



GCSE (9-1)

Biology A (Gateway)

Unit **J247/04**: Higher Tier – Paper 4

General Certificate of Secondary Education

Mark Scheme for June 2018

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Annotations available in RM Assessor

| Annotation | Meaning |
|------------|----------------------------------------|
| ✓ | Correct response |
| ✗ | Incorrect response |
| ▲ | Omission mark |
| BOD | Benefit of doubt given |
| CON | Contradiction |
| RE | Rounding error |
| SF | Error in number of significant figures |
| ECF | Error carried forward |
| L1 | Level 1 |
| L2 | Level 2 |
| L3 | Level 3 |
| NBOD | Benefit of doubt not given |
| SEEN | Noted but no credit given |
| I | Ignore |

Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

| Annotation | Meaning |
|---------------------|---------------------------------------------------------------|
| / | alternative and acceptable answers for the same marking point |
| ✓ | Separates marking points |
| DO NOT ALLOW | Answers which are not worthy of credit |
| IGNORE | Statements which are irrelevant |
| ALLOW | Answers that can be accepted |
| () | Words which are not essential to gain credit |
| — | Underlined words must be present in answer to score a mark |
| ECF | Error carried forward |
| AW | Alternative wording |
| ORA | Or reverse argument |

Subject-specific Marking Instructions

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

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

The breakdown of Assessment Objectives for GCSE (9-1) in 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 | 1.1 | |
| 2 | | D ✓ | 1 | 1.1 | |
| 3 | | A ✓ | 1 | 2.1 | |
| 4 | | C ✓ | 1 | 1.1 | |
| 5 | | B ✓ | 1 | 1.1 | |
| 6 | | C ✓ | 1 | 2.2 | |
| 7 | | C ✓ | 1 | 1.2 | |
| 8 | | C ✓ | 1 | 1.2 | |
| 9 | | A ✓ | 1 | 1.1 | |
| 10 | | D ✓ | 1 | 1.1 | |
| 11 | | D ✓ | 1 | 1.1 | |
| 12 | | C ✓ | 1 | 1.2 | |
| 13 | | B ✓ | 1 | 1.1 | |
| 14 | | D ✓ | 1 | 1.2 | |
| 15 | | B ✓ | 1 | 1.2 | |

| Question | | Answer | Marks | AO element | Guidance |
|----------|---------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 16 | (a) | four / 4 ✓ | 1 | 1.2 | |
| | (b) | badger number have increased ✓ more competition for food / less slugs to eat ✓ | 2 | 3.1b 3.2b | IGNORE reference to hedgehog numbers dropping ALLOW badgers eat more slugs so less for hedgehogs ALLOW less food to eat IGNORE badgers are predators of hedgehogs IGNORE they both eat slugs |
| | (c) (i) | in country/advantage/where badgers live, if it rolls up in a ball then will provide more protection / less attacks from badgers/predators ✓ in cities/disadvantage/many roads, it will be run over by cars ✓ | 2 | 2 x 2.1 | ALLOW in country/advantage/where badgers live hedgehogs have defence against predators/badgers ALLOW hedgehogs have a reduced risk of being eaten |
| | (ii) | hedgehogs that run away are more likely to survive / less likely to get run over ✓ they will reproduce ✓ pass on the allele/gene for running away ✓ over time/many generations (running away will become more common) ✓ | 4 | 4 x 2.1 | ALLOW ORA for each marking point ALLOW reference to how change occurred e.g. mutation for running away ALLOW offspring produced / breed together ALLOW pass on advantageous gene IGNORE trait is pass on / genes are passed on |

| Question | | Answer | Marks | AO element | Guidance |
|----------|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|----------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 17 | (a) | <p>correctly chosen axes, labelled with units ✓</p> <p>suitable scale on both axes ✓</p> <p>all points correctly plotted ✓✓</p> <p>line of best fit through most points ✓</p> | 5 | 5 x 2.2 | <p>place ticks on right hand side of grid</p> <p>minimum 50% of grid used scale must be in ascending order</p> <p>ALLOW +/- half a square 0 to 5 correct points plotted = 0 mark 6 or 7 correct points plotted = 1 mark All 8 correct points plotted = 2 marks</p> <p>DO NOT ALLOW dot to dot line ALLOW line of best fit for their plotting IGNORE any extrapolation of line</p> |
| | (b) | <p>idea of less plants/percentage of plants/% cover in shade/closer to the tree ✓</p> <p>less light (in shade/closer to the tree)✓</p> <p>less photosynthesis (in shade/closer to the tree)✓</p> <p>less food/raw materials produced for growth (in shade/closer to the tree)✓</p> | 4 | 1.2 2.1 3.1b 3.2b | <p>ORA for all marking points</p> <p>ALLOW shows negative correlation</p> <p>IGNORE less sun IGNORE in shade no photosynthesis / no light</p> <p>ALLOW less light for photosynthesis (closer to the tree) 2 marks ALLOW photosynthesis less effective (closer to the tree)</p> |

