CAMBRIDGE
International Education

Cambridge IGCSE™

BIOLOGY **0610/42**

Paper 4 Theory (Extended) **May/June 2024**

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.

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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 descriptions 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.

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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.

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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

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Question	Answer	Marks	Guidance
1(a)(i)	aerobic respiration **;**	**1**	
1(a)(ii)	*any one from:* (composition of) cell wall OR cell walls (in plants) are made of cellulose / cell walls in fungi are made of chitin **;** (presence of) chloroplasts OR chlorophyll (in plants) **;** ora AVP ;	**1**	
1(b)	$C_6H_{12}O_6 \rightarrow 2C_2H_5OH + 2CO_2$ **;;**	**2**	MP1 for correct reactant MP2 for correct products
1(c)(i)	1.6 cm^3 per minute **;;;**	**3**	MP1 correct volumes read from Fig. 1.2 i.e. 11 cm^3 (at 10 minutes) **and** 19 cm^3 (at 15 minutes) MP2 correct calculation of rate MP3 correct units for rate
1(c)(ii)	*any one from:* to prevent oxygen entering (solution) / to keep it anaerobic **;** allow carbon dioxide to (still) escape **;**	**1**	
1(c)(iii)	(all) sugar / glucose / substrate, has been used up / broken down / run out / AW (by the yeast cells) **;**	**1**	**A** alcohol is toxic (to yeast)
1(c)(iv)	*any three from:* enzymes / active site, have denatured **;** enzyme / active site, has changed shape **;** (denatured) active site, does not fit / does not bind / is not complementary to, substrate **;** (denatured enzymes / dead yeast) cannot, respire (anaerobically) **;**	**3**	
1(d)	bread(-making) / to make dough rise / leavening (agent) / AVP **;**	**1**	
1(e)	methane / AVP **;**	**1**	

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Question	Answer	Marks	Guidance
2(a)	1 (groups of) receptor (cells / tissues) OR group of tissues, working together / to perform specific function **;** 2 detecting / sense / reacting / responding, (specific named) stimuli / (change in) surrounding OR transmits impulse to (sensory) neurone **;**	**2**	
2(b)(i)	label line and the letter X that touches the neurone coming from the brain to the eye **;**	**1**	
2(b)(ii)	*any three from:* 1 correct ref to neurotransmitter (molecules) **;** 2 (neurotransmitters) released from vesicles (from first or presynaptic neurone / into synaptic gap) **;** 3 (neurotransmitters) diffuse across (gap / cleft) **;** 4 (neurotransmitters) bind / fit / attach / receive to, receptor (proteins / molecules) / membrane proteins (on the next neurone) **;**	**3**	
2(b)(iii)	*total of four from:* 1 identify **E** as ciliary muscle and **K** as suspensory ligaments and **F** as lens **;** *max three from:* 2 ciliary muscle / **E**, contracts**;** 3 suspensory ligaments / **K**, slacken / loosen / AW **;** 4 lens / **F**, becomes more convex / AW **;** 5 more refraction **;** 6 light / image (of object), is focussed onto the, retina / fovea / **A** or **B** **;**	**4**	

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Question	Answer	Marks	Guidance
2(c)	*any four from:* *distribution:* 1 both (rods and cones) found in, retina / A **;** 2 (high concentration of / more) cones / no rods, are found in the fovea / **B ;** 3 no rods or cones, at blind spot / **C ;** *function:* 4 (rods / cones) are light receptors OR detect / respond / sensitive, to light OR convert light energy to, (nerve / electrical) impulse **;** 5 rods sense / detect / respond to, low light intensity / dim light / AW / give night vision **and** give, greyscale / black and white, image **;** 6 cones sense / detect / respond to, high light intensity / bright light / AW **and** detect colour / give colour vision / (different cones) absorb different wavelengths (of light) **;**	**4**	
2(d)(i)	allele **;**	**1**	
2(d)(ii)	X^aY **;**	**1**	

Question	Answer	Marks	Guidance
3(a)(i)	<table><tr><th>letter in Fig. 3.1</th><th>meiosis</th><th>mitosis</th></tr><tr><td>**P**</td><td>✓</td><td></td></tr><tr><td>**Q**</td><td></td><td>✓</td></tr><tr><td>**R**</td><td>✓</td><td></td></tr><tr><td>**S**</td><td></td><td>✓</td></tr><tr><td>**T**</td><td></td><td>✓</td></tr></table> ;;;	**3**	**R** rows with more than one tick 5 rows correct = 3 marks 3 rows or 4 rows correct = 2 marks 2 rows correct = 1 mark 1 row or no rows correct = 0 marks
3(a)(ii)	fertilisation **;**	**1**	
3(a)(iii)	1 unspecialised / undifferentiated **;** 2 mitosis **;** 3 specialised / differentiated **;** 4 expressed / AW **;** 5 protein(s) / (poly)peptide(s) **;**	**5**	
3(b)	*any two from:* 1 meiosis / **P** / haploid stage **;** 2 formation of, gametes / egg / sperm **;** 3 process **W** / fertilisation / fusion of nuclei (of gametes) OR zygote / embryo, formed **;**	**2**	

