OCR
Oxford Cambridge and RSA

GCSE

Biology B (Twenty First Century)

Unit **J257H/03**: Higher Tier – Breadth 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.

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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)	(i)	There are differences between fossils and living examples of similar organisms✓ Isolated populations of the same species living in different places have different characteristics ✓	2	1.1 x 2	
		(ii)	natural selection ✓	1	1.1	**ALLOW** survival of the fittest
	(b)	(i)	chloroplast(s) ✓	1	1.1	**ALLOW** chlorophyll
		(ii)	water availability ✓	1	1.1	
	(c)	(i)	number of iguanas decrease ✓ due to a shortage of food ✓	2	2.1 x 2	**ALLOW** they will starve **DO NOT ALLOW** (they will have) no food
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **if answer = 1.5 (m) award 2 marks** iguana drawing measures 10 cm 10 x 15 = 150 ✓ 150 cm ÷ 100 = 1.5 (m) ✓	2	2.2 x 2	**ALLOW** working mark if measured incorrectly derived from length (cm) ÷ 100
		(iii)	(1.5 ÷ 100) x 80 = 1.2 (m)	1	2.2	**ALLOW ECF from (c) (ii)**

Question			Answer	Marks	AO element	Guidance
		(iv)	The marine iguanas that decreased in size the most on average lived for a greater length of time ✓ The marine iguanas that did not decrease in size survived for approximately 2 years less than the marine iguanas that decreased in size by up to 60 mm ✓	2	3.2b x 2	

Question			Answer	Marks	AO element	Guidance
2	(a)		(capture a sample of woodlice from an area and) mark the individuals ✓ release the individuals ✓ collect a second sample and count the number of marked individuals ✓ use the equation estimated population size = (number of) individuals given mark x (number of) individuals recaptured ÷ (number of) recaptured individuals that have a mark ✓ **OR** randomly place **quadrat** ✓ count number of woodlice (in the quadrat) ✓ repeat procedure **and** work out mean number of woodlice in one quadrat ✓ correct description of how to process data to calculate population in whole area ✓	4	2.2 x 4	**ALLOW** mark, release, recapture or capture - mark - recapture for 2 marks **ALLOW** (number in) 1st sample x (number in) 2nd sample / (number in) 2nd sample marked **ALLOW** average **ALLOW** correct description of how to calculate mean
	(b)		**Any two from:** lose less water / don't dry out **ORA** ✓ less/by evaporation ✓ water required for decomposition (by microorganisms) of food source ✓	2	2.1 x 2	**ALLOW** woodlice need water for their gills to work or to breathe **ALLOW** osmosis **ALLOW** because this is where they find their food

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>3</td><td>(a)</td><td>(i)</td><td>
<table>
<tr><th>Area of brain</th><th>Function</th></tr>
<tr><td>A</td><td>Responsible for conscious movement.</td></tr>
<tr><td>B</td><td>Responsible for intelligence, memory, consciousness and language.</td></tr>
<tr><td>C</td><td>Responsible for regulation or heart rate and breathing rate.</td></tr>
</table>
</td><td>2</td><td>1.1 x 2</td><td>3 correct answers = 2 marks
2 or 1 correct answers = 1 mark
If candidate gives the same answer for all three areas award 0

ALLOW correct names e.g.
A – Cerebellum
B – Cerebral cortex
C – Brain stem</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Any one from:

they may not be able to give (informed) consent ✓

may cause further damage✓</td><td>1</td><td>1.1</td><td>ALLOW ethical considerations</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>Any one from:
use fMRI ✓

use electrical stimulation ✓</td><td>1</td><td>1.1</td><td>DO NOT ALLOW imaging techniques
ALLOW MRI , CT/CAT scan, PET and EEG</td></tr>
<tr><td></td><td>(b)</td><td></td><td>(Quickly) axon has fatty sheath / is insulated/myelinated ✓

