F

GCSE (9–1)

Biology B (Twenty First Century Science)

J257/02: Depth in biology (Foundation Tier)

General Certificate of Secondary Education

Mark Scheme for June 2019

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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.

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
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

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.

The breakdown of Assessment Objectives for GCSE (9-1) in Biology B:

	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.

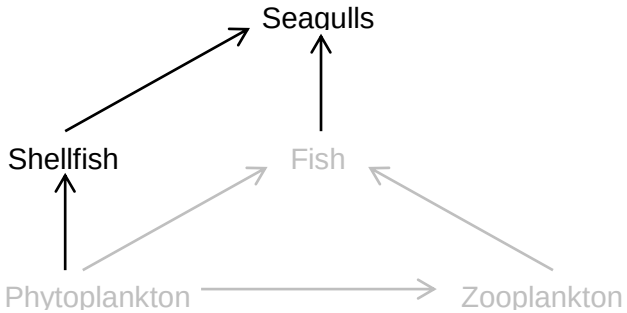
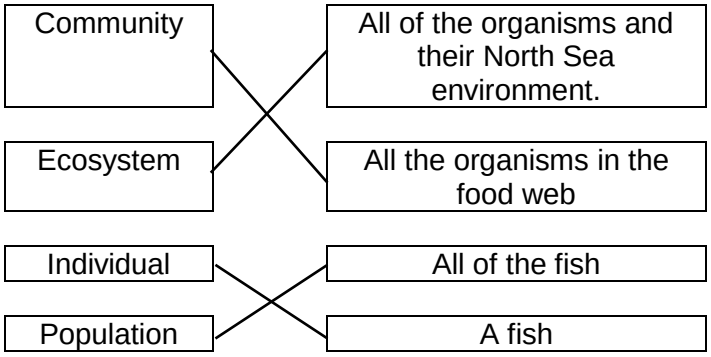
<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td>
<table>
<tr><td>(sweat) gland ✓</td><td>makes/releases/secretes sweat ✓</td><td></td></tr>
<tr><td>(erector) muscle ✓</td><td></td><td></td></tr>
<tr><td>artery/arteriole ✓</td><td></td><td></td></tr>
</table>
</td><td>4</td><td>4 x 1.1</td><td>ALLOW “releases/secretes water” for what the sweat gland does (as sweat is mostly water, and it is evaporation of the water that cools us down)
DO NOT ALLOW “releases/secretes liquid/moisture/fluid”</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>traps (warm) air next to his skin ✓

this insulates / this reduces heat loss / this reduces the rate at which the body warms its surroundings ✓</td><td>2</td><td>2 x 1.1</td><td>DO NOT ALLOW “this warms him up”, as this is given in the question</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>muscle contraction requires (ATP/energy from) cellular respiration ✓

cellular respiration is exothermic / cellular respiration warms its surroundings ✓</td><td>2</td><td>2 x 2.1</td><td>IGNORE refs. to friction</td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
2	(a)		**Any four from:** draw structures using single, continuous lines ✓ don't use shading ✓ label lines shouldn't cross ✓ label lines should touch the thing they're labelling ✓ don't use arrowheads on label lines ✓ add magnification / scale bar ✓ draw/include other structures/organelles/nucleus/mitochondria ✓	**4**	**4 x 3.3b**	**ALLOW** AW (e.g. smooth/neat lines)
	(b)	**(i)**	**Any two pairs of hazard and way of reducing risk:** hazard*:* splashes/scalds from hot water / hot ethanol ✓ way of reducing risk: wear safety spectacles/gloves/PPE **OR** handle with tongs ✓ hazard*:* ethanol is highly flammable / could catch fire ✓ ways of reducing risk: no naked flames / don't use a Bunsen burner / get hot water from a kettle / heat ethanol using a water bath ✓ hazard*:* iodine solution could stain clothes ✓ way of reducing risk: wear lab coat / PPE ✓ hazard*:* iodine solution could splash eyes/skin ✓ way of reducing risk: wear safety spectacles/gloves / PPE ✓	**4**	**1.2** **3.3a** **1.2** **3.3a** **1.2** **3.3a** **1.2** **3.3a**	**DO NOT ALLOW** way of reducing risk that is not linked to correct hazard
		(ii)	(turns from brown to) blue/black/purple ✓	**1**	**1.2**	

