Cambridge Assessment International Education

Cambridge IGCSE™

PHYSICS **0625/42**

Paper 4 Extended Theory **February/March 2023**

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 2023 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

This document consists of **13** printed pages.

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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	<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)	speed = 4.3 m / s	speed = 4.3 m / s	**A2**
	correct vector triangle or rectangle drawn	use of Pythagoras' theorem e.g. $a^2 + b^2 = c^2$ OR (speed =) $\sqrt{(2.5^2 + 3.5^2)}$	(C1)
	direction = 54° or 55°	direction = 54° or 55°	**A2**
	resultant velocity vector (including arrow)	use of trigonometry to find angle e.g. tan Θ = 3.5 / 2.5	(C1)
1(b)	a scalar quantity distance, time, mass, energy, temperature		**B1**
	a vector quantity force, weight, acceleration, momentum, electric field strength, gravitational field strength		**B1**

Question	Answer	Marks
2(a)	ship is not solid steel / there are air spaces in ship	**B1**
	(average) density of ship is less than the density of the water	**B1**
2(b)	the centre of gravity is lower and (so) the ship is more stable	**A2**
	the centre of gravity is lower **OR** ship more stable	(C1)
2(c)	1.4×10^7 J **OR** 14 MJ **OR** 14 000 kJ	**A2**
	$\Delta E_p = mg(\Delta)h$ **OR** $(\Delta E_p =)\ mg(\Delta)h$ **OR** $30\,000 \times 9.8 \times 48$	(C1)

Question	Answer	Marks
3(a)	energy cannot be created or destroyed	**B1**
	energy can be transferred / transformed (between energy stores)	**B1**
3(b)(i)	energy transferred in one hour at a rate of transfer of 1 kW	**B1**
3(b)(ii)	7200 (kWh)	**A2**
	$(\Delta)E = Pt$ **OR** $(\Delta E) = Pt$ **OR** 1800×4.0 **OR** 1.8×4.0 **OR** 7.2×10^n	(C1)
3(c)	any **two** from: • geothermal • nuclear • tidal	**B2**

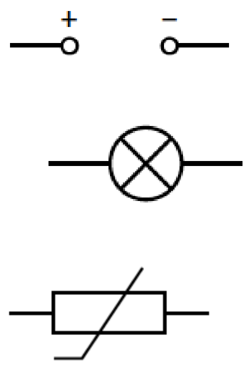
Question	Answer	Marks
4(a)	delocalised / free / mobile electrons	**B1**
	electrons move through metal **OR** electrons collide with distant particles **OR** electrons carry energy through the metal	**B1**
	lattice vibrations transfer energy to neighbouring particles **OR** particles vibrate and cause nearby / adjacent particles to vibrate **OR** vibrating particles collide with particles transferring energy	**B1**
4(b)(i)	(attractive) forces (between particles are much) greater in liquids (than in gases)	**B1**
	particles in gases are (much) further apart (than in liquids)	**B1**
4(b)(ii)	occurs at a fixed temperature	**B1**
	takes place throughout the liquid	**B1**

Question	Answer	Marks
4(c)	3.93 J / (g °C) OR 3930 J / (kg °C)	**A4**
	$\rho = m / V$ **OR** (m =) ρV **OR** 1.03 × 200 OR 206 SEEN	(C1)
	$c = E / m\Delta\Theta$ **OR** (c =) $E / m\Delta\Theta$ **OR** 60 700 / (206 × 75) **OR** 60700 / (1.03 × 200 × 75)	(C1)
	(m =) 206 (g) **OR** ($\Delta\Theta$) = 75 (°C)	(C1)

Question	Answer	Marks
5(a)(i)	42°	**A2**
	$n = 1 / \sin c$ **OR** $c = \sin^{-1} (1 / n)$ **OR** $c = \sin^{-1} (1 / 1.5)$	(C1)
5(a)(ii)	ray continues along radius of semicircle within plastic	**M1**
	ray reflected inside plastic on straight edge, with angle of reflection = angle of incidence AND emerges from block along the normal	**A1**
5(b)(i)	(focal length =) 7.2 cm	**B1**
5(b)(ii)	**two** correct rays from: • ray from top of object through centre of lens • ray from top of object (that would pass through F on LHS of lens) refracted parallel to the principal axis • ray from top of object to lens, parallel to principal axis, refracted through F (same distance on right of lens as F marked on left of lens)	**M2**
	Two rays correctly extended back to intersect to left of object <u>and</u> line from principal axis to top of image labelled I.	**A1**
5(c)	diverging lens in front of eye lens	**B1**
	rays meeting on the retina	**B1**

