Oxford Cambridge and RSA

Foundation

GCSE

Biology A Gateway

J247/03: Paper 3 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2023

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 the annotation SEEN to confirm that the work has been read.

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 questions on this paper is **24(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
I	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**.

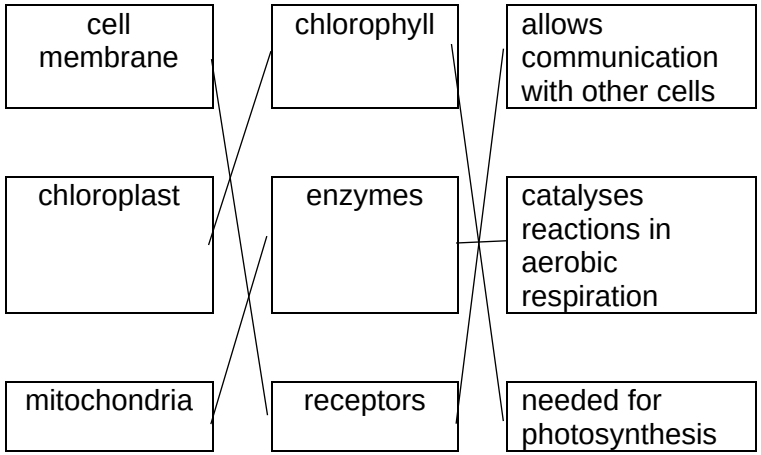
Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

The breakdown of Assessment Objectives for GCSE (9-1) in Biology:

	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.

For answers to Section A if an answer box is blank ALLOW correct indication of answer e.g. circled or underlined.

Question	Answer	Marks	AO element	Guidance
1	A	1	2.1	
2	B	1	1.1	
3	A	1	2.1	
4	D	1	1.1	
5	A	1	1.1	
6	A	1	1.1	
7	C	1	2.1	
8	B	1	2.1	
9	D	1	2.2	**ALLOW** 512
10	A	1	2.1	
11	C	1	1.1	
12	B	1	2.1	
13	D	1	1.1	
14	A	1	1.1	
15	A	1	2.1	

Question			Answer	Marks	AO element	Guidance
16	(a)		**Sub-cellular structure** / **Contents** / **Function**  ✓✓✓✓	4	4 x 1.1	6 correct lines = 4 marks 5/4 correct lines = 3 marks 3 correct lines = 2 marks 2 correct lines = 1 mark **DO NOT ALLOW** more than 1 line from each box
	(b)	(i)	Correct outline shape of this mitochondrion drawn with continuous lines and no shading ✓ Double outer membrane and internal membranes accurately drawn ✓	2	2 x 2.2	**IGNORE** labels
		(ii)	Electron microscope ✓ The image is highly magnified / The image is in a lot of detail / Can see organelles / The resolution is high ✓	2	2 x 2.1	**ALLOW** TEM or SEM Second marking point is dependent on the first **IGNORE** image is black and white **ALLOW** ORA for light microscopes for each reason
	(c)		Ribosome **/** cell membrane / cytoplasm ✓	1	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>17</td><td>(a)</td><td></td><td>
<table>
<tr><th>Feature</th><th>Arteries</th><th>Capillaries</th><th>Veins</th></tr>
<tr><td>Have valves along their length</td><td></td><td></td><td>✓</td></tr>
<tr><td>Have a very thick wall</td><td>✓</td><td></td><td></td></tr>
<tr><td>Have a wide lumen</td><td></td><td></td><td>✓</td></tr>
</table>
✓✓✓</td><td>3</td><td>3 x 1.1</td><td>One mark for each correct row</td></tr>
<tr><td></td><td>(b)</td><td></td><td>Effect: backflow of blood will not be prevented / blood could collect/pool in the veins ✓

Symptom: legs may swell/be painful / have itchy skin ✓</td><td>2</td><td>2 x 2.1</td><td>ALLOW reduced blood flow back to heart/from legs

ALLOW blood clots / (muscle) cramps / varicose veins / numbness</td></tr>
<tr><td></td><td>(c)</td><td></td><td>First check the answer on answer line
If answer = 319 200 award 2 marks

5320 / 4560 / 76 x 70 x 60 ✓

319 200 ✓</td><td>2</td><td>2 x 1.2</td><td></td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
	(d)		Biconcave shape / large surface area ✓ For faster/rapid/maximum uptake/diffusion (of oxygen) ✓ **OR** No nucleus ✓ So more space for haemoglobin/oxygen ✓ **OR** Are small/flexible ✓ So can squeeze/pass/move/fit through capillaries/small blood vessels ✓	**2**	**2 x 1.1**	**IGNORE** to contain/transport more oxygen

