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 November 2020

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

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
BOD	Benefit of doubt given
CON	Contradiction
RE	Rounding error
SF	Error in number of significant figures
ECF	Error carried forward
L1	Level 1
L2	Level 2
L3	Level 3
NBOD	Benefit of doubt not given
SEEN	Noted but no credit given
I	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.

<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>C ✓

AND Any one from:

idea that the 2 sides of the heart are separated / idea of septum / deoxygenated and oxygenated blood does not mix ✓

there are two ventricles ✓

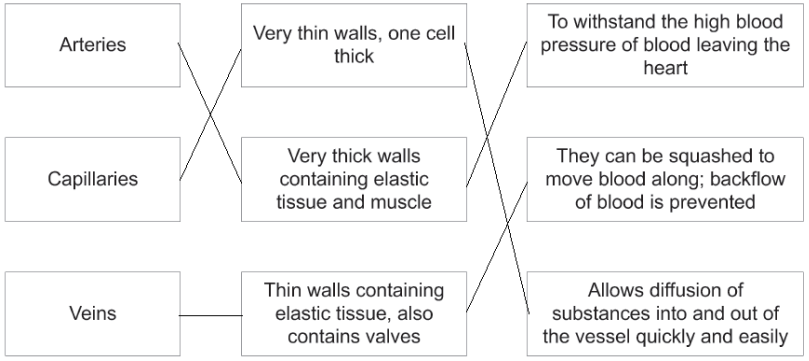
there are 4 separate chambers✓

the blood passes through the heart twice/double circulatory system ✓</td><td>2</td><td>2.1</td><td>ALLOW ECF if B is selected for mark points 2,3 and 4

ALLOW the idea that there are 4 sections in the heart or that in B the blood is only entering 2 chambers/sections of the heart

ALLOW a correct description of a double circulatory system

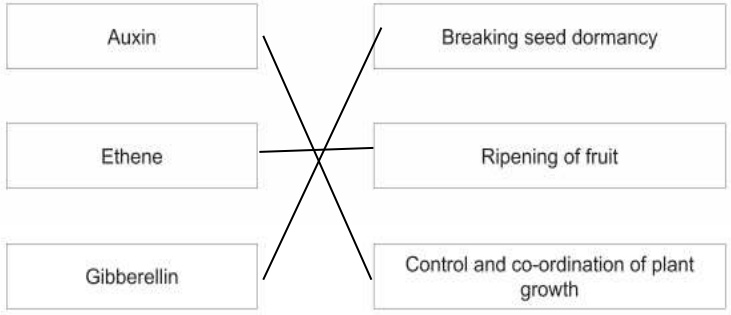
DO NOT ALLOW heart has valves</td></tr>
<tr><td></td><td>(b)</td><td></td><td><table><tr><th></th><th colspan="3">Structure</th></tr><tr><th>Function</th><th>Heart valves</th><th>Cardiac muscle</th><th>Heart chambers</th></tr><tr><td>Contracts to force blood from atria to ventricles</td><td></td><td>✓</td><td></td></tr><tr><td>Contracts to force blood out of the ventricles through vessels</td><td></td><td>✓</td><td></td></tr><tr><td>Prevents backflow of blood during contractions</td><td>✓</td><td></td><td></td></tr><tr><td>Blood temporarily stored in these small spaces to allow blood to be pumped at a high pressure</td><td></td><td></td><td>✓</td></tr></table>✓✓✓✓</td><td>4</td><td>1.1</td><td>one mark for each correct row</td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
	(c)		**Any one from:** baby will be more tired/won't have as much energy ✓ idea of fast or difficulty breathing ✓ idea of reduced cardiac output ✓ idea that there is slower growth/baby does not gain weight ✓ idea that there is less oxygen in (baby's) blood ✓ idea that oxygenated blood and deoxygenated blood can mix ✓	**1**	2.1	**IGNORE** backflow of blood **IGNORE** surgery **ALLOW** any other valid suggestion
	(d)		 ✓✓✓	**3**	1.1	6 correct lines = 3 marks 5/4 correct lines = 2 marks 3/2 correct lines = 1 marks **IGNORE** any box with more than 1 line joined to it

Question			Answer	Marks	AO element	Guidance
2	(a)		**Any one from:** idea that whales move / whales will spend time in different locations ✓ idea that whales live in the ocean so may not be visible/ difficult to find or words to that effect ✓ idea that the same whales could be counted twice ✓ idea that the population keeps changing/more will be born/some will have died ✓	**1**	2.1	**ALLOW** idea that it is impractical/difficult to count all whales or more efficient to estimate **ALLOW** ocean is vast **ALLOW** any sensible suggestions as to why the number is an estimate
	(b)		**Any one from:** Yes: numbers have increased greatly / there has been a 390% increase since ban / about 5 times as many as before the ban ✓ No: numbers are still low / idea that numbers have not returned to pre whaling figures / the number of whales is still only 19.6/20% of the pre whaling numbers ✓	**1**	3.1b	no mark for yes or no unqualified **DO NOT ALLOW** numbers have gone up unqualified **IGNORE** incorrect data manipulation if candidate has clearly stated rise in numbers is great

