



# Cambridge IGCSE™

---

**BIOLOGY****0610/43**

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 **13** 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.

**Mark scheme abbreviations**

- ; separates marking points
- / alternative responses for the same marking point
- **R** reject the response
- **A** accept the response
- **I** ignore the response
- ecf error carried forward
- AVP any valid point
- ora or reverse argument
- AW alternative wording
- underline actual word given must be used by candidate (grammatical variants excepted)
- ( ) the word / phrase in brackets is not required but sets the context

Question	Answer	Marks	Guidance																		
1(a)(i)	reflex ;	<b>1</b>																			
1(a)(ii)	<table border="1"> <thead> <tr> <th data-bbox="336 311 813 478">function</th> <th data-bbox="813 311 1077 478">name of structure</th> <th data-bbox="1077 311 1176 478">letter in Fig. 1.1</th> </tr> </thead> <tbody> <tr> <td data-bbox="336 478 813 611">cell that transmits impulse from the receptor to the central nervous system</td> <td data-bbox="813 478 1077 611">sensory neurone</td> <td data-bbox="1077 478 1176 611"><b>J</b></td> </tr> <tr> <td data-bbox="336 611 813 710">changes the, volume / (air) pressure, in the thorax / AW</td> <td data-bbox="813 611 1077 710">diaphragm</td> <td data-bbox="1077 611 1176 710"><b>N</b></td> </tr> <tr> <td data-bbox="336 710 813 1013">coordinates / controls / communicates / regulates / AW, body functions / responses / reflexes <b>or</b> connects, neurones / brain / CNS, and (named part of) body / PNS / neurones</td> <td data-bbox="813 710 1077 1013">spinal <u>cord</u> / CNS</td> <td data-bbox="1077 710 1176 1013"><b>M</b></td> </tr> <tr> <td data-bbox="336 1013 813 1181">transmits / sends, impulses (in, CNS / <b>M</b>) <b>or</b> connects neurones</td> <td data-bbox="813 1013 1077 1181">relay / AW, neurone</td> <td data-bbox="1077 1013 1176 1181"><b>K</b></td> </tr> <tr> <td data-bbox="336 1181 813 1279">contains cilia to move mucus out of the airway</td> <td data-bbox="813 1181 1077 1279">trachea</td> <td data-bbox="1077 1181 1176 1279"><b>P</b></td> </tr> </tbody> </table> <p style="text-align: right;">♦♦♦♦ ♦♦♦♦</p>	function	name of structure	letter in Fig. 1.1	cell that transmits impulse from the receptor to the central nervous system	sensory neurone	<b>J</b>	changes the, volume / (air) pressure, in the thorax / AW	diaphragm	<b>N</b>	coordinates / controls / communicates / regulates / AW, body functions / responses / reflexes <b>or</b> connects, neurones / brain / CNS, and (named part of) body / PNS / neurones	spinal <u>cord</u> / CNS	<b>M</b>	transmits / sends, impulses (in, CNS / <b>M</b> ) <b>or</b> connects neurones	relay / AW, neurone	<b>K</b>	contains cilia to move mucus out of the airway	trachea	<b>P</b>	<b>5</b>	<i>one mark per row</i>
function	name of structure	letter in Fig. 1.1																			
cell that transmits impulse from the receptor to the central nervous system	sensory neurone	<b>J</b>																			
changes the, volume / (air) pressure, in the thorax / AW	diaphragm	<b>N</b>																			
coordinates / controls / communicates / regulates / AW, body functions / responses / reflexes <b>or</b> connects, neurones / brain / CNS, and (named part of) body / PNS / neurones	spinal <u>cord</u> / CNS	<b>M</b>																			
transmits / sends, impulses (in, CNS / <b>M</b> ) <b>or</b> connects neurones	relay / AW, neurone	<b>K</b>																			
contains cilia to move mucus out of the airway	trachea	<b>P</b>																			

