Collins

# AQA

GCSE

# BIOLOGY

**H**

## SET A – Higher Tier

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# Answers

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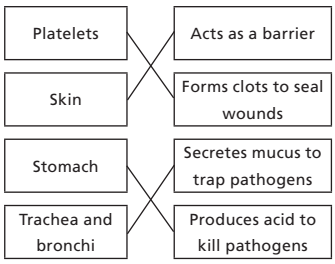
## Paper 1

| Question | Answer(s) | Extra info | Mark(s) | AO/Spec ref. |
|---|---|---|---|---|
| 01.1 |  all four correct for **3** marks<br>two or three correct for **2** marks<br>one correct for **1** mark | | 3 | **AO1** 4.2.2.3 4.3.1.6 |
| 01.2 | advantage: kill bacteria (inside body)<br>disadvantage: do not kill viruses | allow cures bacterial infection<br>allow may lead to antibiotic resistant strains | 1<br>1 | **AO1** 4.3.1.8 |
| 01.3 | introduce dead / inactive / harmless / part of pathogens<br>stimulates white blood cells to produce antibodies<br>in future if same pathogens re-enter the body, white blood cells produce antibodies very quickly<br>pathogens killed before can spread / cause symptoms | | 1<br>1<br>1<br>1 | 4.3.1.7 |
| 02.1 | 60 mm = 60 000 µm<br>actual size = image size ÷ magnification<br>= 60 000 ÷ 5000<br>= 12 (µm) | allow 12 with no working shown for **4** marks<br>allow equivalent marking points if conversion to µm is done at the end | 1<br>1<br>1<br>1 | **AO2** 4.1.1.5 |
| 02.2 | resolution is the ability to distinguish between two points<br>magnification is how many times bigger the image is than the object | | 1<br>1 | **AO1** 4.1.1.5 |
| 02.3 | (not an animal) because it contains chloroplasts<br>(not a plant) because it does not have a cell wall / it does not have a (large / permanent) vacuole<br>(not a bacterium) because it has a nucleus / has chloroplasts / does not have a cell wall / does not contain plasmids / does not have a naked loop of DNA | | 1<br>1<br>1 | **AO2** 4.1.1.1 4.1.1.2 |

| Question | Answer(s) | Extra info | Mark(s) | AO/Spec ref. |
|---|---|---|---|---|
| 03.1 | **Level 3**: A coherent method is described with relevant detail, which demonstrates a broad understanding of the relevant scientific techniques and procedures. The steps in the method are logically ordered. The method would lead to the collection of valid results. | | 5-6 | **AO2/ AO3** 4.2.2.1 |
| | **Level 2:** The bulk of a method is described with mostly relevant detail, which demonstrates a reasonable understanding of the relevant techniques and procedures. The method may not be in a completely logical sequence and may be missing some detail. | | 3-4 | |
| | **Level 1:** Discrete relevant points are made which demonstrate some understanding of the relevant scientific techniques and procedures. They may lack a logical structure and would not lead to the production of valid results. | | 1-2 | |
| | **No relevant content** | | 0 | |
| | **Indicative content**<br>• independent variable is the temperature<br>• temperature is varied by using different temperature water baths<br>• dependent variable is time to digest all the starch<br>• control variables include: concentration / amount of starch, pH<br>• repeat readings and calculate means<br>• plot graph of results to work out the optimum temperature that would give the shortest time / fastest rate of reaction | | | |
| 03.2 | protein: amino acids<br>lipid / fat / oil: glycerol and fatty acids | | 4 | **AO1** 4.2.2.1 |
| 03.3 | add Benedict's solution<br>heat / put in a hot water bath<br>if sugar is present there is a colour change from blue to brick red / orange | | 1<br>1<br>1 | **AO1** 4.2.2.1 |
| 04.1 | 13 / at least 13<br>each colony grew from one original bacterium | | 1<br>1 | **AO3** 4.1.1.6 |
| 04.2 | it is a different species / type<br>**or**<br>there was contamination / imperfect aseptic technique | | 1 | **AO3** 4.1.1.6 |

