

GCE AS
Biology
January 2009

Mark Schemes

Issued: April 2009

**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.

CONTENTS

	Page
AS 1: Module 1	1
AS 2: Module 2	7
AS 3A: Module 3A	13



Rewarding Learning

**ADVANCED SUBSIDIARY (AS)
General Certificate of Education
January 2009**

Biology

Assessment Unit AS 1

assessing

Module 1: Cell Biology

[ASB11]

WEDNESDAY 14 JANUARY, AFTERNOON

**MARK
SCHEME**

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

AVAILABLE
 MARKS

Section A

<p>1 Exocytosis/secretion endocytosis phagocytosis pinocytosis [3] for four, [2] for three, [1] for two</p>	<p>[3]</p>	<p>3</p>
<p>2 (a) $21 \times 3 = 63$;</p> <p>(b) Any four from</p> <ul style="list-style-type: none"> • forms disulphide bridges/covalent bonds • creates bonds between parts of the A chain • folding represents its tertiary structure • bond chains A and B together • bonded chains are its quaternary structure <p>(c) The R group of cysteine;</p>	<p>[1]</p> <p>[4]</p> <p>[1]</p>	<p>6</p>
<p>3 (a) Telophase; metaphase; prophase; anaphase;</p> <p>(b) C, B, D, A;</p>	<p>[4]</p> <p>[1]</p>	<p>5</p>
<p>4 (a) A: tRNA; B: anticodon; C: ribosome;</p> <p>(b) Any four from</p> <ul style="list-style-type: none"> • DNA is unzipped (by the enzyme helicase) • by breaking the hydrogen bonds between the complementary bases/ two strands • one side of the unzipped DNA acts as a template for RNA manufacture/ sense strand • ribonucleotides match up with complementary deoxyribonucleotides on the sense strand according to base pair rules/A–U, C–G, G–C, T–A • newly arranged ribonucleotides are joined together by condensation reactions/adjacent phosphates and sugars bond/phosphodiester bonds form • the process is controlled by the enzyme RNA polymerase 	<p>[3]</p> <p>[4]</p>	<p>7</p>

			AVAILABLE MARKS
5	<p>(a) (i) Both made of α-glucose/possess glycosidic bonds; [1]</p> <p>(ii) Starch is a polymer/polysaccharide/consists of amylose and amylopectin/possess 1,4 and 1,6 glycosidic bonds/may be branched; maltose is a disaccharide/only 1,4 bonds; [2]</p> <p>(b) (i) The amount of starch decreases; rapidly initially and then more slowly/amount of starch is halved approximately every half minute; [2]</p> <p>(ii) The amount of starch decreases as it is broken down by amylase; as the reaction progresses the concentration of starch decreases and so the reaction slows down (since there are fewer collisions between substrate and enzyme); [2]</p>		7
6	<p>(a) The water potential of the immersing solution is higher than that in that in the potato tissue; so water enters (increasing the length of the cylinder); [2]</p> <p>(b) -900 kPa; there is no change in the length of the potato cylinder/the water potential of the potato tissue is equal to that of the immersing solution; [2]</p> <p>(c) 8% of the initial length = 4 mm; = 50 mm less 4 mm = 46 mm [final length reduced by value above]; [2]</p> <p>(d) Diagram showing protoplast pulled away from cell wall; [1]</p>		8
7	<p>(a) A plasmid is a ring of DNA that lies outside the main bacterial DNA (genome)/possesses genes for antibiotic (heavy metal) resistance; [1]</p> <p>(b) Any three from</p> <ul style="list-style-type: none"> • foreign DNA and plasmid are cut using the same restriction endonuclease/<i>Sal</i>I • so that sticky ends are complementary • so exposed bases readily bond (H-bond) • foreign DNA and plasmid are annealed using DNA ligase [3] <p>(c) Uptake induced by treatment with calcium ions/use of heat shock/increase the permeability of the membrane; [1]</p> <p>(d) Any three from</p> <ul style="list-style-type: none"> • treatment of bacteria with antibiotics (ampicillin/tetracycline) • bacteria which take up the modified pBr322 will be resistant to ampicillin (but not to tetracycline) • bacteria which fail to take up plasmids will be susceptible to either antibiotic • bacteria which take up unmodified plasmids will be resistant to both antibiotics [3] 		8
Section A			43
			8

