

GCSE (9–1)

Biology B (Twenty First Century Science)

J257/01: Breadth in biology (Foundation Tier)

General Certificate of Secondary Education

Mark Scheme for November 2020

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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

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)	<table border="0" style="width: 100%;"> <tr> <td style="text-align: center; width: 50%;">Specialised cell</td> <td style="text-align: center; width: 50%;">Function</td> </tr> <tr> <td style="text-align: center;">Red blood cell</td> <td style="text-align: center;">Conduction of impulses</td> </tr> <tr> <td style="text-align: center;">Nerve cell</td> <td style="text-align: center;">Transport of oxygen</td> </tr> <tr> <td style="text-align: center;">White blood cell</td> <td style="text-align: center;">Protection against disease</td> </tr> </table> <p style="text-align: right;">✓✓</p>	Specialised cell	Function	Red blood cell	Conduction of impulses	Nerve cell	Transport of oxygen	White blood cell	Protection against disease	2	1.1 x 2	3 correct lines = 2 marks 2 correct lines = 1 mark 1 correct line = 0 marks IGNORE any box with more than 1 line joined to it
Specialised cell	Function											
Red blood cell	Conduction of impulses											
Nerve cell	Transport of oxygen											
White blood cell	Protection against disease											
(b)	<table border="0" style="width: 100%;"> <tr> <td style="width: 80%;">When the egg is fertilised</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Before the eight-cell stage</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>After the eight-cell stage</td> <td style="text-align: center;"><input checked="" type="checkbox"/></td> </tr> </table> <p style="text-align: right;">✓</p>	When the egg is fertilised	<input type="checkbox"/>	Before the eight-cell stage	<input type="checkbox"/>	After the eight-cell stage	<input checked="" type="checkbox"/>	1	1.1			
When the egg is fertilised	<input type="checkbox"/>											
Before the eight-cell stage	<input type="checkbox"/>											
After the eight-cell stage	<input checked="" type="checkbox"/>											
(c)	mitochondrion ✓ chloroplast ✓	2	1.1									

Question			Answer	Marks	AO element	Guidance									
2	(a)	(i)	dominant ✓ homozygous ✓	2	2.1										
		(ii)	RR <input type="checkbox"/> Rr <input type="checkbox"/> rr <input checked="" type="checkbox"/>	1	2.1										
		(iii)	R and r separated in both male and female gametes ✓ Correct genotypes in Punnett square ✓ Probability correct 0.75/75%/3/4/3 in 4 ✓	3	2.1	<table border="1"> <tr> <td></td> <td>R</td> <td>r</td> </tr> <tr> <td>R</td> <td>RR</td> <td>Rr</td> </tr> <tr> <td>r</td> <td>Rr</td> <td>rr</td> </tr> </table> <p>ALLOW ECF for mp 2 and 3</p>		R	r	R	RR	Rr	r	Rr	rr
	R	r													
R	RR	Rr													
r	Rr	rr													
	(b)		phenotype ✓	1	1.1										
	(c)	(i)	The chromosomes inherited from the mother <input type="checkbox"/> The DNA found in the sperm cell <input type="checkbox"/> The entire genetic material of an organism <input checked="" type="checkbox"/>	1	1.1										

Question			Answer	Marks	AO element	Guidance
		(ii)	Chloroplast <input type="checkbox"/> Cytoplasm <input type="checkbox"/> Nucleus <input checked="" type="checkbox"/>	1	1.1	

Question		Answer	Marks	AO element	Guidance				
3	(a)	Zone of inhibition or white area (in B) is greater (than A and C) / (B) killed more bacteria (than A and C) ✓	1	3.2b	ALLOW B has largest zone of inhibition/white area ALLOW B killed most bacteria IGNORE B has large zone of inhibition/white area				
	(b)	Antibiotic C ✓ No bacteria killed / no zone of inhibition or white area ✓	2	3.2b	ALLOW the plate is all grey / the bacteria are growing right up to the antibiotic				
	(c)	<table border="1" style="display: inline-table; vertical-align: middle;"><tr><td style="text-align: center;">D</td><td style="text-align: center;">B</td><td style="text-align: center;">A</td><td style="text-align: center;">C</td></tr></table> ✓✓✓	D	B	A	C	3	2.1	D before B = 1 mark B before A = 1 mark A before C = 1 mark
D	B	A	C						
	(d)	Darwin and Wallace <input checked="" type="checkbox"/> Mendel and Darwin <input type="checkbox"/> Wallace and Mendel <input type="checkbox"/> ✓	1	1.1					
	(e)	Idea of (fossils showing) change occurring over time/the fossils in the diagram show the skull changed over time / idea of transitional species ✓ AND Any two from (examples of change from the diagram): shape of skull ✓ volume of skull ✓ jaw shape ✓	3	2.1	ALLOW any reasonable change indicated in the diagram				

