

1. (a) Gene is a (length) of DNA;  
 Gene is a sequence of bases/chain of nucleotides;  
 Triplet (base) code/read in three's;  
 On sense/coding strand;  
 Triplet coding for amino acid;  
 Degenerate code; non-overlapping; start/stop code;  
 Sequence of triplets/bases code for protein; max 4
- (b) Restriction enzymes;  
 Cut DNA; at specific base sequences;  
 Same (restriction) enzyme also cuts DNA; into which gene is  
 inserted/plasmid/virus/Agrobacterium;  
 (DNA) ligase;  
 Joins two pieces of DNA together/forms recombinant DNA;  
 Vector needed to insert DNA into host/plasmid enters host/second  
 organism;  
 Correct ref. to sticky ends; Reverse transcriptase; mRNA → DNA; max 6
- (c) Unwinding/unzipping of DNA;  
 involving breaking of hydrogen bonds;  
 Assembly of mRNA nucleotides;  
 Complementary base pairing/example;  
 Role of polymerase enzymes;  
 mRNA enters ribosomes;  
 Specific tRNA molecule associated with specific amino acid;  
 Codon - anticodon relationship;  
 Formation of peptide bonds;  
 Specific role of ATP/energy; Reference to gene switched on; max 7

Quality of language

**Aspect of work**

Grammar, punctuation and spelling of an acceptable standard	1
Material presented in an appropriate scientific style with due regard to correct use of technical terms	1
Argument clearly and logically presented	1

**[20]**

2. All essays are marked using the following scheme.

**Scientific Content** (maximum 16 marks)

Category	Mark	Descriptor
	16	
<b>Good</b>	14	Most of the material of a high standard reflecting 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
	12	
	10	
<b>Average</b>	8	A significant amount 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 most of the principles involved.
	6	
	4	
<b>Poor</b>	2	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.
	0	

**Breadth** (maximum 3 marks)

Mark	Descriptor
3	A balanced account making reference to most if not all 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

**Relevance** (maximum 3 marks)

<b>Mark</b>	<b>Descriptor</b>
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, one mark for each aspect)

	<b>Descriptor</b>
1	Spelling, punctuation and grammar of an acceptable standard
1	Account presented in scientific language with correct use of technical vocabulary.
1	Overall account logical and coherent

[25]

3. All essays are marked using the following scheme.

**Scientific Content** (maximum 16 marks)

Category	Mark	Descriptor
	16	
<b>Good</b>	14	Most of the material of a high standard reflecting 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
	12	
	10	
<b>Average</b>	8	A significant amount 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 most of the principles involved.
	6	
	4	
<b>Poor</b>	2	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.
	0	

**Breadth** (maximum 3 marks)

Mark	Descriptor
3	A balanced account making reference to most if not all 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

**Relevance** (maximum 3 marks)

<b>Mark</b>	<b>Descriptor</b>
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, one mark for each aspect)

	<b>Descriptor</b>
1	Spelling, punctuation and grammar of an acceptable standard
1	Account presented in scientific language with correct use of technical vocabulary.
1	Overall account logical and coherent

[25]

4. All essays are marked using the following scheme.

**Scientific Content** (maximum 16 marks)

Category	Mark	Descriptor
	16	
<b>Good</b>	14	Most of the material of a high standard reflecting 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.
	12	
	10	
<b>Average</b>	8	A significant amount of the contents is of an appropriate depth reflecting the depth of treatment expected from a programme of A-level study. Generally accurate if any fundamental errors. Shows a sound understanding of most of the principles involved.
	6	
	4	
<b>Poor</b>	2	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.
	0	

**Breadth** (maximum 3 marks)

Mark	Descriptor
3	A balanced account making reference to most if not all 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

**Relevance** (maximum 3 marks, one mark for each aspect)

<b>Mark</b>	<b>Descriptor</b>
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

<b>Mark</b>	<b>Descriptor</b>
1	Spelling, punctuation and grammar of an acceptable standard.
1	Account presented in scientific language with correct use of technical vocabulary.
1	Overall account logical and coherent.

[25]

5. All essays are marked using the following scheme.

**Scientific Content** (maximum 16 marks)

Category	Mark	Descriptor
	16	
<b>Good</b>	14	Most of the material of a high standard reflecting 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.
	12	
	10	
<b>Average</b>	8	A significant amount of the contents is of an appropriate depth reflecting the depth of treatment expected from a programme of A-level study. Generally accurate if any fundamental errors. Shows a sound understanding of most of the principles involved.
	6	
	4	
<b>Poor</b>	2	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.
	0	

**Breadth** (maximum 3 marks)

Mark	Descriptor
3	A balanced account making reference to most if not all 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



**Relevance** (maximum 3 marks, one for each aspect)

<b>Mark</b>	<b>Descriptor</b>
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

<b>Mark</b>	<b>Descriptor</b>
1	Spelling, punctuation and grammar of an acceptable standard.
1	Account presented in scientific language with correct use of technical vocabulary.
1	Overall account logical and coherent.

[25]

6. All essays are marked using the following scheme.

**Scientific Content** (maximum 16 marks)

Category	Mark	Descriptor
	16	
<b>Good</b>	14	Most of the material of a high standard reflecting 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.
	12	
	10	
<b>Average</b>	8	A significant amount of the contents is of an appropriate depth reflecting the depth of treatment expected from a programme of A-level study. Generally accurate if any fundamental errors. Shows a sound understanding of most of the principles involved.
	6	
	4	
<b>Poor</b>	2	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.
	0	

**Breadth** (maximum 3 marks)

Mark	Descriptor
3	A balanced account making reference to most if not all 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

**Relevance** (maximum 3 marks, one for each aspect)

<b>Mark</b>	<b>Descriptor</b>
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

<b>Mark</b>	<b>Descriptor</b>
1	Spelling, punctuation and grammar of an acceptable standard.
1	Account presented in scientific language with correct use of technical vocabulary.
1	Overall account logical and coherent.

[25]

7. **Scientific Content** (Maximum 16 marks)

Category	Mark	Descriptor
	16	
<b>Good</b>	14	Most of the material of a high standard reflecting 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.
	12	
	10	
<b>Average</b>	8	A significant amount 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 most of the principles involved.
	6	
	4	
<b>Poor</b>	2	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.
	0	

**Breadth** (Maximum 3 marks)

Mark	Descriptor
3	A balanced account making reference to most if not all 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.

**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.

[25]

**8. Scientific Content** (Maximum 16 marks)

Category	Mark	Descriptor
	16	
<b>Good</b>	14	Most of the material of a high standard reflecting 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.
	12	
	10	
<b>Average</b>	8	A significant amount 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 most of the principles involved.
	6	
	4	
<b>Poor</b>	2	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.
	0	

**Breadth** (Maximum 3 marks)

<b>Mark</b>	<b>Descriptor</b>
3	A balanced account making reference to most if not all 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.

**Relevance** (Maximum 3 marks)

<b>Mark</b>	<b>Descriptor</b>
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.

**[25]**

9. **Scientific Content** (Maximum 16 marks)

Category	Mark	Descriptor
	16	
<b>Good</b>	14	Most of the material of a high standard reflecting 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.
	12	
	10	
<b>Average</b>	8	A significant amount 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 most of the principles involved.
	6	
	4	
<b>Poor</b>	2	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.
	0	

**Breadth** (Maximum 3 marks)

Mark	Descriptor
3	A balanced account making reference to most if not all 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.