Section B

AVAILABLE
MARKS

8 Ten points, at least three in each section.

Golgi apparatus:

- vesicles containing protein join with the formative (cis-) face of the Golgi apparatus
- the Golgi is a stack of membrane-lined flattened cavities/cisternae
- within the Golgi apparatus protein is modified/stabilised/refined/packaged
- carbohydrate may be added to form glycoprotein
- quaternary structure of proteins may be formed
- vesicles containing the glycoprotein are pinched off the mature (trans-) face of the Golgi/Golgi forms lysosomes

Mitochondrion:

- mitochondria are bounded by a double membrane
- the inner membrane is convoluted to form cristae/are the site of the ETC
- suspended material within the mitochondrion is known as the matrix/the matrix is the site of the Krebs cycle
- the mitochondrion is the organelle of aerobic respiration
- synthesises ATP
- contains mitochondrial DNA

Chloroplast:

- the chloroplast is surrounded by an envelope/double membrane
- contains an internal system of membranes known as lamellae
- organised into thylakoids that are stacked to form grana
- the lamellae (thylakoids) contain chlorophyll pigments that absorb light/are the site of the light dependent reaction
- the chloroplast matrix is known as the stroma/the stroma is the site of the light independent reaction
- synthesised products are stored as starch grains (and lipid droplets)/chloroplast DNA is present

[10]

10

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]

Section B

Total

**AVAILABLE
MARKS**

2

12

55



Rewarding Learning

**ADVANCED SUBSIDIARY (AS)
General Certificate of Education
January 2009**

Biology

Assessment Unit AS 2

assessing

Module 2: Physiology and Ecology

[ASB21]

WEDNESDAY 14 JANUARY, AFTERNOON

**MARK
SCHEME**

Section A

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

- | | | | |
|---|---|-----|---|
| 1 | Parenchyma;
collenchyma;
sclerenchyma/fibres;
phloem; | [4] | 4 |
| 2 | (a) A: red blood cell/erythrocyte
B: polymorph/neutrophil
C: lymphocyte
Three for [2], two for [1]. | [2] | |
| | (b) Any two from <ul style="list-style-type: none"> • small and so have a large surface area for efficient gas exchange • biconcave shape and so have an increased surface area • small and so readily pass through capillaries • packed with haemoglobin for efficient oxygen uptake • lack of nucleus allows them to be small/allowing more space for haemoglobin | [2] | |
| | (c) B: phagocytosis;
C: antibody-mediated immunity/cell-mediated immunity; | [2] | 6 |
| 3 | (a) Increased breathing rate/depth of breathing; | [1] | |
| | (b) Any two from <ul style="list-style-type: none"> • there is a limit to the supply of oxygen (even though increased) • energy used exceeds that which can be produced aerobically • extra energy is supplied anaerobically • anaerobic respiration produces lactic acid | [2] | |
| | (c) Lactic acid is still being flushed out of the muscle/
transported to the liver; | [1] | |
| | (d) (i) 12 minutes; | [1] | |
| | (ii) Recovery time would be shorter; | [1] | 6 |

