

GCSE (9-1)

Combined Science A (Gateway)

Unit **J250/01**: Biology

General Certificate of Secondary Education

Mark Scheme for June 2018

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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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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 question on this paper is **15b**

Annotations available in RM Assessor

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
	Ignore

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

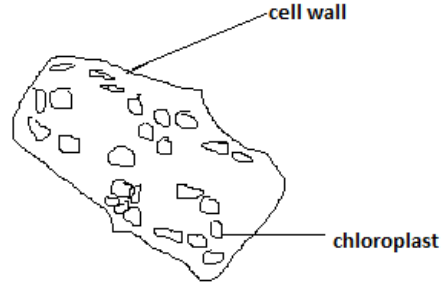
Annotation	Meaning
/	alternative and acceptable answers for the same marking point
✓	Separates marking points
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
()	Words which are not essential to gain credit
—	Underlined words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

The breakdown of Assessment Objectives:

	Assessment Objective
AO1	Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.
AO2.1	Apply knowledge and understanding of scientific ideas.
AO2.2	Apply knowledge and understanding of scientific enquiry, techniques and procedures.
AO3	Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.
AO3.1	Analyse information and ideas to interpret and evaluate.
AO3.1a	Analyse information and ideas to interpret.
AO3.1b	Analyse information and ideas to evaluate.
AO3.2	Analyse information and ideas to make judgements and draw conclusions.
AO3.2a	Analyse information and ideas to make judgements.
AO3.2b	Analyse information and ideas to draw conclusions.
AO3.3	Analyse information and ideas to develop and improve experimental procedures.
AO3.3a	Analyse information and ideas to develop experimental procedures.
AO3.3b	Analyse information and ideas to improve experimental procedures.

For answers to section A if an answer box is blank **ALLOW** correct indication of answer e.g. circled or underlined.

Question			Answer	Marks	AO element	Guidance
1			D ✓	1	1.1	
2			C ✓	1	1.1	ALLOW B.
3			A ✓	1	1.1	
4			C ✓	1	1.1	
5			C ✓	1	2.2	
6			B ✓	1	2.2	
7			B ✓	1	2.2	
8			C ✓	1	2.1	
9			B ✓	1	2.2	
10			C ✓	1	1.1	

Question		Answer	Marks	AO element	Guidance
11	(a)	<p>shape drawn must resemble cell X with similar distribution of chloroplasts ✓</p> <p>drawing (ignoring labels) must take up at least one half of the height or width of the space provided but not overlap with wording of question ✓</p> <p>cell wall AND chloroplast(s) correctly labelled ✓</p>	3	2x 2.2	<p>BLANK PAGES MUST BE ANNOTATED TO SHOW THEY HAVE BEEN SEEN.</p> <p>DO NOT ALLOW sketching/overlapping lines/double lines / gaps DO NOT ALLOW drawing of a 'textbook' cell / presence of a vacuole IGNORE nucleus ALLOW imperfect number and shape to chloroplasts</p>  <p>2.1 Available space should not include margins.</p> <p>ALLOW correct labelling of cell wall and chloroplast(s) on a 'textbook' cell diagram ✓</p> <p>label lines must be touching correct structure (each structure must be in the correct position in the cell, even if they do not resemble the structures in the image)</p> <p>IGNORE other labels IGNORE arrow heads</p>

Question			Answer	Marks	AO element	Guidance
	(b)		(idea that) root cells would not have chloroplasts / chlorophyll ✓ (because) no light available (underground) for photosynthesis ✓	2	1.1 2.1	ALLOW it/the cell has chloroplasts / chlorophyll ✓ DO NOT ALLOW would not have vacuole / cell wall / cell membrane / nucleus / mitochondrion IGNORE reference to root hairs ALLOW root cells cannot photosynthesise ✓ ALLOW photosynthesis happens in the leaves ✓
	(c)	(i)	Iron ✓	1	3.1a	
		(ii)	any two from: (availability of) magnesium is low / magnesium decreased / magnesium in short supply ✓ (idea that low Mg) causes less / no photosynthesis ✓ reduced photosynthesis results in less biomass / glucose (production) ✓	2	2x 3.2a	ALLOW not enough magnesium ✓ ALLOW 'it' to refer to magnesium ALLOW Magnesium bar is thinner ✓ IGNORE reference to other mineral ions (e.g. N, P, K, S, Ca, Fe) IGNORE Plants require Mg to photosynthesise ALLOW higher level responses: magnesium needed to make chlorophyll ✓
	(c)	(iii)	(Root) hairs ✓ Increased / large surface <u>area</u> (for uptake of minerals) ✓	2	2x1.1	ALLOW hair-like structures ✓ IGNORE more space (for uptake of minerals) IGNORE reference to water

