mp	marking point
cao	Correct answer only

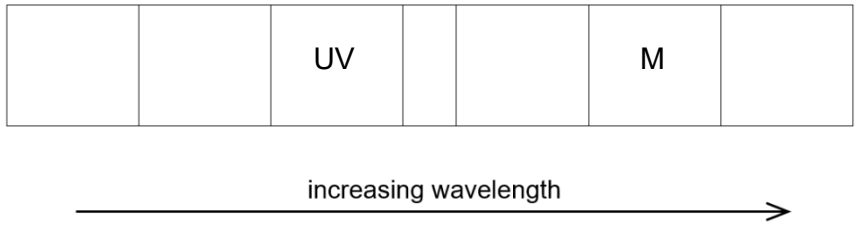
Question	Answer	Marks
1(a)(i)	29 (m / s)	**B1**
1(a)(ii)	(s =) vt **or** 29 × (6.4 – 5.7)	**C1**
	20 (m)	**A1**
1(a)(iii)	(distance travelled =) area under graph **or** ½bh **or** ½(w_1 + w_2)h	**C1**
	½ × 29 × (11.2 – 6.4) **or** ½ × 29 × 4.8 **or** 69.6 (m) **or** ½ × 29 × (11.2 + 6.4)	**C1**
	260 (m)	**A1**
1(b)	any **one** factor from: • (mass) of load / car • (condition / wear on) tyres • (state of) road • brakes • reference to friction	**B1**
	any **one** matching explanation from: • heavy load • worn tyres • slippery / smooth road reference to reduced friction	**B1**
	reduced deceleration **or** increases the time taken (to stop)	**B1**

Question	Answer	Marks
2(a)	(initially its weight causes) acceleration **or** speeds up **or** gains kinetic energy	**B1**
	friction / drag / resistance / resistive force / viscous force increases (as the speed increases) **or** resultant force decreases	**B1**
	acceleration decreases to zero **or** friction / drag / resistance / resistive force / viscous force is (eventually) equal to weight **or** forces balance **or** resultant force = 0	**B1**
2(b)(i)	(ΔE_P =) $mg\Delta h$ **or** $74.0 \times 9.8 \times 32$	**C1**
	2.3×10^4 (J)	**A1**
2(b)(ii)	energy can be neither created **and** nor destroyed	**B1**
	energy can be transferred from one energy store to another	**B1**
2(b)(iii)	(energy transferred) by doing work against friction / drag / resistance / resistive force	**B1**
	to internal (energy) store	**B1**

Question	Answer	Marks
3(a)(i)	(m =) ρV **or** $1000 \times 7.5 \times 10^{-3}$	**C1**
	7.5 (kg)	**A1**
3(a)(ii)	(p =) mv **or** 7.5×24	**C1**
	180 (kg m / s)	**A1**
3(b)	force needed to change momentum **or** answer to **(a)(ii)** is change in momentum	**C1**
	force = $\frac{\text{change in momentum}}{\text{time taken}}$ **or** the momentum of the water that hits the wall in 1.0 s is the rate of change of momentum	**A1**

Question	Answer	Marks
3(c)	Newton's third law quoted **or** when object A exerts a force on object B, then object B exerts an equal and opposite force on object A **or** forces (only) occur in pairs	**B1**
	the wall exerts a force on the water	**B1**
3(d)	mass (flowing through pipe / hitting the wall in 1.0 s) doubles **and** momentum (water hitting wall in 1.0 s) increases by a factor of 4	**B1**

Question	Answer	Marks
4(a)	the temperature remains constant / the line is horizontal (at 63 °C) / gradient of line becomes zero (at 63 °C)	**B1**
4(b)(i)	48 (°C) **or** 27 (°C) **or** (48 – 21) seen	**C1**
	(ΔE =) $mc(\Delta)\theta$ **or** 0.040 × 2100 × (48 – 21) **or** 0.040 × 2100 × 27	**C1**
	2300 (J)	**A1**
4(b)(ii)	gain kinetic energy / move faster	**B1**
	vibrate more vigorously / faster	**B1**
4(c)	work is done (on the molecules) **or** latent heat supplied	**B1**
	force between molecules overcome **or** molecules separated against (attractive) force **or** break bonds	**B1**