| Question | | Answer | Marks | AO element | Guidance | | | | | | | | | |
|----------|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---|----|----|---|----|----|---|--------------------|----------------------------------------------------------------|
| 18 | (a) | Gene: a length of DNA that codes for a protein ✓ Allele: an alternative form/version of a gene ✓ | 2 | 2 x 1.1 | IGNORE section of DNA that codes for a specific characteristic ALLOW a particular copy of a gene | | | | | | | | | |
| | (b) (i) | <table border="1"> <tr> <td></td><td>R</td><td>r</td></tr> <tr> <td>R</td><td>RR</td><td>Rr</td></tr> <tr> <td>r</td><td>Rr</td><td>rr</td></tr> </table> <p>correct gametes ✓ correct genotypes of offspring ✓ probability = 0.25 / $\frac{1}{4}$ / 25% / 1 in 4 / 1:3 ✓</p> | | R | r | R | RR | Rr | r | Rr | rr | 3 | 2.2 2.2 3.2b | ALLOW other forms of diagrams other than Punnett square |
| | R | r | | | | | | | | | | | | |
| R | RR | Rr | | | | | | | | | | | | |
| r | Rr | rr | | | | | | | | | | | | |
| | (ii) | <p>rod cells are do not work / damaged ✓ rod cells can work in dim light ✓ but cannot detect colour ✓</p> | 3 | 2.1 2.1 1.1 | ALLOW only rods cells broken down / cones are not broken down IGNORE rod cells broken down (as in stem of question) ALLOW converse for cones ALLOW converse for cones ALLOW rods only see in black and white | | | | | | | | | |

| Question | | | Answer | Marks | AO element | Guidance |
|----------|--|--|-------------------------------------------------------------------------------------------------------------------------------------------|------------|----------------|------------------------------------------------------------------------------------------------------------|
| | | | stem cells are not differentiated/can still specialise ✓ they could become rod cells ✓ | 1 1 | 1.2 2.1 | ALLOW stem cells are unspecialised / can grow into any type of cell / have ability to differentiate |
| | | | idea it would not be detected as foreign cells (by the immune system/WBC) ✓ OR idea it would not be rejected (by the body) ✓ | 1 | 2.2 | ALLOW accepted (by the body) / (body) more likely to accept |

| Question | | | Answer | Marks | AO element | Guidance |
|----------|--|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 19 (a) | | | sperm/male gametes contain either an X or Y chromosome and eggs/female gametes contain an X chromosome ✓ indication that XX is female and XY is male ✓ | 2 | 2 x 1.1 | ALLOW correct Punnett square but unlabelled for gamete mark ALLOW correct Punnett square that indicates XY is male and XX is female for 2 marks |
| | | | First check answer on answer line If answer = 357512 award 2 marks $\frac{105}{205} \times 698000 \checkmark$ $= 357512 \checkmark$ | 2 | 2 x 2.2 | ALLOW answer given to several dps |
| | | | males do not live as long/ ORA ✓ | 1 | 3.1b | ALLOW they (females) live longer |

| Question | | Answer | Marks | AO element | Guidance |
|----------|-----|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 20 | (a) | <p>< 3(mm) ✓ encourages more microbes from day 0 to 25✓ therefore, more rapid decay/decomposition ✓</p> <p>OR 3 – 5(mm) ✓ encourages more microbes from day 26 to 50/overall ✓ therefore, more rapid decay/decomposition ✓</p> | 3 | 3.1a 3.2b 3.2b | ALLOW > 5 given only 1 mark available for more rapid decay |
| | (b) | <p>Any two from: (small pieces means) there will be a larger surface area of dead plants ✓ therefore, decomposers will be able to reproduce faster / feed faster ✓ therefore, decomposers will be able to respire faster ✓</p> | 2 | 2 x 2.2 | |
| | (c) | <p>idea of recycling in nature ✓ named example of a recycled substance e.g. carbon/nitrogen ✓ example of reason why the recycling is important e.g. for photosynthesis / production of proteins in plants ✓</p> | 3 | 3 x 1.1 | ALLOW mineral being returned to the soil / environment IGNORE nutrients/minerals IGNORE water ALLOW carbon dioxide/nitrates/nitrogen compounds recycled |

