Published Mark Schemes for GCE AS Biology

January 2010

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

MARK SCHEMES (2010)

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
January 2010

Biology

Assessment Unit AS 1

assessing

Module 1: Molecules and Cells

[AB111]

TUESDAY 12 JANUARY, MORNING

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)** A buffer solution is added; [1]

(b) Use of Biuret reagent/use of potassium hydroxide and copper sulphate;
add equal volume of Biuret or KOH to test solution/KOH followed by drops of $CuSO_4$/drops of $CuSO_4$ added down side then shake (not heated);
blue ring/purple colour;
or
Use Albustix;
dip into solution and read after 10 seconds (short time);
turns green/blue; [3]

(c) Benedict's reagent is used to test for a reducing sugar; [1] 5

2 **(a)** Water potential (ψ_{cell}) = solute potential (ψ_s) + pressure potential (ψ_p); [1]

(b) The water potentials of A and B are –100 kPa and –200 kPa respectively;
cell B has a lower water potential/cell A has a higher water potential;
water moves from A to B;
Insist on use of term 'water potential' in second point. [3]

(c) Cell B is more turgid/has a larger vacuole/may have a thicker cell wall; [1] 5

3 **(a)** **(i)** Restriction endonucleases; [1]

(ii) Specific base sequences (like GAATTC) occur at irregular intervals;
therefore they will be different distances apart; [2]

(b) Suspect B;
matching bands/matching fingerprints;
Wording must refer to bands/fingerprints not DNA/genes. [2] 5

4 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:
Any five from
- villus
- columnar epithelium
- lacteal
- crypt of Lieberkuhn
- mucosa layer
- muscularis mucosa
- submucosa layer
- external muscle [5] 10

5 **(a)** Active site; [1]

(b) **(i)** B; [1]

(ii) **Any two from**
- the shape of inhibitor B is complementary to the active site/similar shape to the substrate
- inhibitor B fits into the active site (preventing substrate entering)
- inhibitor C covers/blocks/changes the shape of the active site

Do not allow 'inhibitor is same shape as active site'. [2]

(c) Initially as substrate concentration is increased the rate of reaction increases until a point where any further increase in substrate does not increase the reaction rate;
an increase in substrate concentration in the first part of the graph increases the chances of a collision between the substrate and enzyme;
in the second part of the graph there is not enough enzyme to collide with the increased substrate/the enzyme becomes the limiting factor;
Answers to first point must include both trends.
Answers to second and third points need reference to levels of substrate present. [3]

(d) **(i)** Competitive inhibitor slows the reaction rate/competes with substrate for the active site;
non-competitive inhibitor causes a very low reaction rate/stops substrate combining with enzyme; [2]

(ii) Competitive inhibition is less effective at high substrate concentrations;
since there is a greater chance of a substrate molecule attaching to an active site;
(Allow converse argument) [2] 11

6 **(a)** **(i)** A: mitochondrion;
B: rough endoplasmic reticulum; [2]

(ii) **Any two from**
- nucleus/nucleolus/nuclear envelope
- Golgi body/smooth ER
- vacuole/vesicles/lysosomes
- centrioles
- other appropriate response [2]

(b) **(i)** A: protein/glycoprotein
B: RNA; [2]

(ii) To produce DNA;
from RNA template/which is single stranded; [2]

(c) **(i)** Mitosis;
Spelling must be precise. [1]

(ii) **Any two from**
- the virus cannot synthesise proteins
- the virus cannot synthesise nucleic acid
- it cannot metabolise/synthesise ATP
- the virus has no cell membrane (to evaginate/extend)
- the virus cannot undertake mitosis
- the virus requires a host cell to be active
- other appropriate response [2] 11

7	**(a)**	**(i)**	Three;	[1]	
		(ii)	Methionine (same distance travelled as one of the spots in the mixture);	[1]	
		(iii)	65/100 = 0.65; *Don't allow 0.65 mm.*	[1]	
	(b)	**Any three from** • the chromatogram is dried • then sprayed with ninhydrin • in a fume cupboard/ninhydrin is a carcinogen • then dried/heated (oven/hairdryer) • developed spots are purple (proline produces a yellow spot) • encircle coloured spots before they fade		[3]	
	(c)	**(i)**	Hydrolysis;	[1]	
		(ii)	Fatty acids and glycerol;	[1]	
		(iii)	Protease will hydrolyse other proteins; all enzymes are proteins;	[2]	
	(d)	**Any three from** • starch has many branches/helical arrangement • therefore many ends/loose structure which amylase can act on • cellulose consists of straight chains joined by hydrogen bonds/is not branched • cellulose has only two ends for cellulose to access/cellulose molecules are bounds to others in microfibrils and so is less accessible to the enzyme		[3]	13
			Section A		**60**

