



Cambridge IGCSE™

CO-ORDINATED SCIENCES

0654/43

Paper 4 Theory (Extended)

May/June 2021

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 May/June 2021 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 stigma ; B petal ; C anther ;				3															
1(a)(ii)	(large) petal ; stigma inside of flower ; anther inside of flower ; avp ; max 2				2															
1(a)(iii)	larger ; heavier ; spiky / sticky ; fewer in number produced ; max 2				2															
1(b)	haploid / has half the number (of chromosomes) ;				1															
1(c)	ovary ;				1															
1(d)	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 15%;"></td> <td style="width: 25%;">less genetic diversity</td> <td style="width: 25%;">more energy is used finding a partner</td> <td style="width: 25%;">no or less evolution</td> <td style="width: 30%;">usually takes a longer length of time</td> </tr> <tr> <td>asexual</td> <td style="text-align: center;">✓</td> <td></td> <td style="text-align: center;">✓</td> <td></td> </tr> <tr> <td>sexual</td> <td></td> <td style="text-align: center;">✓</td> <td></td> <td style="text-align: center;">✓</td> </tr> </table>					less genetic diversity	more energy is used finding a partner	no or less evolution	usually takes a longer length of time	asexual	✓		✓		sexual		✓		✓	2
		less genetic diversity	more energy is used finding a partner	no or less evolution	usually takes a longer length of time															
	asexual	✓		✓																
sexual		✓		✓																
;; ;;																				

Question	Answer	Marks
2(a)(i)	hydrogen peroxide → water + oxygen ;	1
2(a)(ii)	(substance that) speeds up a reaction / makes a reaction faster ; (substance that) is not changed at the end of the reaction / is not included in the chemical equation / is not used up ;	2
2(b)(i)	0.4 (g) ;	1
2(b)(ii)	decreases / owtte ;	1
2(c)	increase concentration ; (so) more particles per unit volume / more particles per cm ³ ; more frequent collisions / more collisions per second ; or increase temperature ; (so) particles move faster / particles have more energy ; more frequent collisions / more collisions per second / more successful collisions ; max 3	3

Question	Answer	Marks
3(a)(i)	(plastic is a) poor conductor / good insulator (of thermal energy) ;	1
3(a)(ii)	(white objects) emit less (thermal) radiation ;	1
3(b)(i)	convection (currents); water at the bottom is heated and density decreases ; hot water then rises and displaces (cold) water towards heater ;	3

Question	Answer	Marks
3(b)(ii)	(I =) P / V or 2400 / 240 ; 10 ; A / amps / amperes ;	3
3(b)(iii)	240 / 10 ;	1
3(b)(iv)	$1 / R = 1 / R_1 + 1 / R_2 / 1 / 24 + 1 / 12$; or $\frac{R_1 R_2}{R_1 + R_2}$ or $\frac{24 \times 12}{24 + 12}$; 8 (Ω) ;	2

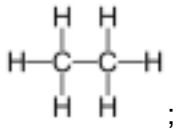
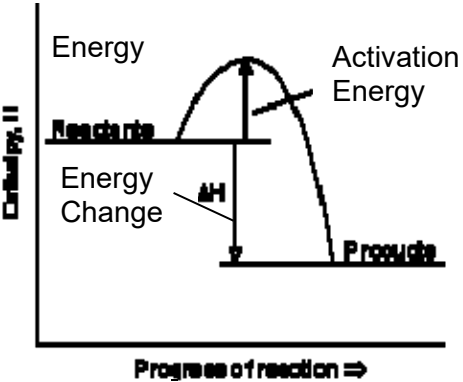
Question	Answer	Marks
4(a)(i)	<i>Any two from:</i> forest cover decreases in continent A ; forest cover increases in continent B ; B always has more forest cover than A ; and data manipulation with correct units ;	2 + 1
4(a)(ii)	loss of food / disruption to food chain / web ; loss of habitat ; extinction ; migration ;	2
4(a)(iii)	less photosynthesis so less carbon dioxide removed ; (more) combustion (of trees) so (more) carbon dioxide produced;	2
4(b)	tip(s) ; shaded ; elongation ; <u>phototropism</u> ;	4

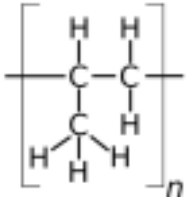
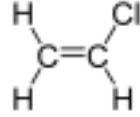
Question	Answer	Marks
5(a)	<p>;;</p>	2
5(b)(i)	hematite ;	1
5(b)(ii)	carbon / coke ;	1
5(b)(iii)	$\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$ formulae ; balancing ;	2
5(b)(iv)	reduction ;	1
5(b)(v)	$\text{Fe}_2(\text{SO}_4)_3$;	1
5(c)	relative molecular mass of $\text{CaCO}_3 = 100$ and of $\text{CO}_2 = 44$; $\left(\frac{44 \times 1000}{100} = \right) 440 \text{ (kg) ;}$	2

Question	Answer	Marks
6(a)(i)	(speed =) d / t or $200 / 25$; 8 (m / s) ;	2
6(a)(ii)	(KE =) $\frac{1}{2} mv^2$ or $\frac{1}{2} \times 90 \times 8^2$; 2880 (J) ;	2
6(b)(i)	(240 – 110 =) 130 (N) ;	1
6(b)(ii)	resultant force forward ; sprinter will accelerate / speed up ;	2

