



GCE

Biology B

H422/03: Practical skills in biology

A Level

Mark Scheme for June 2025

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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.

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**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 40% 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 or the RM Assessor messaging system, or by email.
5. **Crossed Out Responses**
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 is not 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 e-mail.

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(b) and 3(e).

11. Annotations

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
	Benefit of doubt given
	Contradiction
	Rounding error
	Error in number of significant figures
	Error carried forward
	Level 1
	Level 2
	Level 3
	Benefit of doubt not given
	Noted but no credit given

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Annotation	Meaning
	Ignore
	Blank page

12. Subject Specific Marking Instructions

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

Annotation	Meaning
/	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.

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Question			Answer	Marks	AO Element	Guidance
1	(a)	(i)	A = sieve tube (element) ✓ B = xylem (vessel) ✓	2	2.3	IGNORE phloem unqualified ALLOW xylem cell
1	(a)	(ii)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 3.4 award two marks image diameter = 68 mm ✓ 68 / 20 = 3.4 mm ✓	2	2.4	ALLOW 2 marks for +/-0.5mm for image diameter giving final answers which are correctly rounded • 68.5 / 20 = 3.425mm • 67.5 / 20 = 3.375mm
1	(a)	(iii)	(plant tissue) could cause allergic reaction ✓ AVP ✓	1 max	2.7	IGNORE references 'to may get an infection', 'poisonous' e.g. (plant tissue) could contain toxin(s) e.g. <i>idea of</i> only one person hands on

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1	(b)	(i)	<i>set up:</i> add equal volume of, distilled / purified / deionised, water ✓ <i>explanation:</i> to allow comparison / to show that any effects observed are (only as) a result of the salt solution ✓	2	2.7	DO NOT ALLOW '50 mmol dm⁻³ of distilled / deionised water' IGNORE 'amount' IGNORE 'grown in soil with no NaCl solution added' IGNORE 'control group given no NaCl solution' ALLOW see how much uptake occurs without the salt solution
1	(b)	(ii)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = (day) 124 <u>and</u> 105% award two marks day 124 ✓ $(2.25 - 1.1) / 1.1 = 1.04545$ $\times 100 = 105$ ✓	2	2.8	ALLOW 2 marks for • '124 days and 104.5%' or • '124 days and 104.55%' ALLOW 1 mark for incorrect day but with subsequent correctly rounded calculation for the percentage difference

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1	(b)	(iii)	water was taken up even when salt was present ✓ in both groups, (mean) rate of water uptake fluctuates during the experiment ✓ salt has no effect on (mean) rate of water uptake between, day 20 and 26 ✓ salt reduced the (mean) rate of water uptake (on all days), after day 26 ✓ up to 42 days there was little difference in water uptake ✓	2 max	3.1	DO NOT ALLOW the difference in the two (mean) rates of water uptake increased over time (as this is incorrect) ALLOW from day 35 (if using data plots rather than trend line) the salt solution had a lower (mean) rate of water uptake (than the control group)
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1	(c)	1 <i>Reagent used:</i> use of iodine(-KI) solution ✓ any 3 from: 2 prepare / AW , starch <u>solution</u> from tissue sample ✓ 3 calibrate colorimeter ✓ 4 select red filter ✓ 5 measure / record , absorbance / transmission ✓ 6 using solutions of known starch <u>concentration</u> , produce / construct / plot, a calibration curve ✓ 7 <i>idea of</i> using the same , volume / concentration , of iodine(-KI) solution, for both test and known standard starch solutions ✓ 8 estimate concentration (of starch) in the sample using the calibration curve / AW ✓	4 max	1.2 2.7	IGNORE 'iodine' unqualified e.g. 'grind up the plant with 50 ml of water' ALLOW description of serial dilution of a known starch solution for 'using solutions of known starch concentration' IGNORE conc. for concentration DO NOT ALLOW 'amount' in place of volume or concentration IGNORE conc. for concentration
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Question			Answer	Marks	AO Element	Guidance
2	(a)	(i)	remove KOH solution from respirometer, and replace with water ✓ record distance moved by (coloured) liquid (over 1 minute) ✓ <i>idea of</i> change caused by CO₂ production = distance moved by liquid with KOH present minus the distance moved without KOH / AW ✓ calculate volume using $\pi r^2 l$ ✓	3 max	2.7	ALLOW any other inert substance as an alternative for water ALLOW description of distance moved multiplied by the cross-sectional area of the tube (to calculate the volume)
2	(a)	(ii)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 0.794 award one mark 0.050 / 0.063 = 0794 ✓	1	2.4	ALLOW calculator value of 0.7936507937 or any correctly rounded value
2	(a)	(iii)	<i>species C because...</i> RQ (for C) would be greater than, 1(.00) ✓ <u>use</u> of data to support	2	3.1	ALLOW 'third row' or 'species 3' for 'C' ORA e.g. species C has an RQ of 1.07 / 1.0656 e.g. the other species have RQs of approximately 0.7 IGNORE 'volumes of CO₂ is higher than O₂'