(Long distances) Long axon ✓</td><td>2</td><td>1.1 x 2</td><td>IGNORE reference to dendrites and synapses</td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>Relay and motor neurons ✓</td><td>1</td><td>2.1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Diffusion ✓</td><td>1</td><td>1.1</td><td></td></tr>
<tr><td></td><td></td><td>(iii)</td><td>Unspecialised/undifferentiated cells / can differentiate/specialise into neurons/other types of cell✓</td><td>1</td><td>1.1</td><td></td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
4	(a)	(i)	Phototropism ✓	1	1.1	**ALLOW** phototrophism/phototropic **DO NOT ALLOW** phototrophic
		(ii)	C - Only award if qualified with a correct explanation ✓ **Any one from:** There will be more auxin on the side in the shade ORA✓ There will be more cell elongation in the cells in the shaded side than the side in the light ✓	2	1.1 x 2	comparison must be clear **ALLOW** correct use of reasons to justify why B and A are wrong, e.g it can't be B as the auxin is only present on the shaded/left hand side
		(iii)	*idea that* one box of cress seedlings in an area with light/ use of light box to control light from single sources (all directions) – this is the control ✓ *idea that* the second box in an area with light coming in from one direction only ✓ keep all other variables the same ✓ allow to grow several days ✓	4	3.3a x 4	**ALLOW** alternative approach *idea that* one box of cress seedlings in an area with light without foil caps– this is the control ✓ *idea that* the second box of cress seedlings have foil caps to block light ✓ **ALLOW** named variables **ALLOW** time period from 24 hours to 2 weeks
	(b)		(No because) Should use ethene (promotes fruit ripening)✓ Gibberellins break seed dormancy / trigger bolting / promotes flowering ✓	2	1.1 x 2	No mark for saying "no"; the marks are for the explanation **ALLOW** ethylene **ALLOW** allows germination
	(c)		chemical defence – antimicrobials ✓ physical defence – cell walls/ leaf cuticle/ waxy cuticle ✓	2	1.1 x 2	**ALLOW** any correct chemical defence

Question			Answer	Marks	AO element	Guidance
	(d)		**Any one from:** Reference to gaseous exchange ✓ Movement of carbon dioxide/oxygen ✓ Transpiration/ loss of water (vapour) ✓	**1**	**1.1**	

Question			Answer	Marks	AO element	Guidance
5	(a)	(i)	**Any two from:** changes to DNA/genes ✓ uncontrollable cell division/ rapidly dividing cells/ cell divides many times by mitosis ✓ creates a tumour ✓	**2**	**1.1 x 2**	**ALLOW** mutation of DNA/genes
		(ii)	**Any one from:** obesity ✓ family history / inherited allele(s)/variant(s)/ gene mutation✓ smoking ✓ human papilloma virus / HPV ✓ carcinogens ✓ ionising radiation / UV / sunlight ✓	**1**	**1.1**	**ALLOW** examples of carcinogens, e.g. asbestos, radon gas, alcohol **ALLOW** examples of ionising radiation, e.g. ultraviolet/UV/sunlight, X-rays, gamma rays
		(iii)	**FIRST CHECK ANSWER ON ANSWER LINE** **If answer = 33000000 / 33 x10^6 award 2 marks** 65640000 / 2 or 32,820000 ✓ **= 33000000 / 33 x10^6** ✓	**2**	**2.2** **1.2**	**ALLOW** 33 million for 2 marks ALLOW an incorrect answer to 2 sig figs
		(iv)	**Any one from:** because the original figures are an estimate/only given to 2 sig figs ✓	**1**	**2.1**	**ALLOW** any valid suggestion

Question			Answer	Marks	AO element	Guidance
			change of exposure to risk factors ✓ life expectancy increase/ could die before you get cancer✓			
	(b)	(i)	**Any one from:** risk of death from cancer higher than risk of death from surgery ORA ✓ without the operation the chance of death from ovarian cancer increases ✓ idea that the operation may save their life/ operation will stop it spreading ✓	**1**	**2.1**	**IGNORE** benefits outweigh the risk unless qualified
		(ii)	Horizontal line from 0-7 ✓ Line decreasing from 7- 14 must be at lowest point at 14 ✓ Line increasing back to/near to original level at 21 days ✓	**2**	**2.2 x 2**	3 correct aspects of graph = 2 marks 2 or 1 correct aspect = 1 mark **DO NOT ALLOW** lowest point to be 0
		(iii)	patients are most at risk on day 14 ✓	**1**	**2.1**	**ALLOW** day range anywhere between 8-21 but must include day 14 in the range
		(iv)	enzymes denature/ the active site of enzymes will change shape / substrate no longer fits/is not complementary to the active site✓ all reactions in the human body are controlled by enzymes ✓ rate of reactions/named reaction will slow✓	**3**	**1.1** **2.1** **2.1**	**ALLOW** white blood cells produce antibodies ✓ antibodies could denature / their shape changes so don't bind to antigen ✓ so pathogens will not be destroyed ✓