Question	Answer	Marks
7(a)		3
7(b)(i)	ref to vasodilation ; arterioles, widen / dilate / AW ; more blood flows through capillaries ;	3
7(b)(ii)	shivering / hair stands on end / vasoconstriction ;	1
7(b)(iii)	negative feedback ;	1

Question	Answer	Marks
7(c)	increase blood flow / pulse rate ; increase the (blood) glucose (concentration) ; avp ;	2

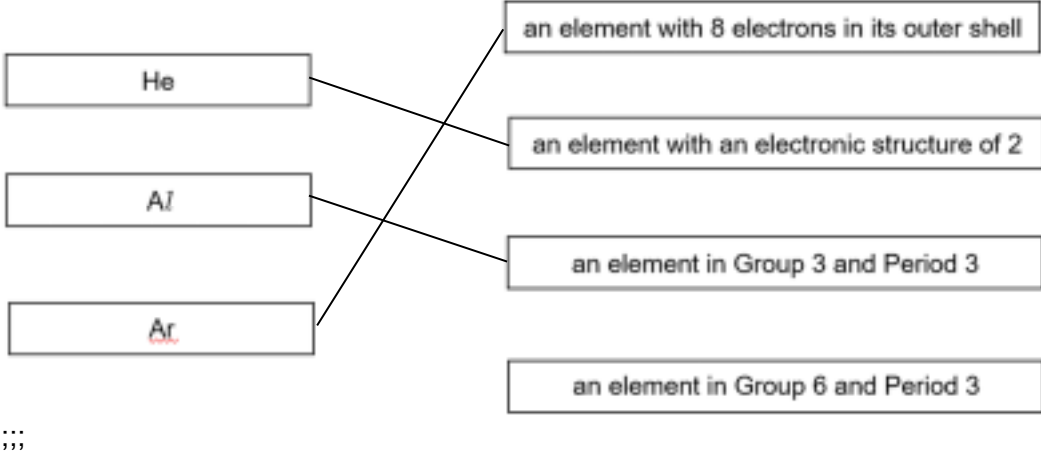
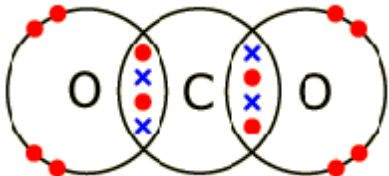
Question	Answer	Marks
8(a)	 ;	1
8(b)	 <p>products shown below reactants ; energy change or correctly labelled ; activation energy correctly labelled ;</p>	3
8(c)	cracking makes more petrol / matches supply with demand ; cracking makes alkanes which can be used as fuels ; cracking makes alkenes which can be used to make plastics / alcohol / ethanol ; max 2	2

Question	Answer	Marks
8(d)	$C_{12}H_{26} \rightarrow C_8H_{18} + 2C_2H_4$ formulae ; balancing ;	2
8(e)	monomer ;	1
8(f)	(propene contains) a (carbon to carbon) double bond ;	1
8(g)	<div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p>(propene)</p>  </div> <div style="text-align: center;"> <p>(chloroethene)</p>  </div> </div>	2

Question	Answer	Marks
9(a)(i)	concentric circles ; anticlockwise ;	2
9(a)(ii)	direction would reverse / it would be clockwise ;	1
9(b)(i)	up ;	1
9(b)(ii)	increasing the current ; increasing the strength of the magnetic field ;	2
9(c)(i)	A – D – E ;;	2
9(c)(ii)	split-ring commutator correctly labelled ;	1
9(c)(iii)	reverses the direction of the current (every half turn) ;	1
9(d)(i)	time period correctly labelled ;	1

Question	Answer	Marks
9(d)(ii)	sine wave drawn with smaller amplitude ;	1

Question	Answer	Marks
10(a)(i)	2(%) ;	1
10(a)(ii)	(more) oxygen used in respiration ; to release energy (for exercise) ;	2
10(b)	increased depth of breathing ;	1
10(c)	carbon dioxide ;	1
10(d)	mouth / nose ; larynx ; trachea ; bronchus ; bronchioles ; max 2	2

Question	Answer	Marks
11(a)	 <p>He</p> <p>Al</p> <p>Ar</p> <p>...</p> <p>an element with 8 electrons in its outer shell</p> <p>an element with an electronic structure of 2</p> <p>an element in Group 3 and Period 3</p> <p>an element in Group 6 and Period 3</p>	3
11(b)	(argon is) inert / unreactive ;	1
11(c)	+ / +1 / positive ;	1
11(d)	<p>metal (atoms) lose electrons ; non-metal (atoms) gain electrons ; metal (atoms) form positive <u>ions</u> and non-metal (atoms) form negative <u>ions</u> ; attraction between (oppositely charged) <u>ions</u> ;</p> <p>max 3</p>	3
11(e)		2

Question	Answer	Marks
12(a)	forces between molecules are strong ; it has a fixed volume ; molecules can only vibrate;	3
12(b)	collisions of molecules with walls ; produces a force ;	2
12(c)(i)	5 (cm ³) ;	1
12(c)(ii)	(density =) m / V or 2.45 / 5 ; 0.5 (g / cm ³) ;	2
12(d)	molecules move faster / have more energy ; molecules collide, more often / more frequently, with walls / with a larger force exerted on walls ;	2