**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.

[25]

**10. Scientific Content** (Maximum 16 marks)

Category	Mark	Descriptor
	16	
<b>Good</b>	14	Most of the material of a high standard reflecting 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.
	12	
	10	
<b>Average</b>	8	A significant amount 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 most of the principles involved.
	6	
	4	
<b>Poor</b>	2	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.
	0	



**Breadth** (Maximum 3 marks)

Mark	Descriptor
3	A balanced account making reference to most if not all 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.

**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.

[25]

11. (a) Locate with the use of a gene probe;  
 Use restriction enzymes / endonucleases;  
 To cut at specific base sequence;  
 By hydrolysing / breaking sugar-phosphate bonds; max 2
- (b) Same restriction enzymes;  
 Cut at same base sequence in bacterial DNA;  
 Leaving sticky ends / hydrogen bonds break;  
 Join / splice with ligase;  
 Use of plasmid; max 4

[6]

**12. 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)

<b>Category</b>	<b>Mark</b>	<b>Descriptor</b>
<b>Good</b>	16	Most of the material of a high standard reflecting 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	
<b>Average</b>	10	A significant amount 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 most of the principles involved.
	8	
	6	
<b>Poor</b>	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)

<b>Mark</b>	<b>Descriptor</b>
3	A balanced account making reference to most if not all 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.

**Relevance** (maximum 3 marks)

<b>Mark</b>	<b>Descriptor</b>
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)

<b>Mark</b>	<b>Descriptor</b>
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

[25]

**13. 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)

<b>Category</b>	<b>Mark</b>	<b>Descriptor</b>
<b>Good</b>	16	Most of the material of a high standard reflecting 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	
<b>Average</b>	10	A significant amount 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 most of the principles involved.
	8	
	6	
<b>Poor</b>	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)

<b>Mark</b>	<b>Descriptor</b>
3	A balanced account making reference to most if not all 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.

**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

[25]

**14. Quality of Communication**

The answers to all sections of this question require the use of continuous prose. Quality of language should be considered in crediting points in the scheme. In order to gain credit, answers should be expressed logically and unambiguously, using scientific terminology where appropriate.

Reptiles are ectotherms; [*Reject: cold blooded*]

Body temperature varies with that of environment,

Temperature of desert fluctuates greatly over 24 hours;

Metabolic reactions controlled by enzymes;

Enzyme activity/ metabolic rate changes with body temperature;

Speed of bodily actions dependent on metabolic rate/ enzyme activity;

Reptiles seek shade/ water when hot/ reduce contact with hot surface;

Seek sun when cool;

max 5

[5]

**15. 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
<b>Good</b>	16	Most of the material of high standard reflecting a comprehensive understanding of the principles involved and knowledge of factual detail fully in keeping with a programme of A-level study. Some material, however, may be little superficial. Material is accurate and free from fundamental errors but there may be minor errors which detract from the overall accuracy
	14	
	12	
<b>Average</b>	10	A significant amount 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 most of the principles involved.
	8	
	6	
<b>Poor</b>	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 if not all areas that might realistically be covered on an A-level course of study.
2	A number of aspects covered but 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 single aspect.
0	Material entirely irrelevant

**Relevance** (maximum 3 marks)

Mark	Descriptor
3	All material represented is clearly relevant to the title. Allowance should be made for judicious use of introductory material.
2	Material generally selected in support 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.

[25]

**16. 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
<b>Good</b>	16	Most of the material of high standard reflecting a comprehensive understanding of the principles involved and knowledge of factual detail fully in keeping with a programme of A-level study. Some material, however, may be little superficial. Material is accurate and free from fundamental errors but there may be minor errors which detract from the overall accuracy
	14	
	12	
<b>Average</b>	10	A significant amount 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 most of the principles involved.
	8	
	6	
<b>Poor</b>	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 if not all areas that might realistically be covered on an A-level course of study.
2	A number of aspects covered but 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 single aspect.
0	Material entirely irrelevant

**Relevance** (maximum 3 marks)

Mark	Descriptor
3	All material represented is clearly relevant to the title. Allowance should be made for judicious use of introductory material.
2	Material generally selected in support 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.

[25]



**17. 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
<b>Good</b>	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	
<b>Average</b>	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	
<b>Poor</b>	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)

<b>Mark</b>	<b>Descriptor</b>
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)

<b>Mark</b>	<b>Descriptor</b>
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.

[25]

**18. 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
<b>Good</b>	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	
<b>Average</b>	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	
<b>Poor</b>	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)

<b>Mark</b>	<b>Descriptor</b>
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)

<b>Mark</b>	<b>Descriptor</b>
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.

[25]

**19. 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
<b>Good</b>	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	
<b>Average</b>	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	
<b>Poor</b>	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.

[25]

**20. Quality of Communication**

The answers to all sections of this question require the use of continuous prose. Quality of language should be considered in crediting points in the scheme. In order to gain credit, answers should be expressed logically and unambiguously, using scientific terminology where appropriate.

- (a)
1. Deviation of a value from norm initiates corrective mechanisms;
  2. fluctuations in plasma glucose concentration detected by hypothalamus/islet cells in pancreas;
  3. initial decrease, no food given (in plasma glucose) stimulates (increased) secretion of glucagon;
  4. increases (in plasma glucose) stimulate (increased) secretion of insulin;
  5. correct ref. to role of  $\alpha$  and/or  $\beta$  cells as secretors;
  6. correct ref. to interconversion of glycogen / glucose;
  7. increased/decreased uptake of glucose by cells (as appropriate)/correct ref to change in membrane permeability;

max 5

- (b) (i) 1. Sensors in skin/hypothalamus detect reduced temperature;  
2. heat gain centre activated/inhibition of heat loss centre;  
3. vasoconstriction/constriction of arterioles in skin surface;  
(**R** capillaries)  
4. dilation of shunt vessels/constriction of – capillary sphincter;  
5. less blood to skin surface/capillaries  
6. reduced heat loss by radiation;  
7. increased heat gain by increased metabolic rate/respiration/  
movement/shivering;  
8. decreased heat loss by putting on clothes/huddling/reduced sweating;

max 5

- (ii) 1. Body temp./37°C is optimum temp for enzymes;  
2. excess heat denatures enzymes/alters tertiary structure/alters  
shape of active site/enzyme;  
3. substrate cannot bind/eq.;  
4. reactions cease/slowed;  
5. too little reduces kinetic energy of molecules / molecules  
move more slowly;  
6. fewer collisions/fewer ES complexes formed'

max 5

[15]

**21. 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
	16	
<b>Good</b>	14	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.
	12	
	10	
<b>Average</b>	8	A significant amount 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.
	6	
	4	
<b>Poor</b>	2	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.
	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.

[25]

### ***Additional notes on marking this question***

Care must be taken in using these notes. It is important to appreciate that the only criteria to be used in awarding marks to a particular essay 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. These notes must therefore be seen merely as guidelines providing an indication of areas of the specification from which suitable factual material might be drawn.