<table>
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<tr><td></td><td>(c)</td><td>(i)</td><td>
<table>
<tr><th>Justification</th></tr>
<tr><td>Men do not get ovarian cancer /do not have ovaries /testing for effectiveness ✓</td></tr>
<tr><td>Testing for effectiveness (so patients needed to have ovarian cancer)/ drugs were to be used in ovarian cancer patients only ✓</td></tr>
<tr><td>Unethical as patient needs treatment/ patient could die if not treated/ placebos won't treat the cancer ✓</td></tr>
<tr><td>Patient needs to agree to having the treatment / neither patient or doctor can influence the survival rate ✓</td></tr>
</table>
</td><td>4</td><td>3.1b x 4</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Group A because:

a higher proportion/percentage of the women survived ✓

cancer death rate is high, so increased survival outweighs the risk of the severe side effects ✓

OR

Group B because:

the side effects are less severe ✓

increased survival rate using drugs 1 and 2 does not outweigh the more severe side-effects ✓</td><td>2</td><td>3.2a x2</td><td>ALLOW 81% of women survived in Group A compared to 71% in Group B</td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
		(iii)	**Any one from:** raises awareness ✓ it allows decisions to be made based on new information ✓ so people (doctors, nurses, NHS trusts, patients) are better informed/ education ✓ so they can be verified/checked/peer reviewed/further tests or research AW ✓	**1**	**1.1**	**ALLOW** examples of decisions that could be made in this context e.g what drugs to prescribe, what risks are associated with the drugs being used
	(d)		**Any three from:** the antibodies **bind** to the cancer (cell) antigens AW✓ this tags the cancer cells for attack by the white blood cells ✓ antibodies can also be attached to radioactive/ toxic substances/enzymes that convert inactive medicine to active medicine ✓ this allows the substance to be delivered only to cancer cells ✓	**3**	**1.1 x 3**	**ALLOW** tumour (cell) antigens/ tumour markers **ALLOW** labels cancer cells

Question			Answer	Marks	AO element	Guidance
6	(a)	(i)	**Max. one from:** can be spread from organism to organism ✓ spread in bodily fluids/on surfaces/ in food and water✓ spread by a pathogen/bacteria/viruses/protists/fungi ✓ **Max. one from:** reduce risk of infection by not coming into contact with the mosquito✓ using insecticide/insect repellent✓ using mosquito nets ✓ covering exposed skin ✓	**2**	**1.1** **2.1**	**ALLOW** specific examples **ALLOW** vector **ALLOW** sensible ideas to prevent infection **DO NOT ALLOW** vaccination (because the question says there is no vaccine for this virus)
	(a)	**(ii)**	idea of intercourse/sex with an uninfected person in a different country ✓ use barrier contraception/ abstain from intercourse/sex on return home ✓	**2**	**2.1** **1.1**	**ALLOW** correct reference to transmission to uninfected via blood **ALLOW** named example of barrier contraception **ALLOW** example to avoid blood transmission **ALLOW** isolate infected/screening/restricting travel
	(b)	**(i)**	**Any three from:** (random) mutation in DNA/gene which creates a new genetic variant ✓ resistant mosquitos survive ✓	**3**	**2.1 x 3**	**ALLOW** different version/mutated/resistance gene/allele for genetic variant throughout.

