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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 Autumn 2021

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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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1. Annotations available in RM Assessor

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

2. 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

3. **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>
<table>
<tr><th>Statement</th><th>Communicable diseases</th><th>Non-communicable diseases</th></tr>
<tr><td>They are caused by alleles</td><td></td><td>✓</td></tr>
<tr><td>They are caused by lifestyle choices</td><td></td><td>✓</td></tr>
<tr><td>They are caused by pathogens</td><td>✓</td><td></td></tr>
<tr><td>They are caused by trauma</td><td></td><td>✓</td></tr>
<tr><td></td><td>✓</td><td>✓</td></tr>
</table>
</td><td>2</td><td>1.1</td><td>Award one mark for each correct column</td></tr>
<tr><td></td><td>(b)</td><td></td><td>antibodies ✓
antigens ✓
digested ✓</td><td>3</td><td>1.1</td><td>Answers must be in the correct order</td></tr>
<tr><td></td><td>(c)</td><td></td><td>Mia more information
Sam ethical decision
Ali ethical decision
Jamal more information
✓✓✓</td><td>3</td><td>3.1b</td><td>All 4 correct = three marks
3 correct = 2 marks
1 or 2 correct = 1 mark</td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
2	(a)		**Any four from:** select the lowest/lower objective lens/lowest power ✓ move the stage (towards the lens) up/until it reaches the top ✓ description of focussing the slide using the (coarse) focussing knob✓ change the objective lens to a higher objective lens/higher power✓ idea of the repeat of the focussing process/refocus/use (fine) focussing knob (to make the image clearer) ✓	4	1.2	**ALLOW** smallest objective lens/smallest power/select the x4 lens **ALLOW** move the stage up until it reaches the lens **ALLOW** bigger objective lens/bigger power/select the x10 lens/select the x40 lens **ACCEPT** any sensible order
	(b)		**Any two from:** dead cells ✓ strengthened/lignified walls ✓ no end walls/continuous tube ✓ pits to allow water to enter and leave ✓	2	1.1	**ALLOW** is one long tube/no cell contents or an example of cell content e.g. mitochondria
	(c)	(i)	provides large surface area/surface area to volume ratio ✓ idea that transport/uptake will be (more) rapid/faster ✓ **OR** has many/lots of mitochondria ✓ to release energy/ATP/ to carry out active transport ✓	2	1.1	
		(ii)	Any two from respiration ✓ makes ATP/release energy ✓ ATP/energy is required for active transport ✓	2	2.1	**DO NOT ALLOW** produce energy
	(d)		Water ions can diffuse through the partially permeable membrane, but nitrate ions cannot. ✓	1	2.1	

Question			Answer	Marks	AO element	Guidance
3	(a)		**Any two from:** Stopping smoking for a year has an effect on/ reduces the risk of cardiovascular disease ✓ The longer the time since quitting, the lower the relative risk of cardiovascular disease ✓ All groups are at risk of cardiovascular disease ✓ Current smokers at most risk of cardiovascular disease ✓ After three years the risk of heart disease is similar for stopped and never smoked. ✓	2	3.2b	**ALLOW** any suitable conclusion from the graph ORA
	(b)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 38 award 2 marks** (100 – 98.8)/100 = 0.012 ✓ 0.012 x 3175 = 38 ✓ **OR** 100- 98.9 = 1.2 (3175 ÷ 100) x 1.2 = 38 **OR** 98.8% of 3175 = 3136.9 3175 – 3136.9 = 38	2	2.2	If answer = 38.1 award 1 mark
	(c)	(i)	idea that it is difficult to test/follow everyone ✓	1	1.2	**ALLOW** other sensible suggestions Eg. Not enough time to count everyone
		(ii)	idea that test is representative/large enough/there are 9 countries in the sample ✓	1	1.2	**ALLOW** carried out over a three-year period.
	(d)		**Any three from:** losing mass/weight/reduce BMI/waist hip ratio ✓ exercising more/more aerobic exercise/example of suitable exercise ✓ reducing stress/example of stress reduction ✓ drinking less/no alcohol ✓ idea of a healthy diet/description of a healthy diet✓	3	1.1	

