

CHERRY HILL TUITION AQA BIOLOGY A2 PAPER 27 MARK SCHEME

Question	Part	Marking Guidance	Mark	Comments
1	(a)	Small surface area to volume ratio / more fat;  Lose less heat (to the environment) / for insulation;  When they are sitting on eggs;	2 max	
1	(b)(i)	The further north/higher the latitude, the higher the percentage (of white snow geese);	1	
1	(b)(ii)	Snow lying longer/melts slower further north/at greater latitudes;  White geese better camouflaged (further north);  Predation linked to survival/reproductive success;	3	<b>Q</b> In order to gain the last marking point, candidates must explain how survival or reproductive success is affected.
1	(c)	Snow melts earlier/snow melts further north / less snow;  White geese decreasing as less well camouflaged/at disadvantage/blue geese increasing as better camouflaged/at an advantage;	2	
1	(d)(i)	Stabilising;	1	Do not accept stable
1	(d)(ii)	Few geese survive at the extremes/most survive from the middle of the range;	1	

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Question	Part	Marking Guidance	Mark	Comments
2	(a)	Extracellular digestion / releases enzymes; Starch to monosaccharides /glucose/sugars/smaller molecules ; Respire product of digestion; Produce carbon dioxide from respiration;	2 max	
2	(b)	Correct answer of 40;; Incorrect answer showing clearly that a difference in mass has been divided by time;	2	
2	(c)	Lower as plants contain a lower proportion of nitrogen/higher proportion of carbon/ higher C:N ratio; Nitrogen found (mainly) in protein/amino acids / nitrogen used to make protein;	2	

2	(d)	<p>Investigation refers to a single species and other species might not respond in the same way;</p> <p>Investigation carried out in greenhouse where conditions controlled;</p> <p>Accept any other valid answers relating to how an increase in carbon dioxide concentration might increase caterpillar damage, e.g.:</p> <p>Caterpillars may eat more to compensate (for low nitrogen/protein);</p> <p>Increased temperature (resulting from higher carbon dioxide concentration will increase rate of growth /reduce generation time;</p> <p>Other organisms interfere with results;</p>	2 max	Remember question concerns caterpillar damage
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Question	Part	Marking Guidance	Mark	Comments
3	(a)	All organisms of one species in a habitat/area/place/at one time;	1	Accept group
3	(b)(i)	From curve <b>C</b> ;  Find age as a percentage of a maximum/find value when 5000/50% still alive;  (Use to) calculate as a percentage of 95/ Answer = 85 years;	3	<b>Q</b> This question tests quality of written communication. Marks may be awarded for calculating the answer but this must be supported by adequate explanation making the points listed.  If curve A or B are given, figures for last mark point are A 8 B 50 All three +/- 2
3	(b)(ii)	More disease/poor food supplies/poor sanitation/poor medical care;  High death rate among the young/in childhood / curve drops steeply at first/in first 40;	2	Overcrowding not enough  Ignore ref to years or percentage

Question	Part	Marking Guidance	Mark	Comments
4	(a)(i)	Method of positioning quadrats, E.g. Find direction and distance from specified point/ find coordinates on a grid / split area into squares;  Method of generating random numbers; E.g. From calculator/telephone directory/numbers drawn from a hat;	2	Last point represents minimum answer  <b>Q</b> Do not credit any method that relies on throwing a quadrat
4	(a)(ii)	Calculate running mean/description of running mean;  When enough quadrats, this shows little change/levels out (if plotted as a graph);  Enough to carry out a statistical test;  A large number to make sure results are reliable;  Need to make sure work can be carried out in the time available;	2 max	Ignore terms that are not incorrect Regards large numbers as 10/10% +
4	(b)	Coppice different parts of the wood at different times;  As data show many daffodils flowering 4/5 years after coppicing;	2	<b>Q</b> Second point needs specific reference to the graph, numbers and time after coppicing. Accept any correct answer that does this.
4	(c)	<u>Positive</u> correlation between rainfall and flowering/the higher the rainfall, the more daffodil flowers;  <u>Negative</u> correlation/the higher the temperature the fewer daffodils in flower;  All statistically significant so not likely to be/not due to chance;	2 max	

