



General Certificate of Education (A-level)
June 2011

Human Biology

HBIO5

(Specification 2405)

**Unit 5: The Air We Breathe, The Water We
Drink, The Food We Eat**

Final

Mark Scheme

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Question	Marking Guidance	Mark	Additional Guidance
1(a)(i)	Cytoplasm;	1	Accept - cytosol
1(a)(ii)	<u>Inner</u> membrane of mitochondrion /cristae;	1	Reject – cristal particle
1(b)	<p>Oxygen is the terminal acceptor; (No) electron transfer chain / proton transfer / no oxidative phosphorylation; Which produces most of the ATP (in aerobic respiration);</p> <p>Only glycolysis takes place; Pyruvate used to make lactate; Only produces (net) 2 ATP (per molecule of glucose);</p>	2 max	<p>Accept ETC abbreviation</p> <p>Accept lactic acid</p> <p>Accept only 4 ATP are made</p>

Question	Marking Guidance	Mark	Additional Guidance
2(a)	A site previously developed/built on by humans;	1	Accept 'derelict' land Reject ref. to previously farmed
2(b)	<p>Three valid suggestions;;; e.g. Lower biodiversity on roofs/on green <u>and</u> brown roofs (than brown-field site); Age (of site), because greater diversity on older/green roof than brown roof; Area, (because) largest area/brown-field/2000m² has largest diversity (index); Age not so important/area more important than age, because brown-field diversity greater than older (green) roof/ same age (brown) roof; Diversity greater where some species present from start/ little diversity when start with gravel; Other factors (could be) responsible for differences/with two variables hard to say which is responsible;</p>	3 max	<p>Accept comparison of brown-field to brown roof</p> <p>Accept age no effect</p>

Question	Marking Guidance	Mark	Additional Guidance
3(a)	(The polluter) pays for the (environmental) consequences/effects/costs of their actions; Direct and indirect (consequences);	2	Accept pay to offset pollution
3(b)	Recycling (of substances); Reduction in landfill; Substitute for non-renewable resource/energy source/fossil fuels/named fuel;	2 max	Accept replacement for fossil fuel
3(c)	Most benefit/least damage to the environment; At an acceptable cost (in long and short term);	2	Accept feasible qualified, e.g. in terms of manpower

Question	Marking Guidance	Mark	Additional Guidance
4(a)	Measure of carbon dioxide/greenhouse gases you are responsible for; Primary/direct and secondary/indirect contributions; kg of carbon dioxide per year;	2 max	
4(b)	1.10, 0.41;	1	Accept 1.1, 0.408, 0.4
4(c)	Two suitable, named, factors;; E.g. Making dog collars; Making dog toys; Making dog baskets/kennels; Veterinary supplies; Transport by car to vets/clubs/classes;	2 max	Factors have to relate to energy-requiring factors or 'making' things for dogs

<p>4(d)</p> <p>Yes (no mark),</p> <p>Car uses less energy;</p> <p>Lot of farmland used to support dogs, which could be used for wildlife/increases demand for land for farming;</p> <p>Correct use of numbers e.g. percentage/number of times more land required to meet the energy requirements of a dog;</p> <p>Cars don't hunt/eat wildlife;</p> <p>No (no mark),</p> <p>Most cars do more than 10 000km per year, so use more energy than calculated / most dogs are smaller than a German shepherd, so use less energy than calculated;</p> <p>Large land areas damaged/used for mining to get materials for car;</p> <p>Environmental damage when obtaining oil/fuel ;</p> <p>Car produces toxic emissions/named e.g./car produces waste that is difficult to dispose of/recycle;</p> <p>Cars run down/kill many animals;</p> <p>Dogs eat/use food which is a renewable resource/cars use fossil fuel;</p> <p>Calculations/figures (on car/dog) may be inaccurate;</p> <p>Factors may have been left out (of calculations);</p> <p>Journalist may have been biased/vested interest;</p>	<p>4 max</p>	<p>'Environmental' answers, not about the social/amenity value of dogs</p> <p>Max 3 marks if only 'yes' or only 'no' addressed</p> <p>Accept example such as tyres</p>
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Question	Marking Guidance	Mark	Additional Guidance
5(a)	Competition described/named biotic factor (that they might compete for);	1	Reject ref. to predation or abiotic factors
5(b)(i)	Not many animals brought home during this period; Overall, detached bring in most animals; Mostly mammals, (fewer birds) and fewest frogs; Cats prefer mammals to birds/find mammals easier to catch; Cats do not prefer frogs/have fewer frogs to catch; Cats in flats take very few birds or frogs; Suitable use of standard deviations;	2 max	Idea of 'preference', not just restating data Idea of 'preference'/'availability', not just restating data
5(b)(ii)	Suggestion; with explanation; Examples, Method underestimates prey; (Because) cats don't bring some prey home/eat it before seen; Cats may kill other animals; But don't bring them home/eat them; Don't know how many cats in each type of housing; So comparisons difficult; Overlap of SDs (in some cases); So no significant differences between means/named examples where this is so; Don't know details of housing; May have different amounts of prey/types of prey around; Number of prey not large; So, possible large variability in results;	2 max	Note that sample size is large – reject ref. to small sample sizes.