Question			Answer	Marks	AO element	Guidance
12	(a)		1 dendrite / cell membrane ✓ 2 cell body / cytoplasm ✓	2	2x 1.1	
	(b)	(i)	(Idea that) larger the diameter the faster the impulse ORA ✓	1	2.2	ALLOW positive correlation / both increase (together) ✓ IGNORE positive relationship ALLOW signal instead of impulse
		(ii)	(most of the) points / data are close to the line (of best fit) / no anomalous results ✓	1	3.1b	IGNORE able to put straight line through data collected

Question			Answer	Marks	AO element	Guidance
13	(a)		childhood / adolescence / teenage / young ✓	1	1.1	ALLOW baby ✓ DO NOT ALLOW at birth / young adult ALLOW stated age, between 1-20 yrs ✓
	(b)		Pancreas ✓	1	1.1	
	(c)		type 1 (normally) requires insulin ✓ AND any two from the following idea that type 2 can (normally be controlled by) diet ✓ idea that type 2 (may) require weight loss ✓ idea that type 2 (may) require insulin / drugs to stimulate insulin production ✓	3	3x1.1	Type of diabetes must be clearly linked to method of treatment If neither insulin mark scored, ALLOW requires insulin, even if not linked to type 1 or type 2 ✓ IGNORE check blood sugar levels IGNORE tablets ALLOW idea of healthy eating ✓ ALLOW reduce / control sugar / fat in diet ✓ IGNORE don't eat fatty / sugary food IGNORE references to junk food IGNORE unqualified references to weight ALLOW (more) exercise ✓

Question			Answer	Marks	AO element	Guidance
14	(a)		histidine ✓	1	2.1	ALLOW answer in table if answer line is blank ✓
	(b)	(i)	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 88 (%) award 2 marks $(2.2 \div 2.5) \times 100$ ✓ 88 (%) ✓	2	1.2 2.2	ALLOW answer in table if answer line is blank ✓
		(ii)	If answer to b(i) is under 100%: less than the recommended amount / RDA ✓ idea that he will not be able to make (correct) proteins ✓ BUT ECF If answer to b(i) is higher than 100%: more than the recommended amount / RDA ✓	2	3.2b	ALLOW idea of not enough / low ✓ ALLOW enzymes instead of proteins ALLOW idea of too much / high ✓

Question			Answer	Marks	AO element	Guidance
15	(a)		carbon dioxide ✓	1	1.2	ALLOW correct formula CO ₂ ✓ IGNORE incorrect formula e.g. CO ² /CO2/Co2
	(b)*		<p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p>Level 3 (5–6 marks) Describes at least one way the method needs improving for precision and repeatability. AND Explains why both improvements are needed. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Level 2 (3–4 marks) Describes at least one way the method needs improving. AND Explains why this improvement is needed <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p>Level 1 (1–2 marks) Describes at least one way the method needs improving, or gives a free-standing explanation. <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p>0 marks <i>No response or no response worthy of credit.</i></p>	6	3x 3.1b 3x 3.3b	<p>AO3.1b. Analyse information and ideas to evaluate the method by identifying where it needs improving</p> <p>Precise</p> <ul style="list-style-type: none"> Measure the volume / mass / amount of gas produced (or reference to method e.g. gas syringe) instead of number of bubbles OR allow example of technology (e.g. Datalogger / use of video) to help count the bubbles Use an electronic water bath / constantly monitor and adjust temperature Read the thermometer at eye level <p>Repeatable</p> <ul style="list-style-type: none"> use a set volume / amount of (yeast OR sugar) solution use the same type of yeast leave the (yeast OR sugar) solution to get to temperature before counting use fresh (yeast OR sugar) solution each time <p>AO3.3b Analyse information and ideas to improve experimental procedures to explain the need for improvements related to precision and repeatability</p>