**Question 5: N/A**

Question	Part	Marking Guidance	Mark	Comments
6	(a)	Vegetation consists mainly of low growing species/herbs/annuals/ no/few trees;  Species <b>X</b> has high rate of photosynthesis at high light intensity;  Species <b>X</b> grow fastest at high rate of photosynthesis / at high light intensities;  Will outcompete other species <b>Y/Z</b> ;	3max	Do not credit Species <b>X</b> is first tree
6	(b)	Produces shade/reduces light intensity;  Species <b>Z</b> grows best/photosynthesis best/ in low light intensity / Species <b>Z</b> does not grow well / low rate of photosynthesis in high light intensity;	2	Accept answers in terms of CO <sub>2</sub> absorption

Question	Part	Marking Guidance	Mark	Comments
7	(a)(i)	Will work in all weather conditions/hairs will stick to it even if shrew/animal is wet/ withstand rain;	1	
7	(a)(ii)	So shrews come into contact with glue;	1	
7	(b)	Avoids bias/allows statistical tests to be carried out;	1	Allow description
7	(c)(i)	Increases the reliability of the measurements;  If measurements are repeatable, differences less likely to be due to measurement/personal error/ anomalies unlikely;	2	Accept advantages of repeatable results. E.g. identifying anomalies/remove errors
7	(c)(ii)	Plot graph/scatter diagram of one set of results against the other;  Expect to see points lying close to line / Line should slope upwards/show positive correlation;  OR  Plot measurement against hair number;  Look for overlying / corresponding points;	2	<b>Q</b> To gain first marking point, candidates must say what has been plotted.  If what is being plotted is not clear, second point cannot be awarded.
7	(d)(i)	One mark for a valid explanation based on individual shrews entering more than one hair tube / many hairs from same shrew/ shrews enter without leaving hair;	1	
7	(d)(ii)	Rules out differences due to changes in population / changes in environmental conditions;  That could be produced by births/deaths/migration/specific example of environmental conditions affects results;	2	



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7	(e)	(A statistical test) determines the probability of results being due to chance;  Enables null hypothesis/description of null hypothesis to be accepted/rejected;  Determines whether correlation/result is significant;	2 max	
7	(f)(i)	(Curve/line of best fit shows) positive correlation/ description of positive correlation;	1	
7	(f)(ii)	Curve/line of best fit (almost) parallel to x-axis/horizontal / level/ no correlation / index is independent of number of shrews;  Hair tubes with positive results when no shrews trapped;  Small size of shrews means shrews may not trigger traps;	2 max	

Question	Marking guidance	Mark	Comments
8 (a)	Will replace themselves/keep dividing/replicate;  Undifferentiated/can differentiate/develop into other cells/totipotent/multipotent/pluripotent;	2	Accept tissues
8 (b)	Reverse transcriptase;	1	Allow phonetic spelling
8 (c) (i)	Alters base/nucleotide sequence/causes frame shift;  Different sequence of amino acids in polypeptide/protein/primary structure;  Alters tertiary structure;	2 max	Accept any reference, such as adding bases, to changing the base sequence of the gene. Reject deletion/substitution. Idea of sequence essential so not makes different amino acids. Accept answers involving stop/start codons and effect on protein.
8 (c) (ii)	Affects tumour suppressor gene;  Inactivates (tumour suppressor) gene;  Rate of cell division increased/tumour cells continue to divide;	2 max	Ignore answers relating to oncogenes. May gain third point.
8 (d)	Yes SCID patients unlikely to survive/quality of life poor unless treated; Cancer that develops is treatable/only affects 25%/five children;  No Risk of developing cancer is high/25%; Cancer may recur/may not be treated successfully in future/only short time scale so more may develop cancer;	2 max	No mark for yes or no. Marks are for supporting argument based on biological reasoning. Accept any points

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Question	Marking guidance	Mark	Comments
9 (a) (i)	To cut the DNA;	1	Reject breakdown, cutting out
9 (a) (ii)	To separate the (pieces of) DNA;	1	
9 (b)	Complimentary base sequence/complementary DNA;  Binds to both (haplotypes);  Label would show up in both;	2 max	Idea of complimentarity required
9 (c) (i)	Bottleneck;  Present population descended from small number/fewer than 100/1970 population;  With small number few haplotypes/little <u>genetic</u> variation /little genetic diversity/few base sequences;	2 max	
9 (c) (ii)	All descended from Italian wolves/founder effect;	1	Reject same wolves. Must convey idea of descendents Accept there would be more if larger samples
9 (d) (i)	Y chromosome inherited/comes from male parents/only found in males;	1	
9 (d) (ii)	Mitochondria in egg/female gamete/no mitochondria come from sperm/male gamete;	1	
9 (e) (i)	Allows comparison;  Different (sized) areas covered;	2	
9 (e) (ii)	Wolves do not eat all of prey animal/do not eat (large) bones/skin;  Inedible parts make up different proportions/wolf eats different proportions;	2	