| Question | Answer(s) | Extra info | Mark(s) | AO/Spec ref. |
|---|---|---|---|---|
| 04.3 | any **two** from:<br>• sterilise Petri dish<br>• sterilise agar medium<br>• sterilise inoculating loop<br>• (when inoculating agar plate) only lift lid slightly<br>• incubate upside down<br>• ensure that the Petri dish is air tight apart from one very small section | | 2 | **AO1** 4.1.1.6 |
| 04.4 | radius (r) = 17.0 ÷ 2 = 8.5 (mm)<br>area = 3.14 × $8.5^2$ ($mm^2$)<br>= 227 ($mm^2$)<br>= 2.27 × $10^2$ ($mm^2$) | allow 2.27 × $10^2$ with no working shown for **4** marks deduct 1 mark if final answer not to 3 significant figures | 1<br>1<br>1<br>1 | **AO2** 4.1.1.6 |
| 04.5 | take several measurements **and** take the mean / average | | 1 | **AO2** 4.1.1.6 |
| 05.1 | lack of leaves / chlorophyll<br>means less photosynthesis<br>so less glucose is made for growth / for making other substances necessary for growth | | 1<br>1<br>1 | **AO2** 4.3.1.4<br>4.4.1.3 |
| 05.2 | method 1: use fungicides<br>explanation: these kill fungus / rose black spot<br>method 2: remove / destroy infected leaves<br>explanation: so they cannot act as a source of infection | explanation must be correctly linked to method it does **not** matter which is method 1 or method 2 | 1<br>1<br>1<br>1 | **AO1/ AO2** 4.3.1.4 |
| 06.1 | lymphocytes can make antibodies (but not divide)<br>tumour cells can divide (but not make antibodies)<br>hybridoma cells can divide and make antibodies<br>so produce many cells making monoclonal antibodies | | 1<br>1<br>1<br>1 | **AO1** 4.3.2.1 |
| 06.2 | antigens | | 1 | **AO1** 4.3.2.1 |
| 06.3 | monoclonal antibodies are joined to a toxic drug / radioactive substance<br>which the monoclonal antibodies deliver to the cancer cells | | 1<br>1 | **AO1** 4.3.2.2 |
| 06.4 | only attach to the cancer cells<br>do not harm other cells | | 1<br>1 | **AO1** 4.3.2.2 |

| Question | Answer(s) | Extra info | Mark(s) | AO/Spec ref. |
|---|---|---|---|---|
| 07.1 | % change = $\frac{\text{change} \times 100}{\text{original mass}}$<br>= $\frac{(29.0 - 24.0) \times 100}{24.0}$<br>= (+) 20.8 (%) | allow 20.8 with no working shown for **3** marks deduct 1 mark for incorrect rounding | 1<br>1<br>1 | **AO2** 4.1.3.2 |
| 07.2 | all points correctly plotted **2** marks<br>**but**<br>three or four points correctly plotted **1** mark<br>smooth line of best fit | allow ± half a small square | 2<br>1 | **AO2** 4.1.3.2 |
| 07.3 | correct reading from graph of where line crosses horizontal axis | allow ± half a small square | 1 | **AO3** 4.1.3.2 |
| 07.4 | as one of the control variables<br>surface area (:volume ratio) affects rate of osmosis | | 1<br>1 | **AO2** 4.1.3.1<br>4.1.3.2 |
| 07.5 | otherwise would include mass of solution in results / otherwise measurements of mass would be too high | | 1 | **AO2** 4.1.3.2 |
| 08.1 | phloem transports (dissolved) sugars | | 1 | **AO2** 4.2.3.2 |
| 08.2 | any **two** from:<br>• phloem is made of elongated cells<br>• xylem is made of hollow tubes<br>• xylem contains lignin<br>• phloem cells have companion cells next to them<br>• phloem has small perforations / plasmodesmata / pores in the end walls | | 2 | **AO1** 4.2.3.2 |
| 08.3 | can find out how to treat them / get rid of them | | 1 | **AO2** 4.3.3.1 |
| 08.4 | (stomata close) to reduce water loss<br>by transpiration / evaporation<br>(disadvantage is) carbon dioxide cannot enter leaves<br>so plant cannot photosynthesise | | 1<br>1<br>1<br>1 | **AO2** 4.1.3.1<br>4.2.3.1<br>4.2.3.2<br>4.4.1.1 |
| 08.5 | enters root hairs<br>travels through xylem<br>in transpiration stream / by transpiration | | 1<br>1<br>1 | **AO2** 4.2.3.2 |
| 09.1 | fatty material builds up<br>inside coronary arteries<br>reducing blood flow through coronary arteries / to heart muscle<br>reducing supply of oxygen / glucose to heart muscle | | 1<br>1<br>1<br>1 | **AO1** 4.2.2.4 |

