

# Foundation

**GCSE**

**Biology B Twenty First Century Science**

**J257/01: Breadth in Biology (Foundation Tier)**

General Certificate of Secondary Education

**Mark Scheme for June 2022**

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.

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**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. **Crossed Out Responses**

Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed out response where legible.

**Rubric Error Responses – Optional Questions**

Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

**Multiple Choice Question Responses**

When a multiple choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate). *When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.*

**Contradictory Responses**

When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

**Short Answer Questions** (requiring only a list by way of a response, usually worth only **one mark per response**)

Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

**Short Answer Questions** (requiring a more developed response, worth **two or more marks**)

If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space.)

**Longer Answer Questions** (requiring a developed response)

Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

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. Award No Response (NR) if:

- there is nothing written in the answer space.

Award Zero '0' if:

- anything is written in the answer space and is not worthy of credit (this includes text and symbols).

Team Leaders must confirm the correct use of the NR button with their markers before live marking commences and should check this when reviewing scripts.

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.**

## 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 |
| II                  | Separates marking points                                      |
| <b>DO NOT ALLOW</b> | Answers which are not worthy of credit                        |
| <b>IGNORE</b>       | Statements which are irrelevant                               |
| <b>ALLOW</b>        | Answers that can be accepted                                  |
| ( )                 | Words which are not essential to gain credit                  |
| —                   | Underlined words must be present in answer to score a mark    |
| <b>ECF</b>          | Error carried forward                                         |
| <b>AW</b>           | Alternative wording                                           |
| <b>ORA</b>          | 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 B:

|              | <b>Assessment Objective</b>                                                                                                                           |
|--------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>AO1</b>   | <b>Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.</b>                                          |
| AO1.1        | Demonstrate knowledge and understanding of scientific ideas.                                                                                          |
| AO1.2        | Demonstrate knowledge and understanding of scientific techniques and procedures.                                                                      |
| <b>AO2</b>   | <b>Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.</b>                                       |
| AO2.1        | Apply knowledge and understanding of scientific ideas.                                                                                                |
| AO2.2        | Apply knowledge and understanding of scientific enquiry, techniques and procedures.                                                                   |
| <b>AO3</b>   | <b>Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.</b> |
| <b>AO3.1</b> | Analyse information and ideas to interpret and evaluate.                                                                                              |
| AO3.1a       | Analyse information and ideas to interpret.                                                                                                           |
| AO3.1b       | Analyse information and ideas to evaluate.                                                                                                            |
| <b>AO3.2</b> | 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.                                                                                                    |
| <b>AO3.3</b> | 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        |  |  | double helix ✓<br>genes ✓<br>amino acids ✓<br>enzymes ✓ | 4     | 1.1        | If more than one answer circled on each answer line = 0 marks for that line |

| Question |     |  | Answer                                                                                                                                                                                                                     | Marks | AO element | Guidance                                                                                                                                                                                                                                                    |
|----------|-----|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 2        | (a) |  | <p>Hormones</p> <p>Are transported in the blood</p> <p>Are transported as an electrical impulse</p> <p>Are secreted by a gland</p> <p>Are made of nerve cells</p> <p>Have effects that can last a long time</p> <p>✓✓✓</p> | 3     | 1.1        | <p>If more than three lines drawn each additional incorrect line negates 1 mark</p> <p>e.g. 4 lines drawn 3 correct = 2 marks</p> <p>4 lines drawn 2 correct = 0 marks</p> <p>5 lines drawn 3 correct = 1 mark</p> <p>5 lines drawn 2 correct = 0 marks</p> |
|          | (b) |  | (Type 1) diabetes ✓                                                                                                                                                                                                        | 1     | 1.2        | <b>ALLOW</b> Type 2 diabetes                                                                                                                                                                                                                                |

