



Cambridge IGCSE™

CO-ORDINATED SCIENCES**0654/32**

Paper 3 Theory (Core)

October/November 2022

MARK SCHEME

Maximum Mark: 120

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 **14** 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.

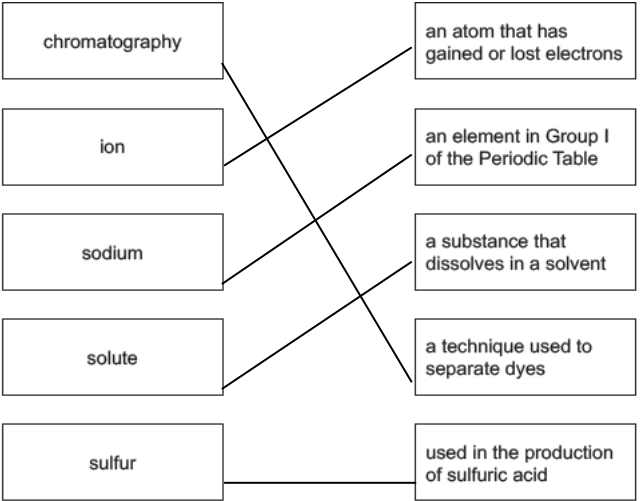
Unless a separate mark is given for a unit, a missing or incorrect unit will normally mean that the final calculation mark is not awarded. Exceptions to this general principle will be noted in the mark scheme.

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.

Question	Answer	Marks
1(a)(i)	A ; E ; D ;	3
1(a)(ii)	cytoplasm ;	1
1(a)(iii)	<i>any two from:</i> chloroplast ; vacuole ; cell wall ;	2
1(b)(i)	(+) 1.1 (mm) ;	1
1(b)(ii)	0.6 ; (-) 1.1 ; osmosis ;	3

Question	Answer	Marks
2(a)	 <p>1 correct 1 mark ; 2 correct 2 marks ; 3 or 4 correct 3 marks ; 5 correct 4 marks ;</p>	4
2(b)(i)	measuring cylinder ;	1
2(b)(ii)	calcium chloride ;	1
2(b)(iii)	(bubble the gas through) lime water ; goes milky / cloudy ;	2
2(b)(iv)	1.8 (cm ³ / s) ;	1
2(b)(v)	<i>any two from:</i> lower temperature (of acid) ; lower concentration of acid ; decrease surface area ;	2
2(b)(vi)	3 ;	1

Question	Answer	Marks
3(a)	thermal energy turns water to steam ; steam drives turbine ; turbine drives generator ;	3
3(b)	advantage – nuclear not reliant on fossil fuels / no CO ₂ produced ; disadvantage – nuclear accidents / disposal of nuclear waste ;	2
3(c)(i)	4 half-lives ; 0.125 (g) ;	2
3(c)(ii)	–1 ;	1
3(c)(iii)	most penetrating γ β α least penetrating ;	1
3(c)(iv)	in a lead lined container ;	1

Question	Answer	Marks
4(a)(i)	thicker wall ; narrower lumen ;	2
4(a)(ii)	valves ;	1
4(b)	pulmonary (vein) ; vena cava ;	2
4(c)	transfer, oxygen/nutrients, to, <u>tissues/cells</u> ; or transfer carbon dioxide/urea/(named) waste product, away from <u>tissues/cells</u> ;	1

Question	Answer	Marks
4(d)	white blood cell ; platelets ; plasma ; red blood cell ;	4

Question	Answer	Marks								
5(a)	<table border="1"> <tr> <td>isotope</td> <td>number of protons</td> <td>number of neutrons</td> <td>number of electrons</td> </tr> <tr> <td>magnesium-26</td> <td>12</td> <td>14;</td> <td>12;</td> </tr> </table>	isotope	number of protons	number of neutrons	number of electrons	magnesium-26	12	14;	12;	2
isotope	number of protons	number of neutrons	number of electrons							
magnesium-26	12	14;	12;							
5(b)	calcium reacts quickly/quicker ; calcium is higher in reactivity series than magnesium ;	2								
5(c)(i)	magnesium + carbon dioxide → magnesium oxide + carbon ;	1								
5(c)(ii)	releases (thermal) energy ;	1								
5(d)	<i>any two from:</i> forms coloured compounds ; acts as catalyst ; variable valency ;	2								
5(e)	91.5 (%) ; 0.915 (kg) ;	2								