| Question | Answer(s) | Extra info | Mark(s) | AO/Spec ref. |
|---|---|---|---|---|
| 09.2 | **Level 3:** A detailed and coherent evaluation is provided which considers arguments on both sides as to whether the graph demonstrates that obesity is a risk factor for Type 2 diabetes, and comes to a conclusion consistent with the reasoning. | | 5-6 | **AO3** 4.2.2.6 |
| | **Level 2:** An attempt to give arguments on both sides as to whether the graph demonstrates that obesity is a risk factor for Type 2 diabetes. The logic may be inconsistent at times but builds towards a coherent argument. | | 3-4 | |
| | **Level 1:** Discrete relevant points made. The logic may be unclear and the conclusion, if present, may not be consistent with the reasoning. | | 1-2 | |
| | **No relevant content** | | 0 | |
| | **Indicative content**<br>• there does appear to be a link between body mass and Type 2 diabetes<br>• but this could simply be correlation not causation<br>• need more evidence, e.g. of a causal mechanism<br>• not a perfect correlation<br>• there may be other factors also linked with Type 2 diabetes<br>• although graph shows body mass it does not show obesity<br>• it's only over a 10-year period<br>• we do not know where the data came from<br>• we do not know how many people were involved | | | |
| 10.1 | **W**: the limiting factor is light intensity | | 1 | **AO2** 4.4.1.2 |
| | explanation: if you increase light intensity the rate of photosynthesis increases | | 1 | |
| | **X**: the limiting factor is carbon dioxide concentration | | 1 | |
| | explanation: if you increase carbon dioxide concentration the rate of photosynthesis increases | | 1 | |
| | **Y**: the limiting factor is temperature | | 1 | |
| | explanation: if you increase temperature the rate of photosynthesis increases | | 1 | |
| 10.2 | **Level 3:** A detailed and coherent description of the tests that would have to be made and the conclusions that could be drawn depending on the outcomes. | | 5-6 | **AO2/ AO3** 4.4.1.2 |
| | **Level 2:** An attempt to give a description of the tests that would have to be made and the conclusions that could be drawn depending on the outcomes. The logic may be inconsistent at times but builds towards a coherent argument. | | 3-4 | |
| | **Level 1:** Discrete relevant points made. The logic may be unclear and any conclusions, if present, may not be consistent with the reasoning. | | 1-2 | |
| | **No relevant content** | | 0 | |
| | **Indicative content**<br>• limiting factor could be carbon dioxide concentration, temperature or amount of light<br>• raise the temperature (above 25 °C) but leave carbon dioxide concentration (4%) the same<br>• if the rate of photosynthesis increases then the limiting factor at **Z** is temperature<br>• raise carbon dioxide concentration (above 4%) but leave the temperature (25 °C) the same<br>• if the rate of photosynthesis increases then the limiting factor at **Z** is carbon dioxide concentration<br>• if neither raising carbon dioxide concentration nor temperature increase the rate of photosynthesis then the limiting factor is light intensity | | | |

## Paper 2

| Question | Answer(s) | Extra info | Mark(s) | AO/Spec ref. |
|---|---|---|---|---|
| 01.1 | amount of light | | 1 | **AO2** 4.5.4.1 |
| | place dishes in a box to keep light out | | 1 | |
| | make sure light comes from all directions / dish is equally lit from all directions | | 1 | |
| | because seedlings will also respond to the direction of light / seedlings are phototropic | | | |
| 01.2 | to make sure results are repeatable / to make sure result is not anomalous | | 1 | **AO2** 4.5.4.1 |
| 01.3 | auxin collected on lower side of shoot | | 1 | **AO2** 4.5.4.1 |
| | increased growth / elongation on lower side (causes upward growth) | | 1 | |
| 01.4 | seedlings would grow horizontally | | 1 | **AO3** 4.5.4.1 |
| | auxin is evenly distributed / seedling experiences gravity on all parts equally because of rotation | | 1 | |
| | so each side grows / elongates equally | | 1 | |

