GCE

Biology B

H422/03: Practical skills in biology

A Level

Mark Scheme for June 2022

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It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

MARKING INSTRUCTIONS

PREPARATION FOR MARKING

RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Online Training*; *OCR Essential Guide to Marking*.
2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are available in RM Assessor.
3. Log-in to RM Assessor and mark the **required number** of practice responses ("scripts") and the **required number** of standardisation responses.

MARKING

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the RM Assessor messaging system.

5. Work crossed out:

Where a candidate has crossed out a response and provided a clear alternative then the crossed-out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed-out response where legible.

Rubric Error Responses – Optional Questions
Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the highest mark from those awarded. (The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)

Multiple Choice Question Responses
When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).
When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses
When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only one mark per response)
Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. (The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)

Short Answer Questions (requiring a more developed response, worth two or more marks)
If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

Longer Answer Questions (requiring a developed response)
Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7. There is a NR (No Response) option. Award NR (No Response)

   - if there is nothing written at all in the answer space
   - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
   - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.

   Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The RM Assessor **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**

   If you have any questions or comments for your Team Leader, use the phone, the RM Assessor messaging system, or email.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:

Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.

Once the level is located, award the higher or lower mark:

The higher mark should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.

The lower mark should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.

In summary:

The skills and science content determines the level.

The communication statement determines the mark within a level.

Level of response questions on this paper are **2(c)** and **4(b)(ii).**

11. Annotations available in RM Assessor

Marking Annotations

Annotation	Use
BOD	Benefit of Doubt
CON	Contradiction
	Cross
ECF	Error Carried Forward
GM	Given Mark
	Extendable horizontal wavy line (to indicate errors / incorrect science terminology)
I	Ignore
	Large dot (various uses as defined in mark scheme)
	Highlight (various uses as defined in mark scheme)
NBOD	Benefit of the doubt not given
	Tick
^	Omission Mark
BP	Blank Page
L1	Level 1 answer in Level of Response question
L2	Level 2 answer in Level of Response question
L3	Level 3 answer in Level of Response question

12. Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
I	alternative and acceptable answers for the same marking point
✓	Separates marking points
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
( )	Words which are not essential to gain credit
__	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

13. **Subject-specific Marking Instructions**

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

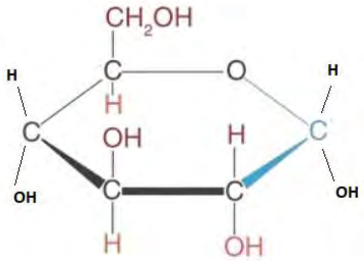
You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

Question			Answer	Mark	AO	Guidance
1	(a)	(i)	secretes (digestive) enzymes ✓	1	2.3	**ALLOW** named example of digestive enzyme
1	(a)	(ii)	alpha / α **AND** beta / β ✓	1	2.3	**IGNORE** endocrine **IGNORE** islets of Langerhans **IGNORE** 'a' and 'b' cells
1	(a)	(iii)	**FIRST CHECK ON ANSWER LINE** **If answer = 55.6 award 2 marks** 20mm x1000 = 20 000μm ✓ 20 000 ÷ 360 = 55.6 (μm) ✓	2	2.4	**ALLOW** measurement of 20mm +/- 0.5mm i.e. **54.2** (using 19.5mm) or **56.9** (using 20.5mm) **Apply ECF** e.g. 19.0 → 19000 / 360 = 52.8 would gain one mark (for ECF 2nd MP for working) **ALLOW** any correct rounding for this working mark e.g. 55.56, 55.556 but only 1 mark maximum if answer less or more than 3 sig figs. **ALLOW** 2cm / 360 = 0.005555cm (as alternative for 2nd working mark)

1	(a)	(iv)	*correct reference to* calibration of the eye piece graticule using the stage micrometer ✓ replace stage micrometer with specimen slide **AND** use, same / specified/ AW, magnification ✓ count the number of graticule divisions that cover the (linear) dimension of the cells **AND** multiply number of graticule divisions by known length of (stage) micrometer / **AW** ✓ **AVP** ✓	**max 2**	**1.2**	**ALLOW** 'eyepiece units' as alternative wording for 'graticule divisions' e.g. micrometer has (scale with) divisions of , known length / 1mm / 0.1mm / 100µm
1	(b)		glucose tolerance test, indicates the person has impaired glucose tolerance / AW **AND** fasting test, indicates the person (probably) has diabetes / AW ✓ *idea that* the person's glucose tolerance may have worsened (over the two months) ✓ *dea that* different test conclusions could have been caused by fault in the person's preparation for the tests ✓	**max 2**	**3.1**	e.g. the person might not have fasted for the correct amount of time