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Question	Answer	Marks	Guidance
4(a)	magnesium (ions) / AVP **;**	**1**	
4(b)(i)	*any four from:* 1 (algae) photosynthesise in light / no photosynthesis in the dark **;** 2 carbon dioxide is, used / absorbed / taken / AW, in photosynthesis **;** 3 (purple because CO_2 used in) photosynthesis results in, pH increase / becomes (more) alkaline / less acidic **;** 4 (algae) respire in light and dark **;** 5 carbon dioxide is, produced / released / AW, in respiration **;** 6 in light there is a higher (rate of) photosynthesis than (the rate of) respiration **;** 7 (yellow because CO_2 given off from) respiration results in, pH decrease / more acidic / less alkaline / becomes (nearer to) neutral **;**	**4**	
4(b)(ii)	*total of three from:* *X:* light (intensity) **;** *Y max two from:* temperature **;** carbon dioxide concentration **;** (amount of) chlorophyll / (number of) chloroplasts **;** water **;**	**3**	
4(c)(i)	*tissue:* phloem **;** *molecule:* amino acids **;**	**2**	

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Question	Answer	Marks	Guidance
4(c)(ii)	*any six from:* 1 (starch is broken down by) physical / mechanical, digestion **;** 2 (physical digestion / AW) uses teeth / occurs in the, mouth / (involves churning) in stomach **;** 3 (physical digestion) increases surface area (for faster enzyme activity) **;** 4 chemical digestion / break down (of insoluble molecules) into (smaller) soluble molecules (by enzymes) **;** 5 salivary glands / pancreas, secrete / make, amylase **;** 6 amylase (breaks down) starch to maltose **;** 7 maltase is found on epithelium (lining) of, small intestine / duodenum / ileum **;** 8 (maltase) breaks down maltose to glucose **;** 9 (optimum) pH for, amylase / maltase / carbohydrase is, neutral / 7 / 8 **;**	**6**	

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>5(a)</td><td>any one from:
fur / hair ;
external ears / pinna(e) ;</td><td>1</td><td></td></tr>
<tr><td>5(b)</td><td>any three from:
1 allows genetic, variation / diversity ;
2 (allows expression of) different combinations, alleles / DNA / mutations (from parents) ;
3 allows adaptation / evolution / natural selection, in response to, changing / new / different / unpredictable, environment / conditions / AW ;
4 example of environment factor where adaptation would be an advantage ;

5 reduces chances of extinction / increases chance of survival ;</td><td>3</td><td>MP1 A genetically different offspring / variety of genotypes
MP2 A allows different recessive alleles to be expressed / AW
MP3 A allows new areas to be inhabited /AW OR allow better / more, adaptation / fitness, to (same) environment

MP4 A adaptation to, new / different / changing, diet / climate / competition / (infectious) diseases / predators / pollutant etc.</td></tr>
<tr><td>5(c)</td><td><table><tr><th>function</th><th>letter from Fig. 5.2</th><th>name</th></tr><tr><td>dilates in the process of birth / AW / AVP</td><td>M</td><td>cervix</td></tr><tr><td>release / production, of oestrogen / egg / ovum / ova / (female) gametes / AVP</td><td>L</td><td>ovary</td></tr><tr><td>site of fertilisation</td><td>J</td><td>oviduct</td></tr><tr><td>site of implantation</td><td>P</td><td>uterus (lining)</td></tr></table>;;;;</td><td>4</td><td>one mark for each correct row</td></tr>
</table>

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Question	Answer	Marks	Guidance
5(d)(i)	*any four from:* 1 gas exchange / oxygen transfers to fetus / oxygen transfers from mother / carbon dioxide transfers to mother / carbon dioxide transfers from fetus **;** 2 transfers of (dissolved) nutrients, from maternal / to fetal (circulation)**;** 3 transfer of excretory products, from fetal / to maternal (circulation) **;** 4 (transfer of nutrients / excretory products) by diffusion **;** 5 (placenta) produces / secretes, (named) hormone **;** 6 transfer of antibodies, from maternal / to fetal (circulation) OR passive immunity provided (to fetus) **;** 7 (placenta) separates fetal and maternal blood supply **;** ora 8 AVP **;**	**4**	
5(d)(ii)	*any two from:* 1 provides support to fetus **;** 2 protect fetus from (mechanical) shock **;** 3 maintains temperature (of fetus) / AW **;** 4 allows movement (of fetus) / allows for development of bones and muscles / lubricant **;** 5 maintains osmotic balance / prevents dehydration **;** 6 ref. to swallowing of (amniotic) fluid / involved in digestive tract development / involved in lung development **;** 7 provides sterile environment **;**	**2**	

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Question	Answer	Marks	Guidance
6(a)	ingestion **;** incisors **;** molars **and** premolars **;** chewing / grinding / crushing / mashing / masticating **;**	**4**	MP3 either order
6(b)(i)	one label line and label that identifies a capillary **and** one label line and label that identifies the lacteal **;**	**1**	
6(b)(ii)	small intestine **;**	**1**	
6(b)(iii)	absorption / transport of, fatty acids / glycerol / fat / lipids **;**	**1**	
6(c)	*any two from:* 1 (amino acids / products of protein digestion) move in(to) capillaries (in villi / Fig. 6.1) **;** 2 (amino acids / products of protein digestion) are carried in (blood) plasma **;** 3 (amino acids / products of protein digestion travel to the) hepatic portal vein **;**	**2**	

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