Published Mark Scheme for GCE AS Biology

Summer 2009

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

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 SUBSIDIARY (AS)
General Certificate of Education
2009

Biology

Assessment Unit AS 1

assessing

Module 1: Cell Biology

[AB111]

MONDAY 1 JUNE, AFTERNOON

MARK SCHEME

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

Section A

1 **(a)** **(i)** A collection of tissues which are grouped together to carry out one function (absorption): [1]

(ii) The digestive system is a collection of organs (including the ileum); [1]

(b) Helps move the villi/increases contact with the digested food (so enhancing concentration gradients for absorption);
produces mucus/to lubricate/protect gut;
contraction produces peristaltic wave/churning; [3] 5

2 **(a)** Condensation; [1]

(b) Carbon one and carbon six; [1]

(c) Compact for storage/readily hydrolised/readily built up; [1]

(d) Glycogen; [1]

(e) **(i)** Benedict's reagent/Clinistix; [1]

(ii) Mix sample with Benedict's reagent and heat/dip Clinistix into sample; [1]

(iii) Yellow/orange/brick red colour with Benedict's reagent/ purple-blue colour with Clinistix; [1] 7

3 (a) A: phospholipid; [1]

(b) (i) Diffusion;
substance moves along the concentration gradient/is a passive process; [2]

(ii) Facilitated diffusion;
substance moves along the concentration gradient/doesn't involve energy expenditure and involves a membrane carrier; [2]

(iii) Active transport;
substance moves against the concentration gradient/involves energy expenditure; [2]

(c) Non-polar/fat soluble/uncharged substances/very small molecules (e.g. O_2, CO_2, H_2O) move through the phospholipid bilayer;
polar/water soluble substances/ions move through the protein hydrophilic channels; [2] 9

4 (a) Between time 0 and 12 hours; [1]

(b) Cytokinesis is taking place/cell splitting in two; [1]

(c) **Any three from**
- DNA mass is constant during G1/G2
- DNA replication doubles the mass of the DNA/ takes place between 12 and 16.8 hours
- during the synthesis/S phase of the cell cycle
- separation of the DNA mass occurs during anaphase/when the chromatids are pulled apart
- DNA mass per nucleus is halved during telophase/when daughter nuclei form [3]

(d) DNA mass will further half/drop to 0.5 arbitrary units;
due to separation of homologous chromosomes/separation of chromatids during the second meiotic division/since there are two divisions/since haploid cells are formed; [2] 7

5 (a) A: chloroplast;
B: mitochondrion;
C: nucleolus;
D: cell wall; [4]

(b) Measured length is 120 mm = 120 000 μm;
actual length is 120 000 ÷ 32 000 = 3.75 μm; [2]

(c) Intercellular spaces present/chloroplasts present/lamellae not well developed; [1] 7

ABLE S

6 **(a)** Caption;
pH as independent variable and appropriate scaling;
axes labels/units;
points accurately plotted;
points joined with straight lines;
appropriate key/lines identified; [6]

