OCR
Oxford Cambridge and RSA

GCSE (9–1) H

Combined Science B

(Twenty First Century Science)

J260/05: Biology (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2019

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
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**.

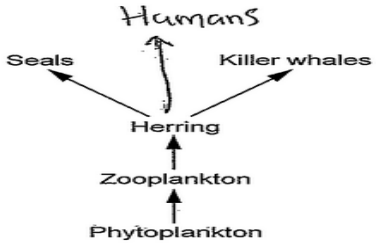
Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

The breakdown of Assessment Objectives for GCSE (9-1) in Combined Science B:

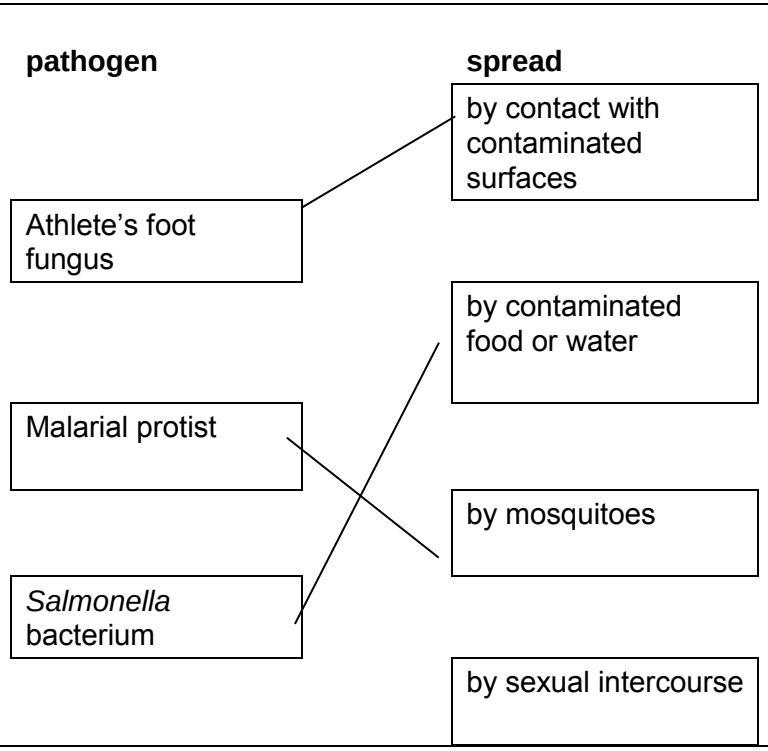
	Assessment Objective
AO1	**Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.**
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	**Apply knowledge 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)		Cytoplasm ✓ Mitochondria ✓	2	2x1.1	
	(b)		Active transport ✓ Muscle contraction ✓	2	2x1.1	
	(c)		**Any three from:** comment on safety/hazards/ways to reduce risk ✓ how much mass of potato is used each time ✓ type/size/surface area of the paper ✓ how much/volume of water each time ✓ the volume/amount/concentration of H_2O_2/solution ✓ the temperature ✓ the size of the test tube ✓ start the timer at the same time e.g. when disc has sunk to the bottom of the test tube ✓	3	3x1.2	**ALLOW** weight/amount of potato used each time/how much potato extract / how much time to soak the disc in the potato extract
	(d)		**Any two from:** the reaction makes oxygen/gas ✓ more oxygen/bubbles formed when (rate of) reaction is faster ✓ more oxygen/bubbles means the disc will rise faster ✓	2	2x2.2	Candidates need to refer to more once for marking points 2 and 3

Question			Answer	Marks	AO element	Guidance
	(e)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.131 (s^{-1}) award 3 marks** 1 ÷ 7.66 ✓ = 0.1305483 ✓ = 0.131 (s^{-1}) (3sf) ✓	**3**	**3x2.2**	Check for answer written in/beside the table
	(e)	(ii)	Between 0.75% and 6.00% H2O2 the reaction rate increases by approximately 2.5 times ✓ The biggest difference in time taken for the paper disc to reach the surface is between 0.75 and 1.50% H2O2 ✓	**2**	**2x3.2b**	
	(f)		Idea of repeat readings ✓	**1**	**3.3b**	
	(g)		Hydrogen peroxide/H_2O_2 is the substrate/key ✓ Substrate fits into the active site/lock of the enzyme ✓ Idea that shapes of substrate and active site are complementary/substrate is the correct shape ✓ Idea that <u>only</u> H_2O_2 can fit into the active site of catalase ✓	**4**	**2.1** **1.1** **1.1** **1.1**	**ALLOW** labelled diagrams for mark points three and four.

Question			Answer	Marks	AO element	Guidance
2	(a)	(i)	Arrow <u>from</u> herring (only) to human ✓	1	2.1	Arrow head can point in any direction but must be from herring to human, e.g. 
		(ii)	Both eat herring ✓ Idea that herring in short supply/not enough herring for all the seals and killer whales ✓	2	2x2.1	
		(iii)	Photosynthesis ✓	1	1.1	
		(iv)	Phytoplankton ✓	1	2.1	
		(v)	Ben ✓ If there are fewer species the biodiversity is lower ✓	2	2x2.1	
	(b)	(i)	1965 **AND** 1.2 (million tonnes) ✓	1	3.1a	
		(ii)	Fall in mass of catch/catch is lower/fewer herring caught ✓	1	3.2a	**ALLOW** correct use of data to justify marking point.