- | | | | |
|----------|--|---|---|
| 4 | <p>(a) Any three from</p> <ul style="list-style-type: none"> • mosaic pattern of leaf canopy/orientation of leaves towards light source • transparency of epidermal layer • plant leaves represent a large surface area • leaves possess an upper palisade mesophyll of packed cells • cells densely packed with chloroplasts • chloroplasts contain chlorophyll/pigments on lamellae • different pigments increase the range of wavelengths absorbed <p>(b) Light fails to strike the leaves/light transmitted through leaves/light reflected from leaves/not all wavelengths are utilised;</p> <p>(c) 92 as numerator;
divided by 7073 = 1.3%;</p> | <p>[3]</p> <p>[1]</p> <p>[2]</p> | 6 |
| 5 | <p>(a) Shrew: 4.8 kPa;
Human: 2.4 kPa;</p> <p>(b) The shrew haemoglobin releases oxygen (dissociates) more readily/at a higher ppO₂;
satisfies the large oxygen requirement for high rate of respiration;</p> <p>(c) When respiration increases;
the ppO₂ decreases/ppCO₂ increases/pH decreases/temperature increases;</p> | <p>[2]</p> <p>[2]</p> <p>[2]</p> | 6 |
| 6 | <p>(a) Inter-specific competition;</p> <p>(b) Shag feeds in the surface water/cormorant feeds in bottom water;
shag predominantly eats sand eels and herring/cormorant predominantly eats flatfish and shrimp;</p> <p>(c) (i) Cormorant lives on the coastline/waterways of Britain/
marine or aquatic birds;
feeds at the bottom/feeds predominantly on flatfish and shrimp;</p> <p>(ii) Competition is particularly severe/both species lose out;
the better competitor would survive, the other bird would become locally extinct/competitive exclusion/niche divergence;</p> | <p>[1]</p> <p>[2]</p> <p>[2]</p> <p>[2]</p> | 7 |

			AVAILABLE MARKS
7	(a) Atrioventricular valves are open/atria are not contracting/semi-lunar valves are closed;	[1]	
	(b) X positioned at top-left of the diagram;	[1]	
	(c) A: AVN/atrio-ventricular node; B: bundle of His/Purkinje tissue;	[2]	
	(d) The atria must contract before the ventricles; to ensure that blood leaves the atria/enters the ventricles;	[2]	
	(e) Any two from • ventricular contraction will drive the blood up • towards the major arteries for blood to exit the heart • ensure complete emptying	[2]	
Section A			8
			43

Section B**8 At least four points from each section**

Movement of water across the root:

- root hair cells maximises the surface area for water uptake by the roots/water moves through the root tissue via an osmotic gradient
- most water moves through the root tissues via the apoplast pathway/movement through the apoplast is faster
- moving by capillarity along the cellulose walls
- water may also move through the cytoplasm of cells via the symplast pathway
- which are directly connected by plasmodesmata
- water may not pass through the endodermis by the apoplast pathway
- since it is prevented from doing so by the Casparian strip
- as the Casparian strip contains a waterproof material/suberin
- water passing through the endodermis via the symplast pathway comes under the control of the cell's metabolism/offers selectivity/control of what enters

Movement of water through stem and leaf:

- water is essentially pumped into the xylem in the root
- causing a root pressure
- water moves along the walls of xylem vessels by capillarity
- because of the adhesive properties of water
- water molecules also attract neighbouring water molecules
- so that there is cohesion in the water column/an unbroken water column
- the forces of adhesion and cohesion are caused by the polarity of water molecules
- the whole water column is moved upwards because of a negative pressure in the leaf/cohesion-tension
- due to water being drawn out of xylem vessels in the leaf
- pits allow for lateral movement of water
- the evaporation of water from the mesophyll surface
- and subsequent diffusion through open stomata/loss of water from the aerial parts of the plant is known as transpiration
- causes water to be drawn through the mesophyll cells (mostly by the apoplast pathway) and ultimately out of the leaf's xylem vessels [10]

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]

Section B

Total

**AVAILABLE
MARKS**

12

12

55



Rewarding Learning

**ADVANCED SUBSIDIARY (AS)
General Certificate of Education
January 2009**

Biology

Assessment Unit AS 3A

assessing

Module 3A: Practical Processes

[ASB31]

