



Cambridge O Level

BIOLOGY

5090/02

Paper 2 Theory

For examination from 2023

MARK SCHEME

Maximum Mark: 80

Specimen

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, unless 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. $a \times 10^n$) 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.</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 marking points
- /** alternatives
- ()** contents of brackets are not required but should be implied
- R** reject
- A** accept (for answers correctly cued by the question, or guidance for examiners)
- Ig** ignore (for incorrect but irrelevant responses)
- AW** alternative wording (where responses vary more than usual)
- AVP** alternative valid point (where a greater than usual variety of responses is expected)
- ORA** or reverse argument
- underline** actual word underlined must be used by candidate
- +** statements on both sides of the + are needed for that mark

Question	Answer	Marks
1(a)	<p>(Fig. 1.2) (name of enzyme) amylase ; (where enzyme acts) mouth / small intestine / duodenum ;</p> <p>(Fig. 1.3) (where enzyme acts) small intestine / duodenum ; (substrate) fat / lipid / oil ; (end products) fatty acid(s) ; glycerol ;</p>	6
1(b)	<p>reference to absorption ; reference to diffusion ; villi ; capillary ; blood / plasma ; reference to hepatic portal vein ;</p> <p>max. 4</p>	4
Question	Answer	Marks
2(a)(i)	<p>no fertiliser + yield is 800 (kg / 10 000 m² crop yield) ; increased / more crop yield ; reference to 150 (kg / 10 000 m² fertiliser) OR 5600 (kg / 10 000 m² crop yield) ; high fertiliser / above 150 + no increase in crop yield ;</p> <p>max. 3</p>	3

Question	Answer	Marks
2(a)(ii)	<p>root hair ; active transport / against concentration gradient or diffusion / down concentration gradient ; production AW of + amino acids / protein; increased AW + growth ; max. 3</p>	3
2(a)(iii)	<p>run-off / leaching AW ; eutrophication or correct description of process ; harm to animals ; high cost / expensive ; possible economic return not beneficial over increased cost AW ; max. 3</p>	3
2(b)	<p>(ion) magnesium ; (importance) chlorophyll / reference to light energy / photosynthesis ;</p>	2

Question	Answer	Marks
3(a)	<p>two strands ; double helix ; nucleotides ; A + T + G + C ; base + pairs ; bonds between bases ; bases always pair up the same way ; max. 4</p>	4

Question	Answer	Marks
3(b)(i)	$I^B I^O + I^A I^O$; $I^B + I^O + I^A + I^O$; $I^A I^B + I^B I^O + I^A I^O + I^O I^O$; AB + B + A + O ;	4
3(b)(ii)	(same sex) 50% / half / $\frac{1}{2}$ / 0.5 / 2 in 4 / 1 in 2 / 1:1 ; (same blood group) 25% / quarter / $\frac{1}{4}$ / 0.25 / 1 in 4 / 1:3 ;	2

Question	Answer	Marks
4(a)(i)	3 ;	1
4(a)(ii)	some may not germinate / some may not produce a pollen tube ; to enable valid comparison ; max. 1	1
4(a)(iii)	8 ;	1
4(a)(iv)	highest AW + % / number ; highest AW + length OR longest ;	2
4(a)(v)	water potential ; less / no + water enters OR water leaves ; osmosis / diffusion ;	3

Question	Answer	Marks
4(b)	<p><u>stigma</u> ; <u>style</u> ; ovary / ovule / ovum / embryo sac / female gamete ; movement of AW + male gamete / male nucleus / pollen nucleus ; fertilisation / fusion of gametes ;</p> <p>max. 4</p>	4

Question	Answer	Marks
5(a)	<p>glucose + required for both ; complete or incomplete breakdown (of glucose) ; reference to oxygen requirement ; amount of energy released ;</p> <p>A each point only if linked to either 'aerobic' or 'anaerobic' respiration</p> <p>max. 3</p>	3
5(b)	<p>glucose + required for both ; reference to oxygen debt AW ; lactic acid ; carbon dioxide ; alcohol / ethanol ;</p> <p>A each point only if linked to either 'muscles' or 'yeast'</p> <p>max. 3</p>	3

Question	Answer	Marks
5(c)	<p>(similarities) require light ; occur in plants ;</p> <p>(differences) (photosynthesis) chlorophyll ; produces AW + carbohydrate / sugar / glucose ; (phototropism) auxin ; growth + towards light / away from light ;</p> <p>A each point only if linked to the correct named process or processes</p> <p>max. 4</p>	4

Question	Answer	Marks
6	<p>(sexual only) H ; I ; J ;</p> <p>(asexual only) (E) G ; K ;</p> <p>(both) F ;</p>	6

Question	Answer	Marks
7(a)	hair / fur ; warm-blooded ; four-chambered heart ; diaphragm ; mammary glands / young fed on milk ; single-boned lower jaw ; one time tooth replacement ; three bones in middle ear ; max. 2	2
7(b)	<u>(Homo) genus</u> ; <u>(sapiens) species</u> ;	2
7(c)	<u>protein coat</u> ; genetic material / DNA / RNA ;	2
7(d)(i)	lymphocyte ; <u>active + immunity / immune response</u> ; <u>detects AW + antigens</u> ; reference to antigens on pathogen ; antibodies bind to pathogen ; (antibody binding leads to) phagocytosis / destruction of pathogen ; reference to shape of antigen / specificity / complementarity ; max. 4	4
7(d)(ii)	<u>vaccination</u> ; inject AW + weakened pathogens / antigens of pathogen ; max. 1	1

Question	Answer	Marks
8(a)	parameter / condition e.g. temperature ; change from set point / norm AW ; detected ; reference to communication or named method (e.g. nerve / impulse / hormone) ; reference to control centre / coordinator / hypothalamus / brain ; response / corrective mechanism(s) ; reversal / correction of initial change / return to set point or norm ; max. 4	4
8(b)	any two from nerve ending / blood vessels / sweat gland / hair ; ; max. 2 <i>(nerve ending)</i> detects / receptor ; change / increase in temperature ; impulse / (message) to brain ; <i>(blood vessels)</i> dilate ; more blood to surface of skin ; reference to capillaries ; reference to increased radiation / heat loss ; <i>(sweat gland / duct)</i> secretion / release / skin surface + sweat ; reference to evaporation ; <i>(hair)</i> lowers ; less air trapped / loss of insulation ; max. 2 from each section only if linked to correct component	2
		4

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