CAMBRIDGE
International Education

Cambridge IGCSE™

BIOLOGY **0610/43**

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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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 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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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1(a)</td><td>
<table>
<tr><th>label in Fig. 1.1</th><th>name</th><th>function</th></tr>
<tr><td>A</td><td>nucleus</td><td>stores genetic information / contains DNA / controls (activity of) the cell</td></tr>
<tr><td>B</td><td>cytoplasm</td><td>where (metabolic / chemical) reactions take place</td></tr>
<tr><td>C</td><td>cell membrane</td><td>controls what goes into and out of the cell</td></tr>
<tr><td>D</td><td>mitochondria</td><td>aerobic respiration / provide energy
using oxygen / produce ATP
using oxygen / release energy using oxygen</td></tr>
</table>
;;;;
</td><td>4</td><td>one mark per correct row

ecf if no correct functions given but all names are correct award 1 mark</td></tr>
<tr><td>1(b)(i)</td><td>any three from:
by osmosis ;
from high(er) water potential to low(er) water potential / down a water potential gradient ;
through a partially permeable membrane ;
ref. to, kinetic energy / random motion of molecules ;</td><td>3</td><td></td></tr>
<tr><td>1(b)(ii)</td><td>in this order vertically:
(blood) plasma
(a very concentrated) salt solution
(pure) water
;;</td><td>2</td><td>three correct = 2 marks
one or two correct = 1 mark</td></tr>
<tr><td>1(b)(iii)</td><td>haemoglobin ;</td><td>1</td><td></td></tr>
<tr><td>1(b)(iv)</td><td>phagocyte ;</td><td>1</td><td></td></tr>
</table>

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Question	Answer	Marks	Guidance
2(a)(i)	*any one from:* strap-shaped / narrow / AW, leaves **;** parallel / not branched, veins **;**	**1**	
2(a)(ii)	*any four from:* *advantages* 1 fast **;** 2 no need for, pollination / pollinators **;** 3 no need for, pollen / gametes / fertilisation **;** 4 offspring adapted to parent's environment **;** *disadvantages* 5 no / low, (genetic) variation **;** 6 more susceptible to (named) environmental change **;** 7 more susceptible to a new disease OR disease spreads fast through a population **;** 8 offspring are, very close / in competition **;** 9 AVP **;**	**4**	**A** only one parent plant / no mate, needed **A** no genetic variation is an advantage in a stable environment e.g. climate change e.g. less energy needed
2(b)(i)	increases the chance of reaching a, stigma / plant / AW **;**	**1**	**A** more chance of, reproduction / pollination **A** most will be, blown way / lost / AW
2(b)(ii)	large / long / feathery / (hanging) outside the flower **;**	**1**	
2(c)	the transfer of pollen grains from the anther to the stigma **;** on a different plant of the same species **;**	**2**	

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Question	Answer	Marks	Guidance
2(d)	*any four from:* 1 pollen tube growing from a pollen grain ; 2 pollen (tube / grain) releases enzymes ; 3 (pollen tube) grows down style / grows into ovary ; 4 pollen / male, nucleus travels down the pollen tube ; 5 pollen tube grows / pollen nucleus *or* male nucleus moves, through the micropyle / (in)to the ovule ; 6 fertilisation occurs ; 7 pollen / male, nucleus fuses with female nucleus ; 8 zygote formed ; 9 AVP ;	**4**	e.g. ref. to mitosis

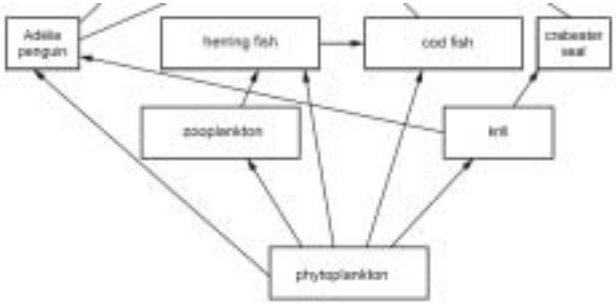
Question	Answer	Marks	Guidance
3(a)	*any six from:* messenger RNA (mRNA) is a copy of, a gene / DNA ; mRNA is made in the nucleus ; the gene (coding for the protein) / DNA, remains in the nucleus ; mRNA moves to the, cytoplasm / ribosome ; mRNA passes through ribosomes ; the ribosome assembles amino acids into, polypeptide / protein ; the (specific) sequence of amino acids is determined by the sequence of bases in mRNA ; AVP ;	**6**	e.g. DNA unwinds
3(b)(i)	*any two from:* (molecule) **D** has a similar shape to (substrate) **A** ; shape of (molecule) **D** is complementary to the active site ; (molecule) **D**, binds to / fits, the active site ; reduces / prevents, (substrate) **A** binding to enzyme ; idea of (substrate) **A** cannot be broken down / less substrate **A** is broken down ;	**2**	
3(b)(ii)	increased temperature ; (increased / decreased / extreme) pH ;	**2**	