<table>
<tr>
<td>1</td><td>(c)</td><td></td><td> 

✓</td><td>1</td><td>1.1</td><td>DO NOT ALLOW lower bonds joining to H rather than O in the OH groups.</td>
</tr>
<tr>
<td>1</td><td>(d)</td><td></td><td>
<table>
<tr><th>carbohydrate molecule</th><th>reagent used in tests for identification</th><th>number of glycosidic bonds per molecule</th></tr>
<tr><td>glucose</td><td>Benedict’s (test)</td><td>0 / none</td></tr>
<tr><td>lactose</td><td>Benedict’s (test)</td><td>1 / one</td></tr>
<tr><td>amylose</td><td>iodine solution / potassium iodide solution</td><td>many</td></tr>
</table>
✓ ✓</td><td>2</td><td>1.1
1.2</td><td>Award one mark per correct column

IGNORE “iodine K-I”</td>
</tr>
</table>

2	(a)		*agree with / supports the conclusion* heroin is more harmful in 3 of the 4 categories ✓ *disagree with / undermines the conclusion* alcohol has a greater economic cost ✓ *general points* correct use of the combined harm scores to justify the data, supporting / undermining, the conclusion ✓ other (named) categories of harm have not been considered (in the graph) ✓ AVP ✓	max 4	3.2	*Allow a maximum of one mark from MP1 and MP2 if no reference to the data supporting or undermining the conclusion* e.g. the total harm score for heroin is higher than for alcohol, so supports the conclusion **OR** the total harm scores are (approximately) the same, so undermines the conclusion e.g. effects on relationships and mental / psychological effects are not shown e.g. many more people (may) use alcohol than heroin (due to availability) *idea that* one drug may be more harmful than the other to, society / the individual *idea that* subjective as to which categories are most important no statistical analysis of the data has been carried out / no error bars plotted (to show variation in data)
2	(b)	(i)	intrinsic / integral (protein) ✓	1	2.1	**ALLOW** ligand-gated ion (channel protein) **IGNORE** 'channel protein' as given in figure 2.2

2	**(b)**	**(ii)**	*comparison* heroin, stops / reduces / AW, release of GABA / AW, from presynaptic neurone / into synaptic cleft **AND** alcohol, mimics / AW, GABA, so binds to GABA receptors ✓ *explanation* heroin, prevents / reduces, GABA from reaching / AW, the postsynaptic neurone **AND** prevents / reduces, the generation / AW, of an action potential (in the inhibitory postsynaptic neurone) ✓ alcohol (binds to GABA receptor so) stimulates, the generation / AW, of an action potential (in the inhibitory postsynaptic neurone) ✓ (alcohol causes channel to remain open for longer causing) more Cl^- ions to enter, causing hyperpolarisation **AND** reduces chance of / inhibits, the generation of an action potential ✓	**3**	**2.5** **3.1**	**ALLOW** the use of the term 'neurotransmitter' in place of 'GABA' (provided no other neurotransmitter is referred to) **ALLOW** *idea of* 'more negative / more polarised, as a result of channels remaining open for longer' in place of 'hyperpolarisation'

<table>
<tr><td>2</td><td>(c)*</td><td></td><td colspan="4">Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.

In summary:
Read through the whole answer. (Be prepared to recognise and credit unexpected approaches where they show relevance.)
Using a ‘best-fit’ approach based on the science content of the answer, first decide which of the level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.
Then, award the higher or lower mark within the level, according to the Communication Statement (shown in italics):
o award the higher mark where the Communication Statement has been met.
o award the lower mark where aspects of the Communication Statement have been missed.
• The science content determines the level.
• The Communication Statement determines the mark within a level.</td></tr>
<tr><td></td><td></td><td></td><td>Level 3 (5-6 marks)
Comprehensive experimental and safe method producing valid data and detailed statistical analysis for the investigation.

There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.

Level 2 (3-4 marks)
Detailed experimental method and simple statistical analysis for the investigation.

There is a line of reasoning with some structure. The information presented is relevant and supported by some evidence.