THURSDAY 22 JANUARY, AFTERNOON

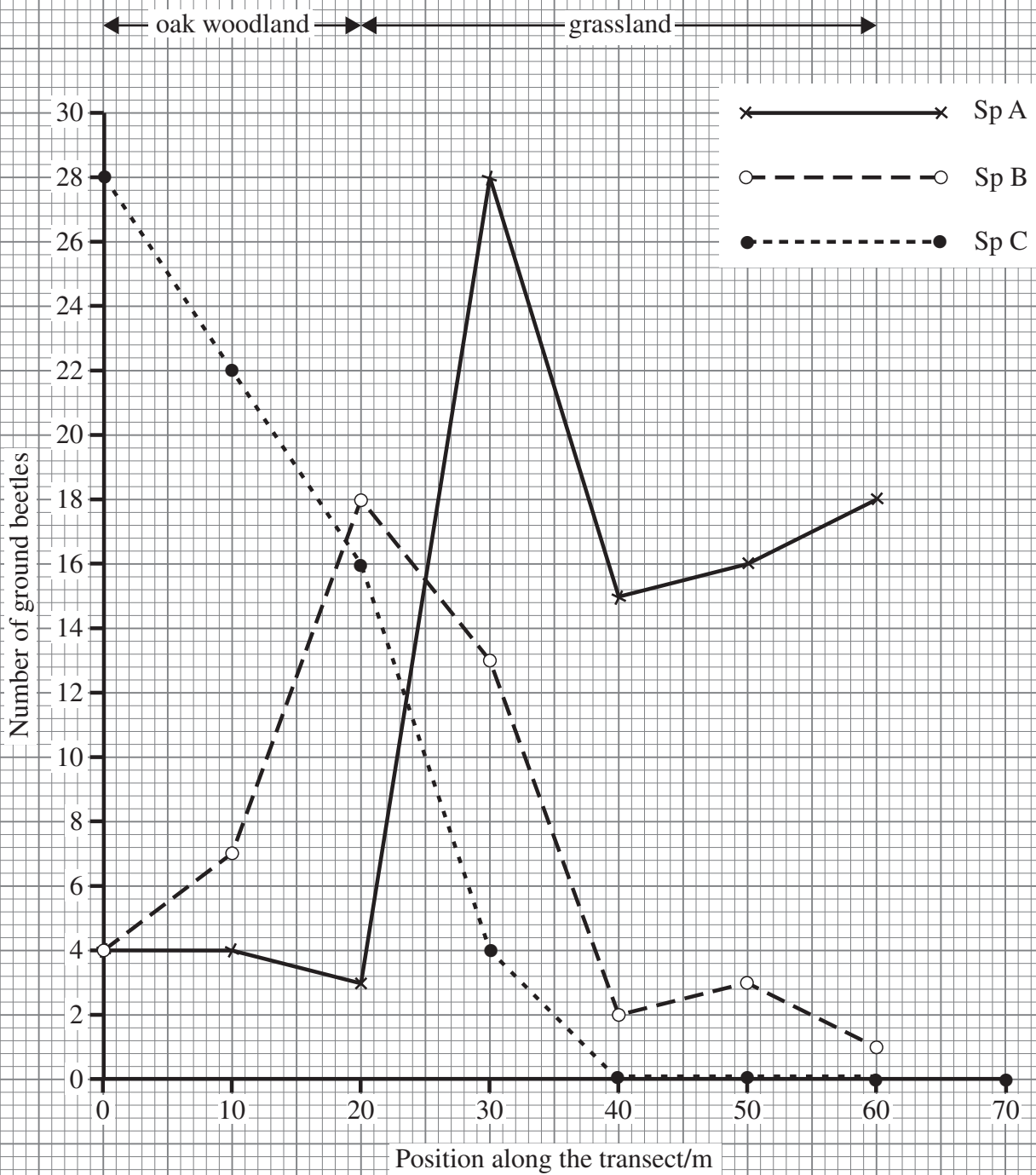
**MARK
SCHEME**

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

- 1 (a) (i)** A is glucose;
 B is starch;
 D is fructose (C is sucrose); [3]
- (ii)** Iodine – blue-black colour
 Clinistix – purple/blue
 Benedict’s – brick-red precipitate
Three for [2], two for [1] [2]
- (b)** Fructose has a relative sweetness of $75\% \times 2 = 150\%$ of sucrose;
 20 g fructose will be equivalent to 30 g of sucrose; [2] 7
- 2** Drawing skills:
 block diagram showing tissue layers;
 all tissue layers drawn (completeness of drawing to show the tissues obvious in the photograph);
 accurate representation of the photograph, i.e. a drawing rather than a diagram;
 accurate positioning and proportionality of the tissue layers;
 quality of drawing (e.g. clear – smooth and continuous – lines drawn, not sketchy); [5]
- Identification of five of the following structures:
 parenchyma/cortex
 endodermis
 pericycle
 xylem
 cambium
 phloem
 stele
- Five for [4], four for [3], three for [2], two for [1]** [4] 9

- 3 (a) Sample of enzyme-substrate mixture;
dilute iodine (to which the samples are added); [2]
- (b) Because otherwise the synthesised starch cannot be detected;
iodine is the test for the presence of starch/iodine turns the starch blue-black;
because red light is most effectively absorbed by a blue solution/red is at the
opposite end of the visible spectrum to the end-point colour (blue);
using the dilute iodine solution (prior to taking a reading of the mixture); [4]
- (c) The solution becomes more blue-black so over time more light is absorbed
as starch is being synthesised the % transmission decreases;
the rate of starch synthesis decreases as the reaction progresses;
since there is less substrate left to react/substrate concentration decreases
over time/colorimeter would need to be calibrated to fully interpret starch
levels; [3] 9
- 4 (a) Pit-fall trap; [1]
- (b) Caption;
scaling of the graph (using the graph paper to maximal effect);
distance along transect as the independent variable along the *x*-axis;
