Cambridge Assessment International Education

Cambridge IGCSE™

PHYSICS **0625/42**

Paper 4 Theory (Extended) **October/November 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 October/November 2022 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 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 fully correct final answers.
C marks	Compensatory marks which may be scored to give partial credit when final answer (A) marks for a question have not been awarded.
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 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	Identifies incorrect or irrelevant points which may be disregarded, i.e., not treated as contradictory. Ignore is also used to indicate an insufficient 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

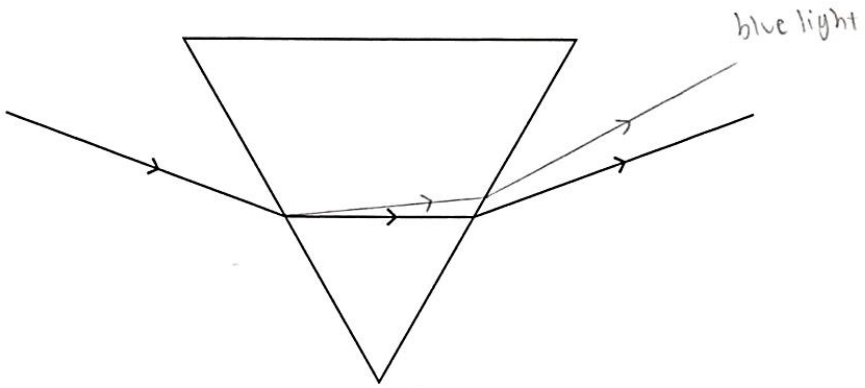
Question	Answer	Marks
1(a)	(depth =) 0.211 m	**A3**
	$\rho = m / V$ **OR** (V =) m / ρ **OR** 800 / 1020	C1
	$V = l \times w \times d$ **OR** (d =) $V / (l \times w)$ **OR** $V \div 3.72$	C1
1(b)	(ΔGPE =) 56(.0) J	**A3**
	GPE = $mg\Delta h$ **OR** (GPE =) $mg\Delta h$ **OR** (800 / 60) × 10 × 0.42(0)	C1
	(mass per second =) 800 / 60 (kg) **OR** their GPE per minute ÷ 60	C1
1(c)	(P =) 8200 Pa	**A3**
	(P =) $h\rho g$	C1
	(P =) 1020 × 10 × 0.8(00) (Pa)	C1
	OR	
	(P =) F / A	(C1)
	$F = mg$ **OR** F = 1020 × 0.8(00) × 3.72 × 10	(C1)

<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th></tr>
<tr><td>2(a)</td><td>(use stop-watch to) time oscillations</td><td>B1</td></tr>
<tr><td></td><td>(use of fiduciary) aid to determine a complete cycle</td><td>B1</td></tr>
<tr><td></td><td>(use of) multiple oscillations AND division (to determine period)</td><td>B1</td></tr>
<tr><td>2(b)</td><td><table><tr><td>quantity</td><td>device</td></tr><tr><td>volume of water in a glass</td><td>measuring cylinder</td></tr><tr><td>width of a small swimming pool</td><td>metre rule</td></tr><tr><td>thickness of a piece of aluminium foil</td><td>micrometer screw gauge</td></tr></table>1 mark for each correct response</td><td>B3</td></tr>
</table>

Question	Answer	Marks
3(a)(i)	*any one from*: • fossil fuel / named fossil fuel • biofuel / wood / crops • hydro • wave • wind • solar cell / panel.	**B1**
3(a)(ii)	geothermal **OR** nuclear	**B1**
3(b)(i)	yes **OR** it is renewable	**B1**
	tides are continuous / regular / happen every day / always there / owtte **OR** Moon / Sun always there **OR** nothing is consumed / used up **OR** tides are an unlimited resource	**B1**
3(b)(ii)	(power =) 4800 W	**A4**
	KE = $\frac{1}{2}mv^2$	C1
	(P =) E / t **OR** (P =) KE / s **OR** (KE / s =) $\frac{1}{2} \times 6(.0) \times 10^3 \times 2(.0)^2$	C1
	electrical (output) power = 40% of KE / s **OR** $0.4 \times 12\,000$	C1

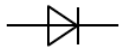
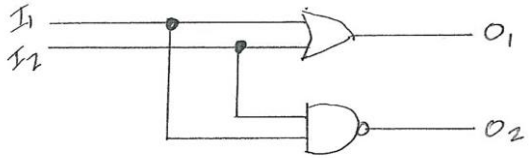
Question	Answer	Marks
4(a)	*any three from*: • moving particles have momentum **OR** particles hit walls • momentum changes when particles hit walls • force exerted (by particles) due to (rate of) change of momentum • pressure is (total) force (of particles) per unit area (of wall).	**B3**
4(b)	pressure increases	**M1**
	(there is a) greater change of momentum **OR** (particles exert) greater force (on same area) **OR** particles move faster **OR** particles have more KE	**A1**
4(c)	(pressure =) 1.5×10^5 Pa	**A3**
	$p_1 V_1 = p_2 V_2$ **OR** (p_2 =) $p_1 V_1 / V_2$ **OR** pV = constant (for fixed m, fixed T)	C1
	(p_2 =) 9(.0) $\times 10^4 \times 170 / 100$	C1

