



**General Certificate of Education  
June 2010**

**Human Biology**

**HBIO5**

**The air we breathe, the water we drink, the  
food we eat**

**Unit 5**

**Final**

<b><i>Mark Scheme</i></b>
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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 meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting 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 the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting 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	Part	Sub Part	Marking Guidance	Mark	Comments
1	a		Genetic (factors)/genes/alleles/mutations/meiosis; Environmental (factors)/environment;	1 1	
1	b		New species form from different populations/groups/gene pools; In different areas/from isolated populations;	1 1	Accept alternatives/descriptions for 'populations'

Question	Part	Sub Part	Marking Guidance	Mark	Comments
2	a	i	Reduced NADP; ATP;	1 1	Accept NADPH/ NADPH <sup>+</sup> /NADPH <sub>2</sub> Accept oxygen/O <sub>2</sub>
2	a	ii	(To incorporate carbon dioxide) to make sugars/glucose/fructose;	1	Accept 'to fix carbon dioxide' Accept correct biochemical answers Accept provide energy to make sugars
2	b		Change (in CO <sub>2</sub> exchange) due to photosynthesis; Plants carry out photosynthesis and respiration; At <b>X</b> (rates of) respiration and photosynthesis same;	1 1 1	2 max

Question	Part	Sub Part	Marking Guidance	Mark	Comments
3	a		<p>Both species move/found further north with time;  <u>Positive</u> correlation;  Species P moved further than Q/species P can survive (better) further north;</p> <p>Suitable use of figures from graph to illustrate changes with time;</p>	<p>1 1 1 1</p>	2 max
3	b		<p>Idea of warming of sea/habitat/environment;  Sea gets warmer further north/too warm in south;  Increasing habitat range for (these) species/ fish adapted to/ used to certain temperature range/fish move to/with suitable temperature;  Food organisms distribution further north/predators haven't moved north;</p>	<p>1 1 1 1</p>	3 max

Question	Part	Sub Part	Marking Guidance	Mark	Comments
4	a		Methane/Natural gas;	1	
4	b		Respiration;	1	Reject anaerobic respiration
4	c		Microorganisms decompose/digest/break down/feed on organic material;  (Use for) respiration/(as source of) for biological molecules; Rate of (carbon dioxide) production falls as organic material is used up; The rate falls as organisms die;	1 1 1 1	3 max Ignore references to anaerobic (bacteria)  Reject references to denaturation

Question	Part	Sub Part	Marking Guidance	Mark	Comments
5	a	i	Cytoplasm (of cell);	1	Accept sarcoplasm/cytosol
5	a	ii	In <u>membranes/cristae</u> (of mitochondria);	1	Reject matrix of mitochondria
5	b		NO stops uptake/use of oxygen (by cells);	1	3 max
			Stops (electron transport chain of) respiration;	1	Accept – stops oxidative phosphorylation
			NO changes shape of protein (in chain);	1	Accept – protein denatured or description
			Oxygen no longer required as final electron acceptor (however stated);	1	Reject accepts hydrogen from etc in 3 <sup>rd</sup> marking point
			As oxygen conc. gets lower effect of NO lasts longer, because NO more likely to interact with protein;	1	

Question	Part	Sub Part	Marking Guidance	Mark	Comments
6	a	i	(All) the organisms/members of the same species living in the same area;	1	
6	a	ii	(All of) the species/populations/organisms living in the same area;	1	
6	b		<p>Three valid descriptions;;;</p> <p>Examples,</p> <p>Bristol more scavenged food;  More 'other' scavenged food in Bristol/larger proportion of 'other' scavenged food in Bristol;  More wild mammals (eaten) in London;  More wild birds (eaten) in London;  More invertebrates (eaten) in London;</p> <p>Suitable use of figures from the pie chart (for comparison);</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>	<p>3 max</p> <p>Accept converse statements</p> <p>} More (wild) animals eaten in London = 1 mark</p>
6	c		<p>Valid suggestion; with explanation;</p> <p>Examples,</p> <p>Increased habitat/niche/protected areas/parks/named example;  Idea of more rats/mice/pigeons/(certain) wild birds (as food for foxes);</p>	<p>1</p> <p>1</p>	<p>2 max</p> <p>Niche to include eg named food source</p>