Question			Answer	Marks	AO element	Guidance
2	(c)	(i)	(living/real) plant will grow (towards the light/window) ✓	1	2.2	**ALLOW** (living/real) plant will bend/curve towards the light/window **ALLOW** fake/plastic plant will not grow
		(ii)	(strong/bright) light/sunlight coming in through the window / idea that light is uneven ✓ auxin(s) ✓ (auxin(s)/hormone) builds up on the darker/shaded side of the shoot/stem ✓ cells on the darker/shaded side grow/elongate more quickly ✓	4	4 x 1.1	
	(d)		**Any two from:** (Ben showed that) the leaves are made of cells / contain chlororplasts ✓ (Ling showed that) the leaves contain starch (from photosynthesis) / iodine turned blue/black ✓ (Kai showed that) the plant grew (in/towards light) ✓	2	2 x 3.1b	

Question			Answer	Marks	AO element	Guidance
3	(a)	(i)	bottle ✓ 450 (years) ✓	2	2 x 3.1a	
		(ii)	carrier bag **AND** coffee cup ✓	1	3.2b	Three or more ticks = zero marks
	(b)	(i)	arrow from phytoplankton to shellfish ✓ arrows from shellfish **AND** fish to seagulls ✓	2	2 x 2.2	e.g.  Four arrows drawn = maximum one mark Five or more arrows drawn = zero marks **DO NOT ALLOW** arrows pointing in wrong direction, branching arrows, or lines without arrowheads
		(ii)		3	3 x 2.1	Three or four lines correct = three marks Two lines correct = two marks One line correct = one mark **IGNORE** any box with more than one line drawn to/from it **IGNORE** any line that branches/splits

Question			Answer	Marks	AO element	Guidance
3	(b)	(iii)	**Any three from:** producer makes its own food / ORA for consumer ✓ producer photosynthesises / ORA for consumer ✓ producer is at the start of the food chain / ORA for consumer ✓ consumer has to eat producers / other consumers / other organisms / consumers are predators ✓ producers and consumers are in different <u>trophic levels</u> ✓	3	3 x 1.1	**DO NOT ALLOW** "producers are plants" **DO NOT ALLOW** "consumers are animals" Must be clear that the food that is made is for the producer (e.g. "its own food"). **DO NOT ALLOW** "producer makes/provides/produces food" unqualified, as this implies teleological thinking (i.e. that they make it for consumers) **IGNORE** refs. to herbivores, carnivores, omnivores, primary/secondary/tertiary consumers

Question			Answer	Marks	AO element	Guidance
3	(b)	(iv)	**Any four from:** fish will eat the pieces of plastic ✓ (the enzymes in the) fish('s gut) will not be able to digest the plastic ✓ because the enzymes only fit molecules in phytoplankton and zooplankton / because the plastic will not fit into the active site(s)/enzyme(s) ✓ idea that plastic will block/fill up the fish's gut / digestive tract ✓ the plastic could be toxic ✓ the fish will not get enough energy/materials/nutrients/food to survive ✓	**4**	**4 x 2.1**	**ALLOW** "the fish will starve (to death)" **DO NOT ALLOW** "the fish will die" without explanation, as this is stated in the question
		(v)	fish (eaten by humans) will contain plastic ✓ plastic could build up to toxic/harmful levels in humans who eat fish / reference to bioaccumulation ✓	**2**	**2 x 2.1**	

Question			Answer	Marks	AO element	Guidance
3	(c)		Jack ✓ **AND** **Any one from:** more plastic could be recycled ✓ less plastic will enter the sea ✓ **AND** **Any one from:** (lower risk because) bacteria released into the sea could disrupt food chains / compete with existing microorganisms / cause disease ✓ (lower risk because) bacteria released into the sea could increase the number of small particles of plastic which will harm fish stocks/bioaccumulate ✓	3	3.2a 2.1 2.1	

Question			Answer	Marks	AO element	Guidance
4	(a)	(i)	it has features of both birds and dinosaurs ✓	1	2.1	Two or more ticks = zero marks
		(ii)	**Any two from:** genetic variation / mutation(s) / different genetic variants / different alleles / differences in genome/DNA/genes ✓ adapted to different environments ✓ different age/sex/species ✓ environmental factor(s) ✓ idea that differences arose during fossilisation process / damage to fossils ✓	2	2 x 2.1	**DO NOT ALLOW** "they evolved" unqualified **ALLOW** example of environmental factor, e.g. disease, injury, lack of food, etc.
	(b)	(i)	**Any five from:** there was <u>competition</u> (for limited food on the island) ✓ there was (genetic) variation in the population of early humans on the island / mutations caused some early humans to be smaller ✓ smaller humans needed less food / it was a (selective) advantage to be smaller ✓ smaller humans were more likely to (survive and) reproduce ✓ smaller humans were more likely to pass their characteristics/variants/alleles/mutations/genes/DNA to the next generation ✓ over a number of generations (the genetic variants/alleles/variants coding for) smaller humans became more common in the population ✓	5	5 x 2.1	