In determining the mark awarded for breadth, content should ideally be 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 taken only from a single area, one mark should be awarded. However, this should only serve as a guide. This list is not exhaustive and examiners should be prepared to offer credit for the incorporation of relevant material from other areas of study.

### **The transfer of energy between different organisms and between these organisms and their environment.**

<b>Biology</b>	<b>Human Biology</b>
<b>14.6 Photosynthesis</b> Photosynthesis uses energy from sunlight to synthesis organic molecules from inorganic sources	14.6
<b>14.7 Ecology</b> Energy is transferred through food chains and food webs in a community	14.7
<b>14.8 Energy loss</b> Respiration produces ATP which is the immediate form of energy for many cell activities	14.8
15.2 Temperature control	16.11
15.9 Receptors convert stimuli into electrical impulses in nerve cells	16.8
Dietary demands of pregnancy	16.5

22. *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
	16	
<b>Good</b>	14	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.
	12	
	10	
<b>Average</b>	8	A significant amount 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.
	6	
	4	
<b>Poor</b>	2	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.
	0	

**Breadth of Knowledge** (maximum 3 marks)

<b>Mark</b>	<b>Descriptor</b>
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)

<b>Mark</b>	<b>Descriptor</b>
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)

<b>Mark</b>	<b>Descriptor</b>
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.

[25]

### ***Additional notes on marking this question***

Care must be taken in using these notes. It is important to appreciate that the only criteria to be used in awarding marks to a particular essay 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. These notes must therefore be seen merely as guidelines providing an indication of areas of the specification from which suitable factual material might be drawn.

In determining the mark awarded for breadth, content should ideally be 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 taken only from a single area, one mark should be awarded. However, this should only serve as a guide. This list is not exhaustive and examiners should be prepared to offer credit for the incorporation of relevant material from other areas of study.

### **Ways in which different species of organisms differ from each other**

<b>Biology</b>	<b>Human Biology</b>
<b>Molecular differences</b>	
10.4 Large molecules are important in the structure and functioning of Cells (proteins)	10.4
<b>Genetic differences</b>	
11.3 Genes incorporate coded information which determines the metabolism of organisms	12.5
14.2 Genes and environmental factors influence variation between individuals	14.2
14.3 Selection can influence the frequency of alleles in a population	14.3
14.4 Evolution has resulted in different species of organisms	14.4
<b>Other aspects of biology</b>	
10.1 The cell is the basic unit of structure in prokaryotic and eukaryotic organisms	
14.5 The concept of ecosystem (niches)	14.5
15.5 Different organisms possess different types of haemoglobin with different oxygen transporting properties	
15.4 Limitation of water loss in xerophytic plants	
15.6 Digestion of cellulose	
Bacteria as examples of pathogenic microorganisms	12.1/12.9
Principles of immunology	12.3

**23. 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
	16	
<b>Good</b>	14	Most of the material of a high standard reflecting 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.
	12	
	10	
<b>Average</b>	8	A significant amount 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 most of the principles involved.
	6	
	4	
<b>Poor</b>	2	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.
	0	

**Breadth of Knowledge** (maximum 3 marks)

<b>Mark</b>	<b>Descriptor</b>
3	A balanced account making reference to most if not all 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.

**Relevance** (maximum 3 marks)

<b>Mark</b>	<b>Descriptor</b>
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)

<b>Mark</b>	<b>Descriptor</b>
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.

**[25]**

### **Additional notes**

Care must be taken in using these notes. It is important to appreciate that the only criteria to be used in awarding marks to a particular essay 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.

These notes must therefore be seen merely as guidelines providing an indication of areas of the specification from which suitable factual material might be drawn.

In determining the mark awarded for breadth, content should ideally be drawn 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 taken only from a single area, one mark should be awarded. However, this should only serve as a guide. This list is not exhaustive and examiners should be prepared to offer credit for the incorporation of relevant material from other areas of study.



**24. 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
	16	
<b>Good</b>	14	Most of the material of a high standard reflecting 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.
	12	
	10	
<b>Average</b>	8	A significant amount 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 most of the principles involved.
	6	
	4	
<b>Poor</b>	2	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.
	0	

**Breadth of Knowledge** (maximum 3 marks)

Mark	Descriptor
3	A balanced account making reference to most if not all 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.

**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.

[25]

### Additional notes

Care must be taken in using these notes. It is important to appreciate that the only criteria to be used in awarding marks to a particular essay 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.

These notes must therefore be seen merely as guidelines providing an indication of areas of the specification from which suitable factual material might be drawn.

In determining the mark awarded for breadth, content should ideally be drawn 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 taken only from a single area, one mark should be awarded. However, this should only serve as a guide. This list is not exhaustive and examiners should be prepared to offer credit for the incorporation of relevant material from other areas of study.

- |     |     |   |   |
|-----|-----|---|---|
| 25. | (a) | progesterone/oestrogen;<br>luteinising hormone/LH;<br>oestrogen;            | 3 |
|     | (b) | little or no oestrogen;<br>produced by follicle;<br>oestrogen inhibits FSH; | 3 |

[6]

26. *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
	16	
<b>Good</b>	14	Most of the material of a high standard reflecting 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.
	12	
	10	
<b>Average</b>	8	A significant amount 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 most of the principles involved.
	6	
	4	
<b>Poor</b>	2	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.
	0	

**Breadth of Knowledge** (maximum 3 marks)

Mark	Descriptor
3	A balanced account making reference to most if not all 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.

**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.

[25]

***Additional notes on marking***

Care must be taken in using these notes. It is important to appreciate that the only criteria to be used in awarding marks to a particular essay 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 be. These notes must therefore be seen merely as guidelines providing an indication of areas of the specification from which suitable factual material might be drawn.

In determining the mark awarded for breadth, content should ideally be drawn 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 taken only from a single area, one mark should be awarded. However, this should only serve as a guide. This list is not exhaustive and examiners should be prepared to offer credit for the incorporation of relevant material from other areas of study.

**27. 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
	16	
<b>Good</b>	14	Most of the material of a high standard reflecting 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.
	12	
	10	
<b>Average</b>	8	A significant amount 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 most of the principles involved.
	6	
	4	
<b>Poor</b>	2	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.
	0	

**Breadth of Knowledge** (maximum 3 marks)

Mark	Descriptor
3	A balanced account making reference to most if not all 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.

**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.

[25]

**Additional notes on marking**

Care must be taken in using these notes. It is important to appreciate that the only criteria to be used in awarding marks to a particular essay 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 be. These notes must therefore be seen merely as guidelines providing an indication of areas of the specification from which suitable factual material might be drawn.

In determining the mark awarded for breadth, content should ideally be drawn 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 taken only from a single area, one mark should be awarded. However, this should only serve as a guide. This list is not exhaustive and examiners should be prepared to offer credit for the incorporation of relevant material from other areas of study.



**28. 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
	16	
<b>Good</b>	14	Most of the material of a high standard reflecting 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.
	12	
	10	
<b>Average</b>	8	A significant amount 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 most of the principles involved.
	6	
	4	
<b>Poor</b>	2	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.
	0	

**Breadth of Knowledge (maximum 3 marks)**

<b>Mark</b>	<b>Descriptor</b>
3	A balanced account making reference to most if not all 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.

**Relevance (maximum 3 marks)**

<b>Mark</b>	<b>Descriptor</b>
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)**

<b>Mark</b>	<b>Descriptor</b>
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.