Question	Part	Sub Part	Marking Guidance	Mark	Comments
7	a		Site previously developed/used for human use/buildings (but now/presently unused);	1	
7	b		Use of quadrats; Large number of quadrats/transects with quadrats; Placed at random/along many lines; Method of randomisation; Count number (of a plant species) in each quadrat/area; Use of mean number (per quadrat) and total area (of site) to estimate number present;	1 1 1 1 1	3 max    Reject percentage cover
7	c		40: 30 ; 1: 0.75 / 1.33:1/ 4:3 ;;	1 1	One mark if ratio wrong way round
7	d		The greater the management,  The lower the number of species; The lower the biodiversity; Plants more (adversely) affected (proportionately);  May be other factors (than management) affecting the above/ correlation doesn't prove causation; Example of other factor;  Doesn't show number of plants/invertebrates; Biodiversity linked to/depends on number of individuals;  Too few sites (in study); More sites to improve reliability/ reduce anomalies;	  1 1 1   1 1   1 1	3 max Accept converse statements

Question	Part	Sub Part	Marking Guidance	Mark	Comments
8	a		Linked to hormonal changes/more testosterone (at puberty); ( <i>Propionibacterium/P. acnes</i> ) bacteria; (Growing in/near) sebaceous glands (in the skin); Redness/inflammation due to immune response;	1 1 1 1	2 max  Accept references to sebum and pores
8	b		Before – After divided by Before x 100 = Percentage reduction; B – 4.1;;	1 2	2 max Accept answers only written in 'working space'
8	c		(As a control,) to show other ingredients/chemicals produced the/an effect;	1	Accept – to see if cream has any effect on its own'
8	d		Four valid points; Examples, (A) did produce greatest (percentage) fall in acne/facial score; Don't know standard error/deviation of means; Don't know if differences (between treatments) significant;  Facial score based on opinion/qualitative/subjective/may not be accurate;  (Trial for twelve weeks) need longer study to see if effects continue;  Only small groups of (33/34) people/ need larger study group/ more repeats needed;  Cream, C, produces improvement, without any added drugs; Drugs may have side-effects;  Don't know if matched for sex, age, diet, facial score etc;  Haven't tested hydrocortisone on its own;	1 1 1  1  1  1 1  1 1	4 max  Accept other valid suggestions

Question	Part	Sub Part	Marking Guidance	Mark	Comments
9	a		Substance recognised/acts (by body) as an antigen; Substance that produces an (inappropriate) immune response;	1 max	Accept protein/glycoprotein
9	b		(Allergen) causes an immune response; IgE antibody; Produced by B cells; Binds to mast cells (that then produce histamine);	1 1 1 1	3 max Accept for 1 mark phagocytes present allergen/antigen
9	c		Skin prick test is, Cheap(er)/small risk/works with low concentration of allergen;	1	1 max Ignore references to speed of test
9	d		(Patient has suffered anaphylaxis), you need to know what the allergy is to; Subsequent attack might be fatal;  Food challenge test gives 100% reliable result/0%/no false positives / other tests less reliable; Food test works with a low concentration of allergen / test with higher dose of allergen could be dangerous;  Patient in hospital (if another anaphylaxis/attack occurs)/doctor can help (at once);  Low concentration of allergen gives low % result with immunoassay;  Skin prick not very specific/food challenge very specific;	1 1  1 1  1 1  1	4 max Ignore references to speed of test