| Question         |                  |           | Answer                                                                                                                                                                                                                                                                                                                       | Marks | AO element       | Guidance                                                            |                    |                  |  |   |  |          |   |  |   |   |                                       |                                                                                                                                                                        |
|------------------|------------------|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------------|---------------------------------------------------------------------|--------------------|------------------|--|---|--|----------|---|--|---|---|---------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 3                | (a)              |           | <div>It is a photosynthetic reaction. <input type="checkbox"/></div> <div>It is an endothermic reaction. <input type="checkbox"/></div> <div>It is an exothermic reaction. <input checked="" type="checkbox"/></div> <div>It is an immune response. <input type="checkbox"/></div> <div>✓</div>                              | 1     | 1.1              | More than 1 box ticked = 0 marks                                    |                    |                  |  |   |  |          |   |  |   |   |                                       |                                                                                                                                                                        |
|                  | (b)              |           | <div>Aerobic respiration in animal cells <input type="checkbox"/></div> <div>Aerobic respiration in plant cells <input type="checkbox"/></div> <div>Anaerobic respiration in animal cells <input type="checkbox"/></div> <div>Anaerobic respiration in microorganisms <input checked="" type="checkbox"/></div> <div>✓</div> | 1     | 1.1              | More than 1 box ticked = 0 marks                                    |                    |                  |  |   |  |          |   |  |   |   |                                       |                                                                                                                                                                        |
|                  | (c)              |           | <table><tr><td></td><td>Active transport</td><td>Diffusion</td><td>Muscle contraction</td></tr><tr><td>Does not use ATP</td><td></td><td>✓</td><td></td></tr><tr><td>Uses ATP</td><td>✓</td><td></td><td>✓</td></tr></table> <div>✓✓</div>                                                                                   |       | Active transport | Diffusion                                                           | Muscle contraction | Does not use ATP |  | ✓ |  | Uses ATP | ✓ |  | ✓ | 2 | <div>2.1 x 1</div> <div>1.1 x 1</div> | <div>1 mark for 'Does not use ATP' row being correct</div> <div>1 mark for 'Uses ATP' row being correct.<br/>Only 1 tick correct in the 'Uses ATP' row = 0 marks</div> |
|                  | Active transport | Diffusion | Muscle contraction                                                                                                                                                                                                                                                                                                           |       |                  |                                                                     |                    |                  |  |   |  |          |   |  |   |   |                                       |                                                                                                                                                                        |
| Does not use ATP |                  | ✓         |                                                                                                                                                                                                                                                                                                                              |       |                  |                                                                     |                    |                  |  |   |  |          |   |  |   |   |                                       |                                                                                                                                                                        |
| Uses ATP         | ✓                |           | ✓                                                                                                                                                                                                                                                                                                                            |       |                  |                                                                     |                    |                  |  |   |  |          |   |  |   |   |                                       |                                                                                                                                                                        |
|                  | (d)              |           | <b>Any one from:</b><br>high resolution ✓<br>high magnification ✓                                                                                                                                                                                                                                                            | 1     | 1.1              | <b>ALLOW</b> correct value for magnification of electron microscope |                    |                  |  |   |  |          |   |  |   |   |                                       |                                                                                                                                                                        |

| Question |     |  | Answer       | Marks | AO element | Guidance |
|----------|-----|--|--------------|-------|------------|----------|
| 4        | (a) |  | sensory ✓    | 1     | 1.1        |          |
|          | (b) |  | pancreas ✓   | 1     | 1.1        |          |
|          | (c) |  | vein ✓       | 1     | 1.1        |          |
|          | (d) |  | kidney ✓     | 1     | 1.1        |          |
|          | (e) |  | retina ✓     | 1     | 1.1        |          |
|          | (f) |  | brain stem ✓ | 1     | 1.1        |          |

| Question |     |      | Answer                                                                                                                                                                                                                                                                                                                               | Marks | AO element | Guidance                                                                                                                                                                                                                                                                                                                                                                            |
|----------|-----|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 5        | (a) |      | The number of breeding pairs has decreased ✓                                                                                                                                                                                                                                                                                         | 1     | 3.1a       |                                                                                                                                                                                                                                                                                                                                                                                     |
|          | (b) |      | <div>There are no predators. <input type="checkbox"/></div> <div>There is a more favourable climate. <input type="checkbox"/></div> <div>There is less competition in the ecosystem. <input type="checkbox"/></div> <div>There is not enough food. <input checked="" type="checkbox"/></div> <div style="text-align: right;">✓</div> | 1     | 3.1a       | More than 1 box ticked = 0 marks                                                                                                                                                                                                                                                                                                                                                    |
|          | (c) | (i)  | <b>FIRST CHECK THE ANSWER ON ANSWER LINE</b><br><b>If answer = 69 (%) award 2 marks</b><br>64 + 5 ✓<br>= 69 (%) ✓                                                                                                                                                                                                                    | 2     | 2.2        |                                                                                                                                                                                                                                                                                                                                                                                     |
|          |     | (ii) | 25600 ✓                                                                                                                                                                                                                                                                                                                              | 1     | 2.2        | More than 1 answer circled = 0 marks                                                                                                                                                                                                                                                                                                                                                |
|          | (d) |      | <div> <div>Benedict's</div> <div>Black</div> <div>Biuret</div> <div>Purple</div> <div>Iodine</div> <div>Red</div> <div style="text-align: right;">✓✓</div> </div>                                                                                                                                                                    | 2     | 1.2        | 1 mark for correct reagent, 1 mark for correct colour e.g. Biuret linked to black = 1 mark, iodine linked to purple = 1 mark<br><br><b>ALLOW</b> 1 mark if three lines drawn to correctly link each reagent with the colour of positive test result<br><br><div> <div>Benedict's</div> <div>Black</div> <div>Biuret</div> <div>Purple</div> <div>Iodine</div> <div>Red</div> </div> |