**[25]**

### **Additional notes on marking this question**

Care must be taken in using these notes. It is important to appreciate that the only criteria to be used in awarding marks to a particular essay 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 be.

These notes must therefore be seen merely as guidelines providing an indication of areas of the specification from which suitable factual material might be drawn.

In determining the mark awarded for breadth, content should ideally come 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 taken only from a single area, one mark should be awarded. However, this should only serve as a guide. This list is not exhaustive and examiners should be prepared to offer credit for the incorporation of relevant material from other areas of study.

**29. 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
	16	
<b>Good</b>	14	Most of the material of a high standard reflecting 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.
	12	
	10	
<b>Average</b>	8	A significant amount 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 most of the principles involved.
	6	
	4	
<b>Poor</b>	2	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.
	0	

**Breadth of Knowledge (maximum 3 marks)**

<b>Mark</b>	<b>Descriptor</b>
3	A balanced account making reference to most if not all 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.

**Relevance (maximum 3 marks)**

<b>Mark</b>	<b>Descriptor</b>
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)**

<b>Mark</b>	<b>Descriptor</b>
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.

**[25]**

### Additional notes on marking this question

Care must be taken in using these notes. It is important to appreciate that the only criteria to be used in awarding marks to a particular essay 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 be. These notes must therefore be seen merely as guidelines providing an indication of areas of the specification from which suitable factual material might be drawn.

In determining the mark awarded for breadth, content should ideally come 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 taken only from a single area, one mark should be awarded. However, this should only serve as a guide. This list is not exhaustive and examiners should be prepared to offer credit for the incorporation of relevant material from other areas of study.

30. (a) Hot receptors in skin;  
nervous impulse;  
to hypothalamus;  
blood temperature monitored;  
heat loss centre involved;  
vasodilation / dilation of arterioles;  
more blood to surface / heat lost by radiation;  
piloerector muscles relax;  
hairs flatten on skin surface;  
less insulation;  
sweating initiated / increased;  
panting / licking;  
evaporation removes latent heat;  
drop in metabolic rate / use less brown fat;  
accept long term changes such as less fat deposition;  
thinner fur;  
migration;  
accept one behavioural process; max. 8
- (b) Rapid / slow;  
direct / broadcast;  
short lived/ long term;  
mainly electrical ; chemical;  
delivery via nerves / blood vessels;  
cause depolarisation of target cell membrane /  
receptors in membrane of target cell; max. 4

[12]

31. (a) extract DNA;  
remove specific section;  
using restriction endonuclease  
base sequence;  
method of finding the base sequence eg gene probe;  
compare with normal sequence for gene; max 3
- (b) screening of individuals at risk for presence of markers;  
example of individual at risk;  
earlier detection of tumours;  
earlier surgery/drug treatment; max 3
32. (i) Rod cells (responsible for sensitivity);  
Several rods connected to each bipolar cell;  
Additive effect of small amount of light striking several rod cells;  
creating a large enough depolarisation to generate an action potential; max 3
- (ii) Cone cells (responsible for acuity);  
Each cone cell connected to an individual neurone;  
*idea* of light striking each individual cone cell to generate a separate  
action potential / impulse;  
very small area of retina stimulated, so very accurate vision; max 3
- Ø;33. section of DNA unwinds / uncoils;  
RNA nucleotides align;  
complementary base pairing / example of pairing;  
mRNA polymerase (joins nucleotides);  
mRNA moves into cytoplasm / through nuclear pore / to ribosome;  
tRNA carries specific amino acid;  
mRNA read in codons / triplets;  
anticodon of tRNA matches codon of mRNA;  
ATP used in activation / joining amino acids;  
amino acids join by peptide bonds;  
tRNA used repeatedly;  
sequence of bases / codons determines sequence of amino acids; max 8
34. (a) (i) P - actin;  
Q - actin + myosin;  
R - myosin; 3
- (ii) Diagram with narrower band P and narrower or no band R 1
- (b) ATP produced by respiration;

[6]

[6]

[8]

Hydrolysis/breakdown of ATP releases energy;  
 Cross-bridges or 'links' between actin and myosin/ in actomyosin;  
 straighten/move myosin along actin;  
 Actin moves towards centre of sarcomere/ ends of sarcomere pulled in;  
 Action of tropomyosin at binding sites / ref. to action of calcium ions.

max 4

[8]

35. (a) **A-B** – sodium channels open;  
 sodium ions enter axon (causing increase in positive charge depolarisation);  
**C-D** – sodium channels shut;  
 potassium channels open;  
 potassium ions leave axon  
 (causing decrease in positive charge/repolarisation);

max 3

- (b) Nerve impulse depolarises the presynaptic membrane;  
 calcium channels opened;  
 calcium ions enter the presynaptic membrane;  
 synaptic vesicles move towards/fuse with, the presynaptic membrane;  
 release of transmitter substance/ACh/noradrenaline into synaptic cleft;  
 diffusion of ACh/transmitter substance across cleft;  
 attachment to receptor sites/protein molecules on post synaptic membrane;  
 (ion gated) sodium channels opened;  
 sodium ion influx;  
 causing depolarisation of post synaptic membrane/sarcolemma;

max 7

- (c) Summation =  
 addition of a number of impulses converging on a single post synaptic neurone;  
 allows integration of stimuli from a variety of sources (spatial summation);  
 allows weak background stimuli to be filtered out before reaching the brain (temporal summation)

max 2

[12]

36. (a) FSH secreted by pituitary gland;  
 Stimulates growth of follicle;  
 Ovary/follicle cells produce oestrogen;  
 Negative feedback/inhibits secretion of FSH;  
 Oestrogen stimulates secretion of LH/LH from pituitary;  
 LH stimulating ovulation;  
 Second increase in FSH also associated with ovulation;

max 6



- (b) Stimulus is increased blood temperature;  
 Increase in temperature results from exercise/respiration/metabolism;  
 Detected by receptors in hypothalamus;  
 Hypothalamus is coordinator;  
 In this case, the heat loss centre;  
 Effectors are muscles;  
 Of arteriole;  
 Response involves vasodilation;  
 Increased blood flow to capillaries;  
 Allowing heat loss by radiation/convection;  
 Correct reference to action potential/nerve impulse; max 6
- [12]**

37. (a) protein (molecules);  
 transcending phospholipid bilayer / intrinsic / transmembrane 2

- (b) (i) (blocking of sodium channels) blocks inward flow of sodium ions;  
 prevents depolarisation / action potential;  
 prevents passage of impulses along nerve cell;  
 no impulse - no contraction *both needed*
- (ii) (blocking receptor) prevents acetylcholine binding onto receptor;  
 on postsynaptic membrane;  
 prevents depolarisation / action potential in postsynaptic nerve cell;  
 prevents passage of impulse by postsynaptic cell to muscle /  
 across synapse max 6
- [8]**

38. (a) use of restriction endonuclease/enzyme;  
 same for human and plasmid DNA;  
 sticky ends;  
 ligase used to insert/join human to plasmid DNA; 4

(b) only yeast cells with the enzyme/plasmid/gene can survive;  
 and only these can produce insulin;  
 so, any living cells will have the insulin gene; 3