Question	Answer	Marks
5(a)	(E =) 410 000 000 J **OR** 410 MJ **OR** 4.1×10^8 J	**A3**
	$\Delta E = mc\Delta T$ **OR** (ΔE =) $mc\Delta T$ **OR** $1200 \times 960 \times 360$	C1
	(ΔT =) 360 (°C)	C1
5(b)	(thermal) radiation	**M1**
	electromagnetic / e-m / infrared / IR (radiation emitted from block)	**A1**
	travels to worker **OR** is absorbed by worker **OR** travels without needing a medium	**A1**
5(c)	conduction	**B1**
	delocalised / free / moving electrons	**B1**
	any one from: • (electrons) move (from outer surface) to interior (of rollers) • (electrons) travel through(out) the solid / large distances • (electrons) collide with <u>distant</u> particles • lattice vibrations transfer thermal energy to neighbouring particles **OR** particles vibrate and cause nearby / adjacent particles to vibrate **OR** vibrating particles collide with particles transferring energy.	**B1**

Question	Answer	Marks
6(a)(i)	*two correct rays from*: • ray from X through centre of lens • ray from X to lens, parallel to principal axis, refracted through RH focus F • ray from X (that would pass through LH focus) refracted parallel to principal axis.	**M2**
	two rays correctly extended back, intersecting to left of object and image labelled	**A1**
	IY drawn **AND** 36 mm ≤ distance ≤ 44 mm	**A1**
6(a)(ii)	*any two from:* • object closer to lens than (one) focal length • (actual) rays do not meet (at image) • image cannot be formed on a screen **OR** image only visible through lens • object and image on same side (of lens) **OR** image on LHS of lens/object.	**B2**
6(b)		**A3**
	blue ray refracted <u>closer</u> to the normal than the green ray as it enters the prism	C1
	blue ray refracted away from the normal as it leaves the prism	C1

Question	Answer	Marks
7(a)	(minimum of) one complete loop above magnet **AND** one complete loop below magnet	**M1**
	additional field lines leaving both poles **OR** additional loops above and below	**A1**
	(minimum of) two correct arrows (from N to S)	**B1**
7(b)	line with arrow to the left	**B1**
7(c)(i)	(force to the) left **OR** (force) away from magnet 2 / towards magnet 1	**B1**
7(c)(ii)	force (on N pole) is in direction of the (magnetic) field / owtte	**B1**

Question	Answer	Marks
8(a)	(R_Y) decreases	**B1**
	change in V consistent with stated effect on R_Y	**B1**
	change in R_Y / R_{total} consistent with their stated effect on R_Y **OR** change in proportion of the total p.d. across Y (or proportion of total p.d. across fixed resistor) consistent with their stated effect on R_Y	**B1**
8(b)(i)	(n =) 1.9×10^{19}	**A3**
	$I = Q / t$	C1
	(n =) 3(.0) / 1.6×10^{-19} **OR** (n =) Q / 1.6×10^{-19}	C1
8(b)(ii)	(P =) 36 W	**A2**
	$P = IV$ **OR** (P =) IV **OR** 3(.0) × 12	C1

Question	Answer	Marks
9(a)(i)		**B1**
9(a)(ii)		**B1**
9(b)(i)	I_1 I_2 Z O 0 0 1 0 0 1 1 0 1 0 0 1 1 1 0 0	
	all Z correct	**B1**
	all O correct	**B1**
9(b)(ii)	NOT	
9(c)		**A4**
	OR gate / box labelled OR	C1
	NAND gate / box labelled NAND	C1
	OR gate with inputs I_1 and I_2 labelled **AND** NAND gate with inputs I_1 and I_2 labelled	C1

Question	Answer	Marks
10(a)(i)	(proton number) 2	**B1**
	(nucleon number) 4	**B1**
10(a)(ii)	3.2×10^{-19} (C)	**B1**
10(b)	${}^{230}_{88}Ra \rightarrow {}^{230}_{89}Ac + {}^{0}_{-1}\beta$	**A3**
	any two from: • nucleon numbers 230 on left **AND** 230 on right • Ra and proton number 88 on left **AND** Ac and proton number 89 on right • ${}^{0}_{-1}\beta$.	C2
10(c)	(mass =) 1.2×10^{-12} g	**A2**
	3 half-lives **OR** $9.6 \times 10^{-12} / 8$ **OR** $9.6 \times 10^{-12} / 2^3$	C1