OCR
Oxford Cambridge and RSA

H

GCSE (9–1)

Combined Science B (Twenty First Century Science)

J260/05: Biology (Higher 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.

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 Combined Science 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.

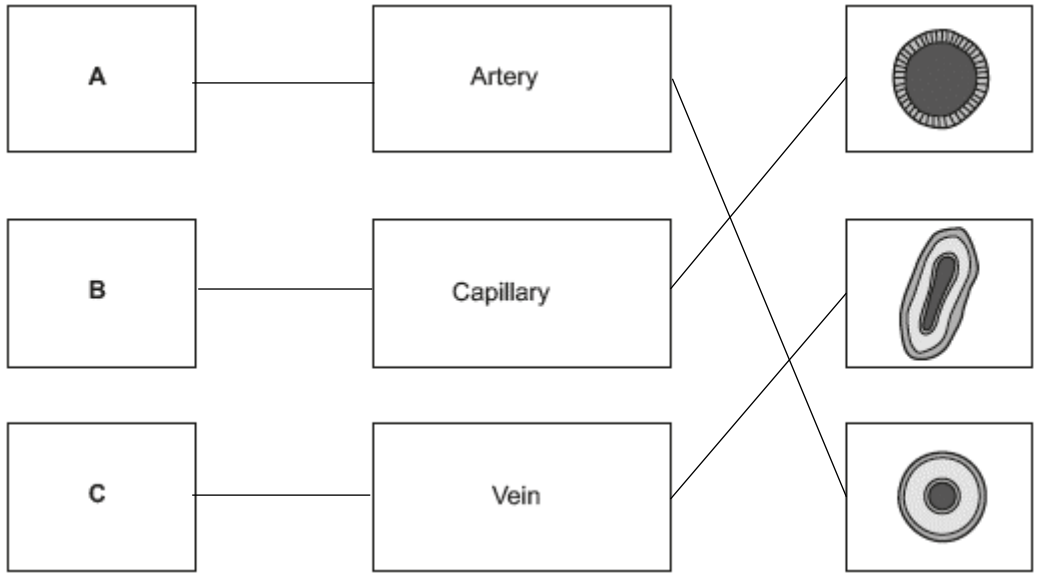
Question			Answer	Marks	AO element	Guidance
1	(a)		27 22 16 22 9 ✓✓	2	1.2	27 and 9 correct = 1 mark 22, 16 and 22 correct = 1 mark
	(b)	(i)	Appropriate scale and labelled axes with units (graph drawn either way acceptable) ✓ All points plotted correctly ✓	2	2.2	**IGNORE** bird names **ALLOW** 1/2 square margin of error in plotting **ALLOW ECF** from part 1 (a)
		(ii)	Line of best fit drawn ✓	1	2.2	**ALLOW** ECF **DO NOT ALLOW** extrapolation beyond 1 and 5
	(c)	(i)	Yes because: there is a positive correlation ✓ **OR** Partly supports / No: One result does not fit the trend/pattern ✓	1	3.1a	**ALLOW** negative correlation if the axes are transposed. **ALLOW** 1 mark if outlier identified
		(ii)	A correlation does not prove cause ✓ there could be other factor(s) that affect dominance ranking ✓	2	3.1b	**IGNORE** identification of outlier **ALLOW** any reasonable suggested factor e.g. aggression/different food preferences
	(d)		**Any two from:** *idea* that species rely on each other for many different resources ✓ example of resources species provides for other species or require from another species e.g. food, shelter, building materials, habitat etc ✓ *idea* that species keep the population of another species constant/affect the population of other species ✓	2	1.1	**ALLOW** 2 marks for named resources linked to the idea of interdependence.

