



**General Certificate of Education (A-level)
June 2012**

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 students' 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 students' 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 students' 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	Comments
1 (a) (i)	Granum/grana/thylakoid (of chloroplast);	1	Reject inner membrane
1 (a) (ii)	Stroma (of chloroplast);	1	Reject stoma
1 (b) (i)	Reduced NADP and ATP;	1	Accept NADPH Reject ADP, NADH
1 (b) (ii)	<ol style="list-style-type: none"> 1. Reduced NADP used to reduce/convert GP to sugar/carbohydrate/triose phosphate; 2. ATP supplies energy (for reactions); 	2	2. Reject references to making or producing energy
Total		5	

Question	Marking Guidance	Mark	Comments
2 (a)	1. Organisms able to interbreed; 2. To produce fertile offspring;	2	Accept – Smallest taxonomic group/taxon; Representing (present) end of a line of evolution; Ignore references to viable
2 (b)	1. Allopatric, (geographically) isolated populations; 2. Sympatric, populations in same area / not (geographically) isolated;	2	1. Ignore references to reproductive isolation
Total		4	

Question	Marking Guidance	Mark	Comments
3 (a)	Two suitable ways;; Examples, Reduces/replaces burning of fossil fuels (which adds more CO ₂); Plants take up carbon dioxide (from atmosphere);	2 max	Accept stops
3 (b)	1. Comma increases in range/moves North; 2. Grouse reduced range/moves to higher altitude;	2	
Total		4	

Question	Marking Guidance	Mark	Comments
4 (a)	<ol style="list-style-type: none"> 1. (Final) electron acceptor; 2. Hydrogen acceptor / proton acceptor / reacts with H/H⁺; 3. At end of electron-transport chain / allows the electron transport chain to work; 	2 max	<ol style="list-style-type: none"> 3. Accept allows oxidative phosphorylation to occur Ignore more ATP
4 (b)	<ol style="list-style-type: none"> 1. Higher concentration/more chlorophenol, less ATP produced; 2. Respiration rate increases/ more glucose used to supply same/larger amount of ATP; 3. Use of figures to support answer; 4. Glycolysis/anaerobic respiration/rate of ETCC increases; 	3 max	<ol style="list-style-type: none"> 2. Accept – to make more/enough ATP 2. Accept more glucose used to maintain metabolism QWC
Total		5	

Question	Marking Guidance	Mark	Comments
5 (a)	All bacteria/organisms of same species, living in the same place;	1	Accept a specific bacterium QWC
5 (b)	1. (Lot of) antibiotics used (in hospitals); 2. (So) many patients have their (normal) (gut) bacteria reduced; OR 3. Bacterium more common in hospitals; 4. Where (ill) patients have weakened immune systems/more susceptible to infection/brought into contact with infection; OR 5. Poor hygiene by staff/visitors; 6. Transfer to other patients;	2 max	
5 (c)	1. Vancomycin kills <i>C. difficile</i> /bacteria; 2. In the gut; 3. Faeces (from healthy people) contain normal/usual gut bacteria; 4. These populate the patient's gut; 5. And prevent (re)establishment of <i>C. difficile</i> / outcompete <i>C. difficile</i> ;	4 max	
5 (d)	1. In hospitals <i>C. difficile</i> (often) exposed to vancomycin / vancomycin acts of agent of selection; 2. (Chance) mutation (in some <i>C. difficile</i>); 3. Produces gene/allele for resistance (to vancomycin); 4. Resistant bacteria survive to reproduce/ pass on resistance; 5. Establish population of <i>C. difficile</i> / resistant bacteria / higher frequency of allele/gene for resistance;	3 max	
Total		10	

Question	Marking Guidance	Mark	Comments
6 (a)	Two suitable variables;; E.g. 1. Same/similar weather conditions; 2. Time of day;	2 max	
6 (b)	Agree because 1. Much larger number (seen) over motorways compared to farmland; 2. (Significantly) more kestrels than buzzards over motorways / larger difference for kestrels; 3. Suitable use of standard errors; But 4. Numbers based on sightings / don't know actual numbers of birds over each type of road; 5. Only one study / need repeats; 6. Assumes birds seen are hunting; 7. (Don't know how many km of roads studied,) might be too small (a sample);	4 max	Max 3 marks for points against. Accept numbers used to make comparisons 4. Reject not enough birds in study
6 (c)	Suitable reason with explanation;; E.g. 1. (Farmland clear of crops in winter, so) small animals move to motorway verges to find food; 2. So more food for kestrels by motorway; 3. (Crops gone from fields but) vegetation on motorway verges, so small animals move to where there is cover; 4. So more food for kestrels by motorway;	2 max	
Total		8	

