



ASSESSMENT and
QUALIFICATIONS
ALLIANCE

General Certificate of Education

Biology 5416/6416 *Specification B*

Applying Biological Principles BYB678/B

Mark Scheme

2005 examination – June series

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

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

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General Guidance for the Mark Scheme

The following conventions are used in the mark scheme:

- A semicolon (;) separates each mark point
- An oblique stroke (/) separates alternatives within a mark point
- Underlining of a word or phrase means that the term must be used by candidates
- Brackets are used to indicate contexts for which a mark point is valid, but which may just be implied by a candidate's answer
- '*Accept*' and '*reject*' show answers which should be allowed or not allowed.
- Additional instructions may be shown in *italics*

The scheme shows the minimum acceptable answer(s) for each mark point - better, more detailed, or more advanced answers are always accepted, provided that they cover the same key ideas. Occasionally, a candidate will give a biologically correct answer that has not come up at standardising. If it is equivalent in standard to the mark scheme answers, it may be credited.

In some cases a mark may be awarded for understanding of a general principle, even though the detailed mark points on the scheme have not been made. This will be indicated on the mark scheme.

All mark points are awarded independently, unless a link between points is specified in the scheme.

Converse answers are normally acceptable, unless the wording of the question rules this out.

Disqualifiers

A correct point is disqualified when the candidate contradicts it in the same answer.

The list rule

When a question asks for a specific number of points, and the candidate gives more, any wrong answer cancels a correct answer. For example, if a question asks for two points and three answers are given, two correct and one clearly wrong, the mark awarded is one, whatever the order of the answers.

Valid points from **diagrams** are credited, if they are not duplicated in the text.

Where a question asks for **differences** between X and Y, the mark may be awarded for a feature of X without the converse for Y, if it is absolutely clear which is being referred to.

BYB678/B**Question 1**

- (a) urea diffused into / entered the tubing;
urea hydrolysed / broken down (inside tubing);
ammonia increases pH / makes (solution) more alkaline;
indicator turns blue as pH above 8 / due to alkalinity / due to ammonia;
idea that outside stays yellow because urease does not pass out; 3 max
- (b) (i) add biuret solution / add sodium hydroxide + copper sulphate (solution);
(*disqualify heat/boil, but accept warm*)
violet/ lilac / purple colour; 2
- (ii) inside: protein present, as enzyme is protein;
outside: no protein, as urease/enzyme/protein unable to pass
through membrane/out; 2
(*accept correct result of biuret test as indicator of protein*)
- (c) method to maintain range of temperatures, e.g. water baths;
method to measure rate of activity - e.g. time taken to turn
indicator blue;
(*principle - measure rate of activity over range of temperatures
= 1 mark, if neither point*)
other conditions kept constant / named examples, e.g. volumes
of solutions, starting pH, sample time;
method of refining optimum, e.g. repeats at narrower range; 3 max

Total 10**Question 2**

- (a) *one mark for conclusion:*
maggots move to/respond to/prefer/like /red rather than green;
(*reject 'most prefer red'*)
maggots move to/prefer/like areas of lower light intensity (except green);
maggots respond more to colour than light intensity / do not respond to differences
in light intensity;
(*reject conclusion relating to single result*)
- one mark for:*
evidence matching conclusion:
more in red than green, but light intensity the same;
more in segments with lower light intensity;
more differences in different colours, little difference in light intensity;
large difference in number of maggots on segments with 25a.u. light intensity; 2 max
- (b) valid statement expressed as null hypothesis, i.e. in negative
form, e.g. no difference in response to different colours /
light intensities; 1
(*must relate to a possible hypothesis*)

- (c) rotate box (so segments in different direction) / change order of coloured segments;
place magnets around box / create alternative magnetic field; 1 max

Total 4

Question 3

- (a) chloroplast, so cell photosynthesises;
moves to optimum/best light intensity for photosynthesis;
avoids damage due to bright light; 2 max

- (b) (i) 2700 1

(ii)
$$\frac{242 \times 7500 \times 900}{60} = 27\,225\,000 / 27 \times 10^6$$

= 2 marks

(allow 1 mark for principle: $\frac{\text{amino acids} \times \text{proteins}}{\text{time}}$) 2

- (c) (i) rate slightly slower / not affected in first 20/30 minutes / lower peak than control;
then decreases/ much lower (than control); 2
(allow 1 mark for increase in first 20/30 minutes, then decreased, if not compared with control/normal)
(disqualify flagellum grows longer)

- (ii) 1. actinomycin has no effect (on growth of flagella);
even though mRNA production / transcription prevented;
(accept references to 'expt 1')

2. (re)growth little affected by puromycin at first;
protein synthesis inhibited, so likely to be using proteins present;

4
Total 11

General Principles for marking the Essay:

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

Scientific Content (maximum 16 marks)

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

Breadth of Knowledge (maximum 3 marks)

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

Relevance (maximum 3 marks)

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

Quality of language (maximum 3 marks)

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

Total 25 marks

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.

Question 4**(a) Negative feedback in living organisms****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.

- (b) Mean temperatures are rising in many parts of the world. The rising temperatures may result in physiological and ecological effects on living organisms. Describe and explain these effects.**

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