Question			Answer	Marks	AO element	Guidance
2	(a)		chlorophyll oxygen respiration glucose energy ✓✓✓	3	1.1	All five correct for 3 marks Any four or three correct for 2 marks Any two or one correct for 1 mark
	(b)	(i)	B ✓ (The indicator turned purple showing that the carbon dioxide level decreased as) used by the pondweed/plant✓	2	3.1a 3.2b	**ALLOW** C if explanation is correct e.g. carbon dioxide produced by snail is equal to carbon dioxide taken in by pondweed/plant.
		(ii)	A ✓ (The indicator turned yellow showing that the carbon dioxide level increased) the plant was not using carbon dioxide in photosynthesis/ was only carrying out respiration ✓	2	3.1a 3.2b	
		(iii)	Carbon dioxide produced by (respiration) snail (and plant) ✓ Is the same amount as carbon dioxide use (by plant /photosynthesis)✓	2	2.1	
		(iv)	**Any one from:** Same length/ mass of pond weed ✓ Same type of pond weed✓ Same size test tube✓ Same light intensity✓ Same temperature✓ Same species of snail/ same size snail✓ Same volume of bicarbonate indicator ✓ Same volume of water ✓ Same amount of indicator ✓	1	3.3b	**ALLOW** amount of pondweed

<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></td><td>Any two from:
(polymer of) nucleotides ✓

with two strands ✓

forming a double helix ✓</td><td>2</td><td>1.1</td><td>ALLOW Complementary base pairs/A=T and G=C for 1 mark, and named for 2nd mark</td></tr>
<tr><td></td><td>(b)</td><td></td><td>light can pass through ✓</td><td>1</td><td>1.2</td><td>ORA</td></tr>
<tr><td></td><td>(C)</td><td>(i)</td><td><table><tr><th>Objective lens</th><th>Focusing Knob</th><th></th></tr><tr><td>x10</td><td>coarse</td><td></td></tr><tr><td>x4</td><td>coarse</td><td>✓</td></tr><tr><td>x10</td><td>fine</td><td></td></tr><tr><td>x4</td><td>fine</td><td></td></tr></table></td><td>1</td><td>1.2</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td><table><tr><th>Objective lens</th><th>Focusing Knob</th><th></th></tr><tr><td>x10</td><td>coarse</td><td></td></tr><tr><td>x4</td><td>coarse</td><td></td></tr><tr><td>x10</td><td>fine</td><td>✓</td></tr><tr><td>x4</td><td>fine</td><td></td></tr></table></td><td>1</td><td>1.2</td><td></td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
4	(a)		 ✓✓	2	1.1	All lines correct = 2 marks Left hand side correct = 1 mark Right hand correct = 1 mark
	(b)		*1 mark from each section and one other from either section.* *Exchange surfaces:* Increases the SA:Vol ratio ✓ more <u>diffusion</u> can take place (into and out of cells) decrease the distance the substances have to diffuse. ✓ *Transport systems:* moves substances around the body ✓ named example of substance ✓	3	1.1	**ALLOW** deliver/remove substances

Question			Answer	Marks	AO element	Guidance
5	(a)		**FIRST CHECK THE ANSWER IN ON ANSWER LINE** **If answer = 21(%) award 3 marks** 115-95x100/95 ✓ = 21.05 ✓ = 21 (%) ✓	3	**2.2x2** **1.2**	**ALLOW** ECF **ALLOW** One mark for two significant figures**.**
	(b)		**Any three from:** idea that the coal tits will compete with each other on island for food/insects/seeds/ other named resources ✓ idea that larger coal tits outcompete smaller coal tits ✓ idea that larger tits more likely to mate with other larger tits ✓ idea that conditions on island and mainland are different this process happens separately✓ idea that there may be no interbreeding between species on the island and mainland ✓	3	2.1	**DO NOT ALLOW** survival of the fittest **ALLOW** mutation only occurred on island Allow explanation of different conditions i.e. different predators and food on island compared to island.
	(c)	(i)	Mainland hatchlings will grow to be bigger ✓	1	2.1	
		(ii)	because size is affected by genes and not environment ✓	1	2.1	

<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 colspan="2"></th><th>Athlete's foot</th><th>HIV/AIDS</th><th>Influenza</th><th>Malaria</th><th>Salmonella</th></tr>
<tr><td rowspan="4">Pathogen</td><td>Bacterium</td><td></td><td></td><td></td><td></td><td>✓</td></tr>
<tr><td>Fungus</td><td>✓</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Protist</td><td></td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>Virus</td><td></td><td>✓</td><td>✓</td><td></td><td></td></tr>
<tr><td rowspan="6">Spread</td><td>Coughing</td><td></td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td>Food</td><td></td><td></td><td></td><td></td><td>✓</td></tr>
<tr><td>Mosquito bite</td><td></td><td></td><td></td><td>✓</td><td></td></tr>
<tr><td>Sexual contact</td><td></td><td>✓</td><td></td><td></td><td></td></tr>
<tr><td>Surfaces</td><td>✓</td><td></td><td>✓</td><td></td><td></td></tr>
<tr><td></td><td></td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td></td></tr>
</table>
</td><td>4</td><td>1.1</td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td>Acid in the stomach kills many bacteria ✓