Question	Answer	Marks	Guidance
1(b)(i)	<i>any two labels to correct structure on Fig. 1.2:</i> nucleus ; cell membrane ; cytoplasm ; AVP ; e.g. cell body / axon / dendrite	<b>2</b>	
1(b)(ii)	<b>X</b> drawn at any tip of left-hand side of the motor neurone ;	<b>1</b>	
1(b)(iii)	<i>any two from:</i> <b>1</b> axons / long, to transmit (impulse), over (long) distance / fast / direct connection ; <b>2</b> (many) branches to connect to, other / relay, neurones / cells / effector / muscle ; <b>3</b> <u>mitochondria</u> to (release energy), for, transmission of impulse / protein synthesis / active transport / making or releasing (neuro)transmitters ; <b>4</b> <u>vesicles</u> to, carry / hold / release, chemicals / (neuro)transmitters (into synapse) ; <b>5</b> receptor (molecules), to ensure unidirectional transmission / to allow signal to be received by next neurone ; <b>6</b> AVP ;	<b>2</b>	MP6 e.g. dendrites have large surface area for many receptors
1(c)	<i>any three from:</i> <i>nerve communication is:</i> <b>1</b> faster / <b>ora</b> ; <b>2</b> shorter-lasting / <b>ora</b> ; <b>3</b> specific / one, target / location ; <b>4</b> electrical (and chemical) ; <b>A</b> uses impulses <b>5</b> conducted through cells / uses neurones / uses nerves / uses CNS ; <b>6</b> AVP ;	<b>3</b>	<i>hormonal communication is:</i>  MP3 widespread / can have multiple target organs MP4 chemical (only) MP5 (travels through) blood / plasma / circulatory system <b>or</b> released from, glands / endocrine system MP6 e.g. can be voluntary

Question	Answer	Marks	Guidance																				
2(a)(i)	any two from: bile ; (hydrochloric) acid ; mucus / water / saliva ; AVP ;	<b>2</b>																					
2(a)(ii)	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th data-bbox="336 464 490 632">name of enzyme</th> <th data-bbox="490 464 710 632">organ where enzyme is secreted</th> <th data-bbox="710 464 943 632">organ where the enzyme acts</th> <th data-bbox="943 464 1176 632">products of digestion involving this enzyme</th> </tr> </thead> <tbody> <tr> <td data-bbox="336 632 490 799">amylase</td> <td data-bbox="490 632 710 799">salivary glands</td> <td data-bbox="710 632 943 799">mouth / buccal cavity</td> <td data-bbox="943 632 1176 799"><u>simple(r) sugars</u> / maltose / glucose</td> </tr> <tr> <td data-bbox="336 799 490 935">pepsin</td> <td data-bbox="490 799 710 935">stomach / gastric glands</td> <td data-bbox="710 799 943 935">stomach</td> <td data-bbox="943 799 1176 935">amino acids</td> </tr> <tr> <td data-bbox="336 935 490 1070">lipase</td> <td data-bbox="490 935 710 1070">pancreas</td> <td data-bbox="710 935 943 1070">small intestine / duodenum / ileum</td> <td data-bbox="943 935 1176 1070">fatty acids and glycerol</td> </tr> <tr> <td data-bbox="336 1070 490 1206">maltase</td> <td data-bbox="490 1070 710 1206">small intestine</td> <td data-bbox="710 1070 943 1206">epithelial lining of the small intestine</td> <td data-bbox="943 1070 1176 1206">glucose</td> </tr> </tbody> </table> <p style="text-align: right; margin-top: 10px;">♦♦♦♦ ♦♦♦♦</p>	name of enzyme	organ where enzyme is secreted	organ where the enzyme acts	products of digestion involving this enzyme	amylase	salivary glands	mouth / buccal cavity	<u>simple(r) sugars</u> / maltose / glucose	pepsin	stomach / gastric glands	stomach	amino acids	lipase	pancreas	small intestine / duodenum / ileum	fatty acids and glycerol	maltase	small intestine	epithelial lining of the small intestine	glucose	<b>4</b>	<i>one mark for each correct row</i>
name of enzyme	organ where enzyme is secreted	organ where the enzyme acts	products of digestion involving this enzyme																				
amylase	salivary glands	mouth / buccal cavity	<u>simple(r) sugars</u> / maltose / glucose																				
pepsin	stomach / gastric glands	stomach	amino acids																				
lipase	pancreas	small intestine / duodenum / ileum	fatty acids and glycerol																				
maltase	small intestine	epithelial lining of the small intestine	glucose																				

Question	Answer	Marks	Guidance
2(b)	<p><i>any six from:</i></p> <p><b>1</b> 39 ± 2 °C is optimum temperature / AW ;</p> <p><b>2</b> highest activity is 2500 U per mg (protein) ;</p> <p><b>3</b> steep(er) decrease in activity after optimum / <b>ora</b> ;</p> <p><b>4</b> no activity after 62 °C ± 2 ;</p> <p><b>5</b> (increased) temperature causes increased <u>kinetic</u> energy / <b>ora</b> ;</p> <p><b>6</b> increased frequency of (effective) collisions / <b>ora</b> ;</p> <p><b>7</b> forming <u>enzyme-substrate complexes</u> / <b>ora</b> ;</p> <p><b>8</b> denaturation occurs (at any temperatures above optimum temperature) ;</p> <p><b>9</b> <u>active site</u> changes shape ;</p> <p><b>10</b> no longer, fit into substrate / complementary (to substrate) ;</p> <p><b>11</b> <i>idea that</i> both enzyme and substrate are proteins and may change ;</p>	<b>6</b>	<i>each unit must be stated at least once</i> ecf on wrong or no units
2(c)(i)	<p><i>any two from:</i></p> <p><u>lactose</u> is found in <u>milk</u> ;</p> <p><u>lactase</u> breaks down <u>lactose</u> ;</p> <p>(young) babies are dependent on, lactose / milk (for their nutrition) / AW ;</p>	<b>2</b>	
2(c)(ii)	(loss of) watery faeces / AW ;	<b>1</b>	
2(c)(iii)	<p><i>any three from:</i></p> <p>(cholera bacterium) release toxins ;</p> <p>causes <u>chloride ions</u> (to be secreted from the body) ;</p> <p>(chloride ions) in <u>small</u> intestine / duodenum / ileum ;</p> <p><i>ref to</i> osmotic movement / lowers <u>water potential</u> (in gut) ;</p> <p>water moves into gut <b>or</b> more water remains, in intestines / gut ;</p>	<b>3</b>	