Question	Answer	Marks
5(a)		**B1**
5(b)(i)	$(\lambda =)\ \frac{c}{f}$ **or** $\frac{3.0\times10^{8}}{1.2\times10^{N}}$	**C1**
	2.5×10^{X} (m)	**C1**
	0.025 (m)	**A1**
5(b)(ii)	encoded microwave / microwave signal / microwave carrying data / microwave transmitting data (to satellite from Earth)	**B1**
	satellite transmits microwave to Earth / dish / antenna / subscriber / television	**B1**
5(c)	to prevent microwaves escaping / leaving the oven / spreading out of the device	**B1**
	microwaves / they can cause burns (in living tissue / people) / damage to tissue through heating / blisters	**B1**

Question	Answer	Marks
6(a)	a d.c. / it has one direction **or** does not (repeatedly) reverse direction **or** polarity / direction does not change	**B1**
6(b)(i)	(Q =) It **or** 41×120	**C1**
	4.9×10^{3} (C)	**A1**

Question	Answer	Marks
6(b)(ii)	(number =) $\frac{41}{1.6 \times 10–19}$ **or** $\frac{4.9 \times 103}{120 \times 1.6 \times 10–19}$ **or** 2.6×10^{N}	**C1**
	2.6×10^{20} **and** towards the positive terminal / away from the motor	**A1**
6(c)(i)	(electrical) work done (by a source) in moving charge around a (complete) circuit;	**B1**
	work done (by a source) per unit charge	**B1**
6(c)(ii)	(e.m.f. =) 92×3.7	**C1**
	340 (V)	**A1**
6(c)(iii)	same answer as candidate's **6(c)(ii) or** 340 (V)	**B1**

Question	Answer	Marks
7(a)(i)	$(I =) \frac{P}{V}$ **or** $\frac{2300}{230}$	**C1**
	10 (A)	**A1**
7(a)(ii)	13 (A)	**B1**
	does not blow when kettle is used / is larger than the current in the kettle / operating current **and** protects the cable / wiring in the wall / power supply **or** is slightly larger than the current in the kettle	**B1**
7(b)(i)	live (line) wire **and** no part of kettle live if fuse blows / disconnects live wire from kettle / disconnects high-voltage wire from kettle	**B1**
7(b)(ii)	(large) current in earth / live wire / casing **or** casing live / causes shock when touched	**B1**
	fuse blows / melts	**B1**

Question	Answer	Marks
7(c)	(energy used =) 34 × 2.3 **or** 34 × 2300 **or** 78 **or** 78 000	**C1**
	$25.02	**A1**

Question	Answer	Marks
8(a)(i)	number of protons / electrons (is same)	**B1**
8(a)(ii)	number of neutrons / nucleons (is different)	**B1**
8(b)(i)	(*X* =) 5	**B1**
	(*Y* =) 3	**B1**
8(b)(ii)	(only) **two** small black dots (in the orbits / shells) **or one** small black dot fewer / missing	**B1**
8(c)(i)	any **one** from: • cell death • mutations • cancer • radiation sickness / hair loss • cataracts • burns • ionisation of cells	**B1**
8(c)(ii)	random: (emission) is unpredictable (in time, direction) **or** no fixed time intervals (between decays) **or** (emission follows) no pattern **or** no fixed value **or** (emission) rate varies / differs in time	**B1**
	spontaneous: emission not influenced by external factors / temperature / pressure / chemical combination / no trigger / cannot be controlled / happens on its own / just happens	**B1**

Question	Answer	Marks
9(a)(i)	9.5×10^{12} (km) $\times$ 26 000 **or** 2.5×10^{17} (km) seen	**C1**
	2.5×10^{17} (km)	**A1**
9(a)(ii)	(v =) $\frac{2\pi r}{T}$ **or** $\frac{2\pi \times 26\,000}{2.3 \times 108}$ ($\times$ 3.0 $\times$ 10^8) **or** $\frac{2\pi \times 2.5 \times 1020}{2.3 \times 108 \times 365 \times 24 \times 3600}$	**C1**
	2.1×10^5 (m/s) **or** 2.2×10^5 (m/s)	**A1**
9(b)(i)	any **two** from: • most of the hydrogen has been converted to helium / it runs out of hydrogen / fuel • (outer region) expands / (radiation pushes) the surface of the star outwards • centre of star / core contracts **or** centre of star / core becomes hotter • hydrogen surrounding centre of star / core begins to fuse / burn • radiation pressure increases	**B2**
9(b)(ii)	(red supergiant / it) explodes	**B1**
	(as a) supernova	**B1**
	producing a nebula (and leaving behind a black hole)	**B1**
9(b)(iii)	(in a supernova explosion) lighter nuclei / elements joined / forced together / small nuclei fuse	**B1**