Higher

GCSE

Combined Science B Twenty First Century Science

J260/05: Biology (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2024

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.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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.

MARKING INSTRUCTIONS

PREPARATION FOR MARKING

RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Online Training*; *OCR Essential Guide to Marking*.
2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are available in RM Assessor.
3. Log-in to RM Assessor and mark the **required number** of practice responses ("scripts") and the **required number** of standardisation responses.

MARKING

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the RM Assessor messaging system.

5. Work crossed out:

   a. where a candidate crosses out an answer and provides an alternative response, the crossed out response is not marked and gains no marks

   b. if a candidate crosses out an answer to a whole question and makes no second attempt, and if the inclusion of the answer does not cause a rubric infringement, the assessor should attempt to mark the crossed out answer and award marks appropriately.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.

7. There is a NR (No Response) option. Award NR (No Response)

   - if there is nothing written at all in the answer space
   - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
   - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.

   Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The RM Assessor **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**

   If you have any questions or comments for your Team Leader, use the phone, the RM Assessor messaging system, or email.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:

Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.

Once the level is located, award the higher or lower mark:

The higher mark should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.

The lower mark should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.

In summary:

The skills and science content determines the level.

The communication statement determines the mark within a level.

Level of response question on this paper is **5(a)**.

11. Annotations available in RM Assessor

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

12. 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

13. **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)		regulate menstrual cycle / ovulation ✓	1	1.1	**ALLOW** any correct reference to a part of human reproduction eg mature follicle/egg / thicken uterus lining / produce gametes / sperm production Any named hormone must have the correct role **IGNORE** ideas of puberty/secondary sexual characteristics
	(b)	(i)	3 ✓	1	2.1	**ALLOW** ovulation
		(ii)	**Any one from:** less risk of catching a sexually transmitted disease ✓ risk of becoming pregnant is higher/1% higher ✓ idea larger decrease of risk of catching an STD than increase from getting pregnant ✓	2	3.1b	Answer must be comparative **ORA** for contraceptive implant contraceptive implant has more risk of catching a sexually transmitted disease contraceptive implant, risk of becoming pregnant is lower idea of contraceptive implant has a larger increase of risk of catching an STD than a decrease from getting pregnant
		(iii)	acts as a barrier (to sperm and to pathogens) ✓	1	2.1	**ALLOW** descriptions of a barrier eg stops sperm entering **IGNORE** condom breaking

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>AO element</th><th>Guidance</th></tr>
<tr><td>2</td><td>(a)</td><td>(i)</td><td>sugar ✓</td><td>1</td><td>2.1</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td><table><tr><th>Small molecule</th><th>Needed for aerobic respiration</th><th>Produced by aerobic respiration</th><th>Not needed or produced by aerobic respiration</th></tr><tr><td>oxygen</td><td>✓</td><td></td><td></td></tr><tr><td>urea</td><td></td><td></td><td>✓</td></tr><tr><td>water</td><td></td><td>✓</td><td></td></tr></table>✓✓</td><td>2</td><td>1.1</td><td>All three correct ticks = 2 marks
One or two correct ticks = 1 mark

DO NOT ALLOW more than 1 tick for each correct statement</td></tr>
<tr><td></td><td>(b)</td><td></td><td>diffusion ✓
osmosis ✓
active transport ✓</td><td>3</td><td>1.1</td><td>DO NOT ALLOW more than 1 ring for each correct statement</td></tr>
<tr><td></td><td>(c)</td><td></td><td><table><tr><th></th><th>True</th><th>False</th></tr><tr><td>Carbon dioxide and urea move out of cells into the blood.</td><td>✓</td><td></td></tr><tr><td>Oxygen and carbon dioxide move between blood in capillaries and air in alveoli.</td><td>✓</td><td></td></tr><tr><td>Urea is filtered into the blood by the kidneys.</td><td></td><td>✓</td></tr><tr><td>Water and food molecules are absorbed from the digestive system into blood in capillaries.</td><td>✓</td><td></td></tr></table>✓✓✓</td><td>3</td><td>1.1</td><td>All four correct ticks = 3 marks
Three correct ticks = 2 marks
One or two correct ticks = 1 mark