Question	Answer	Marks	Guidance
3(a)(i)	7.6 billion / 7 600 000 000 / $7.6 \times 10^9$ ;	1	
3(a)(ii)	0.3(%) ;;	2	MP1 correct calculation MP2 correct rounding to 0.3(%) ecf if wrong values used in the calculation
3(b)(i)	<i>any three from:</i> (named crop) disease ; war ; drought / AW ; flooding / AW ; unequal distribution of food / AW ; (widespread) poverty ; AVP ;	3	MP7 e.g. plagues of crop pests
3(b)(ii)	<i>any four from:</i> <b>1</b> one named chemical (other than fertilisers) used in farming ; <i>pesticides / insecticides / herbicides:</i> <b>2</b> kill / harm, non-target species (in natural environment) ; <b>3</b> example of specific impact from harm of non-target species ; <b>4</b> loss of biodiversity / disrupt food chains ; <b>5</b> bioaccumulation / bioconcentration / biomagnification ; <b>6</b> ref to <u>resistant</u> organisms <b>or</b> super, bugs / weeds ; <b>7</b> pollute / destroy / AW, non-target / named, area / habitat ; <b>8</b> (antibiotics cause) antibiotic-resistance ; <b>9</b> AVP ;	4	MP1 examples: herbicides / 2,4 D / weedkillers / pesticides / insecticides / antibiotics / plant growth regulators / (animal) hormones MP3 e.g. loss of pollination (by bees) MP5 <b>A</b> descriptions MP9 changes / increases, the pH of soil
3(b)(iii)	a single crop in production / AW ;	1	
3(b)(iv)	genetic, engineering / modification ;	1	

Question	Answer	Marks	Guidance
4(a)(i)	(positive) phototropism ;	1	
4(a)(ii)	<i>any two from:</i> (plants have) cell walls ; pressure of water pressing against cell wall / ref. to turgor ; ref. to xylem (offering support) ; AVP ;	2	MP4 e.g. ref. to lignin
4(b)	label to xylem shown on Fig. 4.2 ;	1	
4(c)	<i>any three from:</i> <b>1</b> translocation ; <b>2</b> transport of, sucrose / amino acids / sugars ; <b>3</b> (transports nutrients) from (named) source to (named) sink ; <b>4</b> AVP ;	3	MP4 e.g. transport can occur in both directions some organs can be both a source and / or a sink at different times
4(d)	<i>strip of stalk:</i> <b>1</b> B ;  <i>explanation, max two from:</i> <b>2</b> shows greater degree of, bending / shrivelling / AW ; <b>3</b> because more water moves out (of the cells in the inner surface of the scape) ; <b>4</b> (water moves) from high water potential to, lowest water potential / lower water potential ;	3	MP4 A (cells become) plasmolysed / flaccid / less turgid

Question	Answer	Marks	Guidance
5(a)(i)	(some) protoctists / algae ;	1	A (cyano)bacteria / (phyto)plankton
5(a)(ii)	15 ; mg ;	2	(3.0)×5  A <u>0.015 g</u> for 2 marks
5(a)(iii)	<i>any one from:</i> (organisms) too small / difficult, to count ; AVP ;	1	e.g. easier to measure (in outdoor environment) / there are microorganisms that do not have chlorophyll / (more) accurate / time-efficient
5(a)(iv)	(day) 8 ;	1	
5(a)(v)	<i>any two from:</i> to absorb / receive, (enough) light (energy) ; (light) is necessary for photosynthesis ; (for the organisms) to make sugars / starch / to convert light (energy) into chemical energy ;	2	MP3 A because they are producers / for growth (of organisms)
5(b)(i)	<i>any one from:</i> nitrate / NO <sub>3</sub> <sup>-</sup> ; AVP ;	1	e.g. magnesium
5(b)(ii)	<i>any three from:</i> <b>1</b> eutrophication ; <b>2</b> increase in, decomposition / number of (named) decomposers ; <b>3</b> decomposers respire aerobically ; <b>4</b> decomposition causes a reduction in (dissolved) oxygen ; <b>5</b> (reduced oxygen) causes death of fish / (named aquatic) animals / AW ; <b>6</b> (death of producers means) less food for consumers / loss of biodiversity / knock on effect further along food chain ;	3	MP4 I because there is less photosynthesis

