Cambridge Assessment International Education

# Cambridge IGCSE™

**BIOLOGY** **0610/41**

Paper 4 Theory (Extended) **May/June 2021**

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 May/June 2021 series for most Cambridge IGCSE™, Cambridge International A and AS Level components and some Cambridge O Level components.



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**[Turn over**

**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.

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|---|
| GENERIC MARKING PRINCIPLE 5:<br><br>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:<br><br>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 | <u>'List rule' guidance</u><br><br>For questions that require ***n*** responses (e.g. State **two** reasons …):<br><br>• The response should be read as continuous prose, even when numbered answer spaces are provided.<br>• Any response marked *ignore* in the mark scheme should not count towards ***n***.<br>• Incorrect responses should not be awarded credit but will still count towards ***n***.<br>• 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.<br>• 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.

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1(a)(i)</td><td>prokaryote / plant ;</td><td>1</td><td></td></tr>
<tr><td>1(a)(ii)</td><td>
<table>
<tr><th>cell function</th><th>cell structure</th><th>letter from Fig. 1.1</th><th></th></tr>
<tr><td>storage of genes</td><td>nucleus</td><td>G</td><td>;</td></tr>
<tr><td>aerobic respiration</td><td>mitochondria</td><td>E</td><td>;</td></tr>
<tr><td>amino acids are assembled to make protein</td><td>ribosome(s)<br>OR<br>(rough) endoplasmic reticulum / (R)ER</td><td>H / F<br><br>F</td><td>;</td></tr>
</table>
</td><td>3</td><td>one mark per row</td></tr>
<tr><td>1(b)(i)</td><td>0.002 (mm) ;</td><td>1</td><td></td></tr>
<tr><td>1(b)(ii)</td><td>length of, drawing / image / Fig. 1.2 (in mm) ;</td><td>1</td><td></td></tr>
</table>

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<table>
<tr><th>Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>1(c)</td><td>
total of six from:<br><br>
similarities, max four from:<br>
single cell / unicellular / AW ;<br>
(cell) wall / A ;<br>
cytoplasm / D ;<br>
ribosomes / H ;<br>
cell membrane / B ;<br>
DNA / genetic material ;<br><br>
differences, max four from: ;;;;
<table>
<tr><th>(bacteria have)</th><th>(yeast have)</th></tr>
<tr><td>no nucleus / no G / has nucleoid</td><td>nucleus / G</td></tr>
<tr><td>loop / coil / AW, of DNA</td><td>linear DNA / chromosome</td></tr>
<tr><td>no, (rough) endoplasmic reticulum / ER</td><td>(rough) endoplasmic reticulum</td></tr>
<tr><td>no mitochondria / no E</td><td>mitochondria / E</td></tr>
<tr><td>no (large / permanent) vacuole / no C</td><td>(large / permanent) vacuole / C</td></tr>
<tr><td>plasmid(s)</td><td>no plasmids</td></tr>
<tr><td>no membrane-bound, cell structures / organelles</td><td>membrane-bound, cell structures / organelles</td></tr>
</table>
</td><td>6</td><td></td></tr>
</table>

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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 1(d) | 1 = nitrogen fixation ;<br>2 = deamination ;<br>3 = nitrification ; | **3** | |

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 2(a) | *any four from:*<br>quantity of plastic waste always higher **inside** GPGP than outside it ; **ora**<br>quantity inside GPGP constant (from 1965) to, any year 1975 to 1994 ;<br>quantity increases in GPGP, steeply ;<br>smaller (overall) increase **outside** the GPGP ; **ora**<br>quantity of plastic waste outside the GPGP, fluctuates / AW ;<br>comparative data quote with years and unit ; | **4** | |
| 2(b)(i) | *any one from:*<br>leathery / hard / scaly, skin ;<br>hard(er) / rubbery / leathery / AW, eggs ;<br>lay eggs on land (not in water) ;<br>internal fertilisation ; | **1** | |