Question			Answer	Marks	AO element	Guidance
18	(a)		Hypothalamus ✓ Pituitary (gland) ✓ ADH ✓	3	3 x 1.1	
	(b)		Idea of increased salt intake / sweating / exercise / higher temperatures✓	1	1.1	**ALLOW** descriptions of how salt intake could be increased, e.g., eating salty foods **IGNORE** reference to urea / ADH production
	(c)		Use biuret solution/test ✓ If the sample turns purple, protein is present/patient has nephritis / if the sample remains blue, no protein is present/patient does not have nephritis ✓	2	2 x 1.2	**ALLOW** sodium hydroxide and copper sulphate solutions

Question			Answer	Marks	AO element	Guidance
19	(a)		The skin is not permeable / Water could not move through the skin ✓	1	2.2	**DO NOT ALLOW** the skin would prevent movement of the solution/solute **ALLOW** the skin would inhibit osmosis
	(b)		**First check the answer in table / on answer line** **If answer = (-) 34.0% award 3 marks** (5.3 -3.5 =) 1.8 ✓ (1.8÷ 5.3 =) 0.3396… ✓ 0.3396 x100 = (-) 34.0% ✓	3	3 x 1.2	Mark answer on answer line first **ALLOW** -1.8 **ALLOW** -0.3396…. **ALLOW** 33.9 / 34 for 2 marks **ALLOW** one mark for an incorrect answer if it is clearly shown that it has been correctly rounded to three significant figures.
	(c)		This is where the line intercepts the x axis / This (is the concentration of solution that) produces no change in mass ✓	1	3.2a	
	(d)		Include other concentrations/wider range/smaller intervals of solution ✓ Idea that these should be in the region around 0.46 (mol/dm^3) ✓	2	2 x 3.3b	**IGNORE** just repeat readings

<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>(e)</td><td></td><td>
<table>
<tr><th>Error</th><th>Random error</th><th>Systematic error</th></tr>
<tr><td>Excess fluid was left on some aubergine pieces which will affect the mass.</td><td>✓</td><td></td></tr>
<tr><td>The scale used to weigh the aubergine pieces was not calibrated correctly.</td><td></td><td>✓</td></tr>
</table>
✓
</td><td>1</td><td>3.2a</td><td></td></tr>
</table>

Question			Answer	Marks	AO element	Guidance
20	(a)	(i)	*In method 1 / fresh pineapple:* The bromelain/enzyme will break down the gelatin/protein (so the jelly cannot set) ✓ *In method 2 / tinned pineapple:* The bromelain/enzymes have been denatured ✓ The active site of the bromelain/enzymes will change shape / the gelatin/protein will no longer fit into the active site ✓ The gelatin/protein has not been broken down (so the jelly can set) ✓	**4**	**4 x 2.1**	
	(b)		X placed at approximately half the maximum rate of reactions ✓ Explanation: idea that this is half the maximum rate (so assume that half the active sites are occupied) ✓	**2**	**3.1a** **3.1b**	

Question			Answer	Marks	AO element	Guidance
21	(a)		GnRHα ✓ FSH ✓ Progesterone ✓	2	2 x 2.1	Three correct = 2 marks One or two correct = 1 mark
	(b)	(i)	**Any two from:** The range of the number of eggs produced is 3 – 24 ✓ Very few females produce fewer than 8 eggs or more than 12 / most females produce eggs in the range of 8-12 ✓ Very few females produce high numbers / 24 eggs ✓ Very few females produce low numbers / 3 eggs ✓ The mean/average number of eggs is 10.3 / 10 eggs ✓	2	2 x 3.2a	**Answers must refer to trends not individual women** **ALLOW** the range is 21 **ALLOW** most women produce fewer than 24 eggs **ALLOW** most women produce more than 3 eggs **ALLOW** mode is 8 eggs / median is 9.5 eggs
		(ii)	**First check the answer on answer line** **If answer = 6 award 2 marks** 10 × 80 ÷ 100 = 8 **OR** 8 × 80 ÷ 100 = 6.4 ✓ 6.4 rounded to 6 ✓	2	2 x 2.2	**ALLOW** one mark for an incorrect answer if it is clearly shown that it has been correctly rounded to the nearest whole number.

