OCR
Oxford Cambridge and RSA

GCSE (9-1)

Biology B (Twenty First Century)

Unit **J257H/04**: Higher Tier – Depth in 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.

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

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.

Question			Answer	Marks	AO element	Guidance
1	(a)		(nitrate ions are the plant's only source of) nitrogen ✓ to make amino acids/proteins/nitrogenous compounds ✓	2	1.1 x 2	**ALLOW** examples e.g. enzymes / DNA
	(b)	(i)	**A** (cell/partially-permeable) membrane ✓ **B** mitochondrion ✓	2	2.1 x2	**ALLOW** mitochondria
		(ii)	**A** (transports nitrate ions into the cell by) <u>active transport</u> (using carrier proteins) (against a concentration gradient) ✓ **B** provides ATP/energy (from cellular respiration) (for active transport) ✓	2	1.1 x2	
		(iii)	Increased/large surface area (to volume ratio) ✓ so there is increased/more active transport/absorption/uptake (of nitrate ions) ✓	2	1.1 x 2	**ALLOW** quick<u>er</u> (but not quickly as comparison required)
	(c)		osmosis ✓ xylem ✓ diffusion ✓ stomata ✓	4	1.1 x 4	

Question	Answer	Marks	AO element	Guidance
(d)*	*Please refer to the marking instructions on page 5 of this mark scheme for guidance on how to mark this question.* **Level 3 (5–6 marks)** A detailed description of the apparatus/procedure **and** variables that will be controlled. **AND** A detailed description of how the results should be processed or the measurements to be taken. *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)** A detailed description of apparatus/procedure **or** variables. **AND** A description of how the results should be processed or the measurements to be taken. *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)** A description of the apparatus/procedure or variables. **OR** A description of how the results should be processed or the measurements to be taken. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks**	**6**	**3.3a x 3** **2.2 x 3**	**AO3.3a Developing an experimental procedure** Apparatus and procedure • use the lamp • to change/vary the light intensity • by placing it at different distances from the leafy shoot • use metre ruler • to measure distance of lamp from leafy shoot • use at least four different distances • use the stopwatch • repeat the experiment several times at each distance/light intensity **IGNORE** ref. to thermometer Variables to control or keep the same • same amount of time for each distance/light intensity and for each repeat (**ALLOW** example e.g. 30 min) • control the amount of ambient light e.g. by closing blinds • control air movement e.g. by closing doors/windows • control temperature by shining lamp through tank of water / use the tank of water as a heat shield **DO NOT ALLOW** use thermometer to <u>control</u> temperature

Question			Answer	Marks	AO element	Guidance
			No response or no response worthy of credit.			**AO2.2 Applying understanding of measurement and data processing techniques to this type of investigation** Measurements to be taken For each distance/light intensity/repeat: • record the volume of water in the pipette at the start • record the volume of water in the pipette at the end (e.g. after 30 min) • how much water taken up / how much water decreased Processing the results • calculate the change in volume of water at each distance/light intensity • by subtracting the final volume from the starting volume • calculate the mean change in volume of water of all the repeats at each distance/light intensity • calculate the rate of water uptake by dividing the (mean) change in volume of water by the time • compare results for different light intensities/distances

Question			Answer	Marks	AO element	Guidance
2	(a)		to measure the temperature ✓	1	1.2	more than one tick = 0 marks
	(b)		place beakers in (electric/thermostatically-controlled) water bath ✓	1	2.2	**IGNORE** mention of thermometer **ALLOW** description of water bath
	(c)		add Benedict's solution ✓ look for a red-brown precipitate ✓	2	2.2	**ALLOW** glucose testing strip with correct colour change **DO NOT ALLOW** red solution
	(d)	(i)	glucose (molecules) can diffuse through the tubing/membrane ✓ starch (molecules) too large to diffuse/move/fit through the tubing/membrane ✓ amylase breaks down starch ✓ starch is broken down into (molecules of) sugar ✓	4	3.2b x 4	**NO MARKS FOR DESCRIBING THE RESULTS** **ALLOW** go through the tubing/membrane **ALLOW** maltose/glucose
	(d)	(ii)	*Prediction*: the tests for glucose will be negative ✓ **Any two from:** *Explanation*: the amylase/enzyme has been denatured ✓ has (permanently) changed the shape (of the active site) ✓ by the high temperature /boiling ✓ no longer works/cannot bind ✓	3	2.1 1.1 x2	

Question			Answer	Marks	AO element	Guidance
	(e)		**Any four from:** at the start, the solution outside the tube will be pale brown/red ✓ at the start, the solution inside the tube will be colourless ✓ the solution inside the tube will start to turn black / blue/black ✓ starting from the edges ✓ because iodine can diffuse through the tubing/membrane (molecules small enough)✓	**4**	**2.2 x 4**	**Must be clear whether inside or outside of tube** Refers to colour of iodine **DO NOT ALLOW** 'through osmosis'