Level 1 (1-2 marks)
Simple detail of experimental method assessment and some numerical processing of data

The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.</td><td>6</td><td>3.3
3.4</td><td>Indicative scientific points may include (but are not limited to):

Experimental method
• Details of sample sizes (repeated with at least 10 subjects)
• Details of the independent variable (e.g. ‘caffeine vs no caffeine consumed’, or ‘volume of caffeinated drink consumed’, or ‘concentration of caffeine consumed’ (if the original drink is diluted for different groups, for example))
• Details of group design (e.g. two groups: one consuming caffeine, or several groups receiving different caffeine concentrations, plus a control group)
• Details of standardisation of method (i.e. same procedure every time)
• Details of the measurement of the dependent variable (e.g. distance to reaction time conversion table or online software)

Health & safety
• Gain consent from participants
• Risk assessment: allergies, heart conditions etc</td></tr>
</table>

			0 marks No response or no response worthy of credit.			• Consideration of screen exposure, flicker rate etc (for those methods using online reaction time method) • Possible contraindications with caffeine intake *Statistical analysis* • Idea of identifying and excluding (or replacing) anomalies • Mean calculations • Standard deviation • Appropriate statistical testing (e.g. unpaired t-test if two separate groups are used, paired t-test if same subjects used and tested before/after intake of caffeine, or Spearman's Rank Correlation Coefficient test if a range of caffeine concentrations are used) *Validity* • Minimum of 10 in each group for t-test • Use of dominant hand to catch ruler Stated time period between ingestion of caffeine and testing (to allow for absorption and effect to take place) • Details of control variables (e.g. age of participants, biological sex, typical caffeine intake/ diet, volume of caffeine consumed) or unbiased assignment to groups

3	(a)	(i)	**FIRST CHECK ON ANSWER LINE** **If answer = 0.59 award 2 marks** 47 (mm) / 80 (mm) = 0.5875 ✓ R_f (to 2 significant figures) = 0.59 ✓	2	2.5	**ALLOW** measurements to be +/- 0.5mm **ALLOW** 1 mark for alternative sig figs e.g. 0.6, 0.588 **Apply ECF** for MP2 for incorrect measurements e.g. 48mm / 80mm = 0.60
3	(a)	(ii)	pigments have, different, solubilities in / affinity for, the (new / different) solvent / mobile phase **OR** (new) solvent has, different, affinity for stationary phase ✓	1	2.7	
3	(a)	(iii)	ninhydrin	1	1.2	
3	(b)	(i)	centrifuge (sample) **AND** *idea of* samples spun at (high) speed (in tubes) ✓ separation by density / AW ✓ decanting supernatant to leave sediment which is the 'pellet' ✓	max 2	1.2 2.7	e.g. pellets are denser so they settle at the bottom
3	(b)	(ii)	reduce / AW, enzyme activity (in chloroplasts) ✓	1	2.7	**IGNORE** references to 'enzymes being denatured' or 'enzyme activity prevented'
3	(b)	(iii)	*statement* red (filter) ✓ *explanation* (as it) absorbs green wavelengths **OR** *idea that* the decrease in the, intensity / AW, of the	2	2.7	**ALLOW** orange

			blue colour of the DCPIP is observed ✓			

3	**(b)**	**(iv)**	cuvette ✓ reduced ✓ 1 / one **AND** 3 / three ✓	**3**	**1.2** **2.7**	**ACCEPT** in either order
3	**(b)**	**(v)**	(A = tube) 4 **AND** (B = tube) 2 ✓ any **two** from: *idea that* DCPIP is decolorised, when it is reduced / when it accepts electrons (from light-dependent reactions) ✓ (tube) B / 2, has a high**er**, concentration / number, of, chloroplasts / photosynthetic pigments **ora** ✓ (rate of) light absorption / light-dependent reactions, is greate**r** / faste**r** / AW , in , (tube) B / 2 **ora** ✓	**3**	**3.1**	**ACCEPT** 'supernatant' for '4' and 'pellet in light' for '2' **ACCEPT** 'ETC' or 'photosystem I' for 'light-dependent reactions'
4	**(a)**		<table><tr><th>Feature</th><th>Gram-positive bacteria</th><th>Gram-negative bacteria</th></tr><tr><td>peptidoglycan cell wall</td><td>✓</td><td>✓</td></tr><tr><td></td><td></td><td></td></tr></table>	**3**	**1.1** **1.2**	**2 correct rows = 1 mark** **3 correct rows = 2 marks** **4 correct rows = 3 marks** **IGNORE** crosses in empty cells

			lipopolysaccharide outer envelope: ✓ plasma membrane: ✓ ✓ is stained with crystal violet during the Gram staining procedure: ✓ ✓ has a final colour of pink after Gram staining: ✓ ✓✓✓			
4	**(b)**	**(i)**	*Any two from* extrapolation of control group data points to the y axis at the first solid line above 10^2 which equates to 200 ✓ x 10 (takes into account the final volume) = 2000 ✓ 2.00×10^3 ✓	**max 2**	**2.8**	**ALLOW ecf** for incorrect use of log scale but evidence of dilution factor being taken into account