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9 (f)	Limited by food/prey;  As prey increases so do wolf numbers/positive correlation;  Large range so other factors involved;	2 max	
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## Introduction

The essay is intended to assess a candidate's ability to bring together principles and concepts from different areas of biology, express ideas clearly and logically and use appropriate specialist vocabulary. It also provides an opportunity for candidates to demonstrate that they have met the ideals of stretch and challenge required to gain an A\* grade. Because of this, essays are deliberately worded such that they allow candidates the freedom to respond in a variety of ways. Candidates are offered a choice of essay and it is important that the final mark reflects the quality of work, not the choice of essay.

The marking scheme considers four skill areas

- S** Scientific content
- B** Breadth of knowledge
- R** Relevance
- Q** Quality of written communication

In practice, this means that we are looking for

- evidence of knowledge and understanding in keeping with an A-level course of study
- selection of material relevant to the title, and drawn from different areas of the specification
- the ability to present an argument coherently and logically, using appropriate biological language.

Each of the skill areas is considered and matched against a series of descriptors to give the total mark. Notes are provided to assist in the application of the mark scheme to specific essay titles. Care must be taken in using these notes. It is important to appreciate that the only criteria to be used in awarding marks are those corresponding to the appropriate descriptors. Candidates may gain credit for any information providing that it is biologically accurate, relevant and of a depth in keeping with an A-level course of study. Material used in the essay does not have to be taken from the specification, although it is likely that it will. The notes must therefore be seen as no more than guidelines providing an indication of areas of the specification from which suitable factual material may be drawn.

Plans should be considered in awarding marks. Examiners are instructed to ignore the plan when reading the essay. They should then return to the plan. If further credit can be awarded because of material contained in the plan, this is done. Under no circumstances can a candidate lose credit for incorrect information contained in the plan.

### **Assessing scientific content**

In assessing this area, note the following

- The maximum mark is 16
- Only even marks are awarded (16, 14, 12 etc). Intermediate marks (15, 13, 11 etc) cannot be used. This restricts examiners' choice and increases the reliability of the marking.
- Descriptors are given for 16, 12, 8, 4 and 0 marks. Work is matched to these descriptors. If a particular essay is considered to fall between the criteria for two descriptors an intermediate even mark (14, 10, 6 etc) is awarded.
- Candidates have approximately 40 minutes to plan and write their essays. It is important that candidates who allocate their time wisely should be able to gain maximum marks for what it is possible to write in this time. In practice, this amounts to between three and four sides of normal handwriting.
- Essays do not have to be perfect to gain higher marks. The amount of detail required by the specification should always be born in mind. Average A-grade candidates should be able to achieve 12 marks so it would not be unreasonable to expect around 15% of candidates to achieve such a mark.

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<b>Category</b>	<b>Mark</b>	<b>Descriptor</b>
Exceptional	<b>16</b>	Material accurate and of a high standard throughout, reflecting a sound understanding of the principles involved and a knowledge of factual detail fully in keeping with a programme of A-level study. In addition, there are some significant references to material that indicates greater depth or breadth of study.
	<b>14</b>	
Good	<b>12</b>	Most of the material is of a high standard reflecting a sound understanding of the principles involved and a knowledge of factual detail generally in keeping with an A-level course of study. Material accurate and free from fundamental errors, but there may be minor errors that detract from the overall accuracy.
	<b>10</b>	
Average	<b>8</b>	A significant amount of the content is of appropriate depth. Shows a sound understanding of most of the principles involved and knowledge of factual detail generally in keeping with a programme of A-level study. Most of the content is accurate with few fundamental errors.
	<b>6</b>	
Poor	<b>4</b>	Material presented is largely superficial with only occasional content of appropriate depth. Shows some understanding of some of the basic principles involved. If greater depth of knowledge is demonstrated, then there are fundamental errors.
	<b>2</b>	
Unacceptable	<b>0</b>	Such material as is relevant is both superficial and inaccurate. Fails to demonstrate evidence of knowledge in keeping with a programme of A-level study.