Idea that Salmonella need to be able to successfully compete with bacteria already attached to the cells in the small intestine ✓</td><td>2</td><td>2.1</td><td></td></tr>
<tr><td></td><td>(c)</td><td>(i)</td><td>FIRST CHECK THE ANSWER ON ANSWER LINE
If answer = 2.56 x 10^8 award 2 marks

1x10^6 x 2^8 ✓

= 2.56 x 10^8 ✓</td><td>2</td><td>2.2</td><td></td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
		(ii)	**Any two from:** Infected individual's immune system will kill *Salmonella* / white blood cells engulf/phagocytose *Salmonella* ✓ The more antibiotics that are used the greater the risk of resistance ✓ Antibiotics are not very effective ✓ Antibiotics may be vomited up/out (before they work) ✓	**2**	**2.1**	
	(d)		To reduce the length/severity of symptoms ✓ To prevent/ eliminate the cause of /pathogens causing the disease ✓	**2**	**1.1**	**ALLOW** reduces chance of infecting others/spread
	(e)	**(i)**	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 314 (mm^2) award 3 marks** 10^2 = 100 ✓ 3.14 x 100 ✓ = 314 (.159) ✓	**3**	**2.2**	**ALLOW** ECF
		(ii)	To be sure that the difference between the growth of the salmonella bacteria around the control disc and the antibiotic discs is entirely due to the antibiotic alone ✓	**1**	**2.2**	**ALLOW** the idea that it is the antibiotic that has an effect.

<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>(f)</td><td></td><td>
<table>
<tr><th>Stage</th><th>Preclinical</th><th>Clinical</th><th>Safety</th><th>Effectiveness</th><th></th></tr>
<tr><td>Animal cells</td><td>✓</td><td></td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Cultured cells</td><td>✓</td><td></td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>Healthy volunteers</td><td></td><td>✓</td><td>✓</td><td></td><td>✓</td></tr>
<tr><td>Humans with the disease</td><td></td><td>✓</td><td>✓</td><td>✓</td><td>✓</td></tr>
</table>
</td><td>4</td><td>1.1</td><td>IGNORE any tick in the effectiveness/volunteers.</td></tr>
<tr><td></td><td>(g)</td><td></td><td>Salmonella 4000nm and virus 100 nm ✓

(Not the same order of magnitude as bacteria) are more than 40 times bigger ✓</td><td>2</td><td>1.2</td><td></td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>7</td><td>(a)</td><td></td><td>
<table>
<tr><td></td><td>R</td><td>W</td></tr>
<tr><td>R</td><td>RR</td><td>RW</td></tr>
<tr><td>W</td><td>RW</td><td>WW</td></tr>
</table>
(Yes because)
Correct parent genotype ✓
Correct offspring genotype ✓

Expected 1:2:1 ratio from numbers provided by farmer ✓

The ratio of cows produced is close to expected 25% or ¼ red, 25% or ¼ white and 50% ½ roan ✓
</td><td>4</td><td>2.2</td><td>ALLOW ECF if Punnett square is incorrect for correct ratio and subsequent conclusion.</td></tr>
</table>

Question	Answer	Marks	AO element	Guidance
(b)*	Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** Detailed description of how selective breeding has been used to breed cows that produce meat. **AND** Explains the differences between selective breeding and natural selection. *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)** Detailed description of how selective breeding has been used to breed cows that produce meat. **OR** Explains the differences between selective breeding and natural selection. **OR** An outline description of how selective breeding has been used to breed cows that produce meat. **AND** Explains the differences between selective breeding and natural selection. *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)** An outline description of how selective breeding has been used to breed cows that produce meat. **OR** An attempt to explain the differences between selective breeding and natural selection. *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 x 1.1** **4 x 2.1**	**AO1.1 Recall ideas about selective breeding** • Variation is present in all species • Individuals are selected for desired characteristics • Breeding • Offspring produced with desired characteristic are selected and bred • Continues over generations **AO2.1 Application of knowledge and understanding of natural selection to shorthorn cattle** • Idea that cows and bulls are selected based on their ability to produce beef • Variation in offspring beef production/mass/size • Most productive offspring selected and mated with each other • Over many generations/200 years leads to increase in beef production **AO2.1 Application of knowledge and understanding of the difference between selective breeding and natural selection** • Selected characteristics are beneficial to humans • Natural mating does not occur, cows and bulls which mate are chosen by humans • In Natural selection alleles are advantageous to the organism