Question	Answer	Marks	Guidance																				
5(c)	<p><i>any five from:</i></p> <ol style="list-style-type: none"> <li>1 screening / removal of, large pieces of waste ;</li> <li>2 flocculation / coagulation / clump suspended particles / AW ;</li> <li>3 settling of, (insoluble) particles ;</li> <li>4 digestion / decomposition by, (aerobic) bacteria / fungi / decomposers / microorganisms ;</li> <li>5 (with) aeration (tank) / trickle filter / <u>activated</u> sludge ;</li> <li>6 sludge treated with <u>anaerobic</u> decomposers / <u>anaerobic</u> digestion ;</li> <li>7 (water) treated with, chlorine / ozone / UV (light) ;</li> <li>8 distillation / collection of water from evaporator ;</li> </ol>	<b>5</b>	<p>MP3 <b>A</b> ref to sedimentation / (use of) settlement tank</p> <p>MP5 <b>A</b> with oxygen / description of a trickle filter</p> <p>MP7 <b>A</b> reverse osmosis / disinfect</p> <p>MP8 <b>A</b> use of carbon / charcoal, filters</p>																				
6(a)(i)	<table border="1" style="margin-left: auto; margin-right: auto;"> <tbody> <tr> <td style="padding: 2px;">go to 2</td> <td style="background-color: #cccccc; width: 30px;"></td> </tr> <tr> <td style="padding: 2px;">go to 4</td> <td style="background-color: #cccccc;"></td> </tr> <tr> <td style="padding: 2px;">go to 3</td> <td style="background-color: #cccccc;"></td> </tr> <tr> <td style="padding: 2px;"><i>Pyrus communis</i></td> <td style="text-align: center; font-weight: bold;">D</td> </tr> <tr> <td style="padding: 2px;"><i>Prunus domestica</i></td> <td style="text-align: center; font-weight: bold;">A</td> </tr> <tr> <td style="padding: 2px;"><i>Prunus salicina</i></td> <td style="text-align: center; font-weight: bold;">B</td> </tr> <tr> <td style="padding: 2px;">go to 5</td> <td style="background-color: #cccccc;"></td> </tr> <tr> <td style="padding: 2px;"><i>Punica granatum</i></td> <td style="text-align: center; font-weight: bold;">E</td> </tr> <tr> <td style="padding: 2px;"><i>Prunus amygdalus</i></td> <td style="text-align: center; font-weight: bold;">C</td> </tr> <tr> <td style="padding: 2px;"><i>Olea europaea</i></td> <td style="text-align: center; font-weight: bold;">F</td> </tr> </tbody> </table> <p style="text-align: right; margin-top: 10px;">⋮⋮⋮</p>	go to 2		go to 4		go to 3		<i>Pyrus communis</i>	D	<i>Prunus domestica</i>	A	<i>Prunus salicina</i>	B	go to 5		<i>Punica granatum</i>	E	<i>Prunus amygdalus</i>	C	<i>Olea europaea</i>	F	<b>4</b>	<p>6 correct = 4 marks  4 or 5 correct = 3 marks  2 or 3 correct = 2 marks  1 correct = 1 mark</p>
go to 2																							
go to 4																							
go to 3																							
<i>Pyrus communis</i>	D																						
<i>Prunus domestica</i>	A																						
<i>Prunus salicina</i>	B																						
go to 5																							
<i>Punica granatum</i>	E																						
<i>Prunus amygdalus</i>	C																						
<i>Olea europaea</i>	F																						

Question	Answer	Marks	Guidance
6(a)(ii)	<i>any four from:</i> nectary / nectar ; sticky / spiky / AW, pollen ; sticky stigma ; stigmas / style / carpel, within flower / AW ; anthers / stamens, within flower / AW ; colourful petals ; AVP ;	4	MP7 e.g. nectar guides (on petals) / robust stigma / robust style / landing site
6(b)	<i>features of flowering plants</i> <i>any one from:</i> pollen ; ovule(s) ; (named part of) seed ; fruit ; leaves ; <u>aerial</u> stems ; AVP ;	1	<i>accept parts of a fern for ora</i> <b>A</b> ferns have, spores / fronds / <u>underground</u> stems
6(c)	pectinase ;	1	