Question			Answer	Marks	AO element	Guidance
4	(a)		Any 2 from: has some features in common with birds✓ beak/feathers/wings/wishbone ✓ does not have long bony tail and teeth ✓	2	3.2a	
	(b)		idea that DNA of *Archaeopteryx* could be compared to that of modern birds/genome analysis of modern bird and *Archaeopteryx* ✓ idea that the more similar the genes/alleles/variants the closer the evolutionary relationship/more recently a common ancestor is shared ✓	2	2.1	**ALLOW** similar DNA

Question			Answer	Marks	AO element	Guidance
5	(a)		**Any 2 from:** idea that insulin is acting from 2 minutes until 6 minutes ✓ idea that glucagon is acting in minute 6 to 7 ✓ rapid increase (in blood sugar concentration between) 1 to 2 minutes ✓ insulin acts to decrease blood sugar ✓ glucagon acts to increase blood sugar ✓	**4**	**1.1 x 2** **3.2a x 2**	**ALLOW** correct data for blood sugar concentration E.g. 135-139 to 93-95 mg/dL (2-6 mins) 93-95 to 100 mg/dL (6-7 mins)
	(b)		**Charlie/Type 1 diabetes** Pancreas stops making insulin Insulin injection is always needed as part of treatment ✓ **Taylor/Type 2 diabetes** Cells stop being able to use insulin Change in diet alone can be used ✓	**2**	**1.1**	
	(c)		glucose is a small(er) molecule and can pass through protein channels/ pores/ gaps/ holes in the (partially permeable membrane) ✓ glycogen is too big/bigger is insoluble ✓	**2**	**2.1**	**ALLOW for 1 mark:** idea that partially permeable has small holes Glucose is smaller 2 marks
	(d)	**(i)**	Any 2 from: there is a positive correlation between cardiovascular disease and diabetes ✓ as age increases the percentage of women with cardiovascular disease and diabetes increases ✓ There are always more women with diabetes than cardiovascular dissease.✓	**2**	**3.2b**	**IGNORE** answers which refer to cause.
		(ii)	**Any two from:** knowing how many women were in the study/size of the study ✓ if the study had included men ✓ if the study had included more countries ✓ If the study had included pre exisiting health conditions/lifestyle choices eg obsity and smoking ✓	**2**	**2.2**	**IGNORE** reference to including younger people in study.

Question			Answer	Marks	AO element	Guidance
6*			Please refer to the marking instructions on page 5 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** Gives a full description of natural selection in the context of mosquitoes **AND** explains how this can cause speciation *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)** Correctly describes some aspects of natural selection **AND** with correct reference to context of mosquitoes *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)** Correctly describes some aspects of natural selection but with no reference to context of mosquitoes *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**	**1.1 x 2** **2.1 x 4**	**AO1.1 Showing knowledge of evolution by natural selection and speciation.** • There is usually extensive genetic variation in any population. • This variation arises from mutation/changes in the genes. • Evolution occurs through natural selection • Evolution produces phenotypes and genotypes most suited to their environment. • The role of competition in natural selection. • Change takes place over many generations. • If the changes are great enough populations become reproductively isolated. **AO2.1 Applying knowledge and understanding in the given context** • There will be variation in the mosquitoes trapped underground e.g. some trapped may be able to feed on mammals. • Some could feed and breed more often • These mosquitoes will have a competitive advantage, so find more/have more food. • Those that eat mammals are more likely to survive • Those that survive will breed and will pass on variants/alleles. • Eventually the changes in genotype are so great underground and surface mosquitoes can no longer breed so they are different species.