Question			Answer	Marks	AO element	Guidance
8	(a)		Genome Chromosomes Amino Acids Proteins Phenotype Alleles Environment ✓✓✓	3	1.1	All seven correct for 3 marks Any six, five or four for 2 marks Any three or 2 for 1 mark One correct = 0 mark
	(b)	(i)	**Any two from:** Idea that the genes that are affected depends on the size and or position of the deletion/mutation (so many variants possible) ✓ Idea that the genes affected will affect the proteins that can be produced so, the more genes that are removed the more proteins affected ✓ Symptoms of 22q vary because genes affected vary, which could cause recessive alleles to be expressed ✓ Idea that each child is brought up in a different environment and this could have an effect (environmental factors) ✓	2	2.1	
		(ii)	(Benefit -) Diseases can all be treated successfully/allows early diagnosis and treatment ✓ (Risk/ethical issue -) May have religious objections to testing/test may produce false results/may be worried about side effects from testing ✓	2	1.1	
		(iii)	**FIRST CHECK THE ANSWER IN ON ANSWER LINE** **If answer = 340 award 2 marks** 679106/2000 = 339.553 ✓ 340 ✓	2	2.2	

		(iv)	Journal: other scientists can check/ repeat/ compare work ✓	**1**	**1.1**	
			Newspapers: general public need to know so they can make use of the advances ✓	**1**	**2.1**	**Allow** any relevant example.

Question			Answer	Marks	AO element	Guidance
9	(a)		**Any two from**: These are unspecialised ✓ have some genes switched off ✓ Less variation in what can be made from adult (connective tissue) stem cells ✓	2	1.1	**ALLOW** contain undifferentiated cells
	(b)		The scientists could confirm the source of each tissue in the artificial oesophagus ✓	1	2.1	
	(c)	(i)	(Risk -) stem cells may become cancerous/risk of tissue rejection ✓	1	2.1	
		(ii)	(Ethical -) may be against religious views/may involve the death of embryos/animals ✓	1	2.1	
	(d)		**Any two from**: Plants have Meristem cells ✓ where no genes are switched off ✓ can differentiate/specialise into all cell types ✓	2	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>10</td><td>(a)</td><td></td><td>
<table>
<tr><th>Statement</th><th>Model A</th><th>Model B</th></tr>
<tr><td>Upright humans and modern humans both evolved in Africa</td><td>✓</td><td>✓</td></tr>
<tr><td>Modern humans evolved separately and continuously in three continents</td><td></td><td>✓</td></tr>
<tr><td>Modern humans migrated out of Africa 100 000 years ago,</td><td>✓</td><td></td></tr>
</table>
✓✓✓</td><td>3</td><td>3.1a</td><td>One mark for each statement correct</td></tr>
<tr><td></td><td>(b)</td><td></td><td>
<table>
<tr><th>New evidence</th><th>Model A</th><th>Model B</th></tr>
<tr><td>A fossil modern man dated as 200 000 years old has been found outside of Africa.</td><td></td><td>✓</td></tr>
<tr><td>About 2% the DNA found in modern Europeans is from humans who lived in Europe more than 100 000 years ago.</td><td></td><td>✓</td></tr>
<tr><td>Mitochondrial DNA suggest all modern humans share a single African female common ancestor who lived 200 000 years ago.</td><td>✓</td><td>✓</td></tr>
</table>
✓✓✓</td><td>3</td><td>3.2a</td><td>One mark for each statement correct</td></tr>
<tr><td></td><td>(c)</td><td></td><td>Any one from:
Many scientists don’t think there is enough new evidence to change their minds ✓

Many scientists are waiting for a better hypothesis to explain all of the data ✓</td><td>1</td><td>1.1</td><td></td></tr>
</table>

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