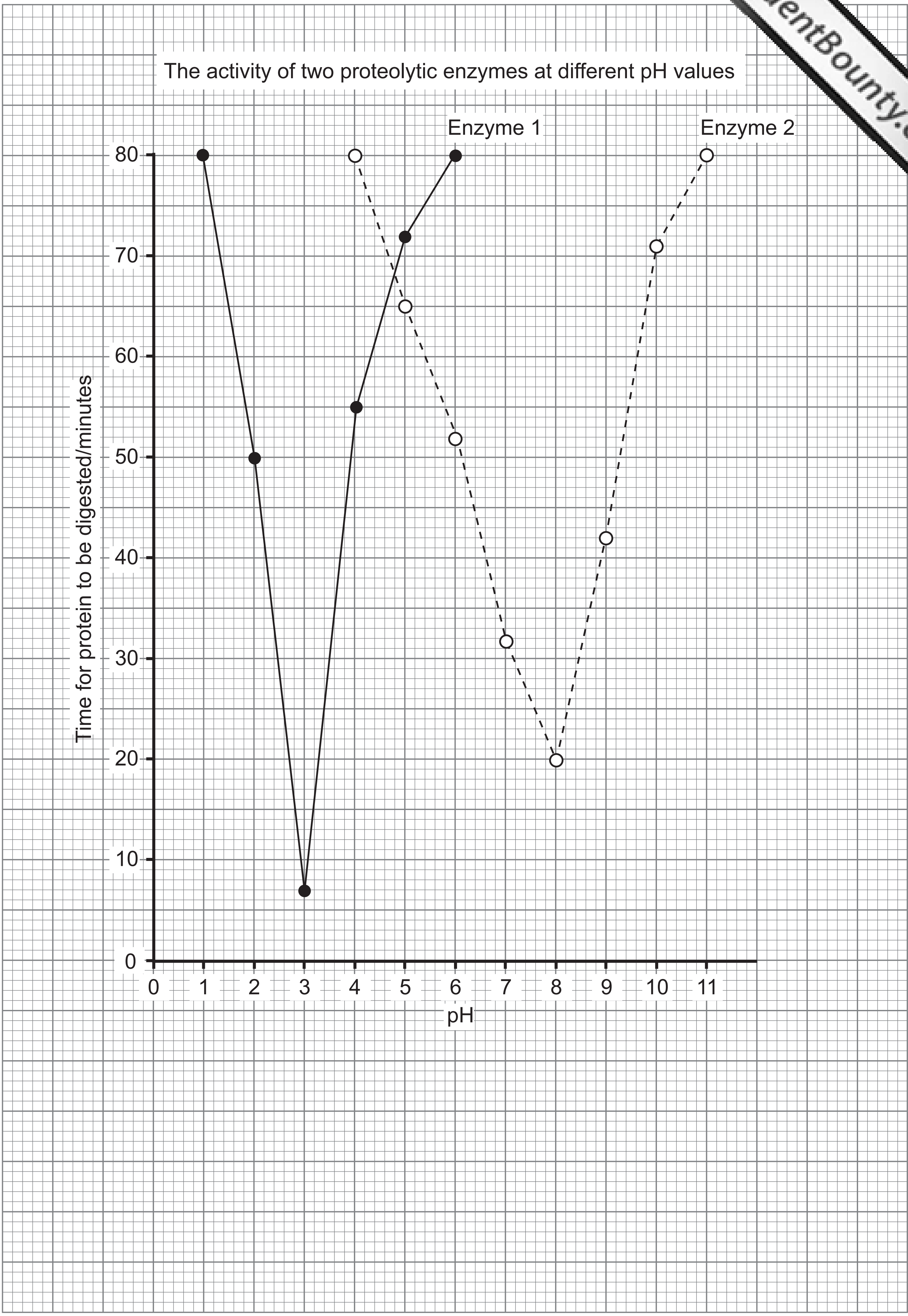
(b) **(i)** Using a buffer solution; [1]

(ii) Temperature;
More collisions between enzyme and substrates at higher temperatures (up to 37°C)/denaturation at very high temperatures (over 37°C);
or
Enzyme/substrate concentration;
more chance of collisions between enzyme and substrate at higher enzyme/substrate concentrations; [2]

(c) 200 mg digested in 50 minutes/4 mg per minute;
240 mg h^{-1}; [2]

(d) Enzyme 1, since peak activity is at pH 3/in the acidic range (of the stomach); [1]

(c) 4–6; [1] 13


The activity of two proteolytic enzymes at different pH values
Enzyme 1
Enzyme 2
Time for protein to be digested/minutes
0
10
20
30
40
50
60
70
80
0 1 2 3 4 5 6 7 8 9 10 11
pH