Question			Answer	Marks	AO element	Guidance
4	(a)	(i)	phototropism ✓	1	1.1	
		(ii)	gravitropism ✓	1	1.1	
		(iii)	auxin ✓	1	1.1	
	(b)		They have a cell wall. <input checked="" type="checkbox"/> They have platelets. <input type="checkbox"/> They have white blood cells. <input type="checkbox"/> They produce antibodies. <input type="checkbox"/> They produce antimicrobial substances. <input checked="" type="checkbox"/> ✓✓	2	1.1	
	(c)	(i)	Anaerobic (respiration) ✓	1	1.1	
		(ii)	Active transport uses ATP. <input checked="" type="checkbox"/> Active transport requires a concentration gradient. <input type="checkbox"/> Active transport needs water. <input type="checkbox"/> Less ATP is made in aerobic respiration. <input type="checkbox"/> Less ATP is made in anaerobic respiration. <input checked="" type="checkbox"/> ✓✓	2	1.1	

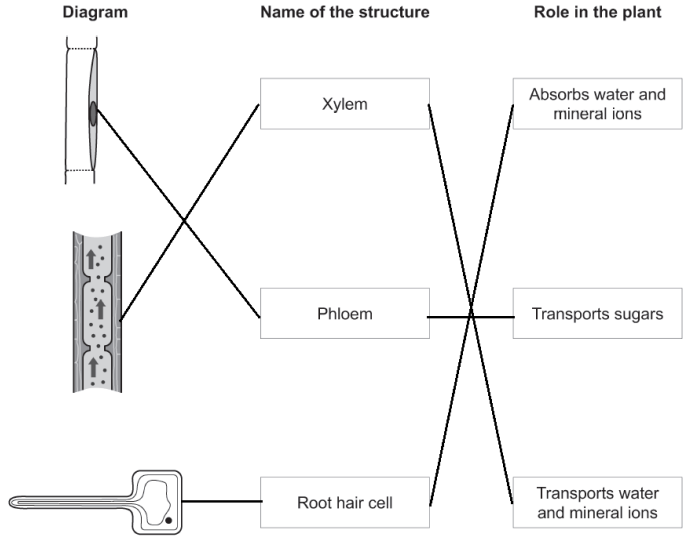
Question		Answer	Marks	AO element	Guidance
5	(a)	39 ✓	1	2.2	
	(b)	Meiosis <input type="checkbox"/> Mitosis <input checked="" type="checkbox"/> Replication <input type="checkbox"/>	1	1.1	
	(c)	<u>Genetic</u> variation ✓	1	1.1	
	(d)	humans have different chromosomes / are not Z and W / are X and Y ✓ idea that male chickens have two of the same chromosome, in humans this is seen in the female/ idea that female chickens have two different chromosomes, in humans this is seen in the male ✓	2	2.1	