Question			Answer	Marks	AO element	Guidance
4	(b)	(ii)	**Any two from:** they were isolated on the island (for many generations) ✓ different physical features/DNA (compared to early/other humans) ✓ they could no longer mate with early/other humans to produce fertile offspring ✓ natural selection can result in the formation of new species ✓	**2**	**2 x 2.1**	

Question			Answer	Marks	AO element	Guidance
5	(a)		**Any four from:** two strands ✓ double helix ✓ polymer ✓ made of (four different) nucleotides ✓ each nucleotide made of sugar, phosphate, base ✓ idea that bases (on the two strands) pair up ✓	**4**	**4 x 1.1**	**ALLOW** made of four (different) bases / ATCG
	(b)	**(i)**	no cystic fibrosis ✓	**1**	**2.1**	**DO NOT ALLOW** no disease / healthy
		(ii)	no cystic fibrosis / carrier ✓	**1**	**2.1**	**DO NOT ALLOW** no disease / healthy
		(iii)	ff / homozygous f ✓	**1**	**2.1**	
	(c)	**(i)**	1 in every 4 ✓	**1**	**1.2**	
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 50 (%) award 2 marks** (2 ÷ 4) x 100 ✓ = 50 (%) ✓	**2**	**2 x 1.2**	
		(iii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.25 award 2 marks** 1 ÷ 4 ✓ = 0.25 ✓	**2**	**2 x 1.2**	**ALLOW** mathematical equivalents, i.e. 25% **OR** 1 in 4

5	(d) *		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)** Explains the possible genotypes and phenotypes, including the chance of the baby having cystic fibrosis **AND** Explains what the couple could do, including ideas about risk/ethics. *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)** Explains partially the possible genotypes/phenotypes **AND** Suggests what the couple could do. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Explains only the possible genotypes and phenotypes. **OR** Explains only explains what the couple could do. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant***.** **0 marks** *No response or no response worthy of credit.*	**6**	**6 x 2.1**	**AO2.1 Applying ideas about single gene inheritance to explain the possible genotypes and phenotypes of the couple's baby** **ALLOW** points communicated in Punnett square(s) • Woman must be Ff / heterozygous / is a carrier because she doesn't have cystic fibrosis • Baby will only get cystic fibrosis if it inherits a recessive/f allele from each parent • Man cannot be ff / homozygous recessive because he doesn't have cystic fibrosis • If man is FF / homozygous F / homozygous dominant, baby could be FF or Ff / baby cannot inherit f from father / baby cannot get cystic fibrosis / probability of cystic fibrosis is 0 / 50% chance the baby could be a carrier • If man is Ff/heterozygous/carrier, baby could be FF or Ff or ff / probability of cystic fibrosis is 0.25 / 1 in 4 chance / 25% chance **AO2.1 Applying knowledge of genetic testing to explain what the couple could do** • Man could get a genetic test before they (decide to) try for a baby, to show what alleles he has • Woman could have (amniocentesis/chorionic villus) test if she gets pregnant, to show what alleles the baby/fetus has • Small risk of miscarriage/infection with amniocentesis/chorionic villus test • Small risk of incorrect result/false positive/false negative with any test • Decide whether to have abortion/termination if baby has cystic fibrosis • Reference to ethical objection to abortion/termination • Idea that they could keep/raise the baby if it has cystic fibrosis, because it/they can have happy life, lots of support available, etc. • Idea of weighing up risk(s)/benefits of having a baby and/or other actions

<table>
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<tr><td>6</td><td>(a)</td><td></td><td>
<table>
<tr><td>Chloroplast</td><td></td><td>✓</td><td></td></tr>
<tr><td>Phloem</td><td>✓</td><td></td><td></td></tr>
<tr><td>Xylem</td><td></td><td></td><td>✓</td></tr>
</table>
</td><td>1</td><td>1.1</td><td>All three ticks correct = one mark
Four or more ticks = zero marks</td></tr>
<tr><td></td><td>(b)</td><td></td><td>Any pair from:
light (intensity) ✓
use same lamp/distance/power/brightness (at each temperature) ✓
OR
carbon dioxide (concentration) ✓
use same concentration of sodium hydrogen carbonate solution (at each temperature) ✓
OR
volume/amount of sodium hydrogen carbonate solution ✓
use measuring cylinder/syringe/(graduated) pipette ✓
OR
length/amount of pondweed ✓
use ruler / weigh it / use same piece (at each temperature)✓
OR
species of pondweed ✓
cut from same plant ✓</td><td>2</td><td>2 x 3.3a</td><td>DO NOT ALLOW temperature (because this is the variable Eve is changing)
IGNORE reference to water in beaker
ALLOW description of ‘how’ before the variable in each pair