Section B

8 **(a)** Behaviour of chromosomes during a cell cycle with mitosis:

Any eight points

- during G1/and G2 of interphase the chromosomal material is unwound/ appears as chromatin
- some of this is inactive, heterochromatin
- while some is active, euchromatin
- during the S phase of interphase DNA is replicated
- chromosomes are replicated as new histones bind to the DNA/DNA replication is semi-conservative
- during prophase chromosomes condense (coil and fold up) and become apparent
- each chromosome appears as a pair of chromatids
- during metaphase chromosomes attach to the spindle fibres at the cell equator
- attachment occurs via their centromeres
- during anaphase chromatids are pulled apart/separate
- and move to opposite poles
- during telophase chromosomes begin to unwind again/change to diffuse active form/chromatin
- cells divide into two during cytokinesis halving the amount of chromosomal material
- daughter cells contain the same chromosome number as the parent cell [8]

(b) Different behaviour of chromosomes during mitosis and meiosis:

Any five points

- mitosis involves the separation of the chromatids into new daughter cells
- thus maintaining the same chromosome number as the parent cell (allow if not awarded in part (a))
- the daughter cells are genetically identical to the parent cell
- during prophase I of meiosis the homologous chromosomes pair to form bivalents
- while chiasmata (points of fusion) occur between chromatids of the homologous pair
- the consequence of this is the recombination/crossing-over of alleles on different chromosomes
- during the first division of meiosis the homologous chromosomes are separated into two intermediary daughter cells
- since the homologous pairs arrive randomly on the spindle/the chromosomes are independently assorted when subsequently separated
- in the second division of meiosis the chromatids are separated
- meiosis results in the production of haploid cells
- which are genetically variable [5]

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.

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**

Rewarding Learning

ADVANCED SUBSIDIARY (AS)
General Certificate of Education
January 2010

Biology

Assessment Unit AS 2

assessing

Module 2: Organisms and Biodiversity

[AB121]

TUESDAY 19 JANUARY, 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 Chitin;
lignin;
suberin/casparian strip; [3] 3

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

(b) *erminea*; [1]

(c) A group of actually or potentially interbreeding natural populations;
producing fertile offspring; [2] 4

3 **(a)** Water insulates the air column from temperature changes that could cause expansion/contraction of the air column; [1]

(b) **(i)** Selection of data and substitution into equation (9.6 – 8)/10;
conversion to percentage = 16 % (× 100); [2]

(ii) Exhaled; [1] 4

4 **(a)** **Any three from**
- mass air flow via the bronchiole (ventilation) to the gas exchange surface
- rounded shape of the alveoli increase the surface area
- the epithelium of the alveoli is squamous/thin
- the endothelium of the blood capillaries is squamous/pavement/thin
- the close proximity of the capillaries to the wall of the alveoli
- many capillaries around the alveoli [3]

insist on interpretation of structures visible in the diagram

(b) Goblet cells produce mucus to trap microbes;
macrophages engulf microbes that have not been trapped by mucus; [2] 5
not simply destroying microbes

5 (a) (i) Any two from

- plants in the hedge provide food and shelter
- nesting sites
- offering more ecological niches/creates habitats
- they allow a means of dispersal and migration to other habitats/act as wildlife corridors
- hedges reduce soil erosion
- associated predator strips may be used as pest control
- other appropriate response [2]

(ii) Promote the use of polyculture/maintain set-aside areas/conserve existing woodland/promote the use of organic fertiliser as an alternative to chemical fertiliser/reduction in grazing density/maintain meadows by only allowing grazing in summer months/cutting grass for hay (species-rich meadows) rather than for silage/planting broad-leaf trees in areas less accessible to farm machinery/reduce use of broad spectrum pesticides/other appropriate example; [1]

