CAMBRIDGE
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BIOLOGY **0610/43**

Paper 4 Theory (Extended) **October/November 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)	liver labelled **A ;** gall bladder labelled **B ;**	**2**	
1(a)(ii)	the breakdown of food into (smaller) pieces **;** without chemical change to the food molecules **;**	**2**	
1(a)(iii)	mouth **;** stomach **;** small intestine / duodenum **;**	**2**	
1(b)(i)	small intestine / duodenum **;** emulsification **;** chemical **;** lipase **;**	**4**	
1(b)(ii)	fatty acids and glycerol **;**	**1**	
1(c)	(bile) is alkaline and so neutralises the mixture (from the stomach) / (bile) neutralises the (named) acidic mixture (from the stomach) **;** provides, optimum / suitable, pH (for trypsin activity) **;**	**2**	

Question	Answer	Marks	Guidance
2(a)(i)	*any two from:* three pairs of legs **;** three (named) body, parts / segments **;** one pair of antennae **;**	**2**	
2(a)(ii)	**M ;**	**1**	
2(a)(iii)	amino acids and sucrose **;**	**1**	

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Question	Answer	Marks	Guidance
2(b)	134(%) **;;;**	**3**	MP1 correct selection of data MP2 correct calculation to any number of significant figures MP3 correct rounding to three significant figures ecf from previous step
2(c)(i)	*any four from:* *in spring* the (growing) shoot is the sink <u>and</u> the, tuber / potato, is the source **;** glucose / sucrose needed for, respiration / growth **or** amino acids / protein, for growth **;** *in summer* the <u>leaves</u> are the source <u>and</u> the, tuber / potato, is the sink **;** <u>leaves</u> photosynthesise to, produce glucose / starch **or** <u>leaves</u> photosynthesise to transfer (light) energy (to chemical energy) **;** *general:* (correctly named) sources are part of the plants that release sucrose / glucose / amino acids **;** (correctly named) sinks, use / store, sucrose / glucose / amino acids / starch / protein **;** the source and sink are different in spring and summer **;**	**4**	
2(c)(ii)	asexual **;**	**1**	

Question	Answer	Marks	Guidance
3(a)	*any two from:* (mother) takes HIV medication **;** reduce / do not, breastfeed **;** C(aesarean) section / AW **;** correct description of how a mother could avoid getting HIV, during pregnancy / while breastfeeding **;** AVP **;** e.g. testing or screening of pregnant mothers for HIV	**2**	
3(b)(i)	*any two from:* (breastfeeding) reduces the chance of a, gastroenteritis / bronchitis infection / ora **;** (breastfeeding) does not change / causes a (small) change in the chance of, influenza / conjunctivitis / bronchitis, infection **;** similar / less, (total) chance of infections in breastfed infants than in not breastfed infants / ora **;** suitable data manipulation **;**	**2**	
3(b)(ii)	white blood cell / phagocyte / lymphocyte **;**	**1**	
3(b)(iii)	*any four from:* (passive immunity) involves antibodies that are acquired from, another individual / outside the body **;** (antibodies pass from mother to infant) when breastfeeding / AW **;** (antibodies pass from mother to, fetus / infant) across the placenta **;** infants need regular antibodies from the mother to maintain passive immunity **;** infants need different antibodies to gain passive immunity to different pathogens / infants only get passive immunity to the specific pathogen for which the mother has antibodies **;** AVP **;** e.g. <u>antibodies</u> / (anti)serum, given (by injection)	**4**	

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Question	Answer	Marks	Guidance
3(b)(iv)	*any three from:* *ref. to* active immunity **;** *idea that* person makes their own antibodies **;** exposure to, antigen / weakened pathogen, stimulates (immune) response **;** memory cells are produced **;** long lasting / long-term (immunity) / ora **;** active immunity is not immediate / slower response than passive immunity / ora **;**	**3**	

Question	Answer	Marks	Guidance
4(a)(i)	glucose → lactic acid **;**	**1**	
4(a)(ii)	*any three from:* anaerobic respiration occurs without oxygen / ora **;** anaerobic respiration releases less energy (per glucose molecule) / ora **;** anaerobic respiration produces lactic acid whereas aerobic produces carbon dioxide and water **;** anaerobic respiration does not occur in the mitochondria / ora **;** both types of respiration use glucose **;**	**3**	
4(b)(i)	*stimulus:* increased / concentration, of carbon dioxide **;** *organ:* brain **;**	**2**	
4(b)(ii)	0.5(33 333) (beats per minute per second) **;**	**2**	MP1 correct readings from graph of 180±2 and 108±2 MP2 correct calculation and answer from their readings ecf for MP2 from wrong readings