	AVAILABLE MARKS
7 **(a)** A large number of DNA copies can be synthesised (from a single DNA sample)/used in DNA profiling; [1]	
(b) **(i)** Heat breaks the hydrogen bonds; forms two separate strands/both strands act as template; [2]	
(ii) Stops DNA strands rejoining/initiates action of DNA polymerase/ selects areas of DNA to be copied/identifies DNA strands by flourescent/radioactive labelling; [1]	
(iii) DNA polymerase; [1]	
(iv) Free nucleotides; [1]	
(c) **Any three from** • mixture is cooled (to 40 °C) to allow primers to bind • temperature is increased and DNA polymerase is added • each side of the separated DNA acts as a template • nucleotide bases are organised according to their complementary base pairing (A–T, C–G, T–A, G–C) • nucleotides are held in place by hydrogen bonds between the complementary bases • adjacent nucleotides become attached to each other via condensation reactions between the phosphate groups and deoxyribose sugar/formation of phosphodiester bonds [3]	
(d) **(i)** Heat could break the bonds (e.g. disulphide, hydrogen, ionic) that hold the enzyme in shape/disrupt the enzyme's active site; [1]	
(ii) Use more thermally-stable (immobilised) enzyme/use enzymes extracted from thermophilic bacteria/other appropriate response; [1]	
(e) Contamination of original sample DNA/errors in the replication process/ other appropriate response; [1]	12
Section A	**60**

Section B

8 The process of osmosis:

At least four points (i.e. maximum six points)
- osmosis is the diffusion of water/passive movement of water
- through a differentially permeable membrane/phospholipid bilayer
- from a region of high water potential to a region of lower water potential
- water potential has two components, the solute potential and the pressure potential/$\psi_{cell} = \psi_s + \psi_p$
- water potential of pure water is zero since all of the water molecules are free/water potential is a measure of the free energy of the water molecules in a system
- in solutions, some of the water molecules form a shell around the solutes (and are no longer free)/reference to hydration shells
- the presence of solutes causes the solute potential to be negative
- pressure potential arises as a result of fluid being in a confined space/is generally positive

Effects in animal and plant cells:

At least seven points (i.e. maximum nine points)
- in a hypotonic/dilute solution cells will gain water
- animals cells will swell and eventually burst
- since animal cells have no cell wall/plant cells do not burst since they possess a cell wall
- in plant cells the protoplast swells and pushes against the cell wall
- the point at which the protoplast is just touching the cell wall is known as incipient plasmolysis
- thereafter a wall pressure/turgor develops and resists further uptake of water
- until the cell becomes fully turgid when no more water can enter
- in a hypertonic/concentrated solution cells will lose water
- animal cells may be said to crenate
- in plant cells the protoplast (cytoplasm/vacuole) shrinks and pulls away from the cell wall/cells become plasmolysed
- except at points where adjacent protoplasts are joined via plasmodesmata
- in an isotonic solution there is no net movement of water [13]

Consider QWC:

2 marks: The candidate expresses ideas clearly and fluently through well-linked sentences and paragraphs, which present relationships and not merely list features. Points 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. The account may stray from the point or may not indicate relationships. There are some errors of grammar, punctuation and spelling.

0 marks: The candidate produces an account that is of doubtful relevance, or obscurely presented with little evidence of linking ideas. Errors in grammar, punctuation and spelling are sufficiently intrusive to disrupt the understanding of the account. [2] 15

Section B	**15**
Total	**75**

New Specification

Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
2009

Biology

Assessment Unit AS 2

assessing

Module 2: Organisms and Biodiversity

[AB121]

FRIDAY 12 JUNE, AFTERNOON

MARK SCHEME

/ denotes alternative points
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Comments on mark values are given in bold
Comments on marking points are given in italics

Section A

1 Squamous epithelium;
Pulmonary;
Bohr shift;
Myoglobin; [4] 4

2 **(a)** **Any three from**

- retains the fertilised eggs inside the body preventing eggs being carried away as the tide goes out (making fertilisation more likely)/eggs protected from desiccation
- development of larval stage inside the body increases survival on the upper shore which is exposed for periods daily
- the gills are modified to absorb air and survival of up to a month out of water allows for long periods each day out of water/when the tide is out
- it has a high temperature tolerance which allows the periwinkle to survive higher temperatures when exposed to higher air temperature more sunlight
- in extremes of desiccation and temperature it cements itself to a rock providing a high tolerance to exposure to air (during periods of neap tides) [3]

