OCR
Oxford Cambridge and RSA

GCSE (9-1)

Biology B (Twenty First Century)

Unit **J257F/02**: Foundation Tier – Depth in biology

General Certificate of Secondary Education

Mark Scheme for June 2018

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

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.

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 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><th>both</th><th>type 1</th><th>type 2</th></tr><tr><td>✓</td><td></td><td></td></tr><tr><td></td><td></td><td>✓</td></tr><tr><td>✓</td><td></td><td></td></tr><tr><td></td><td>✓</td><td></td></tr></table></td><td>4</td><td>1.1 x 4</td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td>Any three from:
having (type 2) diabetes increases his risk of cardiovascular disease / does not make it certain ✓

example of lifestyle change to decrease his risk (of getting cardiovascular disease) ✓

second example of lifestyle change to decrease his risk (of getting cardiovascular disease) ✓

control/treat diabetes to reduce risk of developing cardiovascular disease ✓

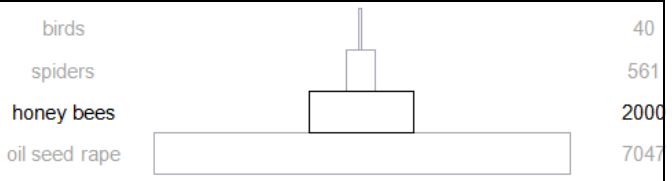
visit the doctor / get medical advice ✓</td><td>3</td><td>2.1 x 3</td><td>ALLOW examples including, e.g. stop smoking / (more) exercise / low salt diet / low fat diet / take medication to reduce blood pressure / lower BMI
DO NOT ALLOW “eat healthy/go on a diet” unless explained

ALLOW idea of low sugar diet (to control diabetes)</td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>exercise/moving/activity/stress could increase the pulse rate / sitting quietly allows the pulse rate to return to normal / allows them to get (more) accurate measurement of the resting pulse rate ✓

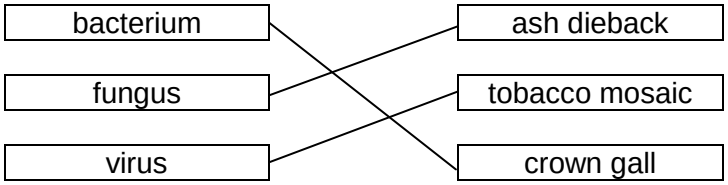
allows them to see the effect of exercise on the pulse rate / idea of comparison with rate after exercise ✓</td><td>2</td><td>2.2 x 3</td><td>ALLOW ‘closer to the true value’ for accurate</td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
1	(c)	(ii)	use (two fingers to press gently against an artery in) a pulse point on their partner's body ✓ **Plus any two from:** (use a stopwatch/clock/timer to) time a fixed period (e.g. 30 seconds) ✓ count/record the number of beats/pulses ✓ per minute ✓	3	3.3a x 3	**ALLOW** specific pulse point, e.g. wrist (radial artery), neck (carotid artery), upper arm (brachial artery), temples **ALLOW** ref. to (digital) heart (rate) monitor
		(iii)	(mean) ✓ median mode	1	1.2	
		(iv)	**Any one from:** likely to be closer to the true value/more accurate✓ is the best estimate (of the true value) ✓ reduces the effects of random error and/or mistakes ✓	1	1.2	
		(v)	25 ✓	1	3.1a	

Question			Answer	Marks	AO element	Guidance
1	(c)	(vi)	**Any two from:** her/his/the student's fitness level is good ✓ she/he is fitter than most people in the class / fitter than 25 other people in the class / above average ✓ only 4 people/3 other people are the same level of fitness/good **OR** only 1 person is fitter ✓ idea that she/he is just 1 point above fair 'fair' is the category containing the highest number of people ✓	**2**	**3.2b x 2**	Assume that references to "their" refer to the student (rather than to the classmates)
		(vii)	yes because: (more) exercise will improve the fitness of the students (which is good for their health) ✓ **Plus any two from:** most/25 students are in the bottom three categories/≥79 ✓ 4 of the students have very poor fitness ✓ 10 (out of 30) / one third of the students have poor fitness ✓ 11 have fair fitness ✓ only 4 of the students have good fitness ✓ only 1 of the students has excellent fitness ✓	**3**	**2.1** **3.2b x 2**	no marks for saying yes; the marks are for the explanation