In marking scientific content, the first decision to be made is the category into which the essay falls. Examiners will discuss a range of specimen scripts at the standardising meeting that help them to make this decision. In general:

An exceptional essay

- reflects the detail that could be expected from a comprehensive knowledge and understanding of relevant parts of the specification
- is free from fundamental errors
- maintains appropriate depth and accuracy throughout
- includes two or more paragraphs of material that indicates greater depth or breadth of study

A good essay

- reflects the detail that could be expected from a comprehensive knowledge and understanding of relevant parts of the specification
- is free from fundamental errors
- maintains appropriate depth and accuracy throughout

An average essay

- contains a significant amount of material that reflects the detail that could be expected from a knowledge and understanding of relevant parts of the specification. In practice this will amount to about half the essay.
- is likely to reflect limited knowledge of some areas and to be patchy in quality
- demonstrates a good understanding of basic principles but will contain some errors and evidence of misunderstanding

A poor essay

- contains much material which is below the level expected of a candidate who has completed an A-level Biology course although there will be occasional valid points
- Contains fundamental errors reflecting a poor grasp of basic principles and concepts

Having decided on the basic category, examiners may award the mark above or below this according to whether the candidate has exceeded the requirements or just failed to meet them.



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**Assessing breadth**

In assessing this area, note the following

- The maximum mark is 3
- The mark scheme will include notes which indicate how the marks for breadth should be awarded for individual essays. In determining the mark awarded for breadth, content should ideally be taken from each of the areas specified if maximum credit is to be awarded. Where the content is drawn from two areas, two marks should be awarded and where it is only taken from a single area, one mark should be awarded. However, this should only serve as a guide. The list is not exhaustive and examiners are prepared to offer credit for the incorporation of relevant material from other areas of study.
- Marks are awarded independently. Therefore it is possible for a candidate to gain full credit for breadth even though much of the essay is below the standard expected.

The general descriptors in the table below form the basis for awarding the mark for breadth.

<b>Mark</b>	<b>Descriptor</b>
<b>3</b>	A balanced account making reference to most of the areas that might realistically be covered in an A-level course of study
<b>2</b>	A number of aspects covered but a lack of balance. Some topics essential to an understanding at this level not covered.
<b>1</b>	Unbalanced account with almost all material based on a single aspect
<b>0</b>	Material entirely irrelevant

The descriptors should be interpreted using these guidelines.

**Essay A          Carbon dioxide may affect organisms directly or indirectly. Describe and explain these effects.**

Section

**Carbon dioxide affects the physiology of organisms**

- 1.4 Pulmonary ventilation and the mechanism of breathing
- 4.3 Light-independent reaction of photosynthesis. Limiting factors
- 5.1 Role of chemoreceptors in controlling heart rate

**The direct effects of increasing carbon dioxide concentration**

- 4.6 Respiration, photosynthesis and human activity giving rise to short-term fluctuations and long-term change.  
Yield of crop plants  
Carbon cycle

**Indirect effects of increasing carbon dioxide concentration**

- 4.6 Role of carbon dioxide in producing global warming;  
Life cycles and number of insect pests;  
Distribution of animals and plants;
- 1.2 Effect of temperature on enzymes;

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**Essay B      The causes of disease in humans**

Section

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**Pathogens**

- 1.1 Pathogens include bacteria, viruses and fungi  
Pathogens cause disease by damaging cells and producing toxins
  - 1.3 Cholera bacteria produce toxins resulting in diarrhoea
  - 1.4 Symptoms and transmission of pulmonary tuberculosis
  - 2.10 Horizontal gene transmission and MRSA
- 

**Lifestyle**

- 1.1 Risk factors associated with cancer and coronary heart disease
  - 1.4 The effects of fibrosis, asthma and emphysema on lung function
  - 1.5 The biological basis of heart disease
- 

**Genetics**

- 2.2 Differences in bases may lead to non-functional enzymes
  - 2.5 Relationship between the cell cycle and cancer
  - 5.6 Proto-oncogenes and tumour suppressor genes  
Gene mutations
-

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**Assessing relevance**

In assessing this area, note the following

- The maximum mark is 3
- Marks are awarded independently. Therefore it is possible for a candidate to gain full credit for relevance even though much of the essay is below the standard expected.
- Be reasonable in considering material presented in the introduction to the essay. Many candidates will incorporate material of marginal relevance in the opening paragraph.
- Essays which are very short (under a page in length) should not be awarded 3 marks. Consideration should be given to awarding a maximum of 1 or 2 marks according to the amount written.

