

GCE A2
Biology
January 2009

Mark Schemes

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**NORTHERN IRELAND GENERAL CERTIFICATE OF SECONDARY EDUCATION (GCSE)
AND NORTHERN IRELAND GENERAL CERTIFICATE OF EDUCATION (GCE)**

MARK SCHEMES (2009)

Foreword

Introduction

Mark Schemes are published to assist teachers and students in their preparation for examinations. Through the mark schemes teachers and students will be able to see what examiners are looking for in response to questions and exactly where the marks have been awarded. The publishing of the mark schemes may help to show that examiners are not concerned about finding out what a student does not know but rather with rewarding students for what they do know.

The Purpose of Mark Schemes

Examination papers are set and revised by teams of examiners and revisers appointed by the Council. The teams of examiners and revisers include experienced teachers who are familiar with the level and standards expected of 16- and 18-year-old students in schools and colleges. The job of the examiners is to set the questions and the mark schemes; and the job of the revisers is to review the questions and mark schemes commenting on a large range of issues about which they must be satisfied before the question papers and mark schemes are finalised.

The questions and the mark schemes are developed in association with each other so that the issues of differentiation and positive achievement can be addressed right from the start. Mark schemes therefore are regarded as a part of an integral process which begins with the setting of questions and ends with the marking of the examination.

The main purpose of the mark scheme is to provide a uniform basis for the marking process so that all the markers are following exactly the same instructions and making the same judgements in so far as this is possible. Before marking begins a standardising meeting is held where all the markers are briefed using the mark scheme and samples of the students' work in the form of scripts. Consideration is also given at this stage to any comments on the operational papers received from teachers and their organisations. During this meeting, and up to and including the end of the marking, there is provision for amendments to be made to the mark scheme. What is published represents this final form of the mark scheme.

It is important to recognise that in some cases there may well be other correct responses which are equally acceptable to those published: the mark scheme can only cover those responses which emerged in the examination. There may also be instances where certain judgements may have to be left to the experience of the examiner, for example, where there is no absolute correct response – all teachers will be familiar with making such judgements.

The Council hopes that the mark schemes will be viewed and used in a constructive way as a further support to the teaching and learning processes.

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Rewarding Learning

ADVANCED
General Certificate of Education
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Biology

Assessment Unit A2 1

assessing

Module 4: Co-ordination, Biochemistry and Environment

[A2B11]

THURSDAY 8 JANUARY, MORNING

MARK
SCHEME

/ denotes alternative points
 ; denotes separate points
 Comments on mark values are given in bold

Section A

1	(a) Virus;	[1]	
	(b) Myofibril;	[1]	
	(c) Ectotherm;	[1]	
	(d) Ecological succession/succession;	[1]	4
2	(a) Blue (other end of the spectrum to red);	[1]	
	(b) P_R is converted to P_{FR} during daylight (since there is more red than far-red light in sunlight); P_{FR} is enzymatically/slowly converted to P_R at night;	[2]	
	(c) The active form inhibits flowering in SDPs (and needs to be removed) and stimulates flowering in LDPs; P_{FR} (P_{730}) is the active form;	[2]	5
3	(a) (i) Rhodopsin;	[1]	
	(ii) Maximises the amount of light absorbed by rhodopsin;	[1]	
	(iii) Supplies ATP, required for the regeneration of rhodopsin;	[1]	
	(b) (i) They exhibit retinal convergence/many rod cells synapse with a smaller number of bipolar cells which synapse with a single ganglion cell;	[1]	
	(ii) Additive effect (of retinal convergence)/summation; explanation of this in terms of sufficient transmitter being released/reaching threshold for action potential;	[2]	6

- 4 (a) Blood group O is the universal donor/lacks antigens (A & B); [1]
- (b) On the outer surface of the membrane/glycocalyx; [1]
- (c) B antigens on the surface of the donor red blood cells;
recipient possesses b antibodies;
the donor red blood cells are agglutinated;
clumped blood blocks capillaries/deprives organs of oxygen; [4]
- (d) Rhesus proteins are an integral part of the membrane and may be hard to
remove/if removed, the membrane integrity may be damaged so rendering the
red blood cells useless; [1]
- 5 (a) Carbon dioxide;
glycerate phosphate;
NADPH;
ATP;
triose (glyceraldehyde) phosphate; [5]
- (b) NADH/glycolysis/Krebs cycle/NADPH/light stage of photosynthesis/
photoactivation of photosystems; [1]
- (c) Readily provides the $-NH_2$ /amino radical for the synthesis of an amino acid
(attaching to a carbon skeleton); [1]
- 6 (a) (i) Grey matter (ventral horn); [1]
- (ii) X located to the left of the neurone; [1]
- (b) **Any three from**
- stimulation of the neurone results in the depolarisation of its membrane/
generation of an action potential
 - the inside becomes positive relative to the outside
 - this sets up a local circuit with neighbouring part of the membrane which
becomes depolarised in turn
 - so the action potential perpetuates itself along the length of the neurone/
action potential “jumps” from node to node [3]
- (c) All or nothing law:
The membrane either becomes depolarised or it does not, it cannot be
partially depolarised, while a larger action potential cannot be generated;
Refractory period:
This is the time it takes for the membrane to recover before it can become
depolarised again/time before an impulse can be fired again (and so limiting
impulse frequency); [2]