Question			Answer	Marks	AO element	Guidance
		(iii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.1375 (million tonnes/year) award 3 marks** 1984 = 0.4 **and** 1988 = 0.85-0.95 ✓ 0.95 – 0.4 = 0.55 ✓ 0.55 ÷ 4 = 0.1375 / 0.14 (million tonnes/year) ✓	**3**	**3.1a** **2.1** **2.1**	 **ALLOW ECF** **ALLOW ECF**
	(c)		**Any two from:** Meeting the needs of people for herring to eat without damaging the herring population for the future ✓ herring are not being used up faster than they can be replaced ✓ Herring population would not decrease / would remain constant ✓	**2**	**2x2.1**	Answers must refer to the context of the question i.e. herring Note: this marking point relates to herring population size, not the size of the catch

Question			Answer	Marks	AO element	Guidance
3	(a)	(i)		1	1.1	All three correct = one mark
		(ii)	**Any three from:** Virus particles sneezed or coughed out are trapped by a tissue / prevents others breathing virus/particles in ✓ Tissue disposed of to prevent further contact ✓ Wash hands to kill/remove viruses ✓ Droplets containing the flu virus are breathed in and infect the breathing system ✓	3	3x2.1	**IGNORE** references to bacteria/germs **ALLOW** Use of hand sanitiser

Question			Answer	Marks	AO element	Guidance
3	(b)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 0.0068 award 2 marks** 170 000 ÷ 25 000 000 ✓ = 0.0068 ✓	**2**	**2x2.2**	**IGNORE** units
		(ii)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 190 or 190.08 award 3 marks** 66 000 000 ÷ 25 000 000 ✓ 72 x (66 000 000 ÷ 25 000 000) ✓ = 190.08 or 190 ✓ **OR** 72 ÷ 25 000 000 ✓ 66 000 000 x (72 ÷ 25 000 000) ✓ = 190.08 or 190 ✓	**3**	**3x2.2**	
	(c)		Electron microscope ✓	**1**	**1.1**	
	(d)	(i)	(Successfully) vaccinated individuals cannot (get flu and therefore cannot) pass on flu ✓ The more individuals that are vaccinated the less likely the infants will be infected with flu/ Idea of herd effect ✓	**2**	**2x2.1**	

Question			Answer	Marks	AO element	Guidance
3	(d*)	(ii)	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)** Explains role of antigens and white blood cells in triggering immune response. **AND** Explanation of why flu vaccine is not 100% effective. *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)** Basic explanation of role of antigens and white blood cells in triggering immune response. **AND** Basic explanation of why flu vaccine is not 100% effective. *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)** Basic explanation of role of antigens and white blood cells in triggering immune response. **OR** Explanation of why flu vaccine is not 100% effective. *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**	**3 x 1.1** **3 x2.1**	**AO1.1 Demonstrate knowledge and understanding of the role of antigens and white blood cells in triggering immune response.** • White blood cells destroy pathogens • Some white blood cells digest pathogens/produce chemicals which kill pathogens or make antibodies • Pathogens have antigens on their surface • Antigens allow white blood cells to identify self and non-self. • White blood cells have receptors which bind to antigens • White blood cells can make an antibody specific to each antigen • (Primary) response (to vaccine) produces memory cells • Memory cells/secondary response provide immunity by quickly producing antibodies on re-infection **AO2.1 Application of knowledge and understanding related to the effectiveness of the vaccine.** • Dead/weakened/attenuated virus/proteins in vaccine cannot cause flu but has antigens so triggers production of antibodies and memory cells • Flu is very infective so need to vaccinate large proportion of the population • Flu virus proteins/antigens mutate/change often producing new shapes. • New shaped antigens will not be recognised by immune systems and so have a selective advantage/spread quickly • So the vaccine may not contain the most common antigens and will not protect against flu • Antibodies made by vaccinated person will be the wrong shape

Question			Answer	Marks	AO element	Guidance
3	(e)	(i)	**Any one from**: both affect respiratory/breathing system/lungs ✓ flu virus damages cells (of respiratory system) making infection by other viruses/bacteria/fungi/microorganisms easier ✓ flu infection weakens immune system (making other secondary infections more likely) ✓	1	2.1	
		(ii)	14:1 ✓	1	2.2	**DO NOT ALLOW** 1:14 **IGNORE** units
		(iii)	**Any two from:** less/smaller volume of air in alveolus ✓ (fluid) reduces surface area of alveoli (in contact with air) ✓ diffusion of oxygen/gas slower (through fluid so takes longer to reach lining/wall of alveolus) ✓ this reduces (the rate/amount of) gas exchange / less oxygen diffuses into blood ✓ **AND any two from:** *(tired/weak because)* oxygen is needed (for cellular) respiration ✓ less oxygen/respiration ✓ therefore less ATP/energy (for life processes)✓	4	**2 x 2.1** **2 x 1.1**	**ALLOW** example of life process e.g. muscle contraction

