OCR
Oxford Cambridge and RSA

H

GCSE (9-1)

Biology B (Twenty First Century Science)

J257/03: Breadth in biology (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2019

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.

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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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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)		A sensory neuron ✓ B motor neuron ✓ C relay neuron ✓	3	3x 1.1	Max one mark for correct order without neuron. Award two marks if order correct and neuron stated in 1/2. If no marks awarded but only neuron is in every box award one mark.
	(b)		(so the impulse/response) is fast(er) ✓ prevents damage/stops you getting hurt ✓	1	1 x 1.1	**IGNORE** involuntary
	(c)	(i)	(results/data) not affected by the reaction times of the person stopping the stop clock ✓	1	1 x 3.1b	**ALLOW** description of reaction time **DO NOT ALLOW** 'results/data more accurate' without explanation of why **IGNORE** ref to human error
		(ii)	**Any two from:** (same) height / position of ruler/hand/fingers ✓ (same length/mass/size) ruler ✓ (use the same) hand/person (to catch with) / <u>participant</u> ✓ (use the same) force to drop the ruler/same person dropping the ruler ✓ (same) stopwatch ✓ (same) angle ✓	2	2 x 3.3a	**ALLOW** correct description
		(iii)	**Any one from:** to identify any outliers/anomalies ✓ to calculate a (more accurate) mean ✓ idea of repeatability (to check precision) ✓	1	1 x 3.3a	**IGNORE** accurate and precise unqualified **IGNORE** average **IGNORE** reliability
	(d)	(i)	1.19×10^2 ✓	1	1 x 1.2	
		(ii)	fatty sheath ✓	1	1 x 1.1	

Question			Answer	Marks	AO element	Guidance
2	(a)		greater than/more than (19,000) ✓	1	1 x 1.2	
	(b)		**Any two from:** the number of cases has increased over 3 years/2013-2016/since 2013/ 2014-2016/ each year ✓ idea of a large increase initially/2013 – 2014 ✓ idea that the increase from 2014 to 2016 is small ✓	2	2 x 3.1a	
	(c)		233% ✓	1	1 x 2.2	
	(d)	(i)	**Any two from*:*** use antibiotics ✓ idea of isolating infected individuals / avoid physical/direct contact✓ idea of barrier to prevent exchange of body fluids/face masks/use of tissues/wear gloves ✓ idea of hygiene ✓ vaccinate ✓	2	2 x 2.1	**IGNORE** medical checks **ALLOW** example of physical contact
		(ii)	**Any one from:** whether the person is allergic to it/side effects of drug / risks to patient ✓ issues with developing bacterial resistance ✓ how effective the drug is / what type of antibiotic ✓ dose ✓ idea of genetic differences ✓ is the patient taking other drugs ✓ pre-existing conditions ✓ age ✓ is the infection bad enough to justify their use ✓	1	1 x 2.1	**IGNORE** safety **ALLOW** named example for pre-existing condition **IGNORE** confirm infection is bacterial
		(iii)	*Salmonella* food poisoning ✓	1	1 x 1.1	

Question			Answer	Marks	AO element	Guidance
3	(a)	(i)	Any indication that the first box - mitochondria are the site of anaerobic respiration is incorrect ✓	1	1 x 1.1	
		(ii)	Correction – (mitochondria are the site of) aerobic (respiration) ✓	1	1 x 1.1	**IGNORE** reference to cytoplasm
	(b)		**Max. two from:** *similarities* both use glucose ✓ both produce ATP ✓ both exothermic ✓ oxygen not used/ occurs when there is a lack/little oxygen ✓ **Max. two from:** *differences* yeast produce ethanol/alcohol, animal cells produce lactic acid ✓ yeast produces carbon dioxide/animal cells do not ✓	3	3 x 1.1	**IGNORE** occurs in cytoplasm
	(c)		**Any two from:** muscle contractions/muscle movement ✓ active transport ✓ synthesis of molecules/named molecules ✓ breakdown of molecules/named molecules ✓	2	2 x 1.1	**ALLOW** named muscle contractions **IGNORE** repair **ALLOW** any correct example e.g. thermoregulation, excretion, nerve impulse, cell division/growth, digestion