Question			Answer	Marks	AO element	Guidance
	(c)		**Any two from:** competition for food ✓ less food available ✓ climate change ✓ illegally hunted/could still be hunted ✓ increase in predators ✓ disease in whale population ✓ being killed by plastic / pollution in oceans ✓ idea that whales have difficulty reproducing / fewer to reproduce ✓ idea of negative effect of shipping on whales ✓	**2**	3.2b	**ALLOW** idea of long gestation period or imbalance in numbers of males and females **ALLOW** idea of less genetic variation in population
	(d)		**Any one from:** idea that numbers have not returned to previous levels / numbers are still very low ✓ idea that numbers could/would begin to fall (quickly) / previous whaling reduced numbers drastically (approx 95%) ✓ they could become endangered again ✓	**1**	3.2a	**ALLOW** idea that numbers could fall to the point where the whales could become extinct **ALLOW** will have an impact on the food web/chain / interdependence argument

Question			Answer	Marks	AO element	Guidance
	(e)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 130 award 3 marks** 5000 ÷ 1.6 = 3125 ✓ 3125 ÷ 24 = 130.2 ✓ 130.2 = 130 (given to 2 sig fig) ✓	**3**	 2.2 x 2 1.2	**ALLOW for 2 marks** 130.21/130.2 **ECF** one mark for a number divided by 24 **ALLOW** one mark for evidence leading to a number given to 2 sig fig

Question			Answer	Marks	AO element	Guidance
3	(a)		They have a cell wall ✓ They produce antimicrobial substances ✓	2	1.1	
	(b)		 ✓✓	2	1.1	3 correct =2 2/1 correct = 1
	(c)		insulin✓	1	1.1	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>4</td><td>(a)</td><td></td><td>
<table>
<tr><th>Event in the cell cycle</th><th>Takes place in interphase</th><th>Takes place in mitosis</th></tr>
<tr><td>Each chromosome is copied.</td><td>✓</td><td></td></tr>
<tr><td>The cell grows larger.</td><td>✓</td><td></td></tr>
<tr><td>The chromosome copies separate.</td><td></td><td>✓</td></tr>
<tr><td>The nucleus divides.</td><td></td><td>✓</td></tr>
<tr><td>The number of organelles increase.</td><td>✓</td><td></td></tr>
</table>
✓✓
</td><td>2</td><td>1.1</td><td>5 correct = 2 marks
4 correct = 1 mark</td></tr>
<tr><td></td><td>(b)</td><td></td><td>Any three from:

place the slide/specimen on the stage ✓

select the lowest/lower objective lens ✓

move the stage (towards the lens) up/until it reaches the top ✓

description of focussing the slide using (coarse) focussing knob ✓

change the objective lens to a more higher objective lens ✓

repeat the focussing process/ refocus/use fine focussing knob (to make the image larger/clearer) ✓</td><td>3</td><td>1.2</td><td>IGNORE ref to stain/dyes

ALLOW x4 or X10 objective lens</td></tr>
<tr><td></td><td>(c)</td><td></td><td>use a stain/dye ✓</td><td>1</td><td>3.3b</td><td>ALLOW named stain/dye</td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
5	(a)		genetically engineered crops **AND Any three from:** Idea that distributing vitamins supplement/ putting vitamin supplements into food will cost a lot of money✓ it will be difficult to get supplements to everyone/some people will not take supplements ✓ idea that selective breeding may not work as not all the crops/rice plants that are grown will be high in carotenoids/nutrients. ✓ idea that selective breeding will take longer than genetic engineering to get crops with a greater nutrient content **ORA** ✓ genetic engineering would provide crops with a large amount of/23 times more beta carotene✓ idea that genetically engineered crops will produce seeds so this can be used for future generations ✓ **OR** selective breeding **AND Any three from:** idea that new technologies not required ✓ idea that selective breeding may be the cheaper/less expensive option ✓ idea of fewer ethical concerns /safety concerns with selective breeding ✓	**3**	3.1b	No mark awarded for method selected **ALLOW** any sensible justification of choice

