



# Cambridge O Level

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**COMBINED SCIENCE**

**5129/22**

Paper 2 Theory

**October/November 2021**

**MARK SCHEME**

Maximum Mark: 100

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**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 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.

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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)	Z ;	1
1(b)	Y ;	1
1(c)	Y ;	1
1(d)	W and X ;	1
1(e)	U ;	1

Question	Answer	Marks
2	<pre> graph LR     A[ovary] --- B[produce egg cells]     C[uterus] --- D[zygote develops]     E[testes] --- F[produce sperm]     G[oviduct] --- H[fertilisation]             </pre>	4

Question	Answer	Marks
3(a)	idea that all the sand is in one bulb to begin with ; turn over and start timer ; stop timer when sand runs out ;	3
3(b)	micrometer ; any one from : <ul style="list-style-type: none"> <li>• highest precision ;</li> <li>• it will measure 0.06 mm ;</li> <li>• 0.06 is much larger than 0.01 ;</li> </ul>	2

Question	Answer	Marks
4	general ; chemical ; saturated ; addition ; double ; carbon monoxide ;	6

Question	Answer	Marks
5	sugar ; respiration ; acid ; enamel ;	4

Question	Answer	Marks
6(a)	decreases ; from 12 to 7 m/s <b>or</b> by 5 m/s ;	<b>2</b>
6(b)	<b>5 and</b> $9.0 \pm 0.2$ ;  $4.7 \pm 0.1$ ;  3 ;	<b>3</b>

Question	Answer	Marks
7(a)(i)	30 ;	<b>1</b>
7(a)(ii)	60 32 ;; 1.5 ;	<b>3</b>
7(b)(i)	$2\text{Li} + \text{Cl}_2 \rightarrow 2\text{LiCl}$ ;	<b>1</b>
7(b)(ii)	increases ;	<b>1</b>

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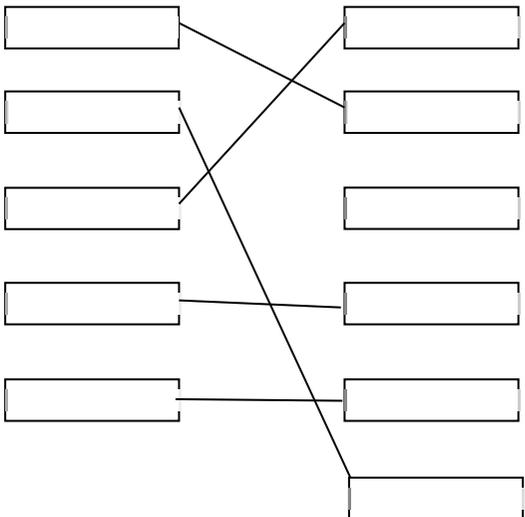
Question	Answer	Marks										
8(a)(i)	plumule ;	1										
8(a)(ii)	cotyledon ;	1										
8(b)	<table border="1" data-bbox="349 357 880 687"> <thead> <tr> <th data-bbox="349 357 654 422">condition</th> <th data-bbox="654 357 880 422">germination</th> </tr> </thead> <tbody> <tr> <td data-bbox="349 422 654 488">carbon dioxide</td> <td data-bbox="654 422 880 488"></td> </tr> <tr> <td data-bbox="349 488 654 553">light</td> <td data-bbox="654 488 880 553"></td> </tr> <tr> <td data-bbox="349 553 654 619">oxygen</td> <td data-bbox="654 553 880 619">✓</td> </tr> <tr> <td data-bbox="349 619 654 687">water</td> <td data-bbox="654 619 880 687">✓</td> </tr> </tbody> </table>	condition	germination	carbon dioxide		light		oxygen	✓	water	✓	2
condition	germination											
carbon dioxide												
light												
oxygen	✓											
water	✓											
8(c)	<p>any <b>two</b> from :</p> <ul style="list-style-type: none"> <li>• optimum pH (for germination) is pH 6 ;</li> <li>• germination is low in low pHs / strong acids ;</li> <li>• germination at pH 10 / high pH is low ;</li> <li>• from pH 6–pH 10 there is a gradual decline in %age of germination ;</li> </ul>	2										
8(d)	unable make amino acids / proteins ;	1										