Question		Answer	Marks	AO element	Guidance																		
6	(a)	high✓ pancreas✓ more✓	3	1.1																			
	(b)	<table border="1"> <thead> <tr> <th>Statement about hormonal control</th> <th>True</th> <th>False</th> </tr> </thead> <tbody> <tr> <td>Effects can be long-lasting.</td> <td>✓</td> <td></td> </tr> <tr> <td>Hormones are transported by the blood.</td> <td>✓</td> <td></td> </tr> <tr> <td>Target cells have specific receptors.</td> <td>✓</td> <td></td> </tr> <tr> <td>Hormones are usually fast-acting.</td> <td></td> <td>✓</td> </tr> <tr> <td>Hormones are secreted by glands.</td> <td>✓</td> <td></td> </tr> </tbody> </table> <p style="text-align: right;">✓✓</p>	Statement about hormonal control	True	False	Effects can be long-lasting.	✓		Hormones are transported by the blood.	✓		Target cells have specific receptors.	✓		Hormones are usually fast-acting.		✓	Hormones are secreted by glands.	✓		2	1.1	4 or 5 correct = 2 marks 2 or 3 correct = 1 mark DO NOT ALLOW more than one tick in a row ALLOW any indication of the correct answer e.g. crosses instead of ticks
Statement about hormonal control	True	False																					
Effects can be long-lasting.	✓																						
Hormones are transported by the blood.	✓																						
Target cells have specific receptors.	✓																						
Hormones are usually fast-acting.		✓																					
Hormones are secreted by glands.	✓																						
	(c)	Unspecialised cells/undifferentiated cells ✓ Can turn into any type of cell ✓	2	2.1	ALLOW for two marks they are able to specialise/differentiate into any type of cell																		

Question			Answer	Marks	AO element	Guidance
7	(a)	(i)	Male = 450 Female = 300 ✓	1	2.2	Both values needed for 1 mark
		(ii)	Men are generally at greater risk of dying from bowel cancer than women. <input checked="" type="checkbox"/> The male risk is always double that of the female. <input type="checkbox"/> Men and women are at the same risk of bowel cancer. <input type="checkbox"/> More women in the age category 45–49 die of bowel cancer than men. <input type="checkbox"/> ✓	1	3.2b	
	(b)		Any two from: being overweight ✓ eating processed meat ✓ low fibre diet ✓	2	3.2a	MAX 1 MARK if any other cause is selected in addition to two or more correct causes
	(c)		Any two from: HIV is infectious/can be passed on / cancer is not infectious /cannot be passed on ✓ cancer is (a disease) caused by uncontrolled cell division or growth / HIV is (a disease) not caused by uncontrolled cell division or growth ✓ cancer has genetic causes/HIV does not have genetic causes ✓	2	1.1	IGNORE HIV is a pathogen/virus or AIDS is caused by a pathogen/virus IGNORE cancer is caused by rapid cell division ALLOW tumours are seen in cancer

Question			Answer	Marks	AO element	Guidance
8	(a)	(i)	Three correct plots ✓✓	2	2.2	two correct plots = 1 mark ALLOW tolerance of ± half a square IGNORE width of bars and spacing between bars
		(ii)	The number of cases roughly doubled between 2010 and 2011. <input checked="" type="checkbox"/> The number of cases confirmed was lowest in 2014. <input type="checkbox"/> The number of cases in 2016 was roughly half that of 2015. <input type="checkbox"/> The number of cases peaked in 2012. <input checked="" type="checkbox"/> The number of cases in 2016 was lower than the number of cases in 2014. <input type="checkbox"/> ✓✓	2	3.1a	One mark for each correct answer
		(iii)	2012 <input checked="" type="checkbox"/> 2013 <input type="checkbox"/> 2014 <input type="checkbox"/> ✓	1	3.2a	
	(b)		The vaccination stimulates the production of platelets. <input type="checkbox"/> The vaccination makes the heart beat faster. <input type="checkbox"/> The vaccination makes the body make more red blood cells. <input type="checkbox"/> The vaccination causes the white blood cells to make antibodies. <input checked="" type="checkbox"/> ✓	1	1.1	

Question	Answer	Marks	AO element	Guidance
(c)	<p>Idea of how the disease could spread max. one mark:</p> <p>hands/physical contact/surfaces ✓ droplet/airborne ✓</p> <p>Idea of how the spread could be prevented max. two marks:</p> <p>treatment/antibiotics ✓ isolation/restrict travel ✓ hygiene or example of hygienic practice e.g. use and dispose of tissues/washing hands ✓ barriers e.g. masks/gloves/cough or sneeze into your elbow /cover your mouth ✓ vaccination ✓</p>	3	2.1	<p>ALLOW cough/sneeze</p>