**[7]**

39. (a) Production of FSH/LH/pituitary hormones;  
 Stimulate ovary/follicle development;  
 Producing oestrogen;  
 Oestrogen stimulating breast development;  
 Oestrogen stimulating pelvic girdle growth;  
 Androgen secretion;  
 Androgens responsible for growth spurt/pubic hair development;  
 Growth hormone also involved; max 6

(b) (i) Negative feedback;  
 Inhibits FSH secretion;  
 Follicles do not develop  
 No ovulation; max 3

(ii) Oestrogen secreted by follicles;  
 Therefore no oestrogen/low concentration of oestrogen;  
 Oestrogen secretion will not be cyclical;  
 Not available to inhibit pituitary gland;  
 Therefore high concentration of FSH; max 3

[12]

40. (a) **For principle, maximum of one mark**  
 Process involves insulin and glucagon;  
**For detail, up to a total of 6 marks**  
 Insulin / glucagon secreted by pancreas / islets of Langerhans;  
 Hormone receptors in membrane (of target cells);  
 (insulin stimulates) conversion of glucose to glycogen / glycogenesis:  
 activates / involves enzymes;  
 stimulates uptake by cells;  
 conversion of glucose to lipid / protein;  
 glucagon stimulates conversion of glycogen to glucose;/ glycogenolysis;  
 glucagon stimulates conversion of lipid / protein to glucose /  
 gluconeogenesis; max 6

(b) feed on polysaccharides / named example (not cellulose);  
 slower digestion therefore no surge in blood sugar level;  
 exercise - increased respiration / BMR; 3

[9]

41. (a) calcium ions move into synaptic knobs / presynaptic membrane;  
causing synaptic vesicles to move;  
towards presynaptic membrane;  
where they release acetylcholine into gap;  
transmitter/acetylcholine diffuses across gap;  
binds onto receptor / protein molecules;  
on postsynaptic membrane;  
causing depolarisation / opening of sodium gates / action potential in  
postsynaptic cell membrane;

max 6

(b) postsynaptic neurone has 'high' threshold;  
simultaneous arrival of impulses from two presynaptic neurones produces  
sufficient transmitter substance;  
to cause depolarisation / action potential in postsynaptic neurone /  
reach threshold (once only);  
this is spatial summation;  
impulses in rapid succession from one presynaptic neurone produce  
sufficient transmitter  
substance;  
to cause depolarisation / action potential in postsynaptic neurone /  
reach threshold (once only);  
this is temporal summation;  
insufficient transmitter substance produced in A / B;  
to cause depolarisation / action potential in postsynaptic neurone /  
reach threshold (once only);

max 6

[12]

42. positive:  
 less crops lost to insect damage/ diseases spread by insects;  
 can spray herbicide with no loss to crop/reduce competition from weeds;  
 more saleable product;  
 less use of insecticide;  
 possibly cheaper food; max 3  
 negative:  
 gene transfer to non-crop species;  
 consumer resistance to “un-natural” products;  
 transfer of genes into food chains/effect of food chains/examples;  
 creation of “plague” weeds/uneconomic plants;  
 excessive use of herbicides;  
 Reject disadvantages of selective breeding max 3

[6]

43. **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
	16	
<b>Good</b>	14	Most of the material of a high standard reflecting 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.
	12	
	10	
<b>Average</b>	8	A significant amount 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 most of the principles involved.
	6	
	4	
<b>Poor</b>	2	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.

**Breadth of Knowledge** (maximum 3 marks)

Mark	Descriptor
3	A balanced account making reference to most if not all 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

**Relevance** (maximum 3 marks)

Mark	Descriptor
3	All materials 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 Written Communication** (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 accurately throughout
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

[25]

**44. 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
	16	
<b>Good</b>	14	Most of the material of a high standard reflecting 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.
	12	
	10	
<b>Average</b>	8	A significant amount 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 most of the principles involved.
	6	
	4	
<b>Poor</b>	2	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.

**Breadth of Knowledge** (maximum 3 marks)

Mark	Descriptor
3	A balanced account making reference to most if not all 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

**Relevance** (maximum 3 marks)

Mark	Descriptor
3	All materials 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 Written Communication** (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 accurately throughout
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

[25]

**45. General principles for marking the Essay:**

Four **skill areas** will be marked: scientific content, breadth of knowledge, relevance and quality of language

The following descriptions will form a basis for marking



**Scientific content** (maximum 16 marks)

Category	Mark	Descriptor
	16	
<b>Good</b>	14	Most of the material of a high standard reflecting a comprehensive understanding of the principles involved and a knowledge of a 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.
	12	
	10	
<b>Average</b>	8	A significant amount 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 most of the principles involved
	6	
	4	
<b>Poor</b>	2	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.

**Breadth of knowledge** (maximum 3 marks)

Mark	Descriptor
3	A balanced account making reference to most if not all 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

**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 Written Communication** (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.

[25]

**46. General principles for marking the Essay:**

Four **skill areas** will be marked: scientific content, breadth of knowledge, relevance and quality of language

The following descriptions will form a basis for marking

**Scientific content** (maximum 16 marks)

Category	Mark	Descriptor
	16	
<b>Good</b>	14	Most of the material of a high standard reflecting a comprehensive understanding of the principles involved and a knowledge of a 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.
	12	
	10	
<b>Average</b>	8	A significant amount 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 most of the principles involved
	6	
	4	
<b>Poor</b>	2	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.

**Breadth of knowledge** (maximum 3 marks)

Mark	Descriptor
3	A balanced account making reference to most if not all 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

**Relevance** (maximum 3 marks)

<b>Mark</b>	<b>Descriptor</b>
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 Written Communication** (maximum 3 marks)

<b>Mark</b>	<b>Descriptor</b>
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.

[25]

47. **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
<b>Good</b>	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	
<b>Average</b>	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	
<b>Poor</b>	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)

<b>Mark</b>	<b>Descriptor</b>
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)

<b>Mark</b>	<b>Descriptor</b>
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.

[25]

**Additional 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 were also given credit where appropriate. For example, in the essay on cycles, the menstrual cycle and viral replication from the option modules, and the ornithine cycle, details of which are not required in the specification, were accepted as suitable examples.

## The structure and functions of carbohydrates

Contain the elements, carbon, hydrogen and oxygen.

Monosaccharides: glucose and fructose, monomers of which other carbohydrates are composed.

Monosaccharides and disaccharides are small soluble molecules easy to transport – glucose transport in blood, sucrose in sieve tube.

Glucose: source of energy; a substrate in aerobic and anaerobic respiration; biochemistry of aerobic respiration (brief outline).

Structural formula of glucose, the condensation of glucose to form the disaccharide, maltose, and of glucose and fructose to form the disaccharide sucrose. The hydrolysis of disaccharides.

The formation and hydrolysis of the polysaccharides: starch, glycogen and cellulose; are polymers of glucose, differ in the number and arrangement of the glucose molecules.

Relationship of structure to function in starch, glycogen and cellulose molecules.

Starch: helical shape provides compact store (in plants); insolubility linked to storage (osmotically inactive), large size does not pass through membrane, provides large number of glucose molecules for respiration.

Starch-agar plates for assaying carbohydrase activity.