(b) *L. littorea* (the edible periwinkle) has gills which are more efficient in absorbing oxygen from seawater than the gills of *L. saxatilis* (the rough periwinkle)/*L. littorea* (the edible periwinkle) releases larvae which rapidly colonise the lower shore/*L. littorea* may have a lighter shell aiding locomotion (feeding)/when *L. saxatilis* is eaten all eggs are lost/*L. littorea* may be growing faster as they are free to feed/other appropriate competitive advantage [1] 4

3 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]

Annotations:
Any two from
1. Thick (waxy) cuticle on upper epidermis;
   (increases) the waterproofing of the epidermis/reduces cuticular transpiration;
2. Double epidermal layer;
   reduces loss of water from the palisade layer/increases diffusion distance;
3. Epidermal hairs on lower epidermis;
   reduces movement of air/maintain humid air immediately outside stomata pores/reduce diffusion gradient for moisture;
4. Few stomata;
   fewer ways in which water diffuses out;
5. Sunken stomata;
   reduces movement of air/maintain humid air immediately outside stomata pores/reduce diffusion gradient for moisture;
6. Leaf curvature;
   reduces movement of air/maintain humid air immediately outside stomata pores/reduce diffusion gradient for moisture; [4] 9

4 **(a)** **Any two from**
- a species is a group of individuals normally capable of interbreeding
- to produce fertile offspring
- unable to breed with members of other groups and produce viable offspring [2]

(b) **(i)** It has a branched gut/digestive system is found throughout the body;
so food is dispersed to all parts of the body; [2]

(ii) It is thin/flat;
so there is a small diffusion distance/has a large surface area to volume ratio; [2]

(c) They will result in low earthworm densities (*not just eat earthworms*);
subsequent effect (e.g. reduced soil fertility/foodchain effect)/reduces species richness); [2] 8

5 (a)

Identification	Function
Lymphocyte;	Production of plasma cells/antibodies/ cell-mediated immunity/production of a variety of T-cells;
Polymorph (microphages);	Phagocytosis/engulf and digest pathogens (at site of infection);
Monocytes (macrophages);	Phagocytosis/engulf and digest pathogens (longer-lived and found at the site of a large infection);

[6]

(b) (i) The partial pressure of oxygen decreases at higher altitudes;
(*Do not allow decreased concentration*) [1]

(ii) Increase in the rbc count allows an increased oxygen uptake;
compensates for the reduced saturation of haemoglobin/for reduced ppO_2; [2]

(iii) Haemoglobin has a higher affinity for oxygen/oxygen dissociation curve lies to the left;
haemoglobin saturates at lower ppO_2;
or
Larger chest/lung capacity;
greater volume inhaled with each breath compensates for lower ppO_2;
or
Increased blood volume;
Increases blood oxygen carrying capacity/loading capability;
or
other appropriate response;
and its consequence; [2]

(iv) Increased rbc count increases blood viscosity/reduces blood flow/ clogging of capillaries/increase chance of clotting/increased risk of heart attack/stroke; [1] 12

6 **(a)** That the rate of transpiration is equal to the rate of water uptake (actually measured using the apparatus); [1]

(b) To prevent air collecting in the xylem vessels/air locks preventing water uptake;
the open end of the capillary tube is exposed to the air which is drawn up as the shoot takes up water;
to enable the air bubble to be moved back to the origin;
to allow the rate of transpiration to acclimatise to the surrounding conditions; [4]

(c) (i) Any three from

- transpiration is reduced when the plant is covered (with a clear plastic bag) since the air becomes more humid
- there are no air currents
- humid air reduces the diffusion gradient of moisture out of the plant/no air movement allows diffusion shells to build up
- transpiration is further reduced when the plant is covered with a black plastic bag since the stomata close in the dark
- thus the main route of water loss from the leaf is closed/only cuticular transpiration occurs [3]