| Question | | Answer | Marks | AO element | Guidance |
|----------|---------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 21 | (a) | number of seeds that germinated ✓ | 1 | 3.1a | IGNORE the number of seeds |
| | (b) | to keep the total volume constant / to dilute the acid by different amounts ✓ | 1 | 3.1a | ALLOW so volume adds up to 20cm ³ ALLOW change/investigate the concentration of acid ALLOW make it more/less acidic / vary acidity |
| | (c) | idea that germination is affected by temperature✓ | 1 | 3.1a | ALLOW higher level answers such as references to rate of diffusion or enzyme action correctly linked to temperature change IGNORE to make it a fair test |
| | (d) | Any two from: acid rain will reduce the number of seeds that germinate ✓ reference to addition of small volumes of acid having little effect / rapid drop in germination between third and fourth flask ✓ germination at the highest volume of acid is still possible / acid concentration would have to be higher to stop germination ✓ | 2 | 2 x 3.1b | ALLOW ORA ALLOW indication of correct flasks from table data |
| | (e) (i) | First check answer on answer line If answer = 100 award 2 marks correct calculation of 10% ✓ $VI = 100$ ✓ | 2 | 2 x 2.2 | |
| | (ii) | takes into account how well the seeds are growing ✓ also better to use percentage germination than number germinated ✓ | 2 | 3.3b | ALLOW shows seeds growing roots/shoots / shows seeds growing above/below soil |

| Question | | Answer | Marks | AO element | Guidance |
|----------|-----|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|-----------------------------------------------------------------------------------------------------------------------|
| 22 | (a) | Any two from: a protein molecule ✓ made by the immune system ✓ destroys/kills pathogens / clumps them together / attaches to antigens ✓ | 2 | 2 x 1.1 | ALLOW made by WBC / found in WBC IGNORE germs and disease IGNORE attack or fight pathogens |
| | (b) | Any four from: (inject) methamphetamine/drug into mice ✓ lymphocytes made/collected ✓ fuse with tumour cells ✓ hybridoma cells made ✓ hybridoma make antibodies against methamphetamine/drug ✓ | 4 | 4 x 1.2 | ALLOW WBC made/collected ALLOW fuse with cancer/myeloma cells |
| | (c) | Any two from: antibodies are specific ✓ only (binds) to one drug/antigen (shape) ✓ | 2 | 1.1 1.1 | ALLOW they would not fit together with other drugs |

| Question | | | Answer | Marks | AO element | Guidance |
|----------|-----|------|-------------------------------------------------------------------------------------------------------------------------------------------|-------|------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 23 | (a) | (i) | <p>First check answer on answer line If answer = 0.9 % award 2 marks</p> $\frac{200}{22000} \times 100 \checkmark$ $= 0.9 \checkmark$ | 2 | 2 x 2.2 | <p>ALLOW 0.91 / 0.909</p> |
| | | (ii) | <p>Any two from:</p> <p>egestion ✓ excretion ✓ respiration ✓ decomposition ✓ uneaten parts ✓</p> | 2 | 2 x 1.1 | <p>ALLOW faeces ALLOW undigested food</p> <p>ALLOW named excretory product / urine</p> <p>ALLOW heat IGNORE movement</p> |

| Question | | Answer | Marks | AO element | Guidance |
|----------|--|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| (b) | | <p>Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.</p> <p>Level 3 (5–6 marks) Detailed explanation including conclusions about how the mechanism affects photosynthesis and links this to less biomass available to humans in the food chain. <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p>Level 2 (3–4 marks) Explanation of how the mechanism affects photosynthesis or affects the biomass available to humans. <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i></p> <p>Level 1 (1–2 marks) Demonstrates some knowledge of how the mechanism affects photosynthesis or affects the biomass available to humans. <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i></p> <p>0 marks No response or no response worthy of credit.</p> | 6 | 3 x 1.1 2 x 2.1 1 x 3.2b | <p>AO1.1 Demonstrate knowledge of photosynthesis and biomass.</p> <ul style="list-style-type: none"> Photosynthesis requires light energy Mechanism reduces photosynthesis Trapped by the leaves and used to produce food molecules Photosynthesis required for plant growth Plant biomass is a food source for animals including humans <p>AO2.1 Apply knowledge and understanding of photosynthesis to the production of biomass</p> <ul style="list-style-type: none"> More light energy converted to heat, then less energy for photosynthesis Less photosynthesis then plants can make less food / plants can grow less Less plant biomass leads to less available food <p>AO3.2b Draw conclusions linking photosynthesis to biomass in food chains</p> <ul style="list-style-type: none"> In low light intensities, light availability is the limiting factor Less plant growth/crops therefore less food for cattle/less food for humans / in the food chain |

| Question | | Answer | Marks | AO element | Guidance |
|----------|-------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|-------------|-----------------------------------------------------------------------------------------------------------------------------------------|
| | (c) | (i) mRNA carries the code for proteins ✓ more protein will be made ✓ | 2 | 2 x 2.1 | ALLOW protein will be made faster |
| | (ii) | First check answer on answer line If answer = 40 award 2 marks $\frac{20 \times 200}{100} \checkmark$ $= 40 \checkmark$ | 2 | 2 x 2.2 | |
| | (iii) | new method uses the plants own genes ✓ concern that plants with the insecticide/gene might be harmful to humans / might impact on food chains / might kill useful insects ✓ | 2 | 2.2 3.2a | ALLOW might have side-effects IGNORE ideas about cultural or religious or ethical objections or that it is playing God |

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