DO NOT ALLOW more than 1 tick for each row</td></tr>
<tr><td></td><td>(d)</td><td>(i)</td><td>First check the answer on answer line
If answer = 3:1 award 4 marks

SA = 6 x (2x2) ✓
= 24(cm^2) ✓
V = 2 x 2 x 2 = 8(cm^3) ✓
(SA:V = 24:8) = 3:1 ✓</td><td>4</td><td>2.2</td><td>ALLOW ECF for correct answer to incorrect SA substitution using numbers from the diagram

ALLOW ECF for simplification of an incorrect calculation/ratio</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>idea that C is made up of lots of A ✓</td><td>1</td><td>2.2</td><td>ALLOW AW eg each square in C is equivalent to A</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>3</td><td>(a)</td><td></td><td>
<table>
<tr><th>Structure</th><th>Only found in eukaryotic cells</th><th>Only found in prokaryotic cells</th><th>Found in both types of cells</th></tr>
<tr><td>Chloroplast</td><td>✓</td><td></td><td></td></tr>
<tr><td>Mitochondria</td><td>✓</td><td></td><td></td></tr>
<tr><td>Nucleus</td><td>✓</td><td></td><td></td></tr>
<tr><td>Plasmid</td><td></td><td>✓</td><td></td></tr>
</table>
✓✓✓
</td><td>3</td><td>1.1</td><td>Four correct ticks = 3 marks
Three correct ticks = 2 marks
Two or one correct ticks = 1 mark

DO NOT ALLOW more than 1 tick for each correct statement</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>correct outline shape of this chloroplast drawn with continuous lines and no shading ✓

internal structures drawn accurately to scale ✓</td><td>2</td><td>2.2</td><td>ALLOW two small errors e.g. small gap in the outline or small lines outside the shape.

Details must be in proportion to the diagram and should be a true likeness
IGNORE Iabels</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>Any two from:

electron microscopes have a high magnification ✓

electron microscopes have a high resolution/resolving power ✓

(internal features of) chloroplasts are too small to see using a light microscope ✓

light microscope image would be too fuzzy / not enough detail ✓</td><td>2</td><td>1.1</td><td>‘It’, assume electron microscope

ALLOW can zoom in more

ALLOW can see very small structures

ORA
ALLOW idea of clearer image/more detail</td></tr>
</table>

Question	Answer	Marks	AO element	Guidance
(c)	**First check the answer on answer line** **If answer = 5.7 (µm) award 4 marks**	4		
	Conversion: (65 mm =) 65000 (µm) ✓		1.2	
	Rearrangement: actual length = image length / magnification = 65000 / 11500 ✓		2.2 x 2	
	= 5.65217391 ✓			**ALLOW** any correct rounding of 5.65217391
	= 5.7 (to 2 sig. fig.) ✓		1.2	**ALLOW** one mark for an incorrect answer if it is clearly shown that it has been correctly rounded to 2 significant figures.

Question			Answer	Marks	AO element	Guidance
4	(a)		(communicable disease) can be spread (from one person to another) / is infectious / is contagious ✓ caused by a pathogen ✓	2	1.1	 **ALLOW** example of pathogen or named disease.
	(b)		sexually ✓ body fluids / semen / blood ✓	2	1.1	
	(c)	(i)	**First check the answer on answer line** **If answer = 400 (%) award 2 marks** ((37.5 – 7.5) ÷ 7.5) x 100 ✓ = 400 (%) ✓	2	2.2	
		(ii)	number of deaths has decreased since 2005 ✓ (even though) the number of people living with HIV has continued to increase ✓	2	3.1b	
		(iii)	**Any one from:** (improved) education / awareness /public health campaigns ✓ (more use of) condoms / safe(r) sex ✓ use of sterile needles ✓ improved testing ✓	1	3.2a	**ALLOW** anti-retroviral drugs, e.g. PrEP, Truvada, PEP **DO NOT ALLOW** vaccine