| Question |     |      | Answer                                                                                                                                                                                                                                                                   | Marks | AO element | Guidance                                                                                                                                                                             |
|----------|-----|------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 6        | (a) |      | Homeostasis ✓                                                                                                                                                                                                                                                            | 1     | 1.1        | More than 1 answer circled = 0 marks                                                                                                                                                 |
|          | (b) | (i)  | 36.0 – 37.0 (°C) ✓                                                                                                                                                                                                                                                       | 1     | 1.2        | <b>ALLOW</b> 36-37 / 37-36                                                                                                                                                           |
|          |     | (ii) | <b>FIRST CHECK THE ANSWER ON ANSWER LINE</b><br><b>If answer = 36.5 (°C) award 2 marks</b><br><br>182.4 ÷ 5 = 36.48 ✓<br><br>36.48 converted to 1dp = 36.5 (°C) ✓                                                                                                        | 2     | 1.2        | <b>ALLOW</b> 1 mark for any number correctly rounded to 1 decimal place where no working or value is incorrect                                                                       |
|          | (c) | (i)  | Elephants have a large surface area. <input type="checkbox"/><br>Elephants have a small surface area : volume ratio. <input checked="" type="checkbox"/><br>Elephants have a small volume. <input type="checkbox"/><br>Elephants sweat a lot. <input type="checkbox"/> ✓ | 1     | 2.1        | More than 1 box ticked = 0 marks                                                                                                                                                     |
|          |     | (ii) | Increase blood flow (to the skin) ✓                                                                                                                                                                                                                                      | 1     | 2.1        | <b>ALLOW</b> vasodilation<br><b>ALLOW</b> correct named behavioural response<br>e.g. seek shade/flap ears/bathe/swim/cover in mud<br><b>IGNORE</b> sweating<br><b>IGNORE</b> panting |

| Question |     |      | Answer                                                                                                                                                                                                                                                                              | Marks | AO element | Guidance                                                                                                                                                                                                                                                                     |
|----------|-----|------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 7        | (a) |      | <p><b>Any two from:</b><br/> use the focussing knob/wheel/dial ✓</p> <p>change the objective/eyepiece lens ✓</p> <p>clean the (objective) lens ✓</p> <p>(idea of) increasing the light ✓</p>                                                                                        | 2     | 3.3a       | <p><b>ALLOW</b> adjust the focus/focus the image/focus the microscope</p> <p><b>ALLOW</b> change the position of the stage</p> <p><b>ALLOW</b> for 2 marks use the coarse then fine focus</p> <p><b>ALLOW</b> rotate the nosepiece</p> <p><b>ALLOW</b> adjust the mirror</p> |
|          | (b) | (i)  | 5 x 2 million = 10 million/10 000 000 ✓                                                                                                                                                                                                                                             | 1     | 2.2        |                                                                                                                                                                                                                                                                              |
|          |     | (ii) | <p><b>Any one from:</b><br/> there could be more or less bacteria in each colony / not every colony has 2 million bacteria / the colonies are different sizes / not every colony has the same amount of bacteria ✓</p> <p>we can't count all of the bacteria (in each colony) ✓</p> | 1     | 2.2        |                                                                                                                                                                                                                                                                              |
|          | (c) |      | cytoplasm ✓                                                                                                                                                                                                                                                                         | 1     | 1.1        | <p><b>ALLOW</b> plasmid</p> <p><b>ALLOW</b> circular chromosome/DNA</p>                                                                                                                                                                                                      |