| Question | Answer(s) | Extra info | Mark(s) | AO/Spec ref. |
|---|---|---|---|---|
| 02.1 | 0 | | 1 | **AO2** 4.7.2.1 |
| 02.2 | 8 | | 1 | **AO2** 4.7.2.1 |
| 02.3 | all points correctly plotted **3** marks<br>**but**<br>at least 10 points correctly plotted **2** marks<br>**but**<br>at least six points correctly plotted **1** mark<br>points joined up to make a 'kite' | allow ± half a small square | 3<br><br><br><br><br>1 | **AO2** 4.7.2.1 |
| 02.4 | **Level 2:** A detailed and coherent argument is given, which explains why species B and D are more common on the path and why species A and C are more common away from the path. | | 3–4 | **AO3** 4.7.1.1 4.7.2.1 |
| | **Level 1:** Discrete relevant points are made, although the arguments may not be clear. | | 1–2 | |
| | **No relevant content** | | 0 | |
| | **Indicative content**<br>• species A and C are tall(er)<br>• species A and C are killed by mowing on the path<br>• species A and C can survive away from the path as they are tall enough to successfully compete for light<br>• species B and D are low-growing<br>• species B and D are not killed by mowing on the path / are missed by the mower<br>• species B and D cannot survive away from the path as they are not tall enough to successfully compete for light | | | |
| 03.1 | **Level 3**: A coherent evaluation is given, with relevant details, which demonstrates an understanding of the principles of investigations and analysis of results. | | 5–6 | **AO3** 4.5.2.1 |
| | **Level 2:** An evaluation is given with mostly relevant detail, which demonstrates a reasonable understanding of the relevant principles. The evaluation may not be completely logical and may be missing some detail. | | 3–4 | |
| | **Level 1:** Discrete relevant points are made which demonstrate some understanding of the relevant principles. | | 1–2 | |
| | **No relevant content** | | 0 | |

| Question | Answer(s) | Extra info | Mark(s) | AO/Spec ref. |
|---|---|---|---|---|
| | **Indicative content**<br>**Method**<br>• only recording the shortest time for each student is not as representative as taking the mean result for each student<br>• only using the right hand means that some students may not be using their dominant hand<br>• different numbers of girls and boys is taken into account by taking mean results<br>• sample sizes are small<br>**Conclusion**<br>• it is correct that the mean time for the girls is less than for the boys<br>• the results for the boys show more variation than for the girls<br>• if the longest boys' result (0.32) is discounted then boys overall have the shortest reaction time<br>• the conclusion is based on a small sample size<br>• the conclusion should only apply to this way of measuring reaction time | | | |
| 03.2 | receptor = ear<br>effector = hand muscles | | 1<br>1 | **AO2** 4.5.2.1 |
| 03.3 | electric impulses<br>along neurones / nerve cells | | 1<br>1 | **AO1** 4.5.2.1 |
| 03.4 | no – no mark<br>pressing the button is a conscious action<br>**or**<br>pressing the button is not an automatic action | | 1 | **AO2** 4.5.2.1 |
| 04.1 | <table><tr><th>Mitosis</th><th>Meiosis</th></tr><tr><td>✓</td><td>✗</td></tr><tr><td>✓</td><td>✗</td></tr><tr><td>✗</td><td>✓</td></tr><tr><td>✓</td><td>✗</td></tr></table><br>all correct for **2** marks<br>4 ,5, 6 or 7 correct for **1** mark | | 2 | **AO1** 4.6.1.1 4.6.1.2 |
| 04.2 | sequence: 2, 3, 1, 4<br>all correct for **2** marks<br>2 or 3 correct for **1** mark | | 2 | **AO2** 4.6.1.2 |
| 04.3 | <table><tr><th></th><th>X</th><th>Y</th></tr><tr><td>X</td><td>XX female</td><td>XY male</td></tr><tr><td>X</td><td>XX female</td><td>XY male</td></tr></table><br>correct gametes<br>correct offspring genotypes<br>correct identification of female offspring<br>correct probability of 0.5 **or** 50% **or** 1 in 2 **or** ½ | | <br><br>1<br>1<br>1<br>1 | **AO1** 4.6.1.6 4.6.1.8 |