Glycogen: similar to starch but more branches, insoluble storage compound in liver and muscles (mammals). Conversion of glucose to glycogen for storage. Importance of control of blood glucose.

Cellulose: long straight chains of glucose molecules, OH groups of chains linked by hydrogen bonds forming microfibrils / macrofibrils. Layers of fibrils orientated in different directions are interwoven and embedded in a matrix - providing rigid cell wall; gaps in layers provide permeability.

Pentoses: Deoxyribose, Ribose in DNA and RNA – sugar-phosphate backbone providing strength.

Light-independent reactions: formation of carbohydrates, Carbon dioxide accepted by RBP, reduction of glycerate-3-phosphate to carbohydrate, and regeneration of RBP.

### **Breadth of Knowledge; max 3 marks**

Condensation reactions resulting in formation of larger carbohydrate molecules (**C**)

Types of carbohydrates; mono, di- and polysaccharides or named examples (**T**)

Functions of carbohydrates – minimum of two. (**F1, F2**)

(The letters shown in bold should be used alongside relevant part of essay)

48. *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
<b>Good</b>	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	
<b>Average</b>	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	
<b>Poor</b>	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)

<b>Mark</b>	<b>Descriptor</b>
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)

<b>Mark</b>	<b>Descriptor</b>
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.

[25]

**Additional 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 were also given credit where appropriate. For example, in the essay on cycles, the menstrual cycle and viral replication from the option modules, and the ornithine cycle, details of which are not required in the specification, were accepted as suitable examples.

## Cycles in biology

### **Ecological cycles**

Nitrogen cycle: role of microorganisms in the processes of saprophytic nutrition, deamination, nitrification, nitrogen fixation and denitrification. (Names of individual species are not required.)

Carbon cycle: role of microorganisms in breakdown (respiration) of complex organic compounds into carbon dioxide making it available for reuse (photosynthesis).

### **Metabolic cycles**

Krebs cycle: acetylcoenzyme A combines with four-carbon molecule to produce a six-carbon molecule which enters Krebs's cycle; the four carbon compound is regenerated during cycle involving series of oxidation reactions and release of carbon dioxide; production of ATP and reduced NAD and FAD.

Electron transport chain: cyclical reduction and oxidation of NAD, FAD and other 'carriers'

Synthesis and breakdown of ATP

Light-independent reactions - Carbon dioxide accepted by RuBP to form two molecules of glycerate-3-phosphate, reduction of glycerate-3-phosphate to carbohydrate, and regeneration of RuBP.

### **Physiological cycles**

Negative feedback mechanisms: Regulation of body temperature / blood glucose / blood water potential.

Cardiac cycle: relate pressure and volume changes in the heart and aorta to maintenance of blood flow.

Role of tropomyosin, calcium ions and ATP in the cycle of actomyosin bridge formation.

Nerve function – depolarisation / repolarisation of a neurone in terms of differential membrane permeability and cation pumps, synthesis and re-synthesis of acetylcholine (synaptic transmission) / rhodopsin (rods) and restoration of a resting potential.

### **Life cycles**

Mitosis / Cell cycle – explanation of stages of mitosis, importance in growth and asexual reproduction - vegetative propagation.

Meiosis – importance in maintaining constant chromosome number from generation to generation;

outline of process (details of stages not required)

Examples of life cycles might be provided in terms of mitosis, meiosis, fertilisation and chromosome number.

DNA replication – semiconservative replication;

Predator / prey life cycles

**Breadth of Knowledge; max 3 marks**

One mark for each type of cycle covered

Ecological (**E**); Metabolic (**M**); Physiological (**P**); Life (**L**)

(The letters shown in bold should be used alongside relevant part of essay)

49. (i) mRNA attaches to ribosome;  
codon on mRNA;  
binds to an anti-codon on tRNA;  
each tRNA brings a specific amino acid;  
sequence of codons/bases on mRNA determines order of amino acids;  
formation of peptide bonds/amino acids joined by condensation  
reactions; 4 max
- (iii) inserted gene/mRNA complementary to normal gene/mRNA;  
binds to it to prevent protein synthesis/form double strand/prevents  
mRNA binding to ribosomes;  
will not stop all translation, some mRNA reaches ribosomes/  
because not all mRNA is bound by inserted gene mRNA; 2 max

[6]  
QWC 1

50. **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
<b>Good</b>	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	
<b>Average</b>	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	
<b>Poor</b>	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)

<b>Mark</b>	<b>Descriptor</b>
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)

<b>Mark</b>	<b>Descriptor</b>
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.

[25]

**Additional 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 were also given credit where appropriate.

### How the structure of proteins in relation to their functions.

1. Structure (S)  
primary structure – peptide bond  
secondary structure  
tertiary structure. Globular - bonds between R groups give spherical shape – shape determines function – active sites and receptor sites  
(*allow quaternary structure – haemoglobin incorporates ions for oxygen transport*)
2. Structural proteins (ST)  
fibrous – regular pattern of hydrogen bonds – coiling,  
(*e.g. keratin coils twist together to form rope-like structures – flexible and strong*)  
(*e.g. collagen – coils more tightly bound – more rigid*)
3. Transport (T)  
channel – complementary shape – charges – gated  
carrier – complementary shape – can change shape  
active transport – phosphate group attached by energy from ATP – can change shape
4. Enzymes (E)  
active site, enzyme-substrate complex  
activation energy reduction - explanation e.g. brings molecules closer
5. Receptors (R)  
synapse  
insulin / glucagon  
ADH  
rhodopsin
6. Muscle (M)  
actin thin – binding site  
myosin thick - cross bridges  
tropomyosin – block binding sites

### Breadth of knowledge

- |         |                                   |
|---------|-----------------------------------|
| 3 marks | Four or more of the above 6 areas |
| 2 marks | Three of the above 6 areas        |
| 1 mark  | Two of the above 6 areas          |

### 51. 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)

<b>Category</b>	<b>Mark</b>	<b>Descriptor</b>
<b>Good</b>	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	
<b>Average</b>	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	
<b>Poor</b>	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)

<b>Mark</b>	<b>Descriptor</b>
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)

<b>Mark</b>	<b>Descriptor</b>
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)

<b>Mark</b>	<b>Descriptor</b>
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.

[25]

**Additional 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 were also given credit where appropriate.



### **The causes of variation and its biological importance**

1. Gene mutation (G)
  - addition
  - deletion
  - substitution
  - effect on alleles
  - effect on polypeptide / protein
  
2. Sexual reproduction (S)
  - crossing over
  - independent assortment
  - random fusion
  - (allow chromosome mutation)*
  
3. Environmental (E)
  - nutrients
  - disease
  - light
  - temperature
  
4. Biological importance (B)
  - enables adaptation
  - natural selection
  - speciation
  - evolution

### **Breadth of knowledge**

- |         |  |
|---------|--|
| 3 marks | Three of the above four areas including cause and importance |
| 2 marks | Two of the above four areas including cause and importance   |
| 1 mark  | Two of the above four areas                                  |

**52. 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
<b>Good</b>	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	
<b>Average</b>	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	
<b>Poor</b>	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.

[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 will be 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 C/D/E grade 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.