| Question |     |       | Answer                                                                                                                                                                                                                                                                                                                                                                                             | Marks | AO element | Guidance                                                                                                                                                                                                                                                                                                                                                                                                             |
|----------|-----|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 8        | (a) | (i)   | <p>(idea of) an overall decrease in percentage of coral over time ✓</p> <p>use of correct quantitative data from the graph to support answer e.g. in 1950 (live coral was) 90±2% in 2007 (live coral was) 19±2% ✓</p>                                                                                                                                                                              | 2     | 3.2b       | <p><b>IGNORE</b> references to increase in 1975/2007</p> <p><b>ALLOW</b> in 1950 the percentage of coral was the highest and in 2002 it was the lowest</p>                                                                                                                                                                                                                                                           |
|          |     | (ii)  | <p>population will decrease ✓</p> <p><b>Any one from:</b></p> <p>(idea of) less shelter ✓</p> <p>(idea of) less camouflage ✓</p> <p>(idea of) fewer places to hide from predators ✓</p> <p>(idea of) less food ✓</p> <p>(idea of) fewer places to lay eggs ✓</p> <p>(idea that) fish (species) cannot adapt fast enough to new environment ✓</p> <p>(idea of) having to find another habitat ✓</p> | 2     | 2.1        | <p><b>ALLOW</b> fish <u>could</u> become endangered/extinct</p> <p><b>ALLOW</b> more predation</p>                                                                                                                                                                                                                                                                                                                   |
|          |     | (iii) | <p>(continue to) decrease / remain at the same level / not recover / not increase ✓</p> <p>due to global warming/climate change ✓</p>                                                                                                                                                                                                                                                              | 2     | 3.2a       | <p><b>ALLOW</b> answers written anywhere in the response area for this question</p> <p><b>ALLOW</b> the coral reef will die off/die out/all die/die</p> <p><b>IGNORE</b> the coral will die</p> <p><b>ALLOW 2 marks</b> for coral reef will increase because (idea of) action is being taken to reduce global warming/reverse climate change/reduce sea temperatures</p> <p><b>IGNORE</b> ideas about adaptation</p> |

| Question |     |  | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                           | Marks | AO element | Guidance                                                                                                                                                                                                                                                                     |
|----------|-----|--|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          | (b) |  | <b>Any one from:</b><br>glucose ✓<br>oxygen ✓<br>food ✓<br>nutrients ✓<br>protein/amino acids ✓                                                                                                                                                                                                                                                                                                                                                  | 1     | 2.1        | IGNORE energy                                                                                                                                                                                                                                                                |
|          | (c) |  | <b>Any two from:</b><br>(idea of) setting up marine conservation/protection areas ✓<br>(idea of) managing fishing ✓<br><br>(idea of) using resources sustainably ✓<br>reduce global warming/limit climate change ✓<br><br>captive breeding of endangered species ✓<br>legal protection of endangered species ✓<br>reduce pollution / remove pollutants ✓<br><br>remove/control invasive species ✓<br>control/limit hunting of (marine) animals ✓ | 2     | 2.1        | <b>ALLOW</b> one named example of a sustainable fishing practice<br><br><b>ALLOW</b> one named example of a relevant activity e.g. less burning of fossil fuels<br><br><b>ALLOW</b> one named example of a pollutant that would be reduced e.g. plastic/oil/chemicals/sewage |