labels and units of measurement shown;
points accurately plotted;
and joined with short straight lines/kite diagrams/series of bar charts;
each identified with labels or a key; [7]
- (c) Species A is most abundant in grassland;
species B is most abundant at the edge of the wood;
species C is most abundant in woodland; [3]
- (d) **Any two from**
- the distribution of beetles reflects the availability of food
 - competition of species/occupy different ecological niches
 - shelter from predators
 - adaptation to light/shaded conditions
 - other appropriate suggestion [2] 13

Distribution of ground beetles along a transect from dense oak woodland to open grassland as shown by three species.



- 5 (a) Parsnip has the lower water potential; since it contains more sugar/solute (and so is sweeter); [2]
- (b) **Any five from**
- cylinders of root tissue are cut using a cork borer (and cut to the same length)
 - cylinders are surface dried and weighed
 - added to a series of different concentrations/molarities of sucrose solutions
 - after some hours the cylinders are removed, surface dried and reweighed
 - the percentage mass change calculated
 - for each tissue, a graph is plotted of percentage change in mass against molarity/solute potential of the immersing solution
 - on each graph, a line of best fit is plotted and the water potential of the tissue determined on the intersection of the x-axis [5]
- (c) Tissues within each tap root are not all of uniform water potential/ inconsistency in the drying technique/explanation of the use of percentage change/other appropriate response; [1]
- (d) Accuracy relates to the measurement technique/how close the observed value lies to a correct/real value; reliability relates to the variability of biological material/consistency in (or confidence with) a set of measurements/determined by repetition (if repeated results lie close together then the results have high reliability); [2]

10

Consider QWC in questions 3(c), 4(c) and 5(b)

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]

2

Total

50