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Question	Answer	Marks	Guidance
4(a)	*any two from:* through mutation **;** (mutation is) a change in the base sequence of DNA **;** (mutation is) caused by, ionising radiation / chemicals **;**	**2**	
4(b)(i)	*any three from:* selection of individual plants which, flower in fewer hours of daylight / show the desirable feature **;** crossing these individuals to produce the next generation **;** selection of offspring that show the desirable feature **;** repeat for (many) <u>generations</u> **;** AVP **;**	**3**	e.g. place bag over the plant to prevent unwanted pollination / pollinate with a paintbrush / relevant description of method
4(b)(ii)	*any two from:* water **;** oxygen **;** a suitable temperature **;**	**2**	
4(b)(iii)	*any three from:* *in natural selection* selection pressure / AW, comes from the environment **;** better adapted individuals (survive and) reproduce **;** (always) produces characteristics suitable for the (new) environment **;** slower **;** affects many characteristics **;**	**3**	

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Question	Answer	Marks	Guidance
4(c)	*any two from:* less pesticides used ; less contamination of food with pesticides ; less pollution / described ; less damage to / higher yield of / higher quality of, crop ; less risk to pollinators / non target species ; improve health of farm workers ; less spread of plant disease ; increases biodiversity ;	**2**	

Question	Answer	Marks	Guidance
5(a)	$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$;;	**2**	MP1 for correct reactants MP2 for correct products
5(b)(i)	phytoplankton and zooplankton in the correct positions ; herring (fish) and cod (fish) in the correct positions ;	**2**	
5(b)(ii)	the Sun / sunlight ;	**1**	

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>5(b)(iii)</td><td>
<table>
<tr><th>feature of the food web</th><th>maximum number in the food web in Fig. 5.2</th></tr>
<tr><td>trophic levels</td><td>6 ;</td></tr>
<tr><td>primary consumers</td><td>5 ;</td></tr>
<tr><td>tertiary consumers</td><td>3 ;</td></tr>
</table>
</td><td>3</td><td></td></tr>
<tr><td>5(b)(iv)</td><td>krill:
decrease (in population size) as more predation (by crabeater seal / Adélie penguin) ;

leopard seal:
increase (in population size) as less predation (by orca) ;</td><td>2</td><td></td></tr>
<tr><td>5(c)(i)</td><td>carbon, hydrogen and oxygen ;</td><td>1</td><td></td></tr>
<tr><td>5(c)(ii)</td><td>1 energy is lost at each trophic level / AW ;

2 & 3 (energy lost through)
metabolism / excretion / movement / faeces / indigestible parts / active transport / thermoregulation ;;

4 krill is at a <u>lower</u> trophic level than seals ; ora</td><td>4</td><td>A krill is on the 2nd trophic level and seals are on 3rd / 4th / 5th trophic level
A in terms of primary / secondary / tertiary / quaternary consumers</td></tr>
</table>

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Question	Answer	Marks	Guidance
5(d)	*any four from:* physical / mechanical digestion ; emulsified by bile (in the small intestine) ; increase the surface area of fats (for enzymes) ; (fats digested by) lipase ; (lipase) secreted / produced, by pancreas ; (lipase) breaks fat down into glycerol and fatty acids ; absorbed by, lacteals / (micro)villi ; (absorbed) in small intestine ;	**4**	

Question	Answer	Marks	Guidance
6(a)	*Anaxyrus* ;	**1**	
6(b)	*any two from*: climate change / global warming ; habitat destruction / deforestation ; hunting ; pollution ; introduced species ; overharvesting ; AVP ;	**2**	e.g. disruption of food chain / increase in predation / decrease in food supply / increased competition for resources
6(c)(i)	62 (%) ;;;	**3**	MP1 correct selection of data i.e. 13 MP2 correct calculation to any number of significant figures MP3 rounding to two significant figures ecf from previous step if evidenced in working

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Question	Answer	Marks	Guidance
6(c)(ii)	*any two from*: bacterial treatment reduces the number of toads with fungal infection **;** there is no effect of treatment in 0 to 20 / (first) 40 days **;** bacteria treatment reduces fungal infections from, 40 to 100 / 60 to 100 days **;** suitable comparative data quote **;**	**2**	
6(d)(i)	*any three from*: maintaining / increasing, biodiversity **;** reducing extinction / increase population size / repopulate **;** maintaining food, webs / chains **;** maintaining source of future, food / drugs / genes **;** protecting vulnerable, ecosystem / habitat **;** ref. to effects on nutrient cycles **;** AVP **;**	**3**	e.g. idea of protecting keystone species / research / monitoring / education / moral responsibility / aesthetic reasons / ecotourism
6(d)(ii)	*any four from:* collect, sperm / gamete / semen (from male) **;** males can be chosen from different breeding programmes **;** to maximise genetic variation **;** sperm, screened / quality checked / AW **;** sperm / semen, frozen **;** (female) given drugs to induce ovulation **;** sperm / semen, placed in, vagina / uterus / oviduct **;** sperm / semen, inserted at appropriate time for ovulation **;**	**4**	**A** cloaca

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