Question			Answer	Marks	AO element	Guidance
5	(a)*		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)** Gives a detailed explanation of how structures of nerve cells relate to their function **AND** Explains how MS causes both slow muscle contractions and unwanted contractions. *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)** Gives a partial explanation of how structures of nerve cells relate to their function **AND** Gives an explanation how MS causes the symptoms described *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)** Gives a partial explanation of how structures of nerve cells relate to their function **OR** Gives an explanation how MS causes the symptoms described *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 x 3.2a	**AO1.1 Demonstrates knowledge and understanding of scientific ideas to describe the structures** • Axon is long to carry nerve impulses far distances/fast response • Branch ending / dendrites to make connections with other neurone / effectors • Fatty sheath / myelin sheath insulates the neurone / speeds up nerve impulses **AO3.2a Analyses information to make a judgement on why MS causes the symptoms described** • Damaged Fatty sheath / myelin sheath • This will mean nerve impulses will travel slower • Slow transmission leads to slow(er) muscle contraction • Lack of insulation • This could lead to other neurons/muscles being stimulated, causing unwanted muscle contractions

Question			Answer	Marks	AO element	Guidance
	(b)	(i)	**FIRST CHECK THE ANSWER ON ANSWER LINE** **If answer = 1.28 (mg/dm^3/min) award 3 marks** 77 (mg/dm^3)/ 60 (min) ✓ = 1.28333333 ✓ = 1.28 ✓	**3** **1.2**	 **2.2 x 2** **1.2**	 **ALLOW** use of value between 77-80 (mg/dm^3) in mp1 **ALLOW** any correct rounding for mp3
		(ii)	insulin concentration is low / is deceasing **AND** glucose concentration is starting to increase ✓	**1**	**3.1a**	
		(iii)	(insulin low/decreasing so) cells absorbing less glucose from the blood ✓ glucagon causing liver to break down carbohydrate to release glucose into the blood ✓	**2**	**2.1**	 **ALLOW** glycogen into glucose

Question			Answer	Marks	AO element	Guidance
6	(a)		**Any two from:** speed up / break down/digestion of (food) molecules ✓ specific to a substrate/food molecule ✓ (biological) catalysts ✓ form enzyme substrate complexes ✓	2	2.1	**ALLOW** named nutrient **ALLOW** break down the stain
	(b)	(i)	**Any one from:** identify anomalies ✓ calculating a mean / better estimate (of the true value) ✓ idea of repeatability/precision/reliability✓	1	2.2	**ALLOW** to make comparisons **ALLOW** outliers **IGNORE** accurate
		(ii)	Independent: temperature Dependent: time taken to go clear/colourless Control: volume of milk/trypsin / concentration of milk/trypsin ✓✓	2	2.2	Three correct = 2 marks One or two correct = 1 mark **ALLOW** amount
		(iii)	**Any two from**: measuring cylinders/syringe/pipette to measure milk/trypsin ✓ (thermostatically controlled/electric) water bath✓ use a stop clock/watch to time low long it takes to go colourless ✓ light meter to measure end point/colourless ✓ narrower range of temperatures / small increments of temperatures/wider range of temperatures to find optimum temperature ✓ start timing immediately as the trypsin is poured into the milk as enzyme will start digestion ✓ use separate pipettes/syringe/measuring cylinder to stop cross contamination ✓ allow time for milk/trypsin to reach desired temperature ✓	2	3.3b	**IGNORE** use a thermometer **ALLOW** any sensible suggestion e.g. read text/cross through milk **ALLOW** test with more temperatures

Question			Answer	Marks	AO element	Guidance
	(c)		**Any three from:** (at 40 degrees) the enzymes have more (kinetic) energy ✓ (at 40 degrees) more (successful) collisions ✓ (at 40 degrees) more enzyme-substrate complexes ✓ above 40 degrees the enzymes denature/ active site changes shape ✓ (above 40 degrees) the substrate no longer fits ✓	3	2.1	**ALLOW** below 40 degrees enzymes have less energy **ALLOW** 40 degrees is the optimum temperature/ fastest rate of reaction **ALLOW** below 40 degrees less enzyme-substrate complexes **ALLOW d**escription of enzyme-substrate complexes
	(d)	(i)	mitochondria ✓	1	1.1	**ALLOW** cytoplasm
		(ii)	**Any one from:** provide energy / release energy (for life processes) ✓ produce ATP✓	1	1.1	**ALLOW** reference to heating the body