Question			Answer	Marks	AO element	Guidance
2	(a)		(molecules of) neurotransmitter (substances) diffuse across the synapse/gap ✓ and bind to/stick to/are detected by the receptors ✓ when the receptors are blocked by neonics there is no stimulation of neuron 2 / no generation of a nerve impulse in neuron 2 ✓	3	1.1 1.1 2.1	**IGNORE** 'neonics block receptors' unqualified, as this is given in the question
	(b)		**Any two from:** to protect them from pathogens/diseases carried by the insects ✓ to protect them from damage caused by insects / protect the crop from being eaten by insects ✓ to protect human food supply ✓ to protect farmer's livelihood / prevent loss of income/sales ✓ to prevent loss of crop / reduced yield ✓	2	1.1 x 2	
	(c)	(i)	bar on correct level (second trophic level) **AND** longer than spiders bar **AND** ≤3cm long ✓ bar labelled 'honey bees' on left **AND** '2000' on right ✓	2	2.1 x 2	
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 25 (%) award 2 marks** (2000 ÷ 8000) x 100% ✓ = 25 (%) ✓	2	2.2 x 2	

Question			Answer	Marks	AO element	Guidance
2	(d)	(i)	bees are pollinators/collect pollen (so are likely to visit flowering crops) ✓	1	2.1	**ALLOW** bees collect nectar / feed on flowers / use flowers to make honey
		(ii)	killing bees/spiders therefore birds have less/no food ✓ idea of bioaccumulation / neonics passed through/along/up the food chain ✓	2	2.1 x 2	
		(iii)	*yes because:* **Any three from:** we need to protect our crops/food from pathogens/diseases carried by insects ✓ we need to protect our crops/food from damage done by insects ✓ need to protect farmers' livelihoods ✓ to ensure we have enough crops/food to eat ✓ **OR** *no because:* **Any three from:** it kills/harms bees/insects/spiders/birds ✓ idea of lack of food for animals that eat bees/insects/spiders/birds ✓ idea of bioaccumulation / neonics passed through/along/up the food chain ✓ idea that we should protect bees because they are pollinators (which is important/useful/vital) ✓ moral/ethical argument against harming animals ✓ need more research/data before discontinuing use ✓ ref. to switching to alternative methods (of protecting crops from insects) ✓	3	3.2a x 3	no mark for saying yes; the marks are for the justification no mark for saying no; the mark are for the justification

Question			Answer	Marks	AO element	Guidance
3	(a)			2	1.1 x 2	two or three correct lines = 2 marks one correct line = 1 mark **IGNORE** any line that branches/splits **IGNORE** any box with more than 1 line joined to it
	(b)	(i)	**Any three from:** use aseptic technique(s) ✓ put on gloves before starting ✓ disinfect/sterilise the bench with alcohol before starting ✓ work next to a Bunsen burner (to create an updraft) ✓ pass the neck of the jar through a flame before dipping wire loop in ✓ pass the wire loop through a flame (and allow to cool) / sterilise the loop before dipping into sample jar ✓ idea of not taking lid fully off Petri dish / putting it back on quickly ✓ secure the Petri dish lid with Sello/sticky tape (following the inoculum spread) ✓	3	3.3b x 3	**DO NOT ALLOW** "clean", as this may not be sterile **DO NOT ALLOW** "seal the Petri dish"
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 380 (mm^2) award 3 marks** 3.14×11^2 **OR** 3.14×121 OR $\pi \times 11^2$ ✓ = 379.94 ✓ = 380 (mm^2) ✓	3	2.2 x3	**Award 2 marks for correct answer not given to 3 s.f. (i.e. 379.94)**

Question			Answer	Marks	AO element	Guidance
3	(b)	(iii)	Disc 2 in Petri dish 2 ✓ **Plus any one from:** the area of the clear zone is much higher / outside the range of results for this disc in the other dishes / it is an outlier ✓ the area of the clear zone is in the range of results for disc 1 in the other dishes ✓ the area of the clear zone suggests it was soaked in antibiotic A ✓	**2**	**3.2b** **3.1b**	**ALLOW** Disc B in Petri dish 2 **ALLOW** same as disc 1 in dish 2
	(c)		antimicrobial substances kill / protect plants from (death/damage caused by) pathogens/disease(s) ✓ **Plus any two from:** we depend on plants for food ✓ (photosynthesising) plants add oxygen to the air / remove carbon dioxide from the air / provide breathable air ✓ plants are an essential part of the carbon cycle ✓ all organisms (in an ecosystem) are <u>interdependent</u> ✓	**3**	**1.1 x 3**	**DO NOT ALLOW** idea of plants being "immune" to diseases/pathogens
	(d)	**(i)**	2×10^{6} m 20^{6} m **2×10^{-6} m** ✓ 20^{-6} m	**1**	**2.2**	