(ii) $90 \times 0.8 = 72\,mm^3$;
$72 \div 10 = 0.72\,mm^3\,min^{-1}$; [2]

(d) Different shoots may be different sized/differ in the number of leaves/ differ in the size of leaves/other appropriate response; [1] 11

BLE

7 (a) **Any two from**
- eukaryotic/possesses eukaryotic feature
- plants are autotrophs/producers
- possessing chlorophyll in chloroplasts
- possessing a cellulose cell wall [2]

(b) (i) Ferns are shade-tolerant and can survive under both types of trees; [1]

(ii) Most species of flowering plant grow in the spring before the ash canopy has developed/other appropriate response; [1]

(c) **Any three from**
- more vascular plant species present under the ash canopy (than under the spruce canopy)
- more bryophyte species present under the sitka canopy (than under the ash canopy)
- more vascular plant species in total in each woodland (when compared with the number of bryophyte species)
- total number of species (bryophyte and vascular plant) similar (24 and 22) under each canopy
- in sitka the number of both plants are more similar than in the ash [3]

(d) (i) Increased variety of niches (provide shelter/cover/food for animals/nesting sites)/other appropriate response; [1]

(ii) Few herbivore species may feed on this introduced species/other appropriate response; [1]

(e) Less imported timber/used as bio fuel/change of land use from agriculture/other appropriate answer/allow converse arguments reduction in agricultural land/food production/jobs; [1]

(f) Management of hedgerows;
act as wildlife corridors;
or Set-aside areas/predator-strips;
to support a wide variety of species/"reservoirs" for natural predators;
or Soil conservation/crop rotation/use of organic fertiliser;
maintaining soil fauna and flora;
or Increased use of hay meadows/planting native species woodland;
"biodiversity hot spots" with a combination of lots of species, high levels of rarity or endemic species;
or Set up and maintain wildlife reserves (assi and sac)
maintain a wide range of ecosystems/protection of habitats;
or Appropriate description of a Biodiversity Strategy at local, regional, national or international level;
explaining the impact; [2] 12

Section A **60**

Section B

8 Any thirteen points

Atrial systole:
- excitation wave is initiated at the SA-node/cardiac muscle myogenic
- electrical impulses discharged across atrial muscle triggers atrial systole
- the remaining blood is forced into the ventricles/atrial systole "tops up" the ventricle
- electrical impulses cannot pass directly to the ventricle muscle (because of a sheet of non-conducting fibrous connective tissue between the atria and the ventricles)
- ensures ventricular systole follows atrial systole

Ventricular systole:
- AV-node "picks-up" the impulses from the atrial muscle
- impulses pass along the Bundle of His and Purkinje fibres to the ventricle wall
- ventricular systole increases pressure within the ventricles
- blood pressure increases from the base of the ventricles
- blood is forced against the AV-valves which close
  (not just closed must relate to above)
- the chordae tendinae prevent the AV-valves blowing inside out (so preventing reflux of blood into the atria)
- closure of the AV-valves causes the first heart sound
- semilunar valves are blown open
- blood exits the ventricles via the pulmonary artery/aorta

Diastole:
- ventricular diastole results in a decrease in pressure within the ventricles
- semilunar valves close as "pockets" fill with blood/ventricular pressure is less than the pressure in the artery
- closure of the semilunar valves causes second heart sound
- reflux of blood into the ventricles is prevented
- blood returns to the atria from the venae cavae or pulmonary veins
  (also during ventricular systole)
- as atria fill with blood, pressure increases/the AV-valves are pushed open during atrial diastole
- blood moves from atria to ventricles [13]

Quality of written communication:

2 marks: The candidate expresses ideas clearly and fluently through well-linked sentences, which present relationships and not merely list features. Points 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. The account may stray from the point or may not indicate relationships. There are some errors of grammar, punctuation and spelling.

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[2]	15
Section B	**15**
Total	**75**