CAMBRIDGE
International Education

Cambridge IGCSE™

PHYSICS **0625/42**

Paper 4 Extended Theory **February/March 2024**

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 2024 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)	constant speed	**B1**
	constant / uniform deceleration	**B1**
	stationary	**B1**
1(b)(i)	7.1×10^5 J **OR** 710 000 J **OR** 710 kJ	**A2**
	$E_K = ½mv^2$ **OR** ($E_K =$) $½mv^2$ **OR** $½ \times 18\,000 \times (8.9)^2$	(C1)
1(b)(ii)	31 000 N **OR** 31 kN	**A3**
	$W = Fd$ **OR** ($F =$) W / d **OR** 710 000 / 23	(C1)
	F = 710 000 / 23	(C1)

Question	Answer	Marks
2(a)	(Impulse =) force × time (for which force acts)	**B1**
2(b)(i)	$F\Delta t = \Delta\{mv\}$ **OR** ($F =$) $\Delta\{mv\} / \Delta t$ **OR** ($F =$) $\Delta p / t$	**M1**
	{2800 × 1400} (/ 1) = 3 920 000 N **OR** {2800 × 1400} (/ 1) = 3920 kN	**A1**
2(b)(ii)	4.0×10^5 kg **OR** 400 000 kg	**A3**
	(at maximum mass) force = weight of rocket **OR** F = mg	(C1)
	($m =$) F / g **OR** $3.9 \times 10^6 / 9.8$ **OR** $4(.0) \times 10^N$ (kg)	(C1)

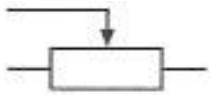
Question	Answer	Marks
3(a)(i)	2.0×10^5 Pa **OR** 200 000 Pa **OR** 200 kPa	**A2**
	(P =) F / A **OR** 13 000 / (0.016 × 4)	(C1)
3(a)(ii)	*Any four from:* • friction between road and tyre • temperature of air / tyre increases • particles (of air in tyre) move faster • particles (of air) collide harder with the walls (of the tyre) **OR** particles (of air) collide more frequently with the walls (of the tyre) • force (on the tyre wall) increases, **AND** area (of tyre) is constant (so tyre pressure increases)	**B4**
3(b)	(maximum number =) 34	**A3**
	pV = constant **OR** $\{2.0 \times 10^6 \times 0.026\} = 1.0 \times 10^5 \times V_2$	(C1)
	V_2 = 0.52 (m^3) **OR** (V_2 =) $\{2.0 \times 10^6 \times 0.026\} / 1.0 \times 10^5$ **OR** (number of balloons =) $\{2.0 \times 10^6 \times 0.026\} / \{1.0 \times 10^5 \times 0.015\}$	(C1)

Question	Answer	Marks
4(a)	energy transferred per unit mass per unit temperature change	**A2**
	(thermal) energy (transferred) per unit temperature change	(C1)
4(b)(i)	(m =) 2.2 kg	**A2**
	$m = \rho V$ in any form **OR** 910 × 0.0024	(C1)
4(b)(ii)	7.0×10^5 J **OR** 700 000 J	**A2**
	$c = \Delta E / \{ m\Delta\theta \}$ **OR** (ΔE =) $mc\Delta\theta$ **OR** 2.2 × 2000 × 160 **OR** 2.184 × 2000 × 160	(C1)

Question	Answer	Marks
4(b)(iii)	1700 W	**A2**
	(P =) E / t **OR** 700 000 / 7 × 60 **OR** 704 000 / 7 × 60 **OR** 698 880 / 7 × 60	(C1)

Question	Answer	Marks
5(a)(i)	<table><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>	**B3**
5(a)(ii)	3.0×10^8 (m / s) **OR** 300 000 000 (m / s)	**B1**
5(b)(i)	three crests parallel to the barrier	**B1**
	same wavelength as wave after the gap	**B1**
5(b)(ii)	central part of crest (parallel to the (gap in the) barrier) is straight	**B1**
	crests have curved ends	**B1**

Question	Answer	Marks
6(a)	ray from top of object to tip of image	**M1**
	line labelled L drawn perpendicular to principal axis at its intersection with previous ray	**A1**
6(b)	ray from top of O parallel to principal axis to lens **AND** ray from lens to tip of I **OR** ray from tip of I parallel to principal axis to lens **AND** ray from lens to top of O	**B1**
	2.1 cm	**B1**
6(c)	virtual	**B1**
	upright	**B1**

Question	Answer	Marks
7(a)		**B1**
7(b)(i)	1.5 V	**A2**
	$V_{out} / V_R = R_{out} / R$ **OR** $V_R = 3\ V_{out}$	(C1)
7(b)(ii)	0.51 C	**A2**
	$I = Q / t$ **OR** $(Q =)\ It$ **OR** $1.7 \times 10^{-3} \times 300$	(C1)

Question	Answer	Marks
8(a)(i)	three concentric circles centred on X	**B1**
	second and third circles further apart than first and second circles	**B1**
	direction of arrows clockwise	**B1**
8(a)(ii)	strength of magnetic field increases	**B1**
	its direction reverses	**B1**
8(b)	any three from: • $P = I^2R$ **OR** power (loss) = I^2R • (high voltage allows) low current (so at same power output, less power / energy lost) • thin wires have high resistance (so more power / energy lost) • (low) current has a greater effect (on efficiency) than (high) resistance (of the thin wires)	**B3**

Question	Answer	Marks
9(a)(i)	most of the atom is empty space	**B1**
9(a)(ii)	any **two** from: 1 the nucleus is very small 2 mass of gold nucleus is much greater than mass of alpha particle 3 the nucleus is positively charged	**B2**
	corresponding explanation to conclusion: 1 not many alpha particles pass close to the nucleus / owtte 2 large force between alpha and nucleus (has bigger effect on small mass of alpha) 3 alpha particles are positively charged, **AND** force is repulsive	**B2**
9(b)(i)	(in the nucleus a) neutron is changed into a proton (and an electron which is the emitted β-particle)	**B1**

Question	Answer	Marks
9(b)(ii)	22 μg	**A3**
	(87 years is) three half-lives **OR** 25 / 8 **OR** 87 / 29 = 3 (half lives)	(C1)
	1 / 8th (of the strontium remains) **OR** 25 / 8 (decays) **OR** 3.125 seen	(C1)

Question	Answer	Marks
10(a)(i)	position A and / or E	**B1**
	position G	**B1**
10(a)(ii)	1 month	**B1**
10(b)(i)	110 000 (km / h)	**A3**
	(v =)$2\pi r / T$	(C1)
	T = 365 × 24h **OR** $2\pi \times 1.5 \times 10^8 / 365 \times 24$	(C1)
10(b)(ii)	500 s	**A2**
	$v = s / t$ **OR** (t =) s / v **OR** $1.5 \times 10^{11} / 3.0 \times 10^8$	(C1)

Question	Answer	Marks
11(a)	inward force / force of gravitational attraction, is balanced by an outward force / force due to fusion reactions	**B1**
11(b)(i)	ratio of the speed at which the galaxy is moving away from the Earth/observer to its distance (from the Earth/observer)	**A2**
	ratio of speed (of a galaxy) to distance (away from observer)	(C1)

Question	Answer	Marks
11(b)(ii)	(age of universe =) $d / v = 1 / H_0$ **OR** age (of universe) = $1 / H_0$	**B1**
11(b)(iii)	4.5×10^{17} (s)	**B1**