



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.

This document consists of **16** printed pages.

PUBLISHED**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.
<u>Underlining</u>	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., <u>not</u> treated as contradictory. Ignore is also used to indicate an insufficient answer not worthy of credit <u>on its own</u> .
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 $110\,000 \times 2.1$	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 $\Rightarrow$) $mv - mu$	C1
	(change in momentum $\Rightarrow$) $(0.058 \times 52) - (-0.058 \times 26)$ OR $(0.058 \times 52) + (0.058 \times 26)$ OR $(0.058 \times -26) - (0.058 \times 52)$	C1
2(a)(ii)	(impulse $\Rightarrow$) force $\times$ time OR (impulse $\Rightarrow$) Ft	B1
2(a)(iii)	0.013 s	A2
	$(t =) \text{change in momentum} / F$ OR $(t =) m(v-u) / F$ OR $(t =) \Delta p / F$ OR 4.5 / 350	C1
2(b)	59 J	A3
	$KE = \frac{1}{2}mv^2$ OR $(KE =) \frac{1}{2}mv^2$	C1
	(change in KE) $= \frac{1}{2} 0.058 \times 52^2 - \frac{1}{2} 0.058 \times 26^2$ OR $\frac{1}{2} 0.058 \times 26^2 - \frac{1}{2} 0.058 \times 52^2$	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

PUBLISHED

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 <u>per °C / unit temperature</u> (because greater volume of liquid present) OR (more liquid to expand so) gives a larger change in the level of the liquid <u>per °C / unit temperature</u>	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

PUBLISHED

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)	<u>three</u> 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

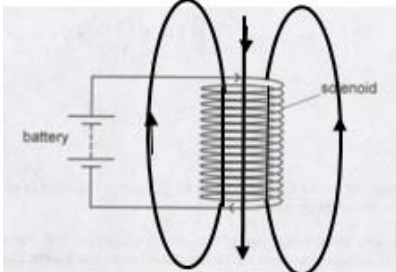
Question	Answer	Marks
7(a)	any two from: • <u>all</u> light is reflected • <u>no</u> light is refracted • (occurs) when light travels in a more dense medium towards a (boundary with a) less dense medium	B2
7(b)(i)	(x =) 48°	A3
	$n = 1 / \sin c$ OR $c = \sin^{-1} (1 / n)$ OR $\sin c = 1 / 1.5$ OR $c = \sin^{-1} (1 / 1.5)$	C1
	$c = 42(^{\circ})$	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 $n = \frac{(\text{approx.}) \text{ speed of light in air}}{\text{speed of light in liquid}}$ 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

PUBLISHED

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)	${}_{11}^{24}\text{Na} \rightarrow {}_{12}^{24}\text{Mg} + {}_{-1}^0\beta$	
	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 $(N_S =) (V_S / V_P) \times N_P$ OR $(N_S =) \frac{11\,000 \times 33\,000}{400\,000}$ OR $(N_S =) \frac{11\,000 \times 33}{400}$	C1