Question			Answer	Marks	AO element	Guidance
3	(a)	(i)	**1** (cellular) respiration **2** photosynthesis **3** (cellular) respiration **4** decomposition	3	1.1 x 3	**check for answers written on diagram** four correct = 3 marks three correct = 2 marks one or two correct = 1 mark **IGNORE** anaerobic in mp1 & 3 & decay In mp 4
		(ii)	**Any three from:** some microorganisms remove carbon dioxide from the ocean/water when they photosynthesise ✓ all microorganisms add carbon dioxide (to the ocean/water) when they respire ✓ some microorganisms/decomposers add carbon dioxide (to the ocean/water from respiration) when they decompose dead organisms ✓	3	2.1 x 3	**Must be carbon dioxide not carbon in mark points 1, 2 & 3** **ALLOW** correct formula for carbon dioxide **IGNORE** decay/rot/breakdown **IGNORE** microorganisms/decomposers dying
		(iii)	**Any two from:** dead organisms (sediment and then) are turned into fossil fuels ✓ which are burnt/combusted (by humans) releasing carbon (dioxide) into the atmosphere ✓ formation of fossil fuels takes millions of years ✓	2	1.1 x 2	**ALLOW** examples of fossil fuels
	(b)	(i)	**Any two from:** the temperature fluctuates (between 28.3 and 31.0 °C) ✓ bleaching events becoming more common ✓	2	3.1a x 2	

Question			Answer	Marks	AO element	Guidance
			coral bleaching occurred in six years / 1995, 1999, 2005, 2006, 2009 and 2010 ✓			
		(ii)	a short term study could show no temperature rise / no bleaching / that temperature fluctuates ✓ idea that overall trend/increase only visible over many years ✓	2	3.1b x 2	**ALLOW** correct example range of years to illustrate the point, e.g. 2001-2004) **ALLOW** reverse argument
3	(b)	(iii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.03 (°C per year) award 2 marks** (29. 5 – 28.5) ÷ (2012 – 1982) **OR** 1 ÷ 30 ✓ = 0.03 (°C per year) ✓	2	3.2b x 2	**ALLOW** 0.03 with a dot above the 3, or "0.03 recurring" or any number of 3s after the first 3
		(iv)	(may have continued to decrease but then within a few years) it would increase again (to a peak above the bleaching point) ✓ (more) coral likely to have died/bleached ✓	2	3.2a x 2	

Question			Answer	Marks	AO element	Guidance
4	(a)		(fungal spores) carried by the wind ✓ import/movement of material from infected ash trees ✓	2	2.1 x 2	**ALLOW (**spores) carried on the back//body/legs of insects **ALLOW** trees/saplings/cuttings/seeds/soil/wood
	(b)	(i)	cross Betty with other tolerant/resistance trees / breed two tolerant or resistant trees ✓ test/identify the offspring for tolerance/resistance to ash dieback ✓ select/breed the (most) tolerant/resistance offspring (and repeat) ✓	3	2.1 x 3	
		(ii)	the cuttings will be genetically identical to Betty / will have no genetic variation ✓ could all have (a variant/allele that codes for) susceptibility to a different disease/pathogen ✓	2	2.1 1.1	**ALLOW** will be clones of Betty but **DO NOT ALLOW** will be similar to Betty /have the same genes as Betty
		(iii)	sequence the genomes of Betty / other tolerant trees ✓ look for variants/alleles/sequences they have in common ✓ isolate/replicate variants/alleles/sequences associated with tolerance/resistance ✓ use genetic engineering to introduce tolerance/resistance (variants/alleles/sequences) into new ash trees ✓	4	2.1 x 4	**ALLOW** use of (restriction) enzymes for this process **ALLOW** description of a method of genetic engineering

Question			Answer	Marks	AO element	Guidance
	(c)	(i)	**Any two pairs of improvement + explanation from:** *improvement:* put on gloves before starting / disinfect the bench (with alcohol) before starting ✓ *explanation*: prevent/reduce risk of contaminating **sample/dish** ✓ *improvement:* use a wire loop to transfer bacteria from sample jar to dish ✓ *explanation*: can be flamed to prevent/reduce risk of contaminating **sample/dish** / regulates the amount of bacteria transferred to each **sample/dish** ✓ *improvement:* pass the neck of the jar through a flame before dipping wire loop in / pass wire loop through a flame (and allow to cool) before dipping into sample jar ✓ *explanation*: prevent/reduce risk of contaminating **sample/dish** ✓ *improvement:* idea of not taking lid fully off Petri dish ✓ *explanation*: prevent/reduce risk of contaminating **sample/dish** ✓ *improvement:* idea of working close to a (roaring) Bunsen flame ✓ *explanation*: prevent/reduce risk of aerial contamination of **sample/dish** ✓	**4**	**3.3b x 4**	If only improvements given with no explanation, only a max. of 2 marks can be awarded' Explanation can only be credited if it relates to the improvement **ALLOW** suitable improvement if regulates the amount of bacteria transferred e.g. pipette/syringe **ALLOW** 'sets up a convection current' for explanation