Question			Answer	Marks	AO element	Guidance
	(b)		modifying/change/alter the genome of an organism ✓ to introduce a desired characteristic or words to that effect ✓	2	1.1	**ALLOW** DNA for genome **ALLOW** a gene from one organism is inserted into the DNA of another **IGNORE** named examples
	(c)		**Any one from**: genes could get out into the environment and enter other plants ✓ safety argument/possible negative effects on human health or food chains ✓ idea that long-term effects are not known✓ idea of reduction in biodiversity/could cause a reduction in variation/crops could all be susceptible to the same disease argument ✓	1	2.1	**ALLOW** idea that GE crops could be clones so would be susceptible to same disease **ALLOW** people may not want GE crops as it could change the taste/appearance of the crops

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>6</td><td>(a)</td><td></td><td>
<table>
<tr><th>Substance</th><th>Diffusion</th><th>Osmosis</th><th>Active transport</th></tr>
<tr><td>Carbon dioxide out of the cell</td><td>✓</td><td></td><td></td></tr>
<tr><td>Oxygen into the cell</td><td>✓</td><td></td><td></td></tr>
<tr><td>Water out of the cell</td><td></td><td>✓</td><td></td></tr>
</table>
✓✓✓</td><td>3</td><td>1.1</td><td>One mark for each correct row</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>electron ✓</td><td>1</td><td>2.1</td><td>ALLOW named electron microscopes – SEM/TEM</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Any two from:

high(er) magnification✓

high(er) resolution✓

increased depth of field ✓

level of detail is greater/ can see the (internal) structure of organelles/subcellular structures ✓

idea that they allow us to link organelle structure to their function/role ✓</td><td>2</td><td>1.1</td><td>ALLOW stated magnification in range of 1-50 million

ALLOW clearer 2D picture

ALLOW examples</td></tr>
<tr><td></td><td></td><td>(iii)</td><td>(mitochondria) provide/produce <u>ATP</u> for muscle contraction ✓</td><td>1</td><td>2.1</td><td>DO NOT ALLOW mitochondria produce ATP by anaerobic respiration.</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
	(c)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.1755 (kg) award 2 marks** 1.3 x 0.75 = 0.975 ✓ 0.975 / 100 x 18 = 0.1755 (kg)✓	**2**	2.2	**ALLOW** 0.18 for 2 marks **ALLOW ECF**

Question			Answer	Marks	AO element	Guidance
7	(a)		**Max. one from (for advantage of using sexual reproduction):** genetic variation/diversity ✓ (onions produced by sexual reproduction) will not be susceptible to the same diseases ✓ **Max. one from (for advantage of using asexual reproduction):** all offspring will be genetically identical/clones so desirable traits will be passed on ✓ idea that it is quick/fast to grow onions/produce offspring✓ all onions will require the same conditions to grow✓ idea that only one parent plant is required ✓	**2**	2.1	**ALLOW** sensible suggestions for both **ALLOW** genetically different offspring
	(b)	(i)	root hair cell✓	**1**	2.1	
		(ii)	**Any three from:** in high temperatures/hot water, enzymes will denature/enzyme active site changes shape✓ (when denatured) substrate no longer fits the active site/ cannot bind to the active site/is no longer complementary to the active site ✓ in low temperatures/cold water less kinetic energy so fewer collisions/slow(er) reactions ✓ fewer enzyme substrate complexes form ✓	**3**	2.1	**DO NOT ALLOW** denaturing at high and low temperatures
	(c)		selective breeding ✓	**1**	2.1	**ALLOW** genetic engineering/modification, use a low sulfur fertiliser/soil

Question			Answer	Marks	AO element	Guidance
8	(a)	(i)	For all plant types as temperature increases the rate of photosynthesis increases, peaks and then decreases✓ The lowest rate of photosynthesis for plant type **C** is at 25 °C.✓ Plant type C is less tolerant of high temperatures✓	**3**	3.1a	
		(ii)	photosynthesis is controlled by enzymes/enzyme catalysed reactions✓ idea that enzymes have an optimum temperature/a range of temperatures that they work in ✓	**2**	1.1	**ALLOW** idea that moving away from optimum will slow rate of photosynthesis
	(b)		chloroplasts contain chlorophyll which absorbs light ✓ **AND Any three from**: first stage requires light ✓ (In the first stage) light and chlorophyll split water into hydrogen and oxygen ✓ second stage does not require light ✓ (in the second stage) hydrogen combines with carbon dioxide to make glucose✓	**4**	1.1	It must be clear which stage candidates are referring to OR events must be in chronological order.