2	(b)*	Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.			
		Level 3 (5-6 marks) Detailed experimental plan and references to working safely and some control variables described. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3-4 marks) Detailed experimental plan and references to working safely considerations or Detailed experimental plan and some control variables or Detailed experimental plan and a control variable and a reference to working safely <i>There is a line of reasoning with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1-2 marks) Basic experimental plan and a control variable mentioned or Basic experimental plan and a reference to working safely <i>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.</i> 0 marks No response or no response worthy of credit.	6	3.3 3.4	<i>Consider the loss of communication mark if method would not be reproducible by another student or inappropriate method e.g. unsuitable temperature range (above 50°C), inappropriate statistical test, using incorrect organism</i> Indicative scientific points may include (but are not limited to): <i>experimental plan</i> • at least four temperatures within a suitable range (up to 40°C) • use of thermostatically controlled water bath • ref. to carrying out 3 replicates (at each temperature) • measure and calculate oxygen use over a set time period (i.e. calculate rate of respiration) • calculate a rate of O₂ use per unit mass (i.e. consider mass of beans used when calculating rate) • appropriate statistical test e.g. ◦ Spearman's rank (for correlation) ◦ unpaired <i>t</i>-test (for comparing the mean rate of respiration between 2 temperatures) <i>control variables</i> • equilibrate for the same duration of time before each test (in water bath) • use same species / variety of bean • same number / volume / mass of beans • same age (of beans) / stage of germination

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						<i>safety</i> • potential hazard identified e.g. cuts from broken glassware, irritation/ allergic reaction from plant material, scalds from hot water (in water bath) • levels of risk assessed for potential hazards e.g. low, medium, high (risk) • mitigations proposed for potential hazards e.g. use of broken glass bin (for clearing broken glass), use of non-latex gloves (to avoid skin irritation) • appropriate actions for any incident e.g. wash wounds and cover (for cuts), seek medical attention (for skin irritations)
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Question			Answer	Marks	AO Element	Guidance
3	(a)		do not use , shading / hatching ✓ use horizontal, ruled / straight , label lines ✓ addition of, scale bar / magnification ✓ add annotations ✓ add name of specimen (as a title) ✓	2	2.4	IGNORE reference to sharp pencil (as in the stem of the Q)
3	(b)		<i>supports because...</i> nucleus present ✓ Any 2 from <i>undermines / does not support because...</i> eukaryotes have other (named) membrane-bound organelles present ✓ eukaryotes do not have ribosomes, in the nucleus ✓ eukaryotes have a double membrane ✓	3 max	3.2	IGNORE references to the cell wall (as cell walls are present in some eukaryotes and prokaryotes) and mitochondria and endosymbionts (as both are present in eukaryotes and <i>P. myojinensis</i>) ALLOW ORA for MP2, MP3 and MP4 ALLOW e.g. 'eukaryotes have endoplasmic reticulum / Golgi apparatus' ALLOW idea that 'nuclear envelope in the eukaryotic cell in the diagram has only has nuclear membrane'