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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 2(b)(ii) | *any four from:*<br><br>*direct effects*<br>(non-biodegradable plastic) does not break down ;<br>*idea that* ability to breathe affected ;<br>*idea that* ability to move affected ;<br>*idea that* ability to gain nutrition affected ;<br>damage / injury / infection / death ;<br>toxic / poisonous ;<br><br>*indirect effects*<br>blocks (sun)light, so algae / plants / producers, cannot photosynthesise ;<br>(so) less, food / energy, enters, food chains / food webs ;<br>loss of (named), habitat / feeding / breeding area ;<br>more likely to be predated ;<br>*idea that* (plastic) accumulates up the food chain / bioaccumulation ;<br><br>AVP ; | **4** | |
| 2(b)(iii) | *any two from:*<br>use (named) alternatives for plastic ;<br>reduce, use of / manufacture, single-use plastic ;<br>use biodegradable plastics instead of non-biodegradable plastics ;<br>reduce unnecessary packaging ;<br>reuse plastic product(s) ;<br>recycle / described ;<br>education / awareness campaigns ;<br>AVP ; e.g. idea of fines / punishment, for unregulated disposal of plastic waste / legislation / taxation / charging for using plastic / money-back schemes / quotas *or* limits for production / international treaties | **2** | |

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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 3(a) | *any three from:*<br>(small so do) not need much space **;**<br>rapid reproduction rate / AW **;**<br>can make complex molecule(s) **;**<br>no ethical concerns over use **;**<br>*idea that* genetic code is universal **;**<br>they have plasmids **;**<br>*idea that* plasmids are used, as vectors / in genetic engineering **;**<br>simple requirements / AW, so, easy / cheap, to grow **;**<br>AVP **;** | **3** | |
| 3(b)(i) | pancreas **;** | **1** | |
| 3(b)(ii) | (type 1) diabetes **;** | **1** | |
| 3(b)(iii) | reduces blood sugar concentration **;** | **1** | |
| 3(c)(i) | 1 *y*-axis = number / population, of (living) bacteria per (1.0) $mm^3$<br>**and**<br>2 *x*-axis = time / hours / days **;** | **1** | |
| 3(c)(ii) | **P** – lag<br>**Q** – exponential / log<br>**R** – stationary<br>**S** – death / decline<br>**;;** | **2** | four correct = 2 marks<br>two or three correct = 1 mark<br>one correct = 0 |
| 3(c)(iii) | *any three from:*<br>limiting factor(s) / factors that limit **;**<br>not enough space / overpopulation **;**<br>competition **;**<br>fewer / no, (named) nutrient(s) / food **;**<br>not enough oxygen **;**<br>change in pH / increase in acidity **;**<br>increase in temperature **;**<br>build-up of, (named) toxic / waste, substances **;** | **3** | |

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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 3(d) | *total of three from:*<br><br>*importance of iron to max 2*<br>to make / for, haemoglobin ;<br>to make / for, red blood cells ;<br>for transport of oxygen ;<br>AVP ;<br><br>*effects of iron deficiency*<br>(iron-deficiency) anaemia ;<br>any symptom of anaemia ; | **3** | |
| 3(e)(i) | restriction (enzyme) ; | **1** | |
| 3(e)(ii) | *any two from:*<br>use same (restriction) enzyme to cut cassava DNA ;<br>sticky ends are, formed / joined ;<br>ref. to complementary, ends / base pairs ;<br>(joined by) ligase ; | **2** | |
| 3(e)(iii) | *any two from:*<br>*idea that* need to check that offspring inherit 'new' gene / trait ;<br>ensure new (GM) variety can grow in field conditions / AW ;<br>make sure the 'new' gene does not cause any adverse effects ;<br>make sure (GM) plants have, the same / a high enough, yield ;<br>*idea of* building up a large quantity of, seed / plants, to sell to farmers ;<br>AVP ; | **2** | |