| Question          |                                                 |                                                           | Answer                                                                                                                                                                                                                                                                                                                                                                                              | Marks             | AO element                                      | Guidance                                                                                                                                                                                                                                                                                           |                                                     |    |  |  |   |    |  |  |   |    |   |  |  |   |     |                                                   |
|-------------------|-------------------------------------------------|-----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|-------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------|----|--|--|---|----|--|--|---|----|---|--|--|---|-----|---------------------------------------------------|
| 9                 | (a)                                             |                                                           | <div><div>Alleles</div><div>Chromosome</div><div>Genetic variant</div><div>Phenotype</div><div>A different version of a gene</div><div>The two copies of a gene in a pair of chromosomes</div><div>The characteristic that results from a gene and interaction with the environment</div><div>A long thin structure made from DNA</div></div> <p>✓✓✓✓</p>                                           | 4                 | 1.1                                             | More than 1 line drawn from genetic term = 0 marks for that term                                                                                                                                                                                                                                   |                                                     |    |  |  |   |    |  |  |   |    |   |  |  |   |     |                                                   |
|                   | (b)                                             |                                                           | <table><tr><th>Person's genotype</th><th>The person <b>will</b> have sickle cell anaemia</th><th>The person <b>may or may not</b> have sickle cell anaemia</th><th>The person will <b>not</b> have sickle cell anaemia</th></tr><tr><td>AA</td><td></td><td></td><td>✓</td></tr><tr><td>Aa</td><td></td><td></td><td>✓</td></tr><tr><td>aa</td><td>✓</td><td></td><td></td></tr></table> <p>✓✓✓</p> | Person's genotype | The person <b>will</b> have sickle cell anaemia | The person <b>may or may not</b> have sickle cell anaemia                                                                                                                                                                                                                                          | The person will <b>not</b> have sickle cell anaemia | AA |  |  | ✓ | Aa |  |  | ✓ | aa | ✓ |  |  | 3 | 2.1 | More than 1 tick per line = 0 marks for that line |
| Person's genotype | The person <b>will</b> have sickle cell anaemia | The person <b>may or may not</b> have sickle cell anaemia | The person will <b>not</b> have sickle cell anaemia                                                                                                                                                                                                                                                                                                                                                 |                   |                                                 |                                                                                                                                                                                                                                                                                                    |                                                     |    |  |  |   |    |  |  |   |    |   |  |  |   |     |                                                   |
| AA                |                                                 |                                                           | ✓                                                                                                                                                                                                                                                                                                                                                                                                   |                   |                                                 |                                                                                                                                                                                                                                                                                                    |                                                     |    |  |  |   |    |  |  |   |    |   |  |  |   |     |                                                   |
| Aa                |                                                 |                                                           | ✓                                                                                                                                                                                                                                                                                                                                                                                                   |                   |                                                 |                                                                                                                                                                                                                                                                                                    |                                                     |    |  |  |   |    |  |  |   |    |   |  |  |   |     |                                                   |
| aa                | ✓                                               |                                                           |                                                                                                                                                                                                                                                                                                                                                                                                     |                   |                                                 |                                                                                                                                                                                                                                                                                                    |                                                     |    |  |  |   |    |  |  |   |    |   |  |  |   |     |                                                   |
|                   | (c)                                             |                                                           | <p><b>Any three from:</b><br/>there might be a family history of the condition ✓</p> <p>(the genetic test will tell them) if they are carriers / heterozygous/ Aa / have the allele (that causes sickle cell anaemia) ✓</p> <p>so they can find out/consider the risk of having a baby with sickle cell anaemia ✓</p>                                                                               | 3                 | 2.1                                             | <p><b>IGNORE</b> to see if one of them is a carrier<br/><b>IGNORE</b> gene</p> <p><b>ALLOW</b> for 2 marks if neither is a carrier/has the allele their baby will not have sickle cell anaemia / if both are carriers/have the allele there is a risk their baby will have sickle cell anaemia</p> |                                                     |    |  |  |   |    |  |  |   |    |   |  |  |   |     |                                                   |

| Question |  |  | Answer                                                                                                                                                                                                                                                                                                                                  | Marks | AO element | Guidance         |
|----------|--|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|------------------|
|          |  |  | (depending on result they could use) donor egg and/or sperm ✓<br>(depending on result they could have) IVF/test embryos ✓<br>Amaya could have test on fetus during pregnancy e.g. amniocentesis ✓<br>so they can be prepared that their child might have sickle cell anaemia ✓<br>they can decide if they want to adopt / have a baby ✓ |       |            | <b>ALLOW</b> PGD |