5(c)(i)	Wearing a bell reduces/affects/changes a cat's probability of catching prey;	1	Accept statements of – Null hypothesis that wearing a bell makes no difference to probability of catching prey
5(c)(ii)	No (significant) difference for birds and frogs; (Significant) fall in mammals caught; Suitable ref. to standard deviations;	2 max	Reject mammals and birds fall

Question	Marking Guidance	Mark	Additional Guidance
6(a)	(Allergen) leads to inappropriate immune response; Allergen leads to production of IgE/antibody; By B cells; IgE/antibody binds to mast cells; Which produce histamine; That causes oedema/swelling/inflammation in airways;	4 max	Accept excess mucus production/constriction in the bronchioles or airways
6(b)(i)	Group A risk is high/higher near to road; Group A risk same as B from (about) 100-200m/further from road; Group B no difference in risk at any distance;	2 max	Accept risk/chance for probability Accept use suitable use of numbers from graph to support answer
6(b)(ii)	(Greater risk) if Group A/lived near road since birth; Group A and live very near road/under 200m; Group B / After age of two no change with distance (so no apparent increase in risk); Could be other environmental factor(s) / named e.g. other than traffic pollution near road; Don't know the probability of asthma in general population; So don't know what is a greater probability;	4 max	Accept risk/chance for probability Accept no statistical data so don't know if the results are significant. Accept references to large sample sizes Reject references to incorrect methodology

Question	Marking Guidance	Mark	Additional Guidance
7(a)	Formation of new species / reproductive isolation; From a population (living in the same area/place)/without geographical isolation;	2	Ignore ref. to mechanisms involved
7(b)	Small shell of T, Wave action (greatest) at top of shore; Only small snails can get into cracks in rock (to shelter); Thick shell of M, More crabs in middle shore; Thicker shelled snails less easy to break open; OR More rocks in middle shore to be moved by waves; Thicker shelled snails less easily broken by rocks; Large opening of T, More wave action likely to wash snails away; Larger opening, (suggests) snails with larger foot to hold on with less likely to be washed away; OR Smaller opening of M, More crabs in middle shore; Snails with smaller opening harder to get claws into;	4 max	Accept converse statements Note – pairs of statements – environmental factor; and possible effect on survival; No mark for giving differences

7(c)	Reproductive isolation required for speciation; Isolation by male choice/form T males nearly always choose form T female, so (nearly) reproductively isolated (from form M); Behavioural isolation/mechanism;	2 max	Accept descriptions of reproductive isolation
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Question	Marking Guidance	Mark	Additional Guidance
8(a)	Populations/ different species (of bacteria); Living in the same habitat/area/part of gut/environment;	2	Accept different sorts/types of bacteria/all the bacteria Accept 'place'
8(b)(i)	There is a significant difference between the two groups / less than 1 in 20/ 5% probability results due to chance;	1	Accept difference not due to chance / reject the null hypothesis / the result is significant
8(b)(ii)	Yes, Because fewer virus particles (with bacterium); So virus less able to survive/replicate; No, Correlation does not show/prove a causal link; Virus sampled in nose, don't know about virus in rest of body; (A lot of) overlap between the results; Overlap because bacterium works for some but not others;	3 max	Reject ref. to immune responses different Reject factors that would have been controlled such as age/breed/diet Accept small sample size / only one study