Question			Answer	Marks	AO element	Guidance
						<p>Precise</p> <ul style="list-style-type: none"> • Measure the volume / mass / amount of gas produced (or reference to method e.g. gas syringe) instead of number of bubbles OR allow example of technology (e.g. datalogger / use of video) to help count the bubbles, as bubbles vary in size / are difficult to count/may miss bubbles • Use an electronic water bath / constantly monitor and adjust temperature, as temperature may fluctuate in beaker of water / temperature needs to keep same • Read the thermometer at eye level, as reading thermometer at an angle gives the wrong reading <p>Repeatable</p> <ul style="list-style-type: none"> • use a set volume/amount of (yeast OR sugar) solution, otherwise (idea that) rate of reaction / number of bubbles will change • use the same type of yeast, as different types of yeast may respire / work at different speeds • leave the (yeast OR sugar) solution to get to temperature before counting, as enzymes need to be at correct temperature • use fresh (yeast OR sugar) solution each time, as concentration of sugar will decrease / sugar will be used up as the reaction takes place

Question			Answer	Marks	AO element	Guidance
	(c)	(i)	suitable scale on correct axes ✓ plotting accurate ✓	2	2x 2.2	Scales on X and Y axis should use at least half of the available axis ALLOW +/- half a square <u>Temperature</u> <u>Bubbles per minute</u> 10 3 20 6 30 11 40 5 50 2 60 1
		(ii)	suitable line of best fit ✓	1	2.2	DO NOT ALLOW dot to dot straight lines DO NOT ALLOW single straight line DO NOT ALLOW overlapping lines DO NOT ALLOW a sharp peak at 30,11 IGNORE extrapolation beyond first or last points on line
	(d)		Any four from: Reaction rate / number of bubbles highest at 30 (°C) / optimum temperature at 30 (°C) ✓ reaction rate / number of bubbles increases as temperature increases, when temp is low / below optimum/between 10 - 30 (°C) ✓ reaction rate / number of bubbles decreases as temperature increases, when temp is (too) high / above	4	4x2.1	ALLOW Ideal temp for enzymes is 30 ⁰ / enzymes most active at 30 ⁰ ✓ ALLOW references to enzymes working faster / better as equivalent to reaction rate ALLOW references to enzymes working more slowly / less well as equivalent to reaction rate

Question			Answer	Marks	AO element	Guidance
			<p>optimum/above 30 (°C) ✓</p> <p>(as temp increases) more (kinetic) energy / more movement (in enzymes and substrates) ✓ ORA</p> <p>(as temp increases) more collisions (between enzymes and substrates) ✓ ORA</p> <p>when temp is (too) high / above optimum / above 30 (°C) enzyme / active site denatures ✓</p>			<p>ALLOW at low temp, less energy/movement (in enzymes and substrates) ✓</p> <p>ALLOW at high temp, more energy / movement (in enzymes and substrates) ✓</p> <p>IGNORE heat / vibration</p> <p>IGNORE between enzyme and sugar</p> <p>DO NOT ALLOW between yeast and sugar</p> <p>IGNORE just temperature increasing, must say high</p> <p>ALLOW active site changes shape</p> <p>ALLOW substrate can no longer fit in active site</p> <p>ALLOW enzyme substrate complex cannot form</p> <p>DO NOT ALLOW yeast denatures / reaction stops</p> <p>DO NOT ALLOW enzymes die</p>