Question	Marking Guidance	Mark	Comments
7 (a)	<p>Suggestion; How it reduces native species;</p> <p>E.g.</p> <ol style="list-style-type: none"> 1. Outcompete for light for photosynthesis; 2. So (native species) less energy for growth/reproduction; 3. Fewer/smaller populations of native plant species; 4. So less food for organisms that feed on these plants; 	2 max	<p>Ignore references to competition for resources or nutrients</p> <p>QWC</p>
7 (b)	<ol style="list-style-type: none"> 1. (Family) closely related in evolution/physiology/genes; 2. Have similar proteins/smell/taste; 3. (So) more likely to be suitable food for <i>A. itadori</i>/insect/to see if eggs laid on them; 4. See if there would be damage to the ecosystem/biodiversity 	2 max	Accept – Choose plants similar to knotweed for 1 mark
7 (c)	<ol style="list-style-type: none"> 1. Females (almost) always lay their eggs on the knotweed/target plant; 2. (So) no/few larvae on other plants (species) / only knotweed is harmed by larvae; 3. If larvae do hatch on other plants, they don't grow (to adults); 4. (Larvae) stay on leaf where egg is laid / won't move onto other plant (species); 	4	<ol style="list-style-type: none"> 2. Accept it has been tried on a lot of other plants with no harm by larvae

Question	Marking Guidance	Mark	Comments
8 (a)	<ol style="list-style-type: none"> 1. Release of histamine; 2. From mast cells; 3. Causes swelling of tissues/oedema; 4. Causes obstruction of airways/hard to breathe; 5. Vasodilation/low blood pressure; 6. Cardiac arrest / pulse rate goes up/down / cardiac effect described; 7. Rash / itching/burning sensation in skin; 	3 max	
8 (b)	<ol style="list-style-type: none"> 1. Very similar responses; 2. All produce some IgE; 3. Highest IgE values/greater range seen with GM extract; 	2 max	<ol style="list-style-type: none"> 3. Reject greater 3. Accept greatest immune response seen in group G
8 (c)	Enzyme is (a protein which could be) an antigen;	1	Accept allergen for antigen
8 (d)	<ol style="list-style-type: none"> 1. Binding of antigen to B cells/plasma cells; 2. Leads to production of IgE (by B cells); 3. More antigen, more IgE produced; 4. Each soybean extract (may) contain a different antigen; 5. IgE produced is specific to that antigen; 6. The <u>more</u> IgE the greater the mast cell stimulation; 7. Which leads to <u>more</u> histamine production (and allergic response); 	2 max	<ol style="list-style-type: none"> 3. Accept allergen for antigen 3. Accept more antigen, the greater the immune response Require reference to <u>more</u> in either 6 or 7.
8 (e)	(Differences in concentrations of IgE) not significant/due to chance / accept the null hypothesis;	1	Accept difference in results not significant
Total		9	

Question	Marking Guidance	Mark	Comments
9 (a)	<ol style="list-style-type: none"> 1. Blue and red light the best; 2. Highest % of volunteers with great reductions; 3. (Overall) benzoyl and blue light similar; 4. (Benzoyl) cream / blue light produced high % / number with little reduction; 	3 max	<ol style="list-style-type: none"> 1. Accept use of group letters 2. Accept number for percentage
9 (b)	<ol style="list-style-type: none"> 1. Agree that blue and red the best; 2. Report greater success for benzoyl; 3. Report blue light does better than in other study; 4. Fewer report clearance / no full clearance with blue light/B; 5. Fewer report unchanged/mild response; 	3 max	Accept use of group letters
9 (c)	<ol style="list-style-type: none"> 1. Scientists more reliable because they use counts / quantitative/objective; 2. But reports subjective/qualitative/opinion; 3. Volunteers may take into account other factors (than spots) 4. E.g. pain/inflammation/previous experience with other creams; 	2 max	Ignore reference to bias or lies
9 (d)	<p>Suitable reason; with explanation;</p> <p>E.g.</p> <ol style="list-style-type: none"> 1. Only 75 volunteers/25 in each group/need larger sample; 2. For reliability/to be representative; 3. Only checked for 12 weeks / need longer study; 4. To know if any changes last for longer time/to see if any harmful side effects; 5. Only one study; 6. Need repeat investigations; 	2 max	
Total		10	

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>How humans affect populations of other organisms.</p> <p>List of Topics</p> <ol style="list-style-type: none"> 1. Humans as hosts for populations of bacteria/viruses/parasites. 2. Effects of humans on other hominids. 3. Effects of farming and land clearances. 4. Domestication of some species. 5. GM organisms. 6. Changing the environment/habitat change and evolution of other species. 7. Introduction of species. 8. Changes in diet/food supply and effect on certain species. 9. Water pollution and effects on populations. 10. Creation of habitats such as brownfield. 11. Climate change effects on other species. 12. Biofuels and effects on other species. 13. MRSA evolution. 14. Medical – use of antibiotics and vaccines 	25	

Question	Marking Guidance	Mark	Additional Guidance
10 (b)	<p>The importance of shapes fitting together in organisms.</p> <p>List of Topics</p> <ol style="list-style-type: none"> 1. Enzymes 2. Cystic fibrosis 3. Membrane transport 4. Immune response 5. DNA and its replication 6. Haemoglobin 7. Sperm and acrosome reaction 8. Mutations 9. DNA and protein synthesis 10. Synapses and drug effects. 11. Nerve impulses and specific carriers/channels 12. Muscles contraction. 13. Allergies. 14. Hormones. 15. Genetic engineering, plasmids, sticky ends 	25	