Question			Answer	Marks	AO element	Guidance
	(c)		**Any two from:** The younger the patient, the higher the (percentage) birth rate ORA ✓ Over time the birth rate per embryo has increased ✓ Greatest increase in birth rate is seen in under 35s ✓ Lowest increase in birth rate is seen in over 44s / birth rate for over 44 has remained very low/has not increased/fluctuates ✓	**2**	**2 x 3.2b**	**ALLOW** conclusions that refer to idea that IVF is less likely to be successful for women over 44/more likely to be successful in under 35 Over time the percentage birth rate has increased for all age groups, except those over 44 = 2 marks

Question			Answer	Marks	AO element	Guidance
22	(a)		**Any three from**: Concentration of solution/sodium hydrogen carbonate ✓ Volume of solution/sodium hydrogen carbonate ✓ Size/number/area of leaf discs / part of the leaf the discs were taken from ✓ Temperature ✓ Light intensity ✓ Same size/height of syringe ✓	**3**	**3 x 2.2**	 **IGNORE** amount **IGNORE** size of leaf **IGNORE** same syringe
	(b)		Oxygen is produced ✓	**1**	**2.2**	
	(c)		Use of a lamp/light at different distances from the syringe ✓ Time how long it takes for the discs to rise ✓ Use of inverse square law to calculate the light intensity ✓	**3**	**3 x 3.3a**	**ALLOW** use bulbs of different brightness/wattage

Question			Answer	Marks	AO element	Guidance
23	(a)		Adrenaline ✓ Digestive ✓ Glucagon ✓ Glycogen ✓	4	4 x 1.1	 **ALLOW** adrenaline Spelling of glucagon/glycogen must be correct
	(b)		**Any two from:** Endocrine system uses chemical messengers/hormones but nervous system uses electrical messages/nerve impulses ✓ Endocrine is slow**er** acting ✓ Endocrine (responses) are long**er**-lived ✓ Endocrine system communicates via blood but nervous system uses neurones/nerves ✓ Idea that endocrine responses are more widespread throughout the body✓	2	2 x 1.1	 **ORA** **ORA**

Question			Answer	Marks	AO element	Guidance
	(c)		**Maximum two from:** More people with a poor diet ✓ More people with a diet high in sugar ✓ More people who are overweight/obese ✓ More people with a sedentary lifestyle ✓ **Maximum two from:** Percentage is plateauing/decreasing because of increased education/awareness of the dangers of poor diet ✓ Percentage is plateauing/decreasing because of an increase in physical exercise ✓	**3**	**3 x 3.1a**	**ALLOW** fast/junk food / unhealthy eating **ALLOW** less exercise

Question			Answer	Marks	AO element	Guidance
24	(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)** Explains the impact the insertion has on the base sequence of the DNA, the mRNA produced **AND** explains how this produces a different protein. *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)** Explains how the impact of the insertion of the bases affects the structure of the DNA and therefore mRNA **OR** Explains how a change in mRNA causes a change in the protein produced. *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)** Explains the function of DNA and why a change in DNA can produce a different protein. *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** Explains the function of DNA and why a change in DNA can produce a different protein • the order of the bases/nucleotides in DNA codes for the production of a protein • so a different order of bases means a different order of amino acids/different protein. **AO2.1** Explains how the impact of the insertion of the bases affects the structure of the DNA and therefore mRNA • idea that in transcription DNA is used as a template to produce mRNA • therefore, a change in the bases in DNA will cause a change in the bases in mRNA **AO2.1** Explains how a change in mRNA causes a change in the protein produced • the order of bases in mRNA determines the order of the amino acids joined together in translation • this is because different tRNA/carrier molecules will bind to the mRNA Any answer referring to the production of amino acids is limited to Level 2

Question			Answer	Marks	AO element	Guidance
	(b)		Breathlessness / Tiredness/fatigue/lethargy/lightheaded/headaches/stitches /(muscle) cramps / Pale/blue skin / Irregular heartbeats/palpations / Anaemia ✓	**1**	**2.1**	
	(c)		Stem cells can differentiate/become specialised into (red) blood cells ✓ (As they are from another person) they would not have the defective allele/disorder / will have functioning/normal haemoglobin ✓	**2**	**2 x 3.1**	**IGNORE** they will have normal red blood cells

Question			Answer	Marks	AO element	Guidance
25	(a)		**Any two from:** Respiration is a universal chemical process ✓ Plants need (to produce) ATP ✓ Named example of ATP/energy use in plants ✓	**2**	**2 x 2.1**	 **ALLOW** all organisms need to respire **ALLOW** plant cells have mitochondria which are the site of respiration. E.g., active transport / protein synthesis / cell division / translocation / photosynthesis **IGNORE** growth unqualified
	(b)		Hydrogen ions cannot build up in the space/cannot become concentrated, as the outer membrane is missing ✓ Therefore, they cannot diffuse back in(to the mitochondria) ✓	**2**	**2 x 3.2a**	

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