Question	Answer	Marks	AO element	Guidance
<p>9 (a)</p>	 <p>The diagram shows a cross-section of a leaf with three main structures labeled in boxes: Xylem, Phloem, and Root hair cell. Lines connect these boxes to their respective roles in the plant. Xylem is connected to 'Absorbs water and mineral ions'. Phloem is connected to 'Transports sugars'. Root hair cell is connected to 'Transports water and mineral ions'. There are five checkmarks (✓✓✓✓✓) at the bottom right of the diagram area.</p>	<p>5</p>	<p>1.1</p>	<p>6 correct lines = 5 marks 5 correct lines = 4 marks 4 correct lines = 3 marks 3 correct lines = 2 marks 1 or 2 correct lines = 1 mark IGNORE any box with more than 1 line joined to it</p>
<p>(b)</p>	<p>stage ✓ objective lens ✓ focussing knob ✓</p>	<p>3</p>	<p>1.2</p>	
<p>(c) (i)</p>	<p>9 ✓</p>	<p>1</p>	<p>2.2</p>	
<p>(ii)</p>	<p>(9 × 60 =) 540 ✓</p>	<p>1</p>	<p>2.2</p>	<p>ALLOW ECF</p>
<p>(iii)</p>	<p>Repeat (the procedure) on more of the leaf/more areas/more fields of view (on the same leaf) ✓ use this to calculate a mean and multiply by the total area (of this leaf)/60 ✓</p>	<p>2</p>	<p>3.3b</p>	<p>IGNORE just repeat DO NOT ALLOW the idea of testing more leaves IGNORE average</p>
<p>(iv)</p>	<p>Number estimated could be too small/too big ✓</p>	<p>1</p>	<p>2.2</p>	

Question		Answer	Marks	AO element	Guidance																							
10	(a)	<p>C ✓</p> <p>AND Any one from:</p> <p>idea that the 2 sides of the heart are separated / idea of septum / deoxygenated and oxygenated blood does not mix ✓</p> <p>there are two ventricles ✓</p> <p>there are 4 separate chambers ✓</p> <p>the blood passes through the heart twice/double circulatory system ✓</p>	2	2.1	<p>ALLOW ECF if B is selected for mark points 2,3 and 4</p> <p>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</p> <p>ALLOW a correct description of a double circulatory system</p> <p>DO NOT ALLOW heart has valves</p>																							
	(b)	<table border="1"> <thead> <tr> <th rowspan="2">Function</th> <th colspan="3">Structure</th> </tr> <tr> <th>Heart valves</th> <th>Cardiac muscle</th> <th>Heart chambers</th> </tr> </thead> <tbody> <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> </tbody> </table> <p style="text-align: right;">✓✓✓✓</p>	Function	Structure			Heart valves	Cardiac muscle	Heart chambers	Contracts to force blood from atria to ventricles		✓		Contracts to force blood out of the ventricles through vessels		✓		Prevents backflow of blood during contractions	✓			Blood temporarily stored in these small spaces to allow blood to be pumped at a high pressure			✓	4	1.1	one mark for each correct row
Function	Structure																											
	Heart valves	Cardiac muscle	Heart chambers																									
Contracts to force blood from atria to ventricles		✓																										
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Blood temporarily stored in these small spaces to allow blood to be pumped at a high pressure			✓																									

Question	Answer	Marks	AO element	Guidance
(c)	<p>Any one from:</p> <p>baby will be more tired/won't have as much energy ✓</p> <p>idea of fast or difficulty breathing ✓</p> <p>idea of reduced cardiac output ✓</p> <p>idea that there is slower growth/baby does not gain weight ✓</p> <p>idea that there is less oxygen in (baby's) blood ✓</p> <p>idea that oxygenated blood and deoxygenated blood can mix ✓</p>	1	2.1	<p>IGNORE backflow of blood</p> <p>IGNORE surgery</p> <p>ALLOW any other valid suggestion</p>
(d)	<p>Arteries</p> <p>Capillaries</p> <p>Veins</p> <p>Very thin walls, one cell thick</p> <p>Very thick walls containing elastic tissue and muscle</p> <p>Thin walls containing elastic tissue, also contains valves</p> <p>To withstand the high blood pressure of blood leaving the heart</p> <p>They can be squashed to move blood along; backflow of blood is prevented</p> <p>Allows diffusion of substances into and out of the vessel quickly and easily</p> <p>✓✓✓</p>	3	1.1	<p>6 correct lines = 3 marks</p> <p>5/4 correct lines = 2 marks</p> <p>3/2 correct lines = 1 marks</p> <p>IGNORE any box with more than 1 line joined to it</p>

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

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

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

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