Question			Answer	Marks	AO element	Guidance
7	(a)		genome ✓ chromosomes **AND** DNA ✓ proteins **AND** amino acids ✓	3	1.1	
	(b)		one nucleotide circled ✓	1	3.1a	
	(c)		**Any three from:** (change in phenotype) due to genetic variation / random mutation ✓ (dogs) with more wolf-like features more likely to eat prey ✓ (these dogs) more likely to survive and reproduce ✓ pass on alleles/mutations/features ✓	3	2.1	**ALLOW** dogs are better adapted to find prey **AW** produce offspring for reproduction **ALLOW** pass on advantageous allele/gene
	(d)		**Any three from:** select wolves with desired/named characteristics ✓ breed these wolves together ✓ select offspring with desired characteristics ✓ repeat the breeding process✓	3	2.1	
	(e)	(i)	idea of modifying genome/introduce new gene from one organism into another ✓	2	1.1	

Question			Answer	Marks	AO element	Guidance
			introduce desirable characteristics ✓			
		(ii)	**Any four from:** isolate the gene✓ replicate required gene ✓ put gene into vector/plasmid ✓ use vector/plasmid to insert gene into bacteria/cell ✓ select modified cells ✓	**4**	**1.1**	

Question			Answer	Marks	AO element	Guidance
8	(a)	(i)	**Any two from:** faster photosynthesis = plant growth faster ✓ more plants available for us /farm animals to eat /more food produced/ more biomass produced ✓ photosynthetic organisms/plants/producers are the source of all food/biomass ✓ reference to food chains / our dependence upon plants for food ✓	2	1.1	**ALLOW** more glucose **ALLOW** increase biomass for growth = 2 marks **IGNORE** producers unqualified
		(ii)	carbon dioxide (concentration) – (more carbon dioxide) to react with water until not limiting ✓ light (intensity) – (more light) means more energy for photosynthesis until not limiting (for photosynthetic reactions) ✓	2	1.1	**ALLOW** two marks for two correct factors **(**carbon dioxide and light) and one credit worthy explanation given **ALLOW** one mark for two correct factors with no credit worthy explanation given
	(b)		**Any two pairs:** pesticides ✓ **AND** build-up in food chains / bioaccumulation / reduces biodiversity ✓ fertilisers ✓ **AND** eutrophication / reduces biodiversity ✓ monoculture ✓ **AND** reduces biodiversity / affects food chains/webs ✓	4	2.1	**ALLOW** other sensible suggestions. **MAX** two marks for named intensive farming practices alone or effects **MAX** two marks for each pair Credit for reducing biodiversity can only be awarded once **ALLOW** description of eutrophication

Question			Answer	Marks	AO element	Guidance
9	(a)		**Any two from:** (evidence of) similarities/differences/comparison between fossil and living organisms ✓ fossils/evidence of transitional species ✓ fossil/evidence of common ancestor(s) of modern species ✓	2	1.1	**DO NOT ALLOW** the fossil record unqualified. **ALLOW** example of transitional species (e.g. *Archaeopteryx)*
	(b)	(i)	**Any two from:** to inform other scientists (who may be working on the topic) ✓ to see if other scientists can replicate the work / peer reviewed ✓ to allow recognition for their work ✓	2	1.1	**ALLOW** communicate scientific rationale/methodology for investigations / share ideas with other scientists / allow other scientists to develop work/compare data/challenge existing research. **ALLOW** check/prove/reproduce results **IGNORE** to let people know / spread it more widely / to make it be accepted as fact
		(ii)	The discovery of a single fossil will not tell you how abundant the species was ✓ We now know the biodiversity of the ecosystem was greater than we thought ✓	2	3.2a	

	(c)		**Any two from:** evolution is due to (natural selection of) mutations/genetic variants ✓ evolution occurs over generations ✓ can have many generations of bacteria in a short time ✓	**2**	**2.1**	**ALLOW** mutations are occurring more often because DNA is copied when bacteria divide/reproduce

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