IGNORE reference to closing curtains/blinds

ALLOW other suitable methods of measuring volume, but not beaker

DO NOT ALLOW “same pondweed”</td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
6	(c)	(i)	**Any two from:** (existing) mean volume at 45 °C does not fit the trend/line/pattern ✓ it is (much) lower than the volumes collected at 40 °C and 50 °C ✓ it appears to be an outlier/anomaly ✓ it may have been due to random/experimental/measurement error/mistake ✓	**2**	**2 x 3.1b**	**DO NOT ALLOW** "unexpected" **ALLOW** examples of errors/mistakes
		(ii)	some indication that the new mean volume is 355 ✓ data point plotted at 45,355 ✓	**2**	**2 x 2.2**	check working and graph **ALLOW** ECF for correct plot of incorrect calculation for one mark **IGNORE** any line(s) drawn to connect plots
	(d)		volume of gas collected increases as temperature increases / positive correlation ✓ idea that it increases most quickly between 30-40 ✓ reference to data from graph that supports trend ✓	**3**	**3 x 3.1a**	**IGNORE** references to incorrectly plotted data **ALLOW** answers that refer to "rate of photosynthesis" instead of "volume of gas collected" **IGNORE** reference to denaturing of enzymes **DO NOT ALLOW** reference to single data point read from the graph (e.g. 25,20 / 30,55 / 35,175 / 40,290 / 45,355 / 50,365); data must illustrate **trend** (e.g. volume rises by 35 mm^3 from 25 °C to 30 °C / rises 235 mm^3 from 30 °C to 40 °C / rises 55 mm^3 from 40 °C to 45 °C / rises 10 mm^3 from 45 °C to 50 °C)

Question			Answer	Marks	AO element	Guidance
	(e)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 23 (mm^3/°C) award 2 marks** (290 – 175) ÷ (40 – 35) **OR** 115 ÷ 5 ✓ = 23 (mm^3/°C) ✓	**2**	**3.1a** **2.2**	

Question			Answer	Marks	AO element	Guidance
7*			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)** Explains in general terms why both washing hands and drinking yogurt drink are good. **AND** Explains why both washing hands and drinking yogurt drink are helpful in Layla's context. *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)** Makes valid points about both washing hands and drinking yogurt drink, but only in general terms (not in Layla's context). **OR** Makes valid points about both washing hands and drinking yogurt drink, but only in Layla's context (not including ideas from general terms). *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Only makes valid points about washing hands. **OR** Only makes valid points about drinking yogurt drink. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant***.** **0 marks** *No response or no response worthy of credit.*	**6**	**4 x 1.1** **2 x 2.1**	**AO1.1 Explains in general terms why washing hands and drinking yogurt drink are good** *Washing hands* • idea that bacteria/viruses/fungi/microorganisms can cause disease(s) / are pathogens • relevant named example, e.g. *Salmonella*, influenza, HIV • they can be present/spread on hands • they can be spread by touching bodily fluids/surfaces/skin • washing hands reduces/stops the spread • washing hands removes/kills microorganisms that cause disease(s) • washing hands removes dirt/sweat/fluids that trap microorganisms that cause disease(s) *Drinking yogurt drink* • contains helpful/good/friendly bacteria • tops up microbial/bacterial defences (in the gut) • helps protect/defend against (microorganisms that cause) disease • by competing with harmful bacteria (for space/nutrients) • improves digestion **AO2.1 Explains why this is helpful in Layla's context** *Washing hands* • Layla touches (contaminated/dirty) patients/surfaces • Stops/reduces chance of Layla spreading diseases/microorganisms to patients • Stops/reduces chance of Layla spreading diseases/microorganisms to food/water/surfaces/equipment • Stops/reduces chance of Layla spreading diseases/microorganisms from patients to herself *Drinking yogurt drink* • Protects/defends against microorganisms that have entered Layla's gut (from patients/surfaces/food/hands) • Stops/reduces chance of Layla developing symptoms

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

www.ocr.org.uk

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