| Question |     |   | Answer                                                                                                                                                                                                                                                                                                                                                                                                                   | Marks | AO element | Guidance                                                                                                                                                                   |   |   |   |     |                                                                   |
|----------|-----|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|---|---|-----|-------------------------------------------------------------------|
| 10       | (a) |   | <table border="1"><tr><td>C</td><td>A</td><td>B</td><td>E</td><td>D</td></tr></table> <div>✓✓✓</div>                                                                                                                                                                                                                                                                                                                     | C     | A          | B                                                                                                                                                                          | E | D | 3 | 1.2 | A before B = 1 mark<br>B before E = 1 mark<br>E before D = 1 mark |
| C        | A   | B | E                                                                                                                                                                                                                                                                                                                                                                                                                        | D     |            |                                                                                                                                                                            |   |   |   |     |                                                                   |
|          | (b) |   | <p><b>Any two from:</b><br/>(idea of) doing the experiment in at least two environments of a different temperature / change the temperature of the room/environment ✓</p> <p>measure the distance moved by the air bubble ✓</p> <p>repeat the experiment ✓</p> <p><b>AND</b></p> <p><b>Any one from:</b><br/>(variables to keep constant)<br/>humidity ✓<br/>length of time ✓<br/>wind speed ✓<br/>light intensity ✓</p> | 3     | 3.3a       | <p>specific temperatures do not need to be given<br/><b>IGNORE</b> change the temperature of the water</p> <p><b>ALLOW</b> explanation of how rate would be calculated</p> |   |   |   |     |                                                                   |
|          | (c) |   | phloem ✓                                                                                                                                                                                                                                                                                                                                                                                                                 | 1     | 1.1        |                                                                                                                                                                            |   |   |   |     |                                                                   |

| Question |     |      | Answer                                                                                                                                                                                                                                                                     | Marks | AO element | Guidance                                                                                                                                                                            |
|----------|-----|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 11       | (a) |      | white blood cell ✓                                                                                                                                                                                                                                                         | 1     | 2.1        |                                                                                                                                                                                     |
|          | (b) |      | platelets ✓                                                                                                                                                                                                                                                                | 1     | 1.1        |                                                                                                                                                                                     |
|          | (c) |      | <b>Any one from:</b><br>hand washing ✓<br>vaccination ✓<br>isolation ✓<br>sanitation ✓<br>(idea of) food hygiene e.g. preparation/storage/cooking ✓<br>(idea of) personal hygiene e.g. cover wounds ✓<br>barriers e.g. masks/gloves/condoms ✓<br>control animal diseases ✓ | 1     | 2.1        | <b>ALLOW</b> be hygienic                                                                                                                                                            |
|          | (d) | (i)  | $3.0 \times 10^7$ ✓                                                                                                                                                                                                                                                        | 1     | 1.2        | More than 1 answer circled = 0 marks                                                                                                                                                |
|          |     | (ii) | <b>FIRST CHECK THE ANSWER ON ANSWER LINE</b><br><br><b>If answer = 4 (%) award 2 marks</b><br><br>$1.2 \div 30 = 0.04$ ✓<br>$0.04 \times 100 = 4 (\%)$ ✓                                                                                                                   | 2     | 1.2        | <b>ALLOW ECF</b> if $1.2/30$ calculation was performed but incorrectly calculated<br><br><b>ALLOW</b> 1 mark for $1.2/30 \times 100$ where no final answer is given or is incorrect |

| Question |     | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Marks | AO element | Guidance                                                                                                                                                  |
|----------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------|
|          | (e) | <p>(Reason to use the treatment)<br/> because (idea that) a high number/most/over 90%/91.5%/91% patients made a full recovery<br/> <b>OR</b><br/> only 4 out of 47/8.5%/9% died ✓</p> <p>(Reasons not to use the treatment)<br/> <b>AND any two from:</b><br/> because it is only a small sample of patients ✓<br/> there could be better treatments ✓<br/> it might not be suitable for certain types of patients/ages of patients ✓<br/> study has not been repeated/only one study done ✓<br/> side effects ✓<br/> long term effects ✓<br/> cost ✓</p> | 3     | 3.2b       | <p><b>IGNORE</b> the treatment was effective</p> <p><b>IGNORE</b> it hasn't been properly/thoroughly tested<br/> <b>IGNORE</b> ethical considerations</p> |

| Question |     |  | Answer                                    | Marks | AO element | Guidance                                                                                                      |
|----------|-----|--|-------------------------------------------|-------|------------|---------------------------------------------------------------------------------------------------------------|
| 12       | (a) |  | auxins ✓<br>more ✓<br>shade ✓             | 3     | 1.1        | <b>ALLOW</b> auxins<br><b>ALLOW</b> less light<br><b>DO NOT ALLOW</b> dark                                    |
|          | (b) |  | gravitropism / (positively) gravitropic ✓ | 1     | 1.1        | <b>ALLOW</b> geotropism<br><b>IGNORE</b> negatively phototropic<br><b>DO NOT ALLOW</b> negatively gravitropic |