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3	(c)		<i>idea that it may rely on , anaerobic respiration / glycolysis ✓</i> AVP ✓	1 max	2.1	DO NOT ALLOW if “do not respire” is also given in the answer e.g. • ‘it could be an obligate anaerobe’ • ‘all/most ATP produced in glycolysis’ • ‘electron transport chain is on cell surface membrane’ • ‘link reaction / Krebs cycle , occurs in cytoplasm rather than matrix’ • uses (only) substrate level phosphorylation occurs in the cytosol
3	(d)		Gram stain(ing) ✓ use of crystal violet stain, and potassium iodide (solution) ✓ purple, colour if peptidoglycan is present ✓ AVP ✓	2 max	2.7	ALLOW ‘Gram’s iodine’ as alternative for potassium iodide ALLOW ‘violet’ as purple DO NOT ALLOW ORA here (as Q asks for testing for the presence of the peptidoglycan) e.g. reference to use of counterstain e.g. detail of counterstain process such as ‘washing with ethanol after adding (named) counterstain’ (to remove unbound crystal violet stain)

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3	(e)*	Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.			
		Level 3 (5-6 marks) Detailed description of method and reference to working safely and steps to avoid contamination. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3-4 marks) Description of method and a step to avoid contamination or Description of method and reference to working safely. <i>There is a line of reasoning with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1-2 marks) Basic method or steps to reduce risk of contamination or an attempt to describe the method and a statement to reduce the risk of contamination. <i>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.</i> 0 marks No response or no response worthy of credit.	6	1.2	<i>Consider the loss of communication mark if errors / omissions in method e.g. no reference to obtaining bacteria from root nodule, incubating above 30°C, reference to using zones of inhibition</i> Indicative scientific points may include (but are not limited to): <i>(steps to reduce risk of contamination are in bold)</i> • disinfect workspace e.g. use Virkon solution • sterilise all/named equipment to obtain <i>Rhizobium</i> (e.g. scalpel/scissors for removing nodules) • select a root nodule (from a leguminous plant) • (select root nodule) with a pink colour (which indicates a healthy nodule) • wash / sterilise the nodule • macerate / crush the nodule • add distilled water (to produce <i>Rhizobium</i> suspension) • description of working aseptically e.g. use of Bunsen flame to generate convection current away from workspace • prepare an agar mixture that includes: ▪ a respiratory substrate (e.g. mannitol) ▪ a nitrogen source (e.g. yeast extract) ▪ a source of essential ions (e.g. magnesium sulfate) ▪ a pH buffer • boil the mixture, then cool and pour in a sterile Petri dish • allow agar to set • add (1cm³) of <i>Rhizobium</i> suspension with sterile pipette/syringe

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						• spread <i>Rhizobium</i> suspension with sterile glass spreader / loop • partially seal petri dish to prevent entry of unwanted micro-organisms • place petri dish upside down in incubator • incubate for several days Risk assessment: • (incubate at) 25-30°C (to prevent potential pathogenic micro-organisms from being cultured) • suitable hazard identified e.g. - o cuts from scalpels - o (skin) irritation / allergy to plant material • level of risk assessed e.g. - o low / medium / high • mitigations suggested e.g. - o cut away from the body / only one set of hands-on specimen (to reduce risk of cuts) - o use of non-latex gloves (to prevent skin irritation)
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Question			Answer	Mark	AO element	Guidelines												
4	(a)		<table><tr><th>Feature</th><th><i>Myc</i></th><th><i>p53</i></th><th><i>Ras</i></th></tr><tr><td>A mutation that causes a loss of function can lead to cancer.</td><td></td><td>✓</td><td></td></tr><tr><td>It is a proto-oncogene.</td><td>✓</td><td></td><td>✓</td></tr></table> ✓	Feature	<i>Myc</i>	<i>p53</i>	<i>Ras</i>	A mutation that causes a loss of function can lead to cancer.		✓		It is a proto-oncogene.	✓		✓	1	1.1	IGNORE all hybrid ticks and crosses all correct = 1 mark
Feature	<i>Myc</i>	<i>p53</i>	<i>Ras</i>															
A mutation that causes a loss of function can lead to cancer.		✓																
It is a proto-oncogene.	✓		✓															
4	(b)	(i)	<table><tr><th>Temperature (°C)</th><th>Process</th></tr><tr><td>97</td><td>Separation of DNA strands</td></tr><tr><td>55</td><td>Annealing / AW, of primers</td></tr><tr><td>75</td><td>DNA polymerase attaches nucleotides to the new strands</td></tr></table> ✓ ✓	Temperature (°C)	Process	97	Separation of DNA strands	55	Annealing / AW, of primers	75	DNA polymerase attaches nucleotides to the new strands	2	1.2	One mark per correct column ALLOW any value in the range 90-97 (because these are temperatures that have been used in published papers). ALLOW any value in the range 68-75 (because these are temperatures that have been used in published papers).				
Temperature (°C)	Process																	
97	Separation of DNA strands																	
55	Annealing / AW, of primers																	
75	DNA polymerase attaches nucleotides to the new strands																	

