



# Cambridge IGCSE™ (9–1)

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**BIOLOGY**

**0970/04**

Paper 4 Theory (Extended)

**For examination from 2023**

MARK SCHEME

Maximum Mark: 80

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**Specimen**

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This document has **12** pages. Any blank pages are indicated.

**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	<p><u>Calculation specific guidance</u></p> <p>Correct answers to calculations should be given full credit even if there is no working or incorrect working, <b>unless</b> the question states ‘show your working’.</p> <p>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.</p> <p>For answers given in standard form (e.g. <math>a \times 10^n</math>) in which the convention of restricting the value of the coefficient (<math>a</math>) 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.</p> <p>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.</p>
7	<p><u>Guidance for chemical equations</u></p> <p>Multiples / fractions of coefficients used in chemical equations are acceptable unless stated otherwise in the mark scheme.</p> <p>State symbols given in an equation should be ignored unless asked for in the question or stated otherwise in the mark scheme.</p>

Mark schemes will use these abbreviations:

;	separates making points
/	alternatives
()	the word / phrase in brackets is not required but sets the context
A	accept (for answers correctly cued by the question, or guidance for examiners)
<b>and</b>	both responses required for the mark
any [number] from:	accept the [number] of valid responses
AVP	alternative valid point
AW	alternative wording (where responses vary more than usual)
ecf	error carried forward
I	ignore as irrelevant
MP	mark point
note:	additional marking guidance
ora	or reverse argument
R	reject
<u>underline</u>	actual word given must be used by candidate (grammatical variants accepted)

<b>Question</b>	<b>Answer</b>	<b>Marks</b>	<b>Guidance</b>
1(a)(i)	absorption of (digested) nutrients into the blood ;	1	
1(a)(ii)	<i>any three from:</i> lacteal / lymph vessel / lymphatic vessel ; capillaries / blood vessel ; epithelium ; microvilli ; large surface area ; AVP ; e.g. epithelium contains goblet cells	3	
1(b)(i)	(blood) plasma ;	1	
1(b)(ii)	assimilation ;	1	
1(b)(iii)	<i>any two from:</i> antibodies / insulin / glucagon / fibrin(ogen) / haemoglobin / AVP e.g. enzyme(s) (in phagocytes) ; ;	2	
1(c)	<i>any four from:</i> (cholera bacteria) produce a toxin ; toxin causes secretion of chloride ions ; into small intestine ; lowering water potential ; movement of water into the gut ; by osmosis ; results in diarrhoea ;	4	

Question	Answer	Marks	Guidance
2(a)	chemical substance produced by a (endocrine) gland ; carried by the blood ; alters the activity of specific target organs / AW ;	3	
2(b)(i)	136(%) ;;;	3	MP1 for correct readings from the graph, 72 and 170 MP2 for correct calculation MP3 for correct rounding to a whole number ecf MP2 and MP3 from incorrect MP1
2(b)(ii)	<i>any three from:</i> similar response first 30 minutes / AW ; increases / decreases, more steeply / faster ; increases to / has, a higher concentration ; reaches a peak / decreases, (much) later ; does not return to, starting concentration / original value / normal / AW ; any comparative use of figures with correct units ;	3	ora throughout
2(b)(iii)	<i>any four from:</i> increase in glucose concentration causes secretion of insulin ; (secretion) by the pancreas ; insulin causes the liver to take up glucose from the blood ; glucose is converted to glycogen ; AVP ; (e.g. ref. to detection of increased glucose by the pancreas / activation of enzymes in the liver)	4	
2(b)(iv)	<i>any two from:</i> taking of insulin ; ref. to injections / pump ; (regular) monitoring of blood glucose concentration ; controlling carbohydrate intake ; AVP ; e.g. exercise regularly / maintain a healthy mass / idea that insulin cannot be taken orally	2	

Question	Answer	Marks	Guidance
3(a)	<p><b>red blood cell:</b>  <i>appearance:</i>            biconcave (disc / shape) / no nucleus /            red blood cells smaller than (named) white blood cell(s) / ora ;  <i>function:</i>            transports oxygen ;</p> <p><b>lymphocyte:</b>  <i>appearance:</i>            little cytoplasm / large(r) nucleus / nucleus fills most of the cell ;  <i>function:</i>            ref. to active immunity / responds to, antigen(s) or vaccine(s)            / produces antibodies / ref. to memory cells ;</p> <p><b>phagocyte:</b>  <i>appearance:</i>            lobed / irregular-shaped / C-shaped / AW, nucleus ;  <i>function:</i>            engulf pathogens / phagocytosis / AW ;</p>	6	A transports carbon dioxide
3(b)(i)	fibrinogen → fibrin ;	1	
3(b)(ii)	prevent blood loss ; prevent entry of (named), pathogens / microbes ;	2	
3(c)(i)	(P) $X^H X^h$ ; (Q) $X^H Y$ ; (R) $X^H Y$ ;	3	
3(c)(ii)	0.25 ;	1	
3(c)(iii)	gene is located on a sex chromosome ; characteristic is more common in / one sex (than the other) ;	2	