| Question                                             |                       | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Marks                          | AO element            | Guidance                         |  |    |    |    |                                         |  |  |   |                                         |  |  |   |                                                      |  |   |  |                                   |   |  |  |   |     |                                                  |
|------------------------------------------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|-----------------------|----------------------------------|--|----|----|----|-----------------------------------------|--|--|---|-----------------------------------------|--|--|---|------------------------------------------------------|--|---|--|-----------------------------------|---|--|--|---|-----|--------------------------------------------------|
| 13                                                   | (a)                   | <table><thead><tr><th rowspan="2">Event in the cactus life cycle</th><th colspan="3">Number of chromosomes</th></tr><tr><th>11</th><th>22</th><th>44</th></tr></thead><tbody><tr><td>At the end of interphase during meiosis</td><td></td><td></td><td>✓</td></tr><tr><td>At the end of interphase during mitosis</td><td></td><td></td><td>✓</td></tr><tr><td>In the cells produced by mitosis as the cactus grows</td><td></td><td>✓</td><td></td></tr><tr><td>In the pollen produced by meiosis</td><td>✓</td><td></td><td></td></tr></tbody></table> <p>✓✓✓✓</p> | Event in the cactus life cycle | Number of chromosomes |                                  |  | 11 | 22 | 44 | At the end of interphase during meiosis |  |  | ✓ | At the end of interphase during mitosis |  |  | ✓ | In the cells produced by mitosis as the cactus grows |  | ✓ |  | In the pollen produced by meiosis | ✓ |  |  | 4 | 2.2 | More than 1 tick in a row = 0 marks for that row |
| Event in the cactus life cycle                       | Number of chromosomes |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                |                       |                                  |  |    |    |    |                                         |  |  |   |                                         |  |  |   |                                                      |  |   |  |                                   |   |  |  |   |     |                                                  |
|                                                      | 11                    | 22                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 44                             |                       |                                  |  |    |    |    |                                         |  |  |   |                                         |  |  |   |                                                      |  |   |  |                                   |   |  |  |   |     |                                                  |
| At the end of interphase during meiosis              |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | ✓                              |                       |                                  |  |    |    |    |                                         |  |  |   |                                         |  |  |   |                                                      |  |   |  |                                   |   |  |  |   |     |                                                  |
| At the end of interphase during mitosis              |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | ✓                              |                       |                                  |  |    |    |    |                                         |  |  |   |                                         |  |  |   |                                                      |  |   |  |                                   |   |  |  |   |     |                                                  |
| In the cells produced by mitosis as the cactus grows |                       | ✓                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                |                       |                                  |  |    |    |    |                                         |  |  |   |                                         |  |  |   |                                                      |  |   |  |                                   |   |  |  |   |     |                                                  |
| In the pollen produced by meiosis                    | ✓                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                |                       |                                  |  |    |    |    |                                         |  |  |   |                                         |  |  |   |                                                      |  |   |  |                                   |   |  |  |   |     |                                                  |
|                                                      | (b)                   | <div>Active transport <input type="checkbox"/></div> <div>Cellular respiration <input type="checkbox"/></div> <div>Photosynthesis <input checked="" type="checkbox"/></div> <div>Transpiration <input type="checkbox"/></div> <p>✓</p>                                                                                                                                                                                                                                                                                                                               | 1                              | 1.1                   | More than 1 box ticked = 0 marks |  |    |    |    |                                         |  |  |   |                                         |  |  |   |                                                      |  |   |  |                                   |   |  |  |   |     |                                                  |
|                                                      | (c)                   | xylem ✓                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1                              | 1.1                   | IGNORE phloem                    |  |    |    |    |                                         |  |  |   |                                         |  |  |   |                                                      |  |   |  |                                   |   |  |  |   |     |                                                  |