Question	Marking Guidance	Mark	Additional Guidance
9(a)	<p>Two features described;; with explanations;;</p> <p>Examples</p> <p>Alga,</p> <p>Contains large amounts of both sugars and lipids;</p> <p>To make bioethanol and biodiesel/maize and oilseed (mainly) one or the other;</p> <p>OR</p> <p>Much higher energy yield per hectare/area of land used;</p> <p>So more fuel per unit area /for less land used;</p> <p>OR</p> <p>Customers concerned about using (potential) food crops for fuel;</p> <p>No such concerns with algae, so buy the fuel;</p> <p>OR</p> <p>Less land area for same fuel/energy;</p> <p>So less land taken from wildlife / less land taken from crop growing;</p> <p>OR</p> <p>Can use seawater to grow them in;</p> <p>Cheaper/easier to obtain than freshwater;</p> <p>OR</p> <p>Use seawater, not freshwater;</p> <p>So not reducing streams, rivers, lakes used by wildlife;</p> <p>Question 9(b) cont. on next page</p>	4 max	<p>Note pairs of statements</p> <p>Accept any other reasonable commercial reason</p> <p>Accept any other reasonable environmental reason</p>

	<p>OR</p> <p>Less land used for same fuel/energy;</p> <p>So less spread of monocultures/loss of food webs/chains;</p>		
9(b)	<p>Rate of oxygen production proportional/related to rate of photosynthesis;</p> <p>Higher rate related to (higher ability to make) more sugars/lipids/biofuel/biomass;</p> <p>Oxygen is easier to measure than other products (of photosynthesis);</p>	2 max	
9(c)	<p>Yes,</p> <p>Get higher rate of oxygen production (at most densities);</p> <p>And after non-mutant levels off / at high densities;</p> <p>No,</p> <p>Not many cultures/small sample size, so not enough data to be sure;</p> <p>No stats analysis to show differences significant;</p> <p>Might only be able to grow (commercially) at lower densities, where no advantage;</p> <p>May not be direct link between oxygen production/photosynthesis and sugar/lipid/biofuel produced;</p>	4 max	<p>Max 3 if all 'no' points made</p> <p>Ignore references here to 'respiration making oxygen', because consequential to error already penalised in 9(b).</p>

General Principles for marking the Essay:

Four skill areas will be marked: scientific content, breadth of knowledge, relevance and quality of language. The following descriptors will form a basis for marking.

Scientific Content (maximum 16 marks)

Category	Mark	Descriptor
Good	16	Most of the material reflects a comprehensive understanding of the principles involved and a knowledge of factual detail fully in keeping with a programme of A-level study. Some material, however, may be a little superficial. Material is accurate and free from fundamental errors but there may be minor errors which detract from the overall accuracy.
	14	
	12	
Average	10	Some of the content is of an appropriate depth, reflecting the depth of treatment expected from a programme of A-level study. Generally accurate with few, if any, fundamental errors. Shows a sound understanding of the key principles involved.
	8	
	6	
Poor	4	Material presented is largely superficial and fails to reflect the depth of treatment expected from a programme of A-level study. If greater depth of knowledge is demonstrated, then there are many fundamental errors.
	2	
	0	

Breadth of Knowledge (maximum 3 marks)

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

Relevance (maximum 3 marks)

Mark	Descriptor
3	All material presented is clearly relevant to the title. Allowance should be made for judicious use of introductory material.
2	Material generally selected in support of title but some of the main content of the essay is of only marginal relevance.
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.

Quality of language (maximum 3 marks)

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

Total 25

Guidelines for marking the essay

Introduction

The essay is intended for the assessment of AO4 (Synthesis of knowledge, understanding and skills) and Quality of Written Communication (Sections 6.4 and 6.5 in the specification). Examiners are looking for

- evidence of knowledge and understanding at a depth appropriate to A level
- selection of relevant knowledge and understanding from different areas of the specification
- coverage of the main concepts and principles that might be reasonably be expected in relation to the essay title
- connection of concepts, principles and other information from different areas in response to the essay title
- construction of an account that forms a coherent response
- clear and logical expression, using accurate specialist vocabulary appropriate to A level

Assessing Scientific Content

Maximum 16 marks.

