Cambridge Assessment International Education

Cambridge IGCSE™

PHYSICS **0625/43**

Paper 4 Extended Theory **May/June 2022**

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 May/June 2022 series for most Cambridge IGCSE, Cambridge International A and AS Level and Cambridge Pre-U 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 descriptors 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	‘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.

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 marks	Final answer marks which are awarded for correct final answers to numerical questions.
C marks	Compensatory marks which may be scored to give partial credit when final answer (A) marks for a question have not been scored.
B marks	Independent marks which do not depend on other marks.
M marks	Method marks which must be scored before any subsequent final answer (A) marks 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 cannot be scored.
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.
owtte	Or words to that effect
ignore	If seen, this incorrect or irrelevant point may be disregarded, i.e. it is not to be treated as contradictory.
not/NOT	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. i.e. their error is carried forward to this question and they are not penalised a second time for one error.
cao	correct answer only

Question	Answer	Marks
1(a)(i)	9.7 s	**A2**
	(a =) $\Delta v \div t$ in any form OR 28 (–0)/2.9	C1
1(a)(ii)	4600 N	**A2**
	(F =) ma in any form OR 1600 × 2.9	C1
1(a)(iii)	630 000 J / 6.3×10^5 J	**A2**
	(KE =) ½ mv^2 in any form OR $\frac{1600 \times 28^2}{2}$	C1
1(b)	960 000 C / 9.6×10^5 C	**A3**
	(Q =) It in any form OR 32 × 8.3 × 60 × 60	C1
	(t s =) 8.3 × 60 × 60	C1
1(c)	any **one** explicit example of a variation from *ideal conditions* such as: (repeated) acceleration / deceleration / use of brakes / varying speed motion uphill / uneven road surface cold weather / headwind	**B1**

Question	Answer	Marks
2(a)	gravitational potential (energy)	**B1**
2(b)(i)	2.0×10^6 J / s	**A3**
	(P =) E/t in any form OR (480 × 10 × 410)/1	C1
	(ΔGPE =) mgh in any form OR 480 × 10 × 410	C1

Question	Answer	Marks
2(b)(ii)	81 (%) OR 82 (%)	**A3**
	$P = V I$ in any form OR 6000 × 270 OR 1 620 000	C1
	(efficiency =) (useful) power out / (total) power in (× 100%) in any form	C1
2(c)(i)	damage to habitats (for fish) / construction is expensive / droughts / flood risk if dam bursts	**B1**
2(c)(ii)	biofuel / wind / geothermal / tidal / solar / wave	**B1**

Question	Answer	Marks
3(a)(i)	suitable scale recorded (e.g. 2 cm : 25 N)	**B1**
	two vectors correctly drawn by eye **AND** correct resultant	**M1**
	130 N	**A1**
	(vertically) upwards	**A1**
3(a)(ii)	13 kg	**B1**
3(b)	acceleration	**B1**
	momentum	**B1**

Question	Answer	Marks
4(a)(i)	zig zag motion / random changes of direction	**B1**
	random length of path in each direction	**B1**

Question	Answer	Marks
4(a)(ii)	any **four** from: • air molecules bombard smoke particles • air molecules are small (compared to smoke particles) / have small(er) mass • air molecules are very fast moving • air molecules move in random directions • (collisions exert unbalanced) forces on smoke particles	**B4**
4(b)(i)	kinetic energy (and potential energy) of molecules increase (hence internal energy increases)	**B1**
4(b)(ii)	bigger change in momentum of molecules OR molecules hit (the walls) harder	**B1**
	(molecules hit) more often / more frequently	**B1**

Question	Answer	Marks
5(a)	energy required to raise the temperature of 1 kg / 1 g / unit mass of a substance by 1 °C / unit temperature	**A2**
	energy required to raise the temperature of a substance by 1 °C	C1
5(b)(i)	0.50 kg	**A2**
	$\rho = m/V$ in any form	C1
5(b)(ii)	190 000J / 1.9×10^5 J / 190 kJ	**A5**
	(E=) $mc\Delta T$ in any form	C1
	(E=) mL in any form	C1
	Use of c = 4200 (J / kg °C) AND ΔT = 5	C1
	Use of c = 2100 AND ΔT = 18	C1

Question	Answer	Marks
6(a)(i)	wavefronts semicircles or part semicircles centred on gap	**B1**
	wavelength of waves to right of barrier same as wavelength of incident wave	**B1**
6(a)(ii)	1 wavelength shorter	**B1**
	correct refraction	**B1**
	2 direction of travel perpendicular to wavefronts	**B1**
6(b)	any **two** from: • particles (in transverse waves) vibrate perpendicular to the direction of travel (of the wave) OR particles in longitudinal waves vibrate parallel to the direction of travel of the wave • longitudinal waves have compressions and rarefactions • transverse waves have troughs and crests	**B2**
6(c)(i)	1000 m / s ⩽ value ⩽ 2000 m / s	**B1**
6(c)(ii)	molecules closer together / water has greater density	**B1**

Question	Answer	Marks
7(a)	ray from left hand corner of the mirror to the eye	**B1**
	angle of incidence = angle of reflection	**B1**
7(b)	any **two** from: virtual upright same size as object laterally inverted	**B2**
7(c)(i)	ultraviolet / X-rays / gamma rays	**B1**
7(c)(ii)	infrared / microwaves / radio (waves)	**B1**

Question	Answer	Marks
8(a)(i)	light-dependent resistor / LDR	**B1**
8(a)(ii)	voltmeter connected in parallel with component Y	**B1**
8(a)(iii)	1 0.016 A	**A2**
	(I =) V/R in any form **or** 12/400 **or** 12/350 **or** 12/750 OR ($R_{total} = R_1 + R_2$ =) 750 (Ω)	C1
	2 6.4 V	**A1**
8(a)(iv)	(in a dark room the p.d. across component Y) decreases	**B1**
8(b)	one named practical application of LDR e.g. switch on street lights (at night) / turn on security light (at night)	**B1**

Question	Answer	Marks
9(a)(i)	any **four** from: • needle oscillates (as magnet moves up and down) • coil cuts magnetic field / magnetic field changes (as magnet moves) • changing (magnetic) field induces voltage/current • induced voltage/current opposes the motion/change causing it • force, magnetic field and induced current are mutually perpendicular	**B4**
9(a)(ii)	larger (maximum) deflection	**B1**
9(b)	2300	**A2**
	(N_P =) $V_P N_S / V_S$ in any form OR (N_P =) $\frac{25\,000 \times 36\,000}{400\,000}$	C1

Question	Answer	Marks
10(a)	background radiation (present in values in Table 10.1)	**B1**
	(background radiation) is removed (before plotting) OR (background radiation) not present in the graph values	**B1**
10(b)	$70 \leqslant$ half-life $\leqslant 76$ (s)	**A2**
	evidence of at least one pair of values for count rate halving taken from graph	C1
10(c)	${}^{234}_{91}\text{Pa} \rightarrow {}^{234}_{92}\text{U} + {}^{0}_{-1}\beta$	
	${}_{92}\text{U}$ on RHS	**B1**
	${}^{234}\text{U}$	**B1**
	$+ {}^{0}_{-1}\beta$ on RHS	**B1**