Question	Answer	Marks	Guidance
4(a)	$C_6H_{12}O_6 + 6O_2 \rightarrow 6H_2O + 6CO_2$ ;;	2	MP1 correct symbol equation MP2 correct balancing of the equation
4(b)	sugar beet ; <i>max. two from:</i> idea that it grows in an appropriate temperature range ; idea that it grows in an appropriate rainfall range ; energy yield is greater than, wheat / corn ; use of data to support answer ;	3	ecf MP2 and MP3 from incorrect MP1
4(c)	<i>any three from:</i> increased rate of transpiration ; greater concentration of water vapour inside the leaf than outside ; more water vapour diffuses out of the leaf ; through stomata ; more water moves up, the xylem / by transpiration pull ;	3	
4(d)	<i>any three from:</i> ref. to asexual reproduction ; minimises genetic variation / gives a uniform crop / AW ; produces plants that all have the same features / AW ; ensures consistency of product / AW ; AVP ; e.g. faster production from cuttings than from seeds	3	



Question	Answer	Marks	Guidance
5(a)(i)	(dry) scaly skin ; leathery / soft-shelled, eggs ;	2	
5(a)(ii)	<i>any two from:</i> cellulose / cell wall ; chloroplast / chlorophyll ; (large / permanent / central) vacuole ;	2	
5(b)(i)	mouth ; small intestine ;	2	
5(b)(ii)	<i>any three from:</i> correct ref. to active site ; active site must be complementary shape to, substrate / starch ; to make enzyme – substrate complex / to allow substrate to bind to enzyme ; ref. to only fits one substrate / specific to one substrate ;	3	

Question	Answer	Marks	Guidance
5(c)	<p>any five from:</p> <ul style="list-style-type: none"> <li>captive breeding programme ;</li> <li>in zoos / reserves ;</li> <li>artificial insemination / IVF / AW ;</li> <li>to, build up numbers / release back to the wild ;</li> <li>seed banks ;</li> <li>in botanic gardens / other named ;</li> <li>store seeds for long periods ;</li> <li>education / awareness ;</li> <li>legislation ;</li> <li>to, protect / restore, habitats ;</li> <li>to, reduce / prevent, pollution ;</li> <li>to, restrict / prevent, introduced species ;</li> <li>to, restrict / prevent, hunting / fishing ;</li> <li>monitoring populations ;</li> <li>to, detect decreases or increases / determine quotas ;</li> <li>AVP ; e.g. protected areas such as, national parks / nature reserves / marine parks</li> </ul>	5	

Question	Answer	Marks	Guidance						
6(a)	<table border="1"> <tr> <td>producer</td> <td>name of organism from Fig. 6.1</td> </tr> <tr> <td>secondary consumer</td> <td>algae / (phyto)plankton ; (stone) crab / mysid shrimp / blenny ; blenny / (spotted) sandpiper ;</td> </tr> <tr> <td>an animal that feeds at two trophic levels</td> <td></td> </tr> </table>	producer	name of organism from Fig. 6.1	secondary consumer	algae / (phyto)plankton ; (stone) crab / mysid shrimp / blenny ; blenny / (spotted) sandpiper ;	an animal that feeds at two trophic levels		3	
producer	name of organism from Fig. 6.1								
secondary consumer	algae / (phyto)plankton ; (stone) crab / mysid shrimp / blenny ; blenny / (spotted) sandpiper ;								
an animal that feeds at two trophic levels									
6(b)(i)	nitrification ; (nitrifying) bacterium / bacteria ;	2	<b>A</b> oxidation						
6(b)(ii)	<i>any three from:</i> root hairs ; (by) active, transport / uptake ; across (cell) membranes ; against a concentration gradient / low to high concentration / AW ; by proteins (molecules / pumps / carriers) ; use of, energy / ATP ; (also by) diffusion ;	3							
6(b)(iii)	ribosome ;	1							
6(b)(iv)	nitrogen fixation ;	1							
6(c)	<i>any three from:</i> energy is lost between the trophic levels / AW ; not enough energy, at the top of the pyramid / at higher trophic levels, to support a large number of organisms ; named example of how energy is lost ; not all organisms / parts of organisms (in one trophic level), are, eaten / digested ;	3							

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