Question	Part	Sub Part	Marking Guidance	Mark	Comments
10	(a)		<p>3 valid points;;;</p> <p>Examples,</p> <p><b>W</b>, <b>X</b> and <b>Y</b> show a drop in HDL/(only) <b>Z</b> shows increase in HDL;</p> <p>No significant change in HDL with <b>W</b> (no cholesterol)/control;</p> <p>(Significantly) lower HDL/biggest drop with <b>X</b> (1% cholesterol);</p> <p>(Significantly) more HDL with <b>Y</b> (1% cholesterol plus <i>E. faecium</i>) compared to <b>X</b>;</p> <p>With <b>Z</b> (1% cholesterol plus statin) get same HDL as <b>W</b>/control/;</p> <p>Suitable use of/ reference to SEs ;</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>	<p>3 max</p> <p>Reject ref. to SDs</p>
10	(b)		<p>4 valid points;;;;</p> <p>Examples,</p> <p><i>E. faecium</i> leads to an increase in HDL/less fall in HDL (compared to cholesterol alone);</p> <p>Significant difference between <b>X</b> and <b>Y</b> according to SEs;</p> <p>(So) may reduce risk of atheroma;</p> <p>May only work if person on high cholesterol diet;</p> <p>Don't know what cholesterol diet contained before investigation;</p> <p>So don't know if 1% cholesterol is a significant risk;</p> <p>(Probably) not as effective as statins at reducing risk of atheroma;</p> <p>Test on rabbits, not humans/different species;</p> <p>Get fall with <i>E. faecium</i>,/no increase, so still greater risk;</p>	<p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>	<p>4 max</p> <p>Accept ref to 'with bacteria'</p> <p>Accept – If cholesterol in diet</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	Part	Sub Part	Marking Guidance	Mark	Comments																														
11	(a)		<p>The functions of proteins are linked to their shape</p> <p>Topic list</p> <table><tr><td>1. Protein structure</td><td><b>S</b></td></tr><tr><td>2. Membrane proteins as receptors</td><td><b>Mr</b></td></tr><tr><td>3. And carriers/channels</td><td><b>Mc</b></td></tr><tr><td>4. Neurones and synapses</td><td><b>N</b></td></tr><tr><td>5. Enzymes</td><td><b>E</b></td></tr><tr><td>6. CFTR and cystic fibrosis</td><td><b>Cf</b></td></tr><tr><td>7. Antigens and antibodies</td><td><b>Aa</b></td></tr><tr><td>8. DNA and proteins</td><td><b>D</b></td></tr><tr><td>9. Classification – proteomes</td><td><b>C</b></td></tr><tr><td>10. Peptide hormones/hormonal control</td><td><b>H</b></td></tr><tr><td>11. Haemoglobin, rhesus and sickle cell</td><td><b>He</b></td></tr><tr><td>12. Rate of reactions/metabolic pathways</td><td><b>Met</b></td></tr><tr><td>13. Restriction enzymes and PCR</td><td><b>Ge</b></td></tr><tr><td>14. Actin and myosin</td><td><b>M</b></td></tr><tr><td>15. Allergens</td><td><b>Al</b></td></tr></table>	1. Protein structure	<b>S</b>	2. Membrane proteins as receptors	<b>Mr</b>	3. And carriers/channels	<b>Mc</b>	4. Neurones and synapses	<b>N</b>	5. Enzymes	<b>E</b>	6. CFTR and cystic fibrosis	<b>Cf</b>	7. Antigens and antibodies	<b>Aa</b>	8. DNA and proteins	<b>D</b>	9. Classification – proteomes	<b>C</b>	10. Peptide hormones/hormonal control	<b>H</b>	11. Haemoglobin, rhesus and sickle cell	<b>He</b>	12. Rate of reactions/metabolic pathways	<b>Met</b>	13. Restriction enzymes and PCR	<b>Ge</b>	14. Actin and myosin	<b>M</b>	15. Allergens	<b>Al</b>	25	<p>Candidates should use their examples to illustrate the importance of ‘shape’ in the functioning of proteins.</p> <p>Includes reg. of hormone production</p>
1. Protein structure	<b>S</b>																																		
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15. Allergens	<b>Al</b>																																		

Peptide hormones to include insulin and glucagon

Question	Part	Sub Part	Marking Guidance	Mark	Comments
11	(b)		<p>How humans become ill</p> <p>Topic list</p> <ol style="list-style-type: none"> <li>1. Diet, obesity, CHD <b>D</b></li> <li>2. Diabetes <b>Di</b></li> <li>3. Life style <b>Ls</b></li> <li>4. Pancreatitis <b>Pc</b></li> <li>5. Cystic fibrosis and faulty CFTR protein <b>Cf</b></li> <li>6. Use of antibiotics and resistant bacteria <b>Ar</b></li> <li>7. Bacterial disease <b>B</b></li> <li>8. Viruses – HIV <b>V</b></li> <li>9. Cardiovascular disease <b>Cd</b></li> <li>10. Cancer <b>C</b></li> <li>11. Parasites – other than bacteria/viruses <b>P</b></li> <li>12. Diseases of ageing <b>A</b></li> <li>13. Inherited disorders <b>G</b></li> <li>14. Hypothermia/failures in homeostasis <b>H</b></li> <li>15. Allergies <b>Al</b></li> <li>16. Pollution <b>Po</b></li> <li>17. Acne <b>Ac</b></li> </ol>	25	