Question			Answer	Marks	AO element	Guidance
4	(a)	(i)	Nina ✓ Amir ✓	2	2 x 3.2a	
		(ii)	**Any two from:** trees photosynthesise/less photosynthesis ✓ (less photosynthesis) so less CO_2 absorbed/removed from atmosphere ✓ (less CO_2 absorbed) more CO_2 in the atmosphere ✓ increases/enhances greenhouse effect / <u>more</u> heat/infra-red radiation is trapped ✓ specific example of the consequences e.g idea of global warming, rising sea level, disruption to ecosystems, extreme weather, effect on rainfall, ocean acidification ✓	2	2 x 2.1	**IGNORE** climate change
	(b)	(i)	ring around B ✓	1	1 x 1.1	
		(ii)	(transpiration) will decrease ✓	1	1 x 2.1	**ALLOW** less water loss from trees
	(c)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 49(%) award 3 marks** 104700 + 7500 + 800 / 113000 ✓ (113 000 ÷ 230 000) x 100 ✓ = 49(%) ✓	3	3 x 2.2	**ECF** if 113 000 incorrect 49.1304347.. correctly rounded to 3 or more sig figs = two marks

Question			Answer	Marks	AO element	Guidance
		(ii)	**Any one from:** (it is an estimate because) all orangutans may not have been counted / impractical/difficult to count <u>all</u> orang-utans ✓ numbers are high / they are mobile / they may be difficult to find / the area is large / more have been born ✓ some orang-utans may have been counted more than once / deaths ✓	**1**	**1 x 3.1b**	**ALLOW** you can't count them <u>all</u>
	(d)	**(i)**	Lemurs ✓	**1**	**1 x 3.1a**	
		(ii)	DNA ✓	**1**	**1 x 1.1**	

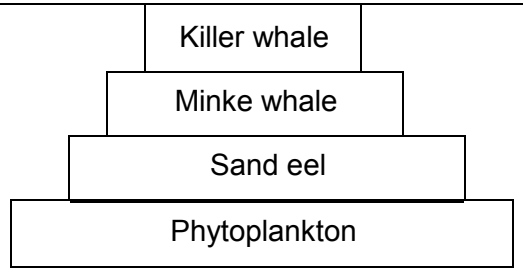
Question			Answer	Marks	AO element	Guidance
5	(a)		(platelets) help seal wounds/ clot blood / form a protective layer ✓ prevent blood from escaping / reduce the chance of (named) microorganisms/pathogen entering the wounds / prevent infection ✓	2	2 x 1.1	**IGNORE** scab, skin repair
	(b)	(i)	**Any three from**: make sure all surfaces are sterile / wipe surfaces with alcohol/disinfectant ✓ make sure equipment/named equipment used is sterile / autoclave equipment / pass equipment through flame / heat equipment to a high temperature ✓ make sure growth medium is sterile / autoclave medium ✓ work next to a Bunsen burner/ keep windows closed ✓ wear gloves/wash hands (before/during aseptic procedures) ✓ only open lid slightly / tape petri dish ✓ store petri dish upside down ✓	3	3 x 1.2	**IGNORE** cleaning
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer is in range of 12 300 to 14 000award 3 marks** (3.5μm =) 0.0035(mm) ✓ length of bacterium (mm) ÷ 0.0035(mm) ✓ = 12 300 to 14 000 (3sf) ✓	3	3 x 1.2	**ALLOW** correct conversion to μm instead of mm for working **ALLOW** ECF **ALLOW** length range 43 – 49 mm

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td>
<table>
<tr><th>Length (mm)</th><th>Magnification</th><th>Mag (3 sig fig)</th></tr>
<tr><td>49</td><td>14 000</td><td>14 000</td></tr>
<tr><td>48</td><td>13 714.2857</td><td>13 700</td></tr>
<tr><td>47</td><td>13428.5714</td><td>13 400</td></tr>
<tr><td>46</td><td>13142.8571</td><td>13 100</td></tr>
<tr><td>45</td><td>12857.1429</td><td>12 900</td></tr>
<tr><td>44</td><td>12571.4286</td><td>12 600</td></tr>
<tr><td>43</td><td>12285.7143</td><td>12 300</td></tr>
</table>
</td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
6	(a)		mRNA/messenger RNA✓	1	1.1	**ALLOW** RNA
	(b)		phenotype ✓	1	1.1	
	(c)		nucleotide ✓	1	1.1	
	(d)		non-coding ✓	1	1.1	**IGNORE** coding

Question			Answer	Marks	AO element	Guidance
7	(a)	(i)	D C A E B ✓	1	1 x 2.1	
		(ii)	natural selection ✓	1	1 x 1.1	
	(b)		**Any one from:** genetic variation (in offspring/population) ORA ✓ adaptability to environmental change / resistance to disease ✓	1	1 x 1.1	.
	(c)		Genome/DNA sequencing ✓	1	1 x 1.1	**ALLOW** DNA fingerprinting/profiling **IGNORE** genetic screening