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 4(a) | gravitropism ; | **1** | |
| 4(b) | *idea of* negating the effect of gravitational pull / gravity, on one side of the plant (only) ;<br>(used as a control) to compare with (the response of) plant **B** ; | **2** | |

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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 4(c)(i) | auxin ; | 1 | |
| 4(c)(ii) | *any three from:*<br>*(auxin / hormone produced in the tip)*<br>moves / diffuses, away from tip / down the, stem *or* shoot *or* plant ;<br>moves to / collects on, one / lower side (of stem / plant) ;<br>stimulates cell elongation ;<br>stem / plant, bends / grows / turns, upwards ;<br>AVP ; | 3 | |
| 4(d) | *any three from:*<br>reach light for photosynthesis ;<br>(reach air for) carbon dioxide for photosynthesis ;<br>(reach air for) oxygen for respiration ;<br>*idea that they* grow tall so that flowers are exposed for, (wind / insect) pollination ;<br>AVPs e.g. roots grow downwards / towards (direction of) gravity ;<br>to reach, water / ions *or* minerals ;<br>to anchor plant in the soil ; | 3 | |

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 5(a) | lumen or wall of left or right oviduct labelled **Q** ;<br>area of uterus with darkest shading labelled **R** ;<br>ovary labelled **S** ;<br>vagina labelled **T** ; | 4 | |
| 5(b)(i) | *any three from:*<br>ref. to making new cells after fertilisation ;<br>making membranes ;<br>(protein for) making enzymes ;<br>making new, (named) cell structures / cytoplasm ;<br>(fat / protein) provide / source of, energy ;<br>energy for, cell division / mitosis / growth (of cell) / metabolism / AW ; | 3 | |

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 5(b)(ii) | *any two from:*<br>hardens / changes, after fertilisation / entry of sperm **;**<br>prevents more sperm entering **;**<br>AVP **;** | **2** | |
| 5(c) | *any four from:*<br>chromosomes / DNA, duplicate(s) / replicate(s) **;**<br>chromosomes separate **;**<br>mitosis / nuclear division **;**<br>(zygote / fertilised egg) divides / splits (into two) **;**<br>(nuclear / cell) division / mitosis, repeated / AW **;**<br>forming a, ball / cluster, of cells **;**<br>cells are genetically identical **;**<br>AVP **;** e.g. cell, specialisation / differentiation **/** ref. to stem cells | **4** | |

| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 6(a)(i) | *any two from:*<br>ref. to <u>passive immunity</u> **;**<br>*idea of* immediate / fast, protection / response / AW **;**<br>AVP **;** e.g. idea that gives time for immune system to produce own, antibodies / antitoxins | **2** | |
| 6(a)(ii) | *any three from:*<br>ref. to <u>active immunity</u> **;**<br>(more) memory cells are produced **;**<br>long-term, immunity / protection **;**<br>after second injection higher concentration of antibodies than passive immunity **;**<br>reduces the chance of catching the disease (again) / AW **;**<br>response to second injection is, fast<u>er</u> / great<u>er</u>, than first **;**<br>AVP **;** | **3** | |

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| Question | Answer | Marks | Guidance |
|---|---|---|---|
| 6(b) | *any four from:*<br>pathogens have antigens **;**<br>antibodies, lock on to, antigens / pathogens **;**<br>antibody is <u>specific</u> (to antigen / pathogen) **;**<br>antibody has a complementary (shape) to antigen / AW **;**<br>antibody marks pathogen for, destruction by phagocytes / phagocytosis **;**<br>antibodies destroy pathogens / described **;**<br>AVP **;** | **4** | |
| 6(c) | *any two from:*<br>absorbs / transports, fat / fatty acids (and glycerol from lacteals) **;**<br>drains / AW, tissue fluid **;**<br>returns, fluid / lymph, to, blood / plasma **;**<br>AVP **;** | **2** | |

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