Cambridge Assessment International Education

Cambridge IGCSE™

PHYSICS **0625/43**

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	<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 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)	change of velocity per unit time or $\frac{v-u}{t}$	**B1**
1(b)(i)	(72 / 35 =) 2.1 m / s^2	**A1**
1(b)(ii)	230 000 N OR 230 kN	**A2**
	$F = ma$ **OR** (F =) ma **OR** 110 000 × 2.1	C1
1(b)(iii)	any **one** from: • (increase / change in) air resistance • (increase / change in) wind	**B1**
1(b)(iv)	any **three** from: • initial acceleration highest value **AND** horizontal line • curved or straight line downwards • curved or straight line downwards **AND** line not reaching zero by 35 s • horizontal line before and up to 35 s.	**B3**

Question	Answer	Marks
2(a)(i)	4.5 kg m / s	**A3**
	$p = mv$ **OR** (change in momentum =) $mv - mu$	C1
	(change in momentum =) $(0.058\times52)-(-0.058\times26)$ **OR** $(0.058\times52)+(0.058\times26)$ **OR** $(0.058\times-26)-(0.058\times52)$	C1
2(a)(ii)	(impulse =) force × time **OR** (impulse =) Ft	**B1**
2(a)(iii)	0.013 s	**A2**
	(t =) change in momentum / F **OR** (t =) $m(v–u)$ / F **OR** (t =) Δp / F **OR** 4.5 / 350	C1
2(b)	59 J	**A3**
	KE = ½mv^2 **OR** (KE =) ½mv^2	C1
	(change in KE) = ½ 0.058 × 52^2 – ½ 0.058 × 26^2 **OR** ½ 0.058 × 26^2 – ½ 0.058 × 52^2	C1

Question	Answer	Marks
3(a)	5 correct: 3 marks, 3 or 4 correct: 2 marks, 2 correct: 1 mark gravitational potential water (tidal) bay kinetic turbines	**B3**
3(b)	any **one** advantage from: • renewable • reliable or predictable • running cost low • does not produce (harmful) pollution. any **one** disadvantage from: • (high) cost of construction • possible effects on (marine) life • not available all day • power produced doesn't always match with peak demand • limited number of sites • maintenance difficult / increased corrosion (because underwater).	**B2**
3(c)	Moon	**B1**

Question	Answer	Marks
4(a)(i)	any **one** from: • volume (of liquid) • length (of thread / liquid in tube).	**B1**
4(a)(ii)	more **OR** greater (sensitivity)	**M1**
	volume of liquid / length of thread increases more per °C / unit temperature (because greater volume of liquid present) **OR** (more liquid to expand so) gives a larger change in the level of the liquid per °C / unit temperature	**A1**
4(a)(iii)	longer (capillary) tube	**M1**
	liquid can expand further so to a higher temperature	**A1**
	OR	
	smaller (volume) bulb	**(M1)**
	less liquid so liquid expands less / lower rise per °C	**(A1)**
	OR	
	larger diameter / wider capillary tube	**(M1)**
	lower increase in level for each °C	**(A1)**
	OR	
	replace liquid with a liquid with lower expansivity	**(M1)**
	liquid expands less for each °C	**(A1)**
4(b)	e.m.f.	**B1**

Question	Answer	Marks
5(a)	energy from the Sun transfers to / is absorbed by (water) molecules, (so KE of (water) molecules increases)	**B1**
	molecules with high(er) energy / KE / fast(er) moving molecules escape (from the surface)	**B1**
	wind removes molecules when they have left the surface (so they do not re-enter the liquid)	**B1**
	any **one** from: • wind increases the rate of evaporation • (absorption of) energy from the Sun increases the rate of evaporation • least / less water evaporates / lower rate of evaporation from dish C • most / more water evaporates / higher rate of evaporation from dish B	**B1**
5(b)	energy to change 1 kg / unit mass from liquid to gas / gas to liquid (without changing its temperature)	**A2**
	energy to change from liquid to gas / gas to liquid **OR** energy to change state of 1 kg	C1
5(c)	A: temperature (of solid / ice) increases **AND** C: temperature (of liquid / water) increases	**B1**
	B: solid / ice changes to liquid / water **OR** solid / ice melts (at constant temperature)	**B1**
	D: liquid / water changes to gas / steam **OR** liquid / water boils (at constant temperature)	**B1**