Mark	Descriptor
3	All material presented is clearly relevant to the title. Allowance should be made for use of marginally relevant introductory material
2	Material generally selected in support of title but some of the main content of the essay is only of marginal importance.
1	Some attempt made to relate material to the title but considerable amounts largely irrelevant.
0	Material entirely irrelevant or too limited in quantity to judge.

**In essay (a) do not penalise references to respiration and carbon dioxide as irrelevant.**

**In essay (b) do not penalise references to antibiotic resistance as irrelevant.**

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**Assessing quality of written communication**

In assessing this area, note the following

- The maximum mark is 3
- Marks are awarded independently. However, it is unlikely that a candidate will gain full credit for the quality of written communication without a substantial proportion of the essay content being of the standard expected.
- Essays which are very short (under a page in length) should not be awarded 3 marks. Consideration should be given to awarding a maximum of 1 or 2 marks according to the amount written.
- Be reasonable in considering material presented at the end of the essay. Some candidates will be rushed and may incorporate information in note form.

<b>Mark</b>	<b>Descriptor</b>
<b>3</b>	Material is logically presented in clear English. Technical terminology has been used effectively and accurately throughout.
<b>2</b>	Account is logical and generally presented in clear scientific English. Technical terminology has been used effectively and is usually accurate.
<b>1</b>	The essay is generally constructed poorly and often fails to use an appropriate scientific style and terminology to express ideas.
<b>0</b>	Material entirely irrelevant or too limited in quantity to judge.

**Definition of symbols to be used when marking the essay**

**Essay symbols**

V	Valid
X	Wrong
+	Over and above A level
Q	Poor QWC
N	Irrelevant

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<b>Category</b>	<b>Mark</b>	<b>Scientific Content Descriptor</b>
Exceptional	<b>16</b>	Material accurate and of a high standard throughout, reflecting a sound understanding of the principles involved and a knowledge of factual detail fully in keeping with a programme of A-level study. In addition, there are some significant references to material that indicates greater depth or breadth of study.
	<b>14</b>	
Good	<b>12</b>	Most of the material is of a high standard reflecting a sound understanding of the principles involved and a knowledge of factual detail generally in keeping with an A-level course of study. Material accurate and free from fundamental errors, but there may be minor errors that detract from the overall accuracy.
	<b>10</b>	
Average	<b>8</b>	A significant amount of the content is of appropriate depth. Shows a sound understanding of most of the principles involved and knowledge of factual detail generally in keeping with a programme of A-level study. Most of the content is accurate with few fundamental errors.
	<b>6</b>	
Poor	<b>4</b>	Material presented is largely superficial with only occasional content of appropriate depth. Shows some understanding of some of the basic principles involved. If greater depth of knowledge is demonstrated, then there are fundamental errors.
	<b>2</b>	
Unacceptable	<b>0</b>	Such material as is relevant is both superficial and inaccurate. Fails to demonstrate evidence of knowledge in keeping with a programme of A-level study.

<b>Mark</b>	<b>Breadth Descriptor</b>
<b>3</b>	A balanced account making reference to most of the areas that might realistically be covered in an A-level course of study
<b>2</b>	A number of aspects covered but a lack of balance. Some topics essential to an understanding at this level not covered.
<b>1</b>	Unbalanced account with almost all material based on a single aspect
<b>0</b>	Material entirely irrelevant

<b>Mark</b>	<b>Relevance Descriptor</b>
<b>3</b>	All material presented is clearly relevant to the title. Allowance should be made for use of marginally relevant introductory material
<b>2</b>	Material generally selected in support of title but some of the main content of the essay is only of marginal importance.
<b>1</b>	Some attempt made to relate material to the title but considerable amounts largely irrelevant.
<b>0</b>	Material entirely irrelevant or too limited in quantity to judge.

<b>Mark</b>	<b>Quality of written communication Descriptor</b>
<b>3</b>	Material is logically presented in clear English. Technical terminology has been used effectively and accurately throughout.
<b>2</b>	Account is logical and generally presented in clear scientific English. Technical terminology has been used effectively and is usually accurate.
<b>1</b>	The essay is generally constructed poorly and often fails to use an appropriate scientific style and terminology to express ideas.
<b>0</b>	Material entirely irrelevant or too limited in quantity to judge.