Question			Answer	Marks	AO element	Guidance
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 415 award 3 marks** $3.14 \times (23 \div 2)^2$ ✓ = 415.265 ✓ = 415 (to 3 s.f.) ✓	**3**	**2.2 x3**	
		(iii)	**Any two from:** the bacteria are resistant to antibiotic **C** ✓ is not effective/does not kill the bacteria ✓ the solution of antibiotic **C** was too dilute ✓ the discs were soaked in only water by mistake ✓	**2**	**3.2a x 2**	**DO NOT ALLOW** bacteria are tolerant or immune to antibiotic C **ALLOW** no antibiotic on disc / not enough antibiotic on disc
	(d)	**(i)**	80 (μm) ✓	**1**	**2.2**	check for answer written in table
		(ii)	2×10^{-6} (m) ✓	**1**	**2.2**	check for answer written in table
		(iii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 10^{-4} (m) award 2 marks** $8 \times 10^{-5} \approx 10 \times 10^{-5}$ ✓ $\approx 10^{-4}$ (m) ✓	**2**	**2.2 x 2**	
		(iv)	2 ÷ 0.25 = 8 / bacterium is 8 times larger ✓ which is less than 10 times larger (so they are the same) order of magnitude) ✓	**2**	**2.2 x 2**	

Question			Answer	Marks	AO element	Guidance
5	(a)		muscle contraction requires more ATP/energy (than is required by other cell types) ✓ ATP/energy is provided by (cellular) respiration (which takes place in part) in the mitochondria ✓	2	1.1 x 2	**ALLOW** released but not made/created/produced
	(b)*		*Please refer to the marking instructions on page 5 of this mark scheme for guidance on how to mark this question*. **Level 3 (5–6 marks)** Explains in detail the effects of adrenaline and links this to the benefits of these effects and to the mechanisms that warm the body. *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 the effects of adrenaline **and** the effects of adrenaline to cellular respiration. **OR** Explains the effects of adrenaline and mechanisms that warm the body. **OR** Explains the effects of adrenaline to cellular respiration and mechanisms that warm the body. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.*	6	1.1 x 4 2.1 x 2	**AO1.1 Demonstrating knowledge of the effects of adrenaline** For example: • adrenaline causes heart rate to increase • adrenaline causes breathing rate to increase • adrenaline causes liver to break down stored carbohydrate/glycogen • adrenaline causes muscle contraction/vasoconstriction/decreases blood flow to skin and digestive organs/diverts blood flow to muscles • contraction of erector pili muscles **AO2.1 Applying synoptic knowledge to link the effects of adrenaline to cellular respiration required for thermoregulation** For example: • increased heart rate pumps more oxygen and glucose around the body to supply cells, and removes waste products (carbon dioxide, lactic acid) more quickly • increased breathing rate provides more oxygen, and removes carbon dioxide more quickly • breakdown of carbohydrate/glycogen in liver provides glucose • all of these enable increased cellular respiration

Question			Answer	Marks	AO element	Guidance
			Level 1 (1–2 marks) Describes thermoregulation mechanisms that warm the body but does **not** consider adrenaline. **OR** Demonstrates knowledge of the effects of adrenaline **OR** The effects of adrenaline to cellular respiration. *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.*			• cellular respiration provides ATP/energy for muscle contraction • cellular respiration is an exothermic process/heats the body **AO1.1 Demonstrating knowledge of thermoregulation mechanisms that warm the body** For example: • shivering / muscles rapidly contract • vasoconstriction / muscles in walls of arteries supplying the skin contract • goosebumps / erector muscles in skin contract to raise hairs (and trap air)
	(c)	**(i)**	the **pituitary gland** secretes/makes **TSH** (thyroid stimulating hormone) ✓ **(TSH** causes the) **thyroid gland** to make **thyroxine** ✓ **Thyroxine** inhibits **TSH** production ✓	**3**	**1.1 x 3**	**thyroxine** causes the **pituitary gland** to stop making **TSH** = 2 marks
		(ii)	thyroxine binds to (thyroxine) receptors (on the cell surface) ✓ this causes (an increase in) gene expression of the gene(s) coding for adrenaline receptors ✓ this causes an increase in protein synthesis ✓ this causes the cell to make (more) adrenaline receptors ✓	**4**	**2.1 x 4**	**ALLOW** thyroxine attaches to receptors

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