Question			Answer	Marks	AO element	Guidance
9	(a)		a description of an eye test to be conducted, either observe affected eye in the light and the dark OR compare both eyes in one condition (light or dark) ✓ observation to be taken – measure pupil size OR note whether the pupil changes size (bigger or smaller) ✓ relates observation to diagnosis - if the pupil does not change size the patient has iritis **ORA** ✓	**3**	2.2	 **ALLOW** correct ref to iris in place of pupil **ALLOW** correct ref to iris in place of pupil
	(b)		**FIRST CHECK THE ANSWER IN TABLE ON ANSWER LINE** **If answer = 62.5 (%) award 3 marks** measures pupils as 8mm and 3mm✓ 8 – 3 = 5 mm✓ 5 ÷ 8 x 100= 62.5 (%) ✓	**3**	2.2	**ALLOW** 63% for 3 marks **ALLOW** conversion of 8mm into 0.8cm **ALLOW ECF** if pupil measurements are incorrect Must be clear that the difference in pupil size is divided by original pupil size for mark point 3
	(c)		**Any three from:** long axon to cover long distances✓ insulated axon/axons have fatty sheath to increase speed✓ idea that neurons have a transmitter substance that enables an impulse to be transmitted from one neuron to another ✓ idea that neurons have receptors which enables an impulse to be transmitted from one neuron to another ✓	**3**	1.1	 **ALLOW** nerve cells are long to cover long distances **ALLOW** myelin sheath for fatty sheath **ALLOW** fatty sheath prevents loss of impulse from neuron **ALLOW** dendrites/branched connections to allow connections/communication with other neurons

Question			Answer	Marks	AO element	Guidance
10	(a)		**Max two from:** correct ref to vaccinations containing parts of/dead/attenuated pathogens ✓ vaccinations stimulate the body to produce antibodies/memory cells ✓ memory cells provide individuals with immunity to disease/ description of the role of memory cells in providing immunity/description of a secondary response✓ **Max two from:** a large proportion of the population needs to be vaccinated /provides 'herd immunity'✓ describes the impact of herd immunity on controlling the spread of a disease e.g protects those who have not been vaccinated ✓	**3**	1.1	**ALLOW** bacteria/virus for pathogen **ALLOW** vaccinations contain/provide antibodies
	(b)		**Max two from:** number of confirmed cases from 2007 to 2011 is low/stays fairly constant ✓ in 2012 the number of cases increases/is at its highest/peaks or spikes ✓ number of cases in 2013 is lower than 2012 **but** idea that the number of cases remains higher than in 2011 ✓	**3**	3.1a	**ALLOW** cases were below 1000 **ALLOW** idea that numbers were at their lowest before 2012 or 2010 has the lowest number of cases

Question			Answer	Marks	AO element	Guidance
			Max one from: numbers of cases was low before 2011 due to high uptake of vaccination/there was herd immunity ✓ the increase in cases (in 2012) may have been due to a drop in vaccination uptake/less people got vaccinated ✓ loss of herd immunity ✓		3.2a	**ALLOW** idea that the pathogen/bacteria/virus mutated so the vaccine was not as effective.
	(c)	**(i)**	Jack ✓	**1**	2.1	
		(ii)	Nina ✓	**1**	2.1	
		(iii)	idea that whole cells could give the patient the disease ✓	**1**	2.1	**ALLOW** cells could secrete toxins
	(d)		D and E (before A) ✓ B, C , F ✓✓	**3**	1.1	 B before C = 1 C before F = 1

Question			Answer	Marks	AO element	Guidance
11	(a)		**Any one similarity:** both are made of nucleotides ✓ both have a sugar ✓ both have a phosphate ✓ both have bases A, G and C ✓ **Any one difference:** mRNA is single stranded but DNA is double stranded✓ mRNA has the base U DNA does not have this base mRNA does not have the base T but DNA ✓	**2**	2.1	**ALLOW** higher level answers e.g type of sugar, named bases **DO NOT ALLOW** mRNA is a single helix If candidate states DNA has bases A,T, C, G but mRNA has bases A,U, C and G award 2 marks
	(b)		protein ✓ mutation ✓ phenotype ✓	**3**	1.1	

Question			Answer	Marks	AO element	Guidance
12	(a)		**Any two from:** use of IVF to create embryos ✓ genetic testing of the embryo/fetus✓ select the embryos without the disease for transfer✓	**2**	2.1	 **ALLOW** a description of IVF **ALLOW** PGD/sampling amniotic fluid to perform genetic test **IGNORE** genetic screening
	(b)	**(i)**	(random) change in the <u>base</u> sequence of the DNA/ gene✓	**1**	1.1	**ALLOW** examples of a change to the base sequence e.g. deletion, addition
		(ii)	(males because) females can only inherit the disease if both parents have the recessive allele on the X chromosome, but males only need to inherit one recessive allele from the mothers X chromosome to have the disease **AW** ✓	**1**	3.2b	no mark for stating male without an explanation

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