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>8</td><td></td><td></td><td>
<table>
<tr><th>Small organic molecules</th><th>Large organic molecules</th></tr>
<tr><td>sugar/glucose ✓</td><td>Carbohydrates</td></tr>
<tr><td>amino acids ✓</td><td>Proteins</td></tr>
<tr><td>fatty acids <u>and</u> glycerol ✓</td><td>Lipids</td></tr>
</table>
</td><td>3</td><td>3 x 1.1</td><td>DO NOT ALLOW starch AND glucose (contradiction)</td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
9	(a)	(i)	phytoplankton (the producer) in the first trophic level ✓ correct transfer of Sand eel, Minke whale and Killer whale to pyramid ✓		2 x 2.2	 = two marks
		(ii)	**Any two from:** respiration ✓ uneaten parts ✓ egestion/indigestible parts/faeces ✓ excretion/urea ✓	2	2 x 1.1	**ALLOW** examples of uneaten parts **ALLOW** examples of indigestible parts
	(b)	(i)	**Any three from:** PCBs enter organisms lower down the food chain/ at lower trophic levels ✓ PCBs stay in the body of the organism/ are not broken down/are not excreted ✓ idea that PCBs are passed up the food chain/ to higher trophic levels, through feeding ✓ idea that each individual organism consumes many organisms (from the trophic level below) ✓ therefore, the amount of PCBs per organisms increases (at higher trophic levels)✓	3	3 x 2.1	
		(ii)	(Yes)100 times higher ✓	1	1 x 3.2a	

Question			Answer	Marks	AO element	Guidance
		(iii)	calves/offspring may die ✓ will reduce whale population ✓	**2**	**2 x 3.2a**	**ALLOW AW** for calves/offspring
	(c)		**Any two from:** decomposed/broken down/will decay ✓ (by) microorganisms/named microorganisms ✓ other organisms may eat it ✓	**2**	**2 x 1.1**	

Question			Answer	Marks	AO element	Guidance
10	(a)		LH ✓	1	1 x 2.1	
	(b)	(i)	21 days ✓	1	1 x 2.2	
		(ii)	The progesterone levels falls ✓	1	1 x 3.2b	
	(c)	(i)	select cattle that produce a high yield of milk ✓ breed with male/bull (to produce offspring) ✓	2	2 x 2.1	
		(ii)	FSH ✓	1	1 x 2.1	
		(iii)	Mitosis ✓	1	1 x 1.1	
	(d)	(i)	all offspring will be genetically identical /are clones ✓ **Any one from:** offspring will produce the same/ high milk yield ✓ calves will be born at similar times ✓ to avoid injury to donor cow during mating/giving birth ✓ more pregnancies/offspring ✓ more efficient ✓ higher chance of pregnancy ✓	2	2 x 3.2a	**ALLOW** reverse argument **IGNORE** desired traits **IGNORE** faster
		(ii)	cells will be stem cells/unspecialised cells / cells will not have undergone differentiation / cells at a later stage would have differentiated/specialised ✓	1	1 x 2.1	**IGNORE** embryo unspecialised
		(iii)	progesterone ✓ to maintain the lining of the uterus / prevents production of FSH/LH /prevents egg developing / prevents ovulation ✓	2	1 x 2.1 1 x 1.1	 **DO NOT ALLOW** it causes the lining to thicken **IGNORE** ref to oestrogen

Question			Answer	Marks	AO element	Guidance
11	(a)	(i)	solid coloured = FF ✓ frame patterned = Ff ✓	2	2 x 2.1	
		(ii)	<table><tr><td></td><td>✓F</td><td>f</td></tr><tr><td>✓ F</td><td>FF</td><td>Ff</td></tr><tr><td>f</td><td>Ff</td><td>ff ✓</td></tr></table> probability = 25%/ 0.25 / 1 in 4 / 1/4✓	4	3 x 2.1 1 x 2.2	**ALLOW** any letter in place of F **ALLOW ECF** if either or both parental genotypes are incorrect **IGNORE** ratio
	(b)		genetic testing / genetic screening / gene analysis / gene sequencing / embryonic testing / embryonic screening ✓	1	1 x 2.1	**IGNORE** genetic engineering **IGNORE** embryo selection
	(c)		**Max two from:** mutations ✓ idea of change in base sequence/nucleotide sequence/ triplet code/codon ✓ order/sequence of amino acids changes ✓ **Max one from:** results in a protein which may not function/functions differently ✓ protein no longer expressed/produced / different protein produced/different protein structure ✓	3	3 x 1.1	 **ALLOW** insertion/deletion/substitution/inversion of base(s) **ALLOW** different amino acids are coded for/ amino acid added/removed **ALLOW** named examples

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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