| Question | Answer(s) | Extra info | Mark(s) | AO/Spec ref. |
|---|---|---|---|---|
| 04.4 | 0.5 **or** 50% **or** 1 in 2 **or** ½ | | 1 | **AO2** 4.6.1.6 4.6.1.8 |
| 05.1 | to stimulate egg maturation / development | | 1 | **AO1** 4.6.1.6 |
| 05.2 | in a laboratory / in a dish | | 1 | **AO1** 4.5.3.6 |
| 05.3 | (reason:)<br>success rates are low<br>to increase chance of success<br>(disadvantage:)<br>multiple pregnancy / birth<br>risk to mother / babies | | <br>1<br>1<br><br>1<br>1 | **AO1** 4.5.3.5 |
| 05.4 | FSH = X<br>LH = W<br>oestrogen = Z<br>progesterone = Y<br><br>all correct for **3** marks<br>2 or 3 correct for **2** marks<br>1 correct for **1** mark | | 3 | **AO1** 4.5.3.4 |
| 06.1 | decreases / goes down<br>ADH / antidiuretic hormone<br>decreases / goes down<br>increases / goes up | in this order only | 1<br>1<br>1<br>1 | **AO1** 4.5.3.3 |
| 06.2 | the idea that a change in one direction brings about a change in the opposite direction | | 1 | **AO1** 4.5.3.3 |
| 06.3 | to remove urea | | 1 | **AO1** 4.5.3.3 |
| 07.1 | Y = sugar<br>Z = phosphate | | 1<br>1 | **AO1** 4.6.1.5 |
| 07.2 | nucleotide | | 1 | **AO1** 4.6.1.5 |
| 07.3 | it is made up of repeating units / nucleotides | | 1 | **AO1** 4.6.1.5 |
| 07.4 | TAAGCGAGT<br>all correct for **2** marks<br>at least half correct for **1** mark | | 2 | **AO1** 4.6.1.5 |
| 07.5 | three | | 1 | **AO2** 4.6.1.5 |
| 08.1 | Dd | allow dD | 1 | **AO2** 4.6.1.6 4.6.1.7 |
| 08.2 | DD | | 1 | **AO2** 4.6.1.6 4.6.1.7 |
| 08.3 | does not have polydactyly | allow normal | 1 | **AO2** 4.6.1.6 4.6.1.7 |

| Question | Answer(s) | Extra info | Mark(s) | AO/Spec ref. |
|---|---|---|---|---|
| 08.4 | no – no mark<br>parents must both be dd<br>child needs to inherit at least one D to have condition | | <br>1<br>1 | **AO2** 4.6.1.6 4.6.1.7 |
| 08.5 | **Level 2:** A detailed and coherent argument is given, which states all possible genotypes for A and C, and fully explains the reasoning leading to the conclusions. | | 3–4 | **AO2** 4.6.1.6 4.6.1.7 |
| | **Level 1:** Discrete relevant points are made, including some of the possible genotypes, although the reasoning may not be clear. | | 1–2 | |
| | **No relevant content** | | 0 | |
| | **Indicative content**<br>**A:**<br>• A = Dd or DD<br>• A has condition so must have at least one D<br>• but not enough information to tell whether A is Dd or DD<br>**C:**<br>• C = Dd<br>• C has condition so must have at least one D<br>• C has a mother (B) who must be dd, so C must have inherited a d from B<br>**or**<br>• C has a child (F) who must be dd, so C must have passed on a d to F | | | |
| 08.6 | if disorder is caused by a dominant allele then each individual carrying the allele is affected by the disorder<br>**or**<br>if disorder is caused by a recessive allele then heterozygous individuals can carry and pass on the condition even though they are unaffected | | 1 | **AO2** 4.6.1.7 |
| 09.1 | variation in size among wrens / some wrens were larger than others<br>variation in size is affected / controlled by different genes<br>larger wrens are more likely to survive / live longer than smaller ones<br>larger wrens pass on the genes for being larger / genes for being smaller are not passed on | | 1<br>1<br>1<br>1 | **AO2** 4.6.2.1 4.6.2.2 |
| 09.2 | breed them together<br>to produce fertile offspring | | 1<br>1 | **AO2** 4.6.2.2 |