Question	Answer	Marks
6(a)	(region where) particles are close(r) together (than normal) **OR** (region where) there is a great(er) pressure (than normal)	**B1**
	(region where) particles are further / far apart (than normal) **OR** (region where) there is a low(er) pressure (than normal)	**B1**
6(b)	light does not need a medium to travel through **OR** sound needs a medium to travel through (and there is no medium between Sun and Earth)	**B1**
6(c)	3100 m **OR** 3.1 km	**A2**
	$v = s / t$ **OR** (s =) vt **OR** 340×9	(C1)
6(d)	1400 C	**A3**
	$I = Q / t$ **OR** (Q =)$I\,t$ **OR** $3.0 \times 10^4 \times 48 \times 10^{-3}$	(C1)
	(t =) 48×10^{-3} OR (t =) 4.8×10^{-2} **OR** (t =) 0.048 SEEN	(C1)

Question	Answer	Marks
7(a)	work done in passing charge <u>through / across</u> a component	**B1**
	work done per unit charge	**B1**
7(b)(i)	(definition of emf:) $E = W / Q$	**B1**
7(b)(ii)	270 J	**A2**
	$W = EQ$ **OR** 9.0×30	(C1)

Question	Answer	Marks
7(c)(i)	correct symbols for d.c. power supply, a lamp and a thermistor 	**B1**
	three components in a complete series circuit	**B1**
7(c)(ii)	resistance (of thermistor) decreases (when temperature increases)	**B1**
	resistance <u>of circuit</u> decreases **OR** greater current (in lamp so brightness of lamp increases) **OR** greater p.d. across <u>lamp</u> (so brightness of lamp increases)	**B1**

Question	Answer	Marks
8(a)	downwards / into the page / anti-clockwise	**B1**
8(b)	current, (magnetic) field, motion at right angles to each other	**B1**
	magnetic field from left to right / N to S **AND** current is from A to B / positive to negative	**B1**

Question	Answer	Marks
8(c)	(at vertical) the coil stops **OR** (at vertical) the coil overshoots and comes back **OR** the coil vibrates (about the vertical)	**B1**
	any one from: • (as the coil approaches vertical) the turning effect decreases • (at vertical) the turning effect is zero • (past vertical) the turning effect reverses / changes direction	**B1**
8(d)	reverses the current	**B1**
	any two from: • (brushes) ensure current is maintained / owtte • coil rotates continuously / continues to move in the same direction • (allows current to change direction) without wires getting tangled • (reverses the current) every half turn / 180 degrees / OR (reverses the current) when the coil is vertical / at right angles to the magnetic field	**B2**

Question	Answer	Marks
9(a)(i)	large unstable nucleus **OR** neutrons hit nucleus **OR** neutrons are released (from nucleus)	**B1**
	(large) nucleus splits (into smaller nuclei)	**B1**
	(large) release of energy	**B1**

Question	Answer	Marks
9(a)(ii)	advantage – **one** from: • Continuous supply of energy • not affected by the weather **OR** not affected by wind strength • produces large amounts of energy	**B1**
	disadvantage – **one** from: • resources finite / not renewable • cost / difficulty of building / cost / difficulty of decommissioning • danger if any leak of radiation • produces hazardous / dangerous waste **OR** difficulty of storage of used radioactive material **OR** nuclear waste must be stored for a long time	**B1**
9(b)	${}^{2}_{1}H + {}^{2}_{1}H \rightarrow {}^{3}_{2}He + {}^{1}_{0}n$	
	LHS correct	**B1**
	${}^{3}_{2}He$ on RHS	**B1**
	${}^{1}_{0}n$ on RHS	**B1**

Question	Answer	Marks
10(a)	24 km / s	**A3**
	$v = 2\pi r / T$ **OR** (v =) $2\pi r / T$ **OR** $(2\pi \times 2.28 \times 10^{8}) / (690 \times 24 \times 60 \times 60)$	(C1)
	$(2\pi \times 2.28 \times 10^{8}) / (690 \times 24 \times 60 \times 60)$ **OR** (T =) 690 × 24 × 60 × 60 **OR** (T=) 59 616 000 (s)	(C1)
10(b)	elliptical / ellipse	**B1**

Question	Answer	Marks
10(c)(i)	wavelength (of light from distant galaxies) increases	**B1**
	occurs when galaxies are moving away (from Earth)	**B1**
10(c)(ii)	speed / velocity (that galaxy is moving away from Earth)	**B1**