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4	(b)	(iv)	reverse transcriptase ✓	1	1.2	
4	(b)	(v)	probe nucleotide sequence should be <u>complementary</u> to (known sequence) in the target allele ✓ fluorescence proportional to (c)DNA concentration /AW ✓ <i>idea that</i> the fluorescence after a certain number of cycles can be used to estimate the initial concentration of (c)DNA ✓ fluorescence detected only when , <i>Taq</i> polymerase catalyses a new DNA strand / a new DNA strand is synthesised ✓	2 max	2.5 3.1	

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4	(c)	(i)	<i>Mark points must be awarded in pairs:</i> <i>substance 1:</i> (running) buffer (solution) ✓ <i>purpose 1:</i> to maintain a <u>constant</u> pH or creates electric field that allows the movement of the DNA (through the gel) ✓ OR <i>substance 2:</i> loading buffer / colour marker (solution) ✓ <i>purpose 2:</i> to enable DNA sample to be added or to , see the movement / monitor the progress / visual tracking , of the DNA (fragments) ✓	2 max	3.3	IGNORE agarose gel (as stem of question refers to loading into wells of the gel) IGNORE references to use of UV light for observation of bands (as this is post electrophoresis) ALLOW 'coloured/ loading dye' as alternative for colour marker
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4	(c)	(ii)	reference / marker, DNA (fragments in solution) or uses a 'DNA ladder' ✓ (to) compare , the <u>distance</u> travelled by sample fragments or deduce / determine , <u>size</u> of sample fragments ✓	2	2.7	ALLOW (using) DNA fragments of known , length / size
4	(c)	(iii)	homozygous normal = 2, 6, 7 ✓ homozygous mutant = 3, 4 and heterozygous = 5 ✓	2	3.1 3.2	DO NOT ALLOW either MP if other numbers also included

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Question			Answer	Mark	AO Element	Guidance
5	(a)		<i>before pregnancy:</i> significantly, increased / greater / higher, risk, when fathers consume >5 units per week ✓ no / almost a, significant risk, when mothers consume >5 units per week ✓ <i>in the first three months of pregnancy:</i> no / less / reduced, effect of alcohol consumption on the risk ✓ <i>general:</i> mother drinking always results in a lower risk (compared to father) ✓	2 max	3.1	

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5	(b)		larger sample size ✓ how information on alcohol use was obtained / AW ✓ reference to (confounding) factor(s) that should have been controlled ✓ ✓	2 max	3.2	IGNORE concentration of alcohol consumed ALLOW named example(s) of confounding variable e.g. - o age of parents - o economic / social background - o folic acid consumption - o maternal diet / maternal malnutrition - o smoking - o drug use - o BMI - o family history (of microcephaly) - o maternal exposure to Zika virus - o maternal rubella infection - o cerebral anoxia - o maternal stroke - o qualified underlying health condition
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