| Question                   |                                      |              | Answer                                                                                                                                                                                                                                                                                                       | Marks | AO element | Guidance                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                            |                                      |              |     |       |       |        |         |       |         |            |       |       |         |       |
|----------------------------|--------------------------------------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|--------------------------------------|--------------|-----|-------|-------|--------|---------|-------|---------|------------|-------|-------|---------|-------|
| 14                         | (a)                                  |              | sex determination in humans is not determined by temperature/environment ✓<br><br><b>AND any one from:</b><br>sex determination in humans is determined genetically / inherited / by chromosomes/genes/alleles ✓<br><br>(the chromosomes that determine sex) are X and Y / males are XY and females are XX ✓ | 2     | 2.1        | <b>DO NOT ALLOW</b> males are XX and females are XY<br><br><b>ALLOW</b> in humans sex determination is at fertilisation, in turtles it is after fertilisation                                                                                                                                                                                                                                                                                                                                                                                                                     |                            |                                      |              |     |       |       |        |         |       |         |            |       |       |         |       |
|                            | (b)                                  | (i)          | <b>FIRST CHECK THE ANSWER ON ANSWER LINE</b><br><b>If answer = 17841 or 17846 or 17847 or 17864 award 3 marks</b><br><br>18 000/117 = 153.846 ✓<br>153.846 x 116 = 17 846.136 ✓<br>= 17 846 ✓                                                                                                                | 3     | 2.2        | <p>For candidates using different numbers of decimal places following the 18000/117 calculation</p> <table><tr><th>answer first marking point</th><th>answer 2<sup>nd</sup> marking point</th><th>final answer</th></tr><tr><td>154</td><td>17864</td><td>17864</td></tr><tr><td>153.85</td><td>17846.6</td><td>17847</td></tr><tr><td>153.846</td><td>17,846.136</td><td>17846</td></tr><tr><td>153.8</td><td>17840.8</td><td>17841</td></tr></table><br><b>ALLOW</b> 1 mark for any number correctly rounded to the nearest whole number where no working or value is incorrect | answer first marking point | answer 2 <sup>nd</sup> marking point | final answer | 154 | 17864 | 17864 | 153.85 | 17846.6 | 17847 | 153.846 | 17,846.136 | 17846 | 153.8 | 17840.8 | 17841 |
| answer first marking point | answer 2 <sup>nd</sup> marking point | final answer |                                                                                                                                                                                                                                                                                                              |       |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                            |                                      |              |     |       |       |        |         |       |         |            |       |       |         |       |
| 154                        | 17864                                | 17864        |                                                                                                                                                                                                                                                                                                              |       |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                            |                                      |              |     |       |       |        |         |       |         |            |       |       |         |       |
| 153.85                     | 17846.6                              | 17847        |                                                                                                                                                                                                                                                                                                              |       |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                            |                                      |              |     |       |       |        |         |       |         |            |       |       |         |       |
| 153.846                    | 17,846.136                           | 17846        |                                                                                                                                                                                                                                                                                                              |       |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                            |                                      |              |     |       |       |        |         |       |         |            |       |       |         |       |
| 153.8                      | 17840.8                              | 17841        |                                                                                                                                                                                                                                                                                                              |       |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                            |                                      |              |     |       |       |        |         |       |         |            |       |       |         |       |

| Question |  |       | Answer                                                                                                                                                                                                                                                                                                                                                                                                                                      | Marks | AO element | Guidance                                                                                                                                                                                                                                                          |
|----------|--|-------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|          |  | (ii)  | <p>(sea turtle) population will decrease / number of males have decreased ✓</p> <p><b>AND any one from:</b><br/> not enough males to breed / fewer matings / more competition for male mates ✓<br/> fewer females fertilised / laying eggs / less offspring ✓</p> <p><b>OR</b></p> <p>(sea turtle) population will increase ✓</p> <p><b>AND any one from:</b><br/> more breeding females ✓<br/> more females fertilised / laying eggs ✓</p> | 2     | 2.1        | <p><b>ALLOW</b> there will be too many females</p> <p><b>ALLOW</b> sea turtles could become endangered/go extinct</p> <p><b>ALLOW</b> less reproduction</p>                                                                                                       |
|          |  | (iii) | <p>incubate the eggs at lower temperatures / temperature of 31(°C) or below (so more males hatch) ✓</p> <p>decrease global warming/reverse climate change ✓<br/> protect beaches where more males seem to hatch ✓<br/> relocate nests that are in warmer/too warm sand ✓<br/> control sand temperature through shade or irrigation ✓</p>                                                                                                    | 1     | 3.2a       | <p><b>ALLOW</b> any named temperature below 31(°C)</p> <p><b>ALLOW</b> incubating between 27 and 31 (°C) (produces males and females)</p> <p><b>ALLOW</b> keep/breed the turtles at 31(°C) or below/lower temperature</p> <p><b>ALLOW</b> stop climate change</p> |

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