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Question	Answer	Marks	Guidance
4(b)(iii)	*any six from:* heart rate and breathing rate, peaked / at highest level, (immediately) as the race ends / at 60 s / AW **;** only aerobic respiration occurs / anaerobic respiration no longer required (after race / from 60 s) / ora **;** less muscle contraction (than during race) / ora **;** less energy required (than during race) / ora **;** decreased need for (delivery of), oxygen / glucose **or** removal of (less) carbon dioxide, from blood / to muscle (cells) / ora **;** no more / less, adrenaline is released (after race / from 60 s) / ora **;** heart rate returns to, resting rate / pre-race level (during the 6 minutes / by 420 s / end) **;** not enough oxygen was supplied (to muscles) during race **;** (resulted in) oxygen debt **;** lactic acid (had been) produced / accumulated, in muscle / blood **;** lactic acid, (aerobically) respired / converted to glucose **;** (lactic acid) broken down / removed, in the liver **;** (removal of lactic acid) requires (extra) oxygen **;** (therefore) breathing rate, stays high for short time after race / not yet returned to, resting rate / pre-race level (during the 6 minutes / by 420 s / end) **;**	**6**	

Question	Answer	Marks	Guidance
5(a)	discontinuous **;**	**1**	
5(b)	*chicken 2* – **F^BF^B** and **F^BF^W** **;** *chicken 7* – **F^WF^W** <u>and</u> **F^BF^W** <u>and</u> **F^BF^B** **;**	**2**	

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Question	Answer	Marks	Guidance
5(c)	*phenotypes: (**5**)*(male) black and white (feathers) × *(**6**)(*female) black (feathers) **;** *parental genotypes:* F^BF^W × F^BF^B **;** *gametes:* F^B , F^W F^B , F^B **;** *offspring genotypes:* F^BF^W, (F^BF^W) and F^BF^B, (F^BF^B) **;** *offspring phenotype percentage:* 50(%) black and white and 50(%) black **;**	**5**	ecf from previous step
5(d)	(ABO) blood group / AVP **;**	**1**	

Question	Answer	Marks	Guidance
6(a)(i)	transmission of genetic information **;** from generation to generation **;**	**2**	
6(a)(ii)	*any four from:* involves platelets **;** fibrinogen converted to fibrin **;** (fibrinogen is) soluble to insoluble (fibrin) / fibrin is insoluble **;** (fibrin) forms a, mesh AW **;** traps blood cells **;** AVP**;**	**4**	
6(b)(i)	**A**: restriction enzyme **;** **B**: (DNA) ligase **;**	**2**	
6(b)(ii)	forms sticky ends **;** (sticky) ends will be complementary **;**	**2**	
6(b)(iii)	recombinant plasmid **;**	**1**	
6(b)(iv)	ensure even / uniform, distribution (of contents / AW) **;**	**1**	

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Question	Answer	Marks	Guidance
6(b)(v)	*any two from:* presence of plasmids **;** few / no, ethical concerns (in use of bacteria) **;** rapid reproduction rate **;** reproduce asexually / offspring are genetically identical **;** small / do not need much space **;** simple requirements to, grow / keep / AW **;** same, genetic code / AW, as other organisms **;** AVP **;**	**2**	
6(b)(vi)	*animal cells have* a nucleus **;** mitochondria **;** linear DNA **;** no cell wall **;** no plasmids **;** AVP **;**	**2**	

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Question	Answer	Marks	Guidance
6(c)	*total of four from:* *max **three** advantages from:* increased, yield / quantity **;** increased nutritional, quality / content **;** reduced use of fertiliser **;** decrease damage from pests **;** resistance to (insect) pests / (crops) produce insecticide / reduced use of insecticides **;** resistance to, herbicides **;** resistance to disease **;** resistance to, salinity / cold / drought / AW **;** *max **three** disadvantages from:* (genetically modified) seeds / plants, cost more (to farmer / consumer) **;** (genetically modified) seeds, are sterile / need to be bought for each new crop **;** (modified) genes may transfer into other (nearby) plants by cross pollination / AW **;** ethical / religious, concerns about altering natural genomes / of consumers **;** disruption of food chain by pest losing food source **;** reduced genetic variability (of the crop) / (crop) less able to adapt to a change in the environment **;**	**4**	

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