Question			Answer	Marks	AO element	Guidance
		(ii)	80-6 µm **80 µm** ✓ 75 µm 40 µm 0.00008 µm	1	2.2	
3	(d)	(iii)	*No because:* 250 nm = 0.25 µm / is smaller than 1 µm ✓ (viruses are) too small for his light microscope to see/resolve ✓	2	3.2b 3.1a	no mark for saying no; the mark is for the explanation
		(iv)	electron microscope ✓ because it provides greater magnification / higher resolving power / can see things smaller than 1 µm ✓	2	2.1 1.1	**IGNORE** references to scanning or transmission **DO NOT ALLOW** "electric/electronic" microscope **DO NOT ALLOW** "lets you see smaller things" or similar unless explained
	(e)		**Any three from:** plants do not have white blood cells ✓ plants cannot make antibodies ✓ plants cannot make memory cells ✓ therefore plants cannot develop immunity against a specific pathogen/antigen from a vaccination ✓	3	2.1 x 3	**DO NOT ALLOW** references to "remembering"; must refer to immunity or becoming immune
4	(a)	(i)	☐ ☐ An enzyme speeds up a chemical reaction ☑ ☐	1	1.1	

Question			Answer	Marks	AO element	Guidance
		(ii)	**B** ✓	**1**	**2.1**	
	(b)	(i)	low dose is less risky / reduces the risk / is safer ✓ **Plus any two from:** (reduces risk of) side-effects from a high dose / high dose could be toxic / overdose / kill ✓ high dose could prevent patient from being able to seal/clot wounds / lead to excess blood loss and/or risk of infection ✓ it is easier to add more warfarin (bit by bit) than it is to take it out of the blood if too high a dose ✓	**3**	**2.1 x 3**	
		(ii)	different people have different genetic variants/alleles/mutations ✓ some variants/alleles/mutations will affect how the body reacts to warfarin / how warfarin is broken down in the body / (how well warfarin fits into) blood clotting enzyme active site ✓	**2**	**1.1** **2.1**	**DO NOT ALLOW** different genes
4	**(b)**	**(iii)**	genetic testing/test(s) ✓ for variants/alleles/mutations that affect how the body reacts to warfarin / how warfarin is broken down in the body / (how well warfarin fits into) blood clotting enzyme active site **OR** to develop <u>personalised medicine</u> for the patient ✓	**2**	**1.1** **2.1**	**DO NOT ALLOW** genes

Question			Answer	Marks	AO element	Guidance
4	(c) *		*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)** Explanation of how the rat population became resistant to warfarin includes ideas about genetic variant/allele. *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)** Explanation at phenotypic level of how the rat population became resistant to warfarin. *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 the advantage of resistance and recognises that the change in the population is an example of evolution/adaptation but does not explain how it occurs. *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**	**2.1 x 6**	**AO2.2 Applying understanding of natural selection of variants to the context of rats and warfarin resistance** Indicative scientific points at Level 3 may include: • there was genetic variation within the population of rats • a mutation created a genetic variant/allele that gives resistance to warfarin • mutated variant/allele was passed on to offspring when the rat mated/reproduced • over many generations the resistance variant/allele became more common in the population Indicative scientific points at Level 2 may include: • there was variation within the population of rats • at first, one rat was resistant to warfarin • mutation created resistance • resistant rats have an advantage / are better suited to their environment • resistance rat(s) more likely to reproduce (than non-resistant rats) • resistant rats pass on the mutation to their offspring **ALLOW** ref. to passing on the "gene" • over many generations resistance became more common in the population • this is natural selection Indicative scientific points at Level 1 may

Question			Answer	Marks	AO element	Guidance
						include: • resistance means the warfarin/poison does not kill/affect the rats • resistance passed on to offspring • the rats evolved/adapted **IGNORE** 'survival of the fittest' without explanation
5	**(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
5	(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** No response or no response worthy of credit.	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 **AO2.2 Applying understanding of measurement and data processing techniques to this type of investigation**

Question			Answer	Marks	AO element	Guidance
						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

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

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; The Triangle Building, Shaftesbury Road, Cambridge, CB2 8EA
Registered Company Number: 3484466
OCR is an exempt Charity

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