Question			Answer	Marks	AO element	Guidance
7	(a)		genome ✓ DNA ✓ proteins ✓ enzymes ✓	4	1.1	
	(b)	(i)	0.25/25%/ $\frac{1}{4}$/ 1 in 4/ 1:3 0% 0.50/50%/ $\frac{1}{2}$ / 1 in 2/ 1:1 ✓✓	2	2.1	All three correct = 2 marks One or two correct = 1 mark
		(ii)	Homozygous offspring: $X^H X^H$ ✓ Heterozygous offspring: X^H X^h ✓ Explanations: **Homozygous** idea that zygote/cell with two (alleles) that are the same genetic variants✓ **Heterozygous** idea that zygote/cell with two (alleles) but they are different genetic variants ✓	4	1.1 x 2 2.1 x 2	**ALLOW:** X^H Y
		(iii)	X^H ✓ Gametes have a single copy of sex/ each chromosomes ✓	2	1.1 2.1	
		(iv)	Platelets can stick to the edges of damaged blood vessels and start clot formation.✓	1	1.1	
	(c)		(Like most characteristics) eye colour is controlled by many genes. ✓ each gene can have many alleles each of which has a small effect on eye colour/characteristic ✓	2	2.1	Allow idea of dominant/recessive/codominance of alleles

Question			Answer	Marks	AO element	Guidance
8	(a)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.14 (%) award 3 marks** 906 000 x 100 / 670 000 000 ✓ = 0.13522388 ✓ = 0.14 (%) ✓	3	**2.2 x 2** **1.2**	**ALLOW** ECF
	(b)		**MAX one from each section:** **Ecological** reduction in biodiversity ✓ disruption of carbon cycle ✓ **Moral** rights of tribes/indigenous people owtte ✓ responsibility for environment ✓ **Economic** farming needs of local people ✓ access to raw materials which can be sold ✓ **Political** votes of local people ✓ election promises to local people ✓	4	**2.1**	**ALLOW** any sensible suggestion for each section E.g. Deforestation increases global warming. Mark each section independently.

	(c)	(i)	**Any four from:** **Photosynthesis** idea that carbon dioxide and water are inputs/reactants ✓ idea that photosynthesis produces glucose (and oxygen) ✓ **Storage** idea that glucose represents biomass ✓ idea that glucose can be converted to storage carbohydrates e.g. starch or structural carbohydrates e.g. cellulose ✓ idea that glucose can be converted to lipids or (if nitrates and phosphates are available) proteins and DNA ✓	**4**	**1.1**	**ALLOW** two marks for correct reactants and products.
		(ii)	**Any two from:** carbon is essential to life/forms a major part of biochemical molecules/carbohydrates/proteins/lipids/DNA ✓ idea that if it is not recycled then it cannot be reused ✓ idea that photosynthesis provides food/biomass is the start of the food chain ✓ idea that food/carbohydrates/lipids/proteins can be respired ✓	**2**	**1.1**	**IGNORE** references to global warming. **ALLOW** oxygen produced used for respiration.
		(iii)	enzymes ✓ respire ✓	**2**	**1.1**	

Question			Answer	Marks	AO element	Guidance
9	(a)		**Any one from:** Cytoplasm ✓ Mitochondria ✓	1	1.1	
	(b)		**Any three from:** glucose is used for respiration ✓ starch is insoluble so does not affect osmosis/movement of water into or out of the cell ✓ too big so cannot pass through partially permeable membrane✓ polymer so lots of glucose molecules ✓	3	2.1	
	(c)		5.0×10^{-6}m/0.000005m ✓ 7.0×10^{-6}m/0.000007m ✓ 5.0×10^{-6}m/0.000005m ✓	3	2.2	
	(d)	(i)	respiration produces CO_2 ✓ absorbed by KOH (so volume/pressure lower in B than A) ✓	2	2.1 3.1a	
		(ii)	**Any one from:** respiration is an exothermic process ✓ respiration will increase the temperature ✓	1	2.1	
		(iii)	put whole apparatus/test tube containing germinating seeds in a water bath at a set temperature ✓	1	3.3a	**ALLOW** use a thermostatically controlled water bath.

	(e)		**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 4.0 x 10^{-3} award 4 marks** 1.6 - 0.8 = 0.8 (mlO_2 in 20 min) ✓ 0.8 ÷ 20 = 0.04 (mlO_2/min) ✓ 0.04 ÷ 10 = 0.004 (mlO_2/min/^oC) ✓ 4.0 x 10^{-3} mlO_2/min/^oC ✓	**4** **3.1a** **2.2 x 2** **1.2**		

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