## The process of osmosis and its importance to living organisms

- (1) definition (D)
- (2) effects on cells (C)
  - turgity and support
  - plasmolysis (idea)
  - lysis
  - cystic fibrosis
- (3) importance in animals (A)
  - role in relationship between plasma and tissue fluid
  - role in medulla of kidney
  - reabsorption in gut
  - sweat production neutral*
- (4) importance in plants (P)
  - role in movement of water from soil to leaves in plants
  - role in mass flow hypothesis for movement in plants

## Breadth of knowledge

3 marks	reference to all 4 areas
2 marks	definition + 2 other areas
1 mark	any 2 areas

**(b) Energy transfers which take place in living organisms**

- (1) ATP (A)  
synthesis from ADP and P  
role as an energy source
- (2) photosynthesis (P)  
excitation of electrons  
generation of ATP and reduced NADP  
photolysis  
reduction of glycerate phosphate to carbohydrate  
structure of chloroplast in relation to energy transfers
- (3) respiration (R)  
net gain of ATP in glycolysis  
production of ATP in Krebs cycle  
synthesis of ATP associated with electron transfer chain  
ATP production in anaerobic respiration  
structure of mitochondrion in relation to energy transfers
- (4) uses of energy in biological processes (B)  
active transport  
muscle contraction  
nerve transmission  
synthesis  
translocation  
kidney function  
nitrogen fixation  
receptors

**Breadth of knowledge**

3 marks	reference to all 4 areas
2 marks	ATP + 2 other areas
1 mark	any 2 areas

**53. 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
<b>Good</b>	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	
<b>Average</b>	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	
<b>Poor</b>	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.

[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 will be 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 C/D/E grade 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.

## Energy transfers which take place in living organisms

- (1) ATP (A)  
synthesis from ADP and P  
role as an energy source
- (2) photosynthesis (P)  
excitation of electrons  
generation of ATP and reduced NADP  
photolysis  
reduction of glycerate phosphate to carbohydrate  
structure of chloroplast in relation to energy transfers
- (3) respiration (R)  
net gain of ATP in glycolysis  
production of ATP in Krebs cycle  
synthesis of ATP associated with electron transfer chain  
ATP production in anaerobic respiration  
structure of mitochondrion in relation to energy transfers
- (4) uses of energy in biological processes (B)  
active transport  
muscle contraction  
nerve transmission  
synthesis  
translocation  
kidney function  
nitrogen fixation  
receptors

### Breadth of knowledge

3 marks	reference to all 4 areas
2 marks	ATP + 2 other areas
1 mark	any 2 areas

54. (a) (cut out gene using an) endonuclease / restriction enzyme;  
reference to specificity / recognition site;  
sticky ends;  
use the same enzyme to cut;  
plasmid / virus / potato DNA;  
fixed by ligase;  
method of introducing vector e.g. micropipette / virus injects DNA /  
remove plant cell wall; 6 max
- (b) introduced gene / characteristic passed to offspring;  
rapid process;  
larger number of plants produced;  
asexual reproduction genetically identical / sexual reproduction  
causes variation; 3 max
- (c) different genes are expressed;  
producing different enzymes/proteins; 2

[11]

### 55. *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
<b>Good</b>	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	
<b>Average</b>	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	
<b>Poor</b>	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)

<b>Mark</b>	<b>Descriptor</b>
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)

<b>Mark</b>	<b>Descriptor</b>
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.

[25]

**Guidelines for marking the essay**

**Introduction**

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- 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 will be 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 C/D/E grade 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 of the essays. In both essays, topics either from the option modules or beyond the scope of the specification should also given credit where appropriate.

### **Enzymes and their importance in plants and animals**

- (1) principles of enzyme action (A)  
e.g. catalysis, protein structure, active site, activation energy, enzyme-substrate complex, specificity.

good candidates relate protein structure to specificity /active site, catalysis to activation energy.

- (2) factors affecting enzyme action (F)  
e.g. temperature, pH, enzyme/substrate concentration, inhibition.

good candidates – relate changes in activity to denaturing/tertiary structure; effects of concentration to active site availability, distinguish competitive/non-competitive inhibition.

- (3) enzyme synthesis (S)  
reference to protein synthesis; link to genes, gene expression, effects of mutation.

good candidates – appreciation of connection between genes and enzyme production, e.g. 'one gene, one enzyme'.

roles and functions of enzymes in different processes. In each case good candidates should specify enzyme and its function.

- (4) digestion (D)  
enzymes involved in mammalian digestive system, breakdown of polymers in other circumstances, e.g. saprophytic digestion/ mobilisation of storage compounds.

good candidates – range of enzymes giving source and action in sequence in mammalian digestion; reference to other breakdown.

- (5) metabolic pathways - photosynthesis (Ps) and respiration (R)  
e.g. light independent reaction, Krebs cycle, ATP formation.

good candidates - reference to specific roles e.g. in l.i.r., distribution in mitochondria/chloroplasts.

- (6) other specific examples  
e.g. in nervous system (N), such as role of acetylcholinesterase in synapses,  
in homeostasis (H), such as in glycogenesis,  
in muscle action (M), such as role of ATPase,  
in fertilisation (Sp), such as enzymes in acrosome,  
in transcription / translation (T), such as role of polymerases.

### **Breadth of Knowledge**

- 3 marks    significant coverage of areas 1 and 2, + 3 others, or brief references to 5 others  
2 marks    areas 1 or 2 + 2 other areas, or brief reference to 5 + areas in total  
1 mark    any 3 areas



**56. 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
<b>Good</b>	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	
<b>Average</b>	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	
<b>Poor</b>	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.

[25]

**Topic areas for assessment of scientific content:**

- (1) principle of negative feedback – departure from a norm initiates changes which restore a system to the norm. (P)
- (2) importance in homeostasis; principles of detection of change, role of receptors, corrective response, role of effectors. (H)
- (3) thermoregulation; roles of thermoreceptors and hypothalamus in detection; heat loss and heat gain centres; sweating and vasodilatation in heat loss; vasoconstriction, hair erection, shivering and increased metabolism in heat gain. (T)
- (4) regulation of blood glucose; roles of receptors in pancreas, secretion of insulin or glucagon; effect of insulin on surface membrane receptors/carrier proteins in stimulating uptake of glucose and glycogenesis; role of glucagon in glycogenolysis. (G)

- (5) regulation of blood water potential; role of receptors in hypothalamus; secretion of ADH from pituitary; effect of ADH on permeability of d.c.t. and collecting duct; role of loop of Henle in maintaining high ion concentration in the medulla; effect on urine concentration. (W)
- (6) control of ventilation; stimulation of chemoreceptors in medulla; effect on inspiration; stimulation of stretch receptors in lungs; stimulation of expiratory cells in medulla. (B)
- (7) control of heartbeat; roles of chemoreceptors and pressure receptors; inhibitory and acceleratory centres in medulla; effect on SAN and rate of heartbeat; effect of change in rate on pH/pressure of blood. (HB)
- (8) metabolic pathways; examples of build-up of a product in a metabolic pathway resulting in inhibition of its formation. (M)
- (9) population stability; effect of increasing competition/predation on increasing population size and restoration of balance. (Pop)
- (10) (selection – stabilising selection resulting in constancy of species) (S)
- (11) (Oestrous cycle; effect of feedback on hormone production, e.g. oestrogen on FSH and progesterone on both FSH and LH. From Option 8) (O)

Any other sensibly argued example showing negative feedback should be credited.