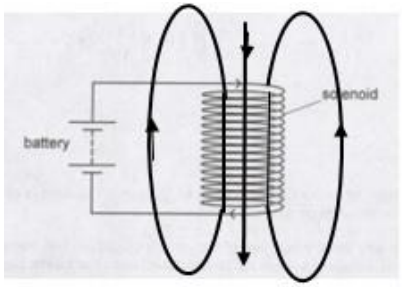
Question	Answer	Marks
6(a)(i)	correct direction, with angle made with surface correct	**B1**
6(a)(ii)	three wavefronts perpendicular to their answer to **(a)(i)**	**B1**
	wavelength 1.6 cm / same as incident wave	**B1**
6(b)	at least two correct arcs (after the gap in the barrier)	**B1**
	three circular arcs (after the gap on the barrier) centred on gap	**B1**
	wavelength same as wavelength of incident wavefronts	**B1**
6(c)	6.4 cm / s **OR** 0.064 m / s	**A2**
	$v = f\lambda$ **OR** (v =) $f\lambda$ **OR** 4.0×1.6 **OR** 4.0×0.016	C1

Question	Answer	Marks
7(a)	any **two** from: • all light is reflected • no light is refracted • (occurs) when light travels in a more dense medium towards a (boundary with a) less dense medium	**B2**
7(b)(i)	(x =) 48°	**A3**
	$n = 1 / \sin c$ **OR** $c = \sin^{-1}(1/n)$ **OR** $\sin c = 1 / 1.5$ **OR** $c = \sin^{-1}(1/1.5)$	C1
	c = 42(°)	C1
7(b)(ii)	(speed =) 2.0×10^8 m / s	**A2**
	$n = \frac{\text{speed of light in vacuum}}{\text{speed of light in liquid}}$ **OR** $n = \frac{\text{(approx.) speed of light in air}}{\text{speed of light in liquid}}$ **OR** $n = c / v$ **OR** (v =) c / n **OR** $1.5 = \frac{3 \times 10^8}{\text{speed of light in liquid}}$	C1

Question	Answer	Marks
8(a)	positively charged / plastic rod is brought close to metal plate	**B1**
	negative charges / electrons (from metal plate) move to top of metal plate / close(r) to rod	**B1**
	earth lead connected to (metal) plate **AND** negative charges / electrons move on to plate	**B1**
	(at the end of the process) earth lead removed (before charged rod removed) **OR** (at the end of the process) metal plate has (net) negative charge	**B1**
8(b)	correct direction – pointing away from negative terminal / clockwise arrow **AND** current flow in opposite direction to flow of electrons	**B1**

Question	Answer	Marks
9(a)	0.02 s	**A2**
	$t = 1 / f$ **OR** ($t =$)$1 / f$ OR $1 / 50$	C1
9(b)(i)	correct shape shown with rectification for two cycles	**A2**
	sine shape shown (without rectification for two cycles)	C1
9(b)(ii)	340 marked	**A1**
9(b)(iii)	one correct time value marked on time axis	**B1**
	a second correct time value marked on time axis	**B1**

Question	Answer	Marks
10(a)	α-particles are short and thick / β-particles are long and thin	**B1**
	any **two** from: • α-particles are more ionising / β-particles are less ionising • α-particles are less penetrating or have shorter range / β-particles are more penetrating or have longer range • α-particles have more energy / β-particles have less energy	**B2**
10(b)(i)	(element with) same number of protons	**B1**
	(element with) different number of neutrons	**B1**
10(b)(ii)	$^{24}_{11}\text{Na} \rightarrow {}^{24}_{12}\text{Mg} + {}^{0}_{-1}\beta$	
	Na on left with correct proton and nucleon number	**B1**
	β on right with correct proton and nucleon number	**B1**
	Mg on right with correct proton and nucleon number	**B1**
10(b)(iii)	half life (of Na 24) long enough (to allow detection of leaks)	**B1**
	negligible amount (of Na 24) remains in liquid after a few days (so) less hazardous (to human health) **OR** decays to something stable/magnesium (is stable) **AND** (so) less hazardous (to human health)	**B1**

Question	Answer	Marks
11(a)	at least one line on the left and one line on the right, outside coil **AND** curved back over the top and under the base of the coil, towards the central core of the coil	**B1**
	at least two (straight vertical) lines inside coil	**B1**
	direction of arrow correct on at least one line and none wrong  	**B1**
11(b)	910	**A2**
	$N_P / N_S = V_P / V_S$ **OR** (N_S =) (V_S / V_P) × N_P **OR** (N_S =) $\frac{11000 \times 33\,000}{400\,000}$ **OR** (N_S =) $\frac{11000 \times 33}{400}$	C1