Question			Answer	Marks	AO element	Guidance
4	(a)	(i)	<table><tr><td></td><td>H✓</td><td>h</td></tr><tr><td>h✓</td><td>Hh</td><td>hh</td></tr><tr><td>h</td><td>Hh</td><td>hh✓</td></tr></table> Parent: Hh Parent: hh Correct possible fertilised eggs	3	3x2.1	**ALLOW** for all three marks: Parent: HH <table><tr><td></td><td>H</td><td>H</td></tr><tr><td>h</td><td>Hh</td><td>Hh</td></tr><tr><td>h</td><td>Hh</td><td>Hh</td></tr></table>
		(ii)	50% ✓	1	1.2	**ECF** from 4ai
	(b)	(i)	Amino acids ✓	1	1.1	
		(ii)	Nucleotide (monomers) ✓ Two strands ✓ Double helix ✓	3	3x1.1	**ALLOW** higher level ideas, i.e.: four different nucleotides/bases each nucleotide made from sugar, phosphate and base A-T and C-G base pairing
		(iii)	**Any two from:** Change/mutation in a gene ✓ Can change the order of the amino acids (in a protein) ✓ New order of bases/amino acids makes different protein. ✓	2	2x1.1	**ALLOW** higher level ideas, i.e.: order of bases (in DNA/gene) changes example of mutation (e.g. deletion / insertion / substitution)

Question			Answer	Marks	AO element	Guidance
5	(a)	(i)	**Any two changes and explanations:** **Change 1** Misshapen/sickle rbc ✓ **Explanation 1** Less surface area for diffusion of oxygen in and out of cell or cannot pass through capillaries ✓ **Change 2** nucleus in some rbcs reduces amount of haemoglobin ✓ **Explanation 2** haemoglobin carries oxygen ✓ **Change 3** Fewer rbc ✓ **Explanation 3** less haemoglobin to carry oxygen ✓	**4**	**3.1a** **1.1** **3.1a** **1.1** **3.1a** **1.1**	Explanation must be linked to change to get all three marks. **ALLOW** two marks for two changes/two explanations.
		(ii)	Stain or appropriately named stain e.g. methylene blue ✓	**1**	**1.2**	**IGNORE** dye
	(b)		Gene (for haemoglobin production) ✓ switched off ✓	**2**	**2x1.1**	**ORA**
	©	**(i)**	**Any two from**: Idea of peer review /claims checked by other scientists ✓ Only one person cured ✓ idea that it may only be a temporary cure/don't know how long after treatment blood was tested ✓	**2**	**2x3.1b**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>5</td><td>(c)</td><td>(ii)</td><td>Any two from:

Embryos cannot give consent ✓

Stem cells are obtained from embryos that are killed ✓

Killing embryos is destroying a human life ✓</td><td>2</td><td>2x1.1</td><td>

ORA</td></tr>
<tr><td></td><td>(d)</td><td></td><td><table>
<tr><td>Atria contracting</td><td>✓</td><td></td></tr>
<tr><td>Ventricles contracting</td><td></td><td>✓</td></tr>
<tr><td>Valves between atria and ventricles shut</td><td></td><td>✓</td></tr>
</table></td><td>2</td><td>2x2.1</td><td>One mark for each correct column.
ALLOW any clear indication of choice instead of tick.</td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
6	(a)	(i)	Light intensity 2 ✓ because more than 50% of maggots moved away from the light/more than twice as many maggots moved away compared to towards the light.✓	2	2x3.2a	
		(ii)	**Any two from**: Use filters/different coloured light bulbs (sources) e.g. red, blue, green, UV, IR. ✓ Use (the same) light intensity (4) for all ✓ Use the same card circle each time ✓ Use the same time period before counting the maggots ✓	2	2x3.3a	**DO NOT ALLOW** different colours of light **ALLOW** light at different wavelengths **ALLOW** general idea that everything else would stay the same (as in the original experiment) and only light colour would be changed
	(b)		**Any four from:** Arrival of a nerve impulse at the synapse ✓ Causes release of transmitter substance✓ (Neuro)transmitter diffuses (across synaptic gap)✓ (Neuro)transmitter attaches/binds to the receptors✓ If enough (neuro)transmitter attaches, then an impulse is triggered in second neuron✓	4	4x1.1	

Question			Answer	Marks	AO element	Guidance
7	(a)	(i)	1 ✓	1	1.1	
		(ii)	2 and 4 ✓	1	1.1	Both needed to be awarded the mark
		(iii)	**Any two from:** active transport requires ATP/respiration/energy ✓ respiration only takes place in living cells / mitochondria ✓ xylem is dead / does not have mitochondria/companion cells ✓	2	2x1.1	
		(iv)	Membranes are partially permeable/proteins are too big ✓	1	1.1	
	(b)		**Any two from:** Cut leaf into a thin section ✓ Place on a slide with a drop of water ✓ Add a drop of stain ✓ Use a mounted needle to lower a coverslip over the leaf section ✓	2	2x1.2	

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