In a good essay the description of the changes in a system should be clearly related to the principles of negative feedback, with sufficient detail for the relationship to be explained.

#### **Assessment of breadth of knowledge:**

- 3 marks Clear understanding of principle of negative feedback and coverage of 4 examples with sufficient detail to illustrate the principle effectively.
- 2 marks 3 examples described in some detail, but without necessarily making the link explicit.
- 1 mark reference to 2 examples.

## **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 C/D/E grade 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.

#### 57. 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
<b>Good</b>	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	
<b>Average</b>	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	
<b>Poor</b>	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.

[25]

**Topic areas for assessment of scientific content:**

- (1) principle of destabilising effect of rising temperature on metabolic systems within organisms and on balance in ecosystems. (P)
- (2) effect on rate of diffusion/gaseous exchange; possible consequences, e.g. increased evaporation, more rapid uptake of ions by plants. (D)
- (3) effect on proteins; possible increased rate of denaturation of tertiary structure. Increased rate of enzyme activity; possible increased dislocation of metabolic pathways. (E)
- (4) effect on photosynthesis (light independent reaction); increased rate with small increases, disruption with larger; increased rate of growth of (some) plants; possible increased rate of crop growth; effect of other limiting factors. (PS)

- (5) effect on transpiration; increased rate of water loss and hence wilting/dehydration; reduced stomatal opening may affect photosynthesis; possible consequences of drought on ecosystems. (T)
- (6) effect on respiration and metabolism; increased effect on growth and activity, especially of ectotherms. (M)
- (7) ecological effects of disruption of food webs and the dynamics of ecosystems, with changes in niches and hence communities. (EC)
- (8) effect on species; extinction of species that are unable to adapt, especially ones with specialised requirements; limited opportunity for plants and some animals to spread to more suitable conditions as climate changes. (S)
- (9) effect on agriculture; increased growth of some crops and loss of others, and effect on productivity; possible redistribution to different parts of the world, and overall loss of agricultural land. (A)
- (10) ecological effect of increased rates of growth and reproduction, especially of bacteria, insects and pests; possible increased incidence of disease. (R)
- (11) role of natural selection in adaptation to change. (N)

There are many possible alternative approaches to this essay and any biologically sensible effect of increasing change in temperature on living organisms should be credited. In a good essay the specific effects of rising temperature will be explained and explicitly linked to their possible effects on physiology or ecology. A good candidate will also recognise the complex interactions involved and avoid giving simplistic explanations and doomsday scenarios.

**Assessment of breadth of knowledge:**

- 3 marks: includes descriptions of at least 5 different areas, including both physiological and ecological effects.
- 2 marks: refers to 3 different areas, including at least one physiological and one ecological.
- 1 mark: refers to 2 different areas



## **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 C/D/E grade 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.

#### 58. *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
<b>Good</b>	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	
<b>Average</b>	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	
<b>Poor</b>	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	
	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.

[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 will be 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 C/D/E grade 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.

#### Breadth of Knowledge

3 marks	five topics - at least two from each set of examples
2 marks	five from one set of topics four topics - at least one from each set
1 mark	three topics

### 59. General principles for marking essay questions

Four skill areas will be marked:

Scientific content (**S**)

Breadth of knowledge (**B**)

Relevance (**R**)

Quality of written communication (**Q**)

These skill areas are marked independently of each other. Providing that there is sufficient evidence, and the subject content is relevant to the question answered, it is possible for candidates to obtain maximum credit for skill areas **B**, **R** and **Q**, even if they gain little credit for Scientific content.

The following descriptors will form the basis for marking.

**Scientific content** (Maximum 16 marks)

<b>Mark</b>	<b>Descriptor</b>
<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 which indicates greater depth or breadth of study.
<b>14</b>	
<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 a programme of A-level study. Material accurate and free from fundamental errors, but there may be minor errors which detract from the overall accuracy.
<b>10</b>	
<b>8</b>	A significant amount of the content is of appropriate depth. Shows a sound understanding of most of the principles involved and a 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>	
<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 a greater depth of knowledge is demonstrated, then there are many fundamental errors.
<b>2</b>	
<b>0</b>	Such material as is relevant is both superficial and inaccurate, rarely demonstrating evidence of knowledge in keeping with a programme of A-level study.

Note: Only 0, 2, 4 marks etc. are awarded. This limits the number of categories and improves the consistency of marking.

Marks intermediate between descriptors may be awarded.

**Breadth** (Maximum 3 marks)

<b>Mark</b>	<b>Descriptor</b>
3	A balance account making reference to most areas that might realistically be covered in an A-level course of study.
2	A number of areas 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.

**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 only of marginal relevance.
1	Some attempt made to relate material to the title but considerable amounts are largely irrelevant.
0	Material entirely irrelevant or too limited in quantity to judge.

**Quality of written communication** (maximum 3 marks)

Mark	Descriptor
3	Material is 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 generally been used effectively and is usually accurate.
1	The essay is poorly constructed. Often fails to use an appropriate scientific style and terminology to express ideas.
0	Material entirely irrelevant or too limited in quantity to judge.

[25]

**60. General principles for marking essay questions**

Four skill areas will be marked:

Scientific content (**S**)

Breadth of knowledge (**B**)

Relevance (**R**)

Quality of written communication (**Q**)

These skill areas are marked independently of each other. Providing that there is sufficient evidence, and the subject content is relevant to the question answered, it is possible for candidates to obtain maximum credit for skill areas **B**, **R** and **Q**, even if they gain little credit for Scientific content.

The following descriptors will form the basis for marking.



**Scientific content** (Maximum 16 marks)

<b>Mark</b>	<b>Descriptor</b>
<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 which indicates greater depth or breadth of study.
<b>14</b>	
<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 a programme of A-level study. Material accurate and free from fundamental errors, but there may be minor errors which detract from the overall accuracy.
<b>10</b>	
<b>8</b>	A significant amount of the content is of appropriate depth. Shows a sound understanding of most of the principles involved and a 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>	
<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 a greater depth of knowledge is demonstrated, then there are many fundamental errors.
<b>2</b>	
<b>0</b>	Such material as is relevant is both superficial and inaccurate, rarely demonstrating evidence of knowledge in keeping with a programme of A-level study.

Note: Only 0, 2, 4 marks etc. are awarded. This limits the number of categories and improves the consistency of marking.

Marks intermediate between descriptors may be awarded.

**Breadth** (Maximum 3 marks)

<b>Mark</b>	<b>Descriptor</b>
3	A balance account making reference to most areas that might realistically be covered in an A-level course of study.
2	A number of areas 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.

**Relevance** (Maximum 3 marks)

<b>Mark</b>	<b>Descriptor</b>
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 only of marginal relevance.
1	Some attempt made to relate material to the title but considerable amounts are largely irrelevant.
0	Material entirely irrelevant or too limited in quantity to judge.

**Quality of written communication** (maximum 3 marks)

<b>Mark</b>	<b>Descriptor</b>
3	Material is 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 generally been used effectively and is usually accurate.
1	The essay is poorly constructed. Often fails to use an appropriate scientific style and terminology to express ideas.
0	Material entirely irrelevant or too limited in quantity to judge.

[25]