Question			Answer	Marks	AO element	Guidance
16	(a)	(i)	<p>Z has a larger lumen (than X) / ORA ✓</p> <p>Z has thinner wall (than X) / thinner layer of muscle (than X) / ORA ✓</p>	2	2x2.1	<p>ANSWER MUST BE COMPARATIVE</p> <p>ALLOW description of lumen e.g. larger passage / hole / centre / space ✓</p> <p>ALLOW Z has a large lumen compared to X ✓</p> <p>ALLOW Z has large lumen X has small lumen ✓</p> <p>ALLOW Z has large lumen X does not / ORA ✓</p> <p>ALLOW Z has a thin wall or muscle layer compared to X ✓</p> <p>ALLOW Z has thin wall X has thick wall ✓</p> <p>ALLOW Z has thin wall X does not / ORA ✓</p> <p>ALLOW Z has thin muscle layer X has thick muscle layer ✓</p> <p>IGNORE just Z has less fibres / ORA</p> <p>DO NOT ALLOW thinner cell wall</p> <p>IGNORE Z has a smaller wall / X has a bigger wall</p> <p>IGNORE references to size, shape, name or role of each blood vessel / strength of wall</p> <p>IGNORE presence absence of valves / pressure of blood</p> <p>IGNORE references to Y</p>
		(ii)	<p>wall only one cell thick / thin wall / semi or partially permeable wall ✓</p> <p>for quick(er) diffusion / short(er) diffusion distance / efficient diffusion ✓</p>	2	2x1.1	<p>IGNORE references to surface area</p> <p>DO NOT ALLOW (thin) muscular wall / (thin) cell wall</p> <p>ALLOW easy diffusion / better diffusion ✓</p> <p>DO NOT ALLOW diffusion of blood</p> <p>ALLOW gas exchange or exchange of materials for diffusion</p> <p>IGNORE just 'diffusion' or 'gas exchange' or 'exchange of materials'</p>

Question			Answer	Marks	AO element	Guidance
	(b)	(i)	<p>any one from</p> <p>(heart has) three chambers / not four chambers ✓ (heart has) one ventricle / not two ventricles ✓ only one artery leaving (heart) ✓</p>	1	2.1	<p>ASSUME ANSWER REFERS TO LUNGFISH UNLESS OTHERWISE STATED</p> <p>ALLOW humans have four chambers / humans have two ventricles / humans have two arteries leaving (heart)</p> <p>ALLOW double circulatory system in humans / ORA ✓ ALLOW lungfish have single circulatory system / ORA ✓</p> <p>ALLOW in humans' blood goes through heart twice / in lungfish blood goes through heart once ✓</p> <p>ALLOW lung fish has only one lung / humans have two lungs ✓</p> <p>IGNORE oxygenated and deoxygenated blood mixes (on leaving heart) IGNORE differences in pressure IGNORE references to names of blood vessels</p>
		(ii)	<p>(in humans) oxygenated and deoxygenated blood kept separate ✓</p> <p>(so) more oxygen is carried around the body / more oxygen is supplied to the body cells ✓</p>	2	2x2.1	<p>ALLOW ORA if clear it is about lungfish ALLOW (in humans) oxygenated blood goes to body and deoxygenated blood goes to lungs ✓ ALLOW blood pressure (in humans) is greater / flow rate of blood is faster ✓</p> <p>ALLOW oxygen delivered at a faster rate ✓ ALLOW more oxygenated blood ✓ IGNORE just 'circulatory system can work faster'</p>

Question			Answer	Marks	AO element	Guidance
17	(a)	(i)	(chromosomes) separate / split / divide / pulled apart ✓ (chromatids) move to opposite ends / by spindle fibres ✓	2	2x1.1	WHERE A CANDIDATE USES A DIAGRAM LOOK FOR THE CORRECT IDEAS LABELLED ON THE DIAGRAM IGNORE just by fibres ALLOW AS AN EXTRA MARKING POINT (two) new nuclei form / membrane forms around them / nuclear envelope forms around them ✓ IGNORE cell membrane splits IGNORE references to DNA replication IGNORE cytokinesis / cell splitting
		(ii)	double helix ✓ polymer ✓	2	2x1.1	IGNORE references to amino acids ALLOW polynucleotide ✓✓ ALLOW AS EXTRA MARKING POINTS contains (four) <u>bases</u> ✓ reference to ATCG ✓ (made up of) nucleotides ✓ contains sugar / deoxyribose / phosphate group ✓ IGNORE deoxyribonucleic acid
	(b)		idea of (stem) cells becoming specialised ✓	1	1.1	ALLOW when (stem) cells turn into cells that do a particular job or task or role or shape ✓ ALLOW cells adapt to do a specific task or job or role or shape ✓ IGNORE just cells become adapted / cells change

OCR (Oxford Cambridge and RSA Examinations)
The Triangle Building
Shaftesbury Road
Cambridge
CB2 8EA

OCR Customer Contact Centre

Education and Learning

Telephone: 01223 553998

Facsimile: 01223 552627

Email: general.qualifications@ocr.org.uk

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OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553

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