Question			Answer	Marks	AO element	Guidance
			the resistant mosquito reproduces and passes on the resistant variant ✓ so the resistant variant becomes more common in subsequent generations of mosquitoes ✓			
		(ii)	**Any three from:** isolate the gene ✓ replicate/copy the gene ✓ use of a vector/plasmid ✓ to insert the gene into (mosquito) cells ✓ select the modified cells ✓	**3**	**1.1 x3**	**ALLOW** (enzymes to) cut out the gene **ALLOW** virus as an example of a vector
		(iii)	**Any one from:** essential genes are transcribed so mosquitos can survive and reproduce in lab✓ only kills offspring not the original (breeding) mosquito✓	**1**	**2.1**	
		(iv)	**Any three from:** *yes because:* **Max. two from:** insecticides can bioaccumulate in the food chain ✓ insecticides can be toxic to other insects ✓ idea of killing other insects would affect the food chain ✓ **Max. one from:** idea that pollinators could be killed ✓ insecticides could be washed/run off into other communities/ecosystems ✓	**3**	**2 x1.1** **2.1**	no marks for saying yes/no; the marks are for the explanation

Question			Answer	Marks	AO element	Guidance
			genetic engineering should not affect other organisms ✓ insecticides are less effective due to resistance✓ new insecticides will need to be developed and this may be costly ✓ *no because:* **Max. two from:** long term studies would be needed to check for adverse effects AW✓ there are moral concerns about modifying genomes AW✓ **Max. one from:** inserted genes could spread to other organisms ✓ costly to genetically engineer/insecticides may be less expensive ✓ may need to keep breeding/releasing genetically engineered mosquitos ✓		**2 x 1.1** **2.1**	

<table>
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<tr><td>7</td><td>(a)</td><td>(i)</td><td>Jack genotype Dd ✓
Nina genotype Dd ✓
Mia genotype dd ✓</td><td>3</td><td>2.1 x 3</td><td>ALLOW other letters in place of D, allow correct descriptions of genotype – heterozygous and homozygous recessive</td></tr>
<tr><td></td><td></td><td>(ii)</td><td><table><tr><th></th><th>D</th><th>d</th></tr><tr><td>D</td><td>DD</td><td>Dd</td></tr><tr><td>d</td><td>Dd</td><td>dd</td></tr></table>✓
Probability = 0.75 ✓</td><td>2</td><td>2.1

3.2b</td><td>ALLOW ECF

All four genotypes must be correct for first mark

ALLOW 3 in 4, ¾, 75%</td></tr>
<tr><td></td><td>(b)</td><td></td><td>Any one from:

both parents are heterozygotes ✓

other genes/ mutations ✓</td><td>1</td><td>2.1</td><td></td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
8	(a)		gene ✓ mRNA ✓ ribosome ✓ amino acids ✓ genetic variant ✓	4	1.1 x 4	5 correct = 4 marks 4 correct = 3 marks 3 correct = 2 mark 2 correct = 1 mark
	(b)		(mutation) changes the base sequence in the DNA / order of bases/ triplet codes ✓ this would give rise to a different sequence of amino acids/ a different amino acid is coded for (in the receptor protein made from the gene) ✓	2	1.1 x 2	**DO NOT ALLOW** the idea that triplet bases *make* different amino acids
	(c)		**Any two from:** *Explanation 2 because:* links different DNA sequences/variants to being separate mutations / the mutations did not occur in the common ancestor idea that if explanation 1 was correct, the mutation would have occurred in the common ancestor and the DNA sequences would be the same ✓ states mutations would occurred after speciation/after they became separate species AW ✓ despite the low chance of two mutations creating the same outcome ✓ **OR** *cannot tell / insufficient evidence to decide / both could be correct /or explanation 1 could be correct because:*	2	 3.1a 3.2a 3.1a	No marks for 'explanation 2' unqualified No marks for 'cannot tell / insufficient evidence to decide / both could be correct' unqualified

Question			Answer	Marks	AO element	Guidance
			it is not clear how different the DNA sequences are so difficult to tell ✓ the non-tasting variants could have mutated further✓ after they appeared in the common ancestor/after speciation (as in Explanation 1) ✓ it is not clear how different the DNA sequences are so difficult to tell ✓		**3.2a**	

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