| Question | Answer(s) | Extra info | Mark(s) | AO/Spec ref. |
|---|---|---|---|---|
| 09.3 | first two names / genus and species name are the same because they are the same species | | 1 | **AO3** 4.6.4 |
| | the different / third name shows that there is a difference | | 1 | |
| 09.4 | *Troglodytes hirtensis* | | 1 | **AO2** 4.6.4 |
| | same genus name because similar, but different species name | | 1 | |
| 10.1 | **Level 3**: A detailed and coherent explanation is given, with relevant details, which demonstrates an understanding of the efficiency of biomass transfer along food chains and its implications for the future feeding of the human population. | | 5–6 | **AO1/ AO2/ AO3** 4.7.4.3 |
| | **Level 2:** A description and explanation is given with mostly relevant detail, which demonstrates a reasonable understanding of the relevant principles. The argument may not be completely logical and may be missing some detail. | | 3–4 | |
| | **Level 1:** Discrete relevant points are made which demonstrate some understanding of the relevant principles. | | 1–2 | |
| | **No relevant content** | | 0 | |
| | **Indicative content**<br>• biomass / energy is lost between trophic levels<br>• only about 10% (on average) of the biomass / energy from one trophic level is transferred to the next<br>• some biomass / energy is lost from food chains because not all ingested materials are absorbed / some are egested as faeces<br>• some biomass / energy is lost from food chains because some is lost as waste such as carbon dioxide / urea<br>• some biomass / energy is lost from food chains because large amounts of glucose are used in respiration<br>• more biomass / energy is available to humans by eating at a lower trophic level<br>• there is more food available / more people can be fed, if they eat at a lower trophic level<br>• as the human population increases / food becomes more scarce, people will need to eat more plant crops and less meat | | | |
| 10.2 | less energy / biomass is used in respiration | | 1 | **AO2** 4.7.4.3 |
| | more energy / biomass is passed to next trophic level | | 1 | |

| Question | Answer(s) | Extra info | Mark(s) | AO/Spec ref. |
|---|---|---|---|---|
| 11.1 | **Level 3**: A coherent description and explanation is given, with relevant details, which demonstrates an understanding of the links between predator and prey populations. | | 5–6 | **AO3** 4.7.2.1 |
| | **Level 2:** A description and explanation is given with mostly relevant detail, which demonstrates a reasonable understanding of the relevant principles. The argument may not be completely logical and may be missing some detail. | | 3–4 | |
| | **Level 1:** Discrete relevant points are made which demonstrate some understanding of the relevant principles. | | 1–2 | |
| | **No relevant content** | | 0 | |
| | **Indicative content**<br>• snowy owls nest when there are peaks in lemming abundance<br>• snowy owls do not nest when lemming abundance is low<br>• this is because snowy owls need lemmings to feed their young / they could not raise young if there were not enough lemmings to eat<br>• lemming abundance falls after the years when snowy owls have nested<br>• this is because so many lemmings have been eaten by the snowy owls and their young<br>• lemming numbers begin to rise in the years after snowy owls have nested<br>• this is because there is less predation as there will be fewer snowy owls<br>• there is not a perfect correlation between snowy owl nesting and lemming abundance<br>• for example, the years with the highest number of nests are not the years with the highest lemming abundance<br>• this may be because snowy owls may be forced to breed on the island as they are less able to breed elsewhere | | | |
| 11.2 | respiration by snowy owls | | 1 | **AO1** 4.7.2.2 |
| | decay of waste / dead bodies | | 1 | |
| | respiration by microorganisms (responsible for decay) | | 1 | |
| 11.3 | by protecting places with a higher biodiversity more species may be protected | | 1 | **AO3** 4.7.3.1 |
| | places with a low biodiversity have their own unique species which should also be protected | | 1 | |