Question	Answer	Marks																																								
9(a)	(moment =) $f \times d$ <b>or</b> $5.0 \times 0.04$ ; 0.2 ; Ncm ;	<b>3</b>																																								
9(b)	<table border="1" style="display: inline-table; margin-right: 20px;"> <thead> <tr> <th>bear</th> <th>stay</th> <th>move left</th> <th>move right</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>B</td> <td></td> <td></td> <td>✓</td> </tr> <tr> <td>C</td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>D</td> <td></td> <td>✓</td> <td></td> </tr> </tbody> </table> <b>or</b> <table border="1" style="display: inline-table;"> <thead> <tr> <th>bear</th> <th>stay</th> <th>left</th> <th>right</th> </tr> </thead> <tbody> <tr> <td>A</td> <td>✓</td> <td></td> <td></td> </tr> <tr> <td>B</td> <td></td> <td></td> <td>✓</td> </tr> <tr> <td>C</td> <td></td> <td>✓</td> <td></td> </tr> <tr> <td>D</td> <td>✓</td> <td></td> <td></td> </tr> </tbody> </table>	bear	stay	move left	move right	A	✓			B			✓	C	✓			D		✓		bear	stay	left	right	A	✓			B			✓	C		✓		D	✓			<b>3</b>
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Question	Answer	Marks
10(a)	<b>A</b> = hydrogen ; <b>B</b> = carbon dioxide ; <b>C</b> = blue ; <b>D</b> = ammonia ;	<b>4</b>
10(b)	ionic ; compound made from metal and non-metal ;	<b>2</b>

Question	Answer	Marks								
11(a)	<table border="1"> <tr> <td>lumen smaller in a vein</td> <td></td> </tr> <tr> <td>a vein contains frequent valves</td> <td>✓</td> </tr> <tr> <td>vein carries blood away from the heart</td> <td></td> </tr> <tr> <td>Veins carry deoxygenated blood</td> <td>✓</td> </tr> </table>	lumen smaller in a vein		a vein contains frequent valves	✓	vein carries blood away from the heart		Veins carry deoxygenated blood	✓	<b>4</b>
lumen smaller in a vein										
a vein contains frequent valves	✓									
vein carries blood away from the heart										
Veins carry deoxygenated blood	✓									
11(b)	<p>any <b>three</b> from ;</p> <ul style="list-style-type: none"> <li>• provide oxygen to the tissue / cell ;</li> <li>• remove carbon dioxide from the tissue / cell ;</li> <li>• provide glucose to the tissue / cell ;</li> <li>• remove urea from the tissue / cell ;</li> <li>• water transfer in and out of the tissue / cell ;</li> <li>• diffusion of oxygen from the lung / alveoli to the blood ;</li> <li>• diffusion of carbon dioxide from the blood to the lung / alveoli ;</li> </ul>	<b>3</b>								

Question	Answer	Marks
12(a)	resistance changes as temperature changes ;	<b>1</b>
12(b)	$1.7 \pm 0.01(\Omega)$ ;	<b>1</b>
12(c)	voltage / potential difference ; current ;	<b>2</b>

Question	Answer	Marks
13		5

Question	Answer	Marks
14(a)	externally ; chemical / metabolic ;	2
14(b)	any <b>two</b> from : <ul style="list-style-type: none"> <li>• high blood pressure ;</li> <li>• heart disease ;</li> <li>• liver disease ;</li> <li>• cancer (of breast, mouth, throat, oesophagus, liver, colon)</li> <li>• depression ;</li> <li>• addiction ;</li> <li>• withdrawal symptoms ;</li> </ul>	2

Question	Answer	Marks
14(c)(i)	in the blood / plasma ;	1
14(c)(ii)	any <b>one</b> from <ul style="list-style-type: none"> <li>• deaminates amino acids ;</li> <li>• produces urea ;</li> <li>• converts (excess) glucose to glycogen ;</li> <li>• stores glycogen ;</li> <li>• converts glycogen to glucose ;</li> <li>• destroys hormones ;</li> <li>• produces bile ;</li> <li>• destroys red blood cells ;</li> </ul>	1

Question	Answer	Marks
15(a)	5 negative charges ; evenly distributed ;	2
15(b)	all negative charges move to right of sphere ;	1
15(c)	(amount of) charge ; moving charge <b>or</b> current ; 1 amp ;	3

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Question	Answer	Marks
16(a)	condensation ;	1
16(b)	kinetic energy decreases ; particles become closer together ;	2

Question	Answer	Marks
17(a)	<b>W:</b> oesophagus ; <b>X:</b> liver ; <b>Y:</b> pancreas ; <b>Z:</b> ileum / small intestine ;	4
17(b)	wave of muscular contraction (and relaxation) ; to push food along tube / oesophagus / alimentary canal ;	2

Question	Answer	Marks
18(a)	any sine curve of <b>one</b> wavelength ; same amplitude above and below equilibrium <b>and</b> each half wavelength is $7.5 \times 10^{-6}$ m ;	2
18(b)(i)	vertical line drawn at $15 \times 10^{-6}$ m ;	1
18(b)(ii)	P – ultraviolet ; Q – visible ;	2
18(c)	thermal energy increase ;	1

Question	Answer	Marks
19(a)	any <b>one</b> from : <ul style="list-style-type: none"><li>• making car bodies ;</li><li>• machinery ;</li><li>• making bridges ;</li><li>• making pipes ;</li><li>• making doors ;</li><li>• in buildings ;</li></ul>	<b>1</b>
19(b)	stainless steel is  harder ; more resistant to corrosion ;	<b>2</b>