Question	Answer	Marks															
6(a)(i)	force ; distance ;	2															
6(a)(ii)	gravitational potential energy ;	1															
6(b)(i)	$W = mg$ (symbols or words) or $(3500 + 180) \times 10$; $= 36\,800$ (N) ;	2															
6(b)(ii)	density = mass \div volume (symbols or words) or $3500 \div 3.4$; 1029 (kg / m ³) ;	2															
6(c)	<table border="1"> <thead> <tr> <th>measurement</th> <th>size</th> <th>unit</th> </tr> </thead> <tbody> <tr> <td>area of one foot</td> <td>0.13</td> <td>m²</td> </tr> <tr> <td>length of a tusk</td> <td>0.75</td> <td>m</td> </tr> <tr> <td>mass of elephant</td> <td>3500</td> <td>kg</td> </tr> <tr> <td>body temperature</td> <td>35.9</td> <td>°C</td> </tr> </tbody> </table> <p>2 correct ; 3 correct ;</p>	measurement	size	unit	area of one foot	0.13	m ²	length of a tusk	0.75	m	mass of elephant	3500	kg	body temperature	35.9	°C	2
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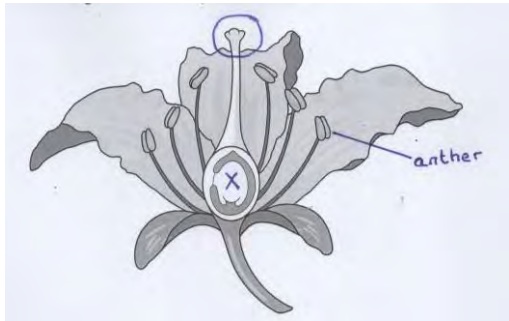
Question	Answer	Marks
7(a)(i)	20 ;	1
7(a)(ii)	sheep have the same number of pre-molar and molar teeth ticked ; humans have twice the number of molar teeth than sheep ticked ;	2

Question	Answer	Marks
7(b)	<pre> graph LR A[incisor] --- B[cut food] C[canine] --- D[grind food] E[pre-molar] --- D F[molar] --- D C --- G[pierce and tear food] F --- G </pre> <p>1 or 2 teeth linked correctly ; 3 teeth linked correctly ; 4 teeth linked correctly ;</p>	3
7(c)	dentine ; enamel ;	2
7(d)	mechanical ;	1

Question	Answer	Marks
8(a)	process X – fractional distillation ; process Y – cracking ;	2
8(b)	steam ;	1
8(c)	contains carbon and hydrogen (atoms) ; only ;	2

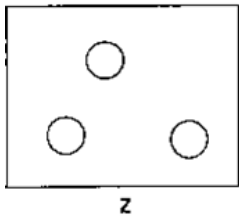
Question	Answer	Marks
8(d)	carbon dioxide ; water ;	2
8(e)	$ \begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{O}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array} $ <p>O – H attached to carbon ; all else correct ;</p>	2

Question	Answer	Marks							
9(a)(i)	4 000 000 (N) ;	1							
9(a)(ii)	rocket would not, move/take off ;	1							
9(a)(iii)	conversion of 75 hours to seconds / 270 000 s ; speed = distance ÷ time or substituted distance ÷ time ; speed = 1.43 (km / s) ;	3							
9(b)(i)	principal focus correctly identified ;	1							
9(b)(ii)	focal length correctly identified ;	1							
9(b)(iii)	refraction ;	1							
9(c)(i)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 20%; text-align: center;">γ-rays</td> <td style="width: 20%;"></td> <td style="width: 20%; text-align: center;">ultraviolet</td> <td style="width: 20%;"></td> <td style="width: 20%; text-align: center;">infrared</td> <td style="width: 20%;"></td> <td style="width: 20%; text-align: center;">radio waves ;</td> </tr> </table>	γ-rays		ultraviolet		infrared		radio waves ;	1
γ-rays		ultraviolet		infrared		radio waves ;			
9(c)(ii)	γ- rays ;	1							
9(c)(iii)	there is no medium / there is a vacuum ; no particles to transfer the vibrations (preventing sound from travelling) ;	2							

Question	Answer	Marks
10(a)(i)	 <p>circle around stigma ; X on ovule ; label line to anther with correct name ;;</p>	4
10(a)(ii)	any two from: style ; stigma ; ovary ;	2
10(a)(iii)	attract (named), pollinator/insects (for pollination) ;	1
10(b)	oviduct ; zygote ; embryo ; uterus ;	4

Question	Answer	Marks
11(a)	gas particles in (constant) random motion ; (particles move) from region of high concentration to region of low concentration ;	2
11(b)	iodine / fluorine / astatine ;	1
11(c)	metallic to non-metallic (from left to right) ;	1

Question	Answer	Marks
11(d)	to kill, microorganisms/bacteria/pathogens ;	1
11(e)	shared pair ; correct number of electrons on each atom / 14 electrons in total ;	2
11(f)(i)	2 HCl ;	1
11(f)(ii)	two non-metals bonding / shared pair of electrons ;	1

Question	Answer	Marks
12(a)	cooled ; warmed ; convection ; all correct ;	1
12(b)(i)	 <p>random arrangement and widely spaced ;</p>	1
12(b)(ii)	liquid and solid ; gas and liquid ;	2
12(b)(iii)	0 °C and 100 °C ;	1
12(c)(i)	ammeter ; voltmeter ;	2

Question	Answer	Marks
12(c)(ii)	R = $V \div I$ (symbols or words) or $6 \div 0.3$; R = 20 (Ω) ;	2