Descriptors are divided into 3 categories: Good (16, 14, 12), Average (10, 8, 6) and Poor (4, 2, 0). Only even scores can be awarded, i.e. not 15, 13, etc. Examiners need first to decide into which category an essay comes.

A good essay

- includes a level of detail that could be expected from a comprehensive knowledge and understanding of relevant parts of the specification
- maintains appropriate depth and accuracy throughout
- avoids fundamental errors
- covers a majority of the main areas that might be expected from the essay title. (These areas are indicated in the mark scheme. Occasionally a candidate may tackle an essay in an original or unconventional way. Such essays may be biased in a particular way, but where a high level of understanding is shown a high mark may be justified.)
- demonstrates clearly the links between principles and concepts from different areas.

Note that it is not expected that an essay must be 'perfect' or exceptionally long in order to gain maximum marks, bearing in mind the limitations on time and the pressure arising from exam conditions.

An average essay

- should include material that might be expected of grade C/D/E candidates
- is likely to have less detail and be more patchy in the depth to which areas are covered, and to omit several relevant areas
- is likely to include some errors and misunderstandings, but should have few fundamental errors
- is likely to include mainly more superficial and less explicit connections

A poor essay

- is largely below the standard expected of a grade E candidate
- shows limited knowledge and understanding of the topic
- is likely to cover only a limited number of relevant areas and may be relatively short
- is likely to provide superficial treatment of connections
- includes several errors, including some major ones

Having decided on the basic category, examiners may award the median mark, or the ones above or below the median according to whether the candidate exceeds the requirements or does not quite meet them.

Marking the essay

In marking scientific content, letters in the margin show each key area covered; these are used to assess the breadth of criteria. A single tick is used to indicate accurate coverage of each significant area, and a double tick to emphasise 'good depth of content.' Errors are indicated with a cross. A squiggly line in the margin is used to highlight irrelevance and 'Q' to highlight poor use of terminology, unclear grammar and inappropriate style.

Specific guidance for assessing Scientific Content and Breadth of Knowledge in Essays

The following provides guidance about topics which might be included in the essays. It is not an exclusive list; the assessment of scientific content does not place restrictions on topics that candidates might refer to, provided they are

- relevant;
- at an appropriate depth for A Level and
- accurate.

It is not expected that candidates would refer to all, or even most, of the topics to gain a top mark; the list represents the variety of approaches commonly encountered in the assessment to the essays. In both essays, topics either from the option modules or beyond the scope of the specification should also given credit where appropriate.

Question	Marking Guidance	Mark	Additional Guidance
10(a)	<p>Environmental factors affect all aspects of human life.</p> <p>Topic list</p> <ol style="list-style-type: none"> 1. Diet and obesity/diabetes/heart disease 2. Pancreatitis (internal environment) 3. Enzyme activity 4. Bacteria/viruses in food/air 5. Reaction to antigens 6. Oedema/DVT 7. Mutations and cancer 8. Adaptations and evolution 9. Development of farming 10. Where variation comes from 11. Stimuli and perception 12. Flight and fight 13. Hypothermia 14. Allergies 15. Pollution and health 16. Climate change 17. Ecology of skin 18. Ecology of gut 19. Evolution of resistant bacteria 20. Human impact on communities 	25	

10(b)	<p>The importance of movement.</p> <p>Topic list</p> <ol style="list-style-type: none"> 1. Enzymes 2. Movement across membranes 3. Cystic fibrosis 4. Osmosis 5. Protein synthesis 6. The heart 7. Circulation and exchange 8. Cardiovascular disease 9. Cell division 10. Cancer 11. Gas exchange 12. Fertilisation 13. Neurones 14. Synapses 15. Hormones 16. Muscle contraction 17. Evolution 18. Ecosystems 19. Succession 20. Chemical reactions 	25	
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