7

7

7

- 7 (a) Krebs cycle; [1]
- (b) The mitochondrial matrix;
the cristae/inner mitochondrial membranes; [2]
- (c) **Any four from**
- hydrogen is carried through initial carriers (flavoprotein, coenzyme Q)
 - thereafter electrons are transferred through cytochromes (and protons released into the matrix)
 - these carriers are links in a chain at progressively lower energy levels
 - at specific steps hydrogen/electron transfer is coupled to ATP synthesis (oxidative phosphorylation)/as energy is sufficiently available at a number of steps in the transfer chain ATP is synthesised
 - oxygen is the ultimate hydrogen/electron acceptor (forming water) [4]
- (d) NADH generates 3 ATPs, FADH₂ generates 2 ATPs;
(3 × 3) + (1 × 2) = 11 ATPs in total; [2]
- (e) The breakdown of glucose/glycolysis can be continued since NAD is regenerated (during the further metabolism of pyruvate to lactate or ethanol); fatty acid breakdown involves Krebs cycle which is dependent on aerobic conditions; [2]
- 8 (a) Glomerulus;
Bowman's capsule;
convoluted tubule (proximal); [3]
- (b) High pressure in the glomerulus is generated by the narrower diameter of the efferent vessel;
basement membrane (of the glomerulus) acts as the filter/filtration facilitated by the porous nature of the endothelium of the glomerulus (restricting passage of blood cells)/filtration slits of the inner endothelium (podocytes) of the capsule;
plasma less blood proteins are forced in the capsular space; [3]
- (c) Mitochondria provide ATP for active transport in reabsorption of glucose/ amino acids;
infoldings in the outer membrane increase surface area for movement of substances into the neighbouring capillary; [2]
- (d) (i) Values for water, 180 (filtrate) and 1.5 (urine);
values for urea, 55 (filtrate) and 35 (urine);
(35 ÷ 55) × (180 ÷ 1.5) = × 76.4; [3]
- (ii) Water reabsorption concentrates the urea (in proximal tubule and collecting duct);
explanation of water reabsorption/some urea is selectively absorbed (in distal convoluted tubule); [2]

11

13

Section A

60

Section B

9 Thirteen points, with at least six in each section.

The cycles:

Carbon cycle:

- much carbon is “locked” in organic molecules especially cellulose
- respiration releases carbon dioxide
- particularly of decomposers
- photosynthesis removes carbon dioxide from the atmosphere

Nitrogen cycle:

- decomposers release ammonium
- converted by nitrifying bacteria to nitrate
- taken up by plants
- used to manufacture proteins/nitrogenous organic compounds
- denitrifying bacteria in anaerobic conditions remove nitrate converting it to ammonia/nitrogen gas
- nitrogen fixing bacteria convert nitrogen from the atmosphere into organic form

Adverse effects on the environment:

Greenhouse effect (global warming):

- results from increased levels of carbon dioxide in the atmosphere
- due to the combustion of fossil fuels
- and deforestation since less carbon dioxide is absorbed by this hugely productive ecosystem
- longer wavelength infra-red is absorbed by greenhouse gases and re-radiated back towards the Earth’s surface
- global warming results in extremes in weather patterns
- global warming should result in the melting of the polar ice caps with a consequent rise in sea levels and coastal flooding

Acid rain:

- combustion of fossil fuels will release NO_2 into the atmosphere
- where it reacts with water in clouds to form nitrous acid which may be precipitated as acid rain some hundreds of miles from the source of production
- acid rain results in the defoliation and death of trees
- mainly due to the acidity resulting in an imbalance of soil nutrients (some minerals such as calcium and magnesium become more soluble and are leached out of the soil)
- the acidification of soils causes a release of aluminum ions
- aluminium is directly toxic to plant roots/aluminium causes mucus to coagulate on fish gills and consequent asphyxiation

Eutrophication:

- eutrophication refers to the condition of waterways such as lakes becoming nutrient-rich
- resulting from the leaching of nitrogenous fertilisers from agricultural land
- high levels of nutrients will result in massive growth of algae (and blue-green algae) forming algal blooms which die
- decomposition of the dead algae by bacteria causes anoxia in lakes
- resulting in fish kills and death of other aquatic organisms
- further, high nitrate (and nitrite) levels in drinking water have been linked with possible health risks

[13]

Consider QWC:

2 marks: The candidate expresses ideas clearly and fluently, through well-linked sentences and paragraphs. Arguments are generally relevant and well-structured. There are few errors of grammar, punctuation and spelling.

1 mark: The candidate expresses ideas clearly, if not always fluently. Arguments may sometimes stray from the point. There are some errors of grammar, punctuation and spelling, but not such as to suggest a weakness in these areas.

0 marks: The candidate expresses ideas satisfactorily, but without precision. Arguments may be of doubtful relevance or obscurely presented. Errors in grammar, punctuation and spelling are sufficiently intrusive to disrupt the understanding of the passage.

[2]

15

Section B

15

Total

75