4	**(b)**	**(ii)***	***Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.*** ***In summary:*** *Read through the whole answer. (Be prepared to recognise and credit unexpected approaches where they show relevance.)* *Using a 'best-fit' approach based on the science content of the answer, first decide which of the level descriptors,* ***Level 1****,* ***Level 2*** *or* ***Level 3****, best describes the overall quality of the answer.* *Then, award the higher or lower mark within the level, according to the* ***Communication Statement*** *(shown in italics):* o *award the higher mark where the Communication Statement has been met.* o *award the lower mark where aspects of the Communication Statement have been missed.*

			• ***The science content determines the level.*** • ***The Communication Statement determines the mark within a level.***			
			Level 3 (5-6 marks) Description **and** detailed explanation for all 3 groups. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3-4 marks)** Description of all 3 groups **and** brief explanation for at least 2 groups **OR** Description for at least 1 group **and** detailed explanation for at least one group. *There is a line of reasoning with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1-2 marks)** Description for at least 1 group **and** an attempt at explanation for at least one group. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** No response or no response worthy of credit.	**6**	**2.7** **3.3** **3.4**	**Indicative scientific points may include (but are not limited to):** *Description* • linear increase for all three groups between 2 and 4 hours • linear increase/ exponential growth, for control group between 2 and 8 hours • plateau, after 8 hours/ between 8 to 14h, for control group • plateau, after 4 hours/ between 4 to 14h, for P • peak at 4h for Q • (gradual/inconsistent) decrease, after 4 hours / between 4 to 14h, for Q • antibiotic Q is most effective, as after 14h, there are the least number of (bacterial) cells *Explanation* **Control group**: • exponential growth before carrying capacity is reached • (stationary phase occurs) when waste products have accumulated • nutrients are (becoming) limited (in stationary phase) **Antibiotic P**: • the antibiotic is bacteriostatic • replication is prevented (but bacteria are <u>not</u> killed) • binary fission is prevented • named reason e.g. protein synthesis is stopped, tRNA is prevented from binding to ribosomes

						Antibiotic Q: • the antibiotic is bactericidal • bacteria are killed • named reason e.g. peptidoglycan synthesis is stopped, plasma membrane is damaged, plasma membrane ruptures
4	**(c)**	**(i)**	*idea that* only, glycolysis / substrate level phosphorylation, occurs ✓	**1**	**2.1**	**ACCEPT** no Krebs cycle / oxidative phosphorylation, occurs **ACCEPT** substrate-linked phosphorylation
4	**(c)**	**(ii)**	plasma / cell surface , membrane ✓	**1**	**2.1**	**ACCEPT** on mesosome

5	(a)	(i)	*change*: increase temperature (by using a water bath) / stir / mix **AND** *explanation*: (water) molecules have more kinetic energy ✓ *change*: increase sucrose concentration **AND** *explanation*: *idea of* osmotic / water potential, gradient increases ✓ *change*: increase, number of foldings / (surface) area, of, bladder / semipermeable membrane **AND** *explanation*: increased, surface area (for osmosis / diffusion) ✓ *change*: reduce thickness of bladder / use a (named) membrane with reduced thickness **AND** *explanation*: reduced diffusion, pathway / distance ✓ *change*: AVP **AND** *explanation*: allow AVP ✓	**max 3**	**2.3** **2.7**	Only award mark if change and explanation are both given. Correct explanation must be paired with the change matched. **ACCEPT** heat in a water bath **ACCEPT** '(water) molecules gain energy and move faster' **ALLOW** 'size' in place of 'surface area' e.g. increase height of thistle funnel **AND** reduces pressure acting on goat bladder membrane

5	**(a)**	**(ii)**	mm / cm ✓	**1**	**2.4**	**IGNORE** conversion of heights to volumes as this is the processed data not the DV (raw data) e.g. mm min^{-1} / cm min^{-1} / ml min^{-1} / mm^3 min^{-1} / cm^3 min^{-1}
5	**(a)**	**(iii)**	Visking tubing / dialysis membrane ✓	**1**	**2.3**	
5	**(b)**	**(i)**	proximal convoluted tubule ✓	**1**	**1.1**	**ACCEPT** PCT
5	**(b)**	**(ii)**	collecting duct ✓	**1**	**1.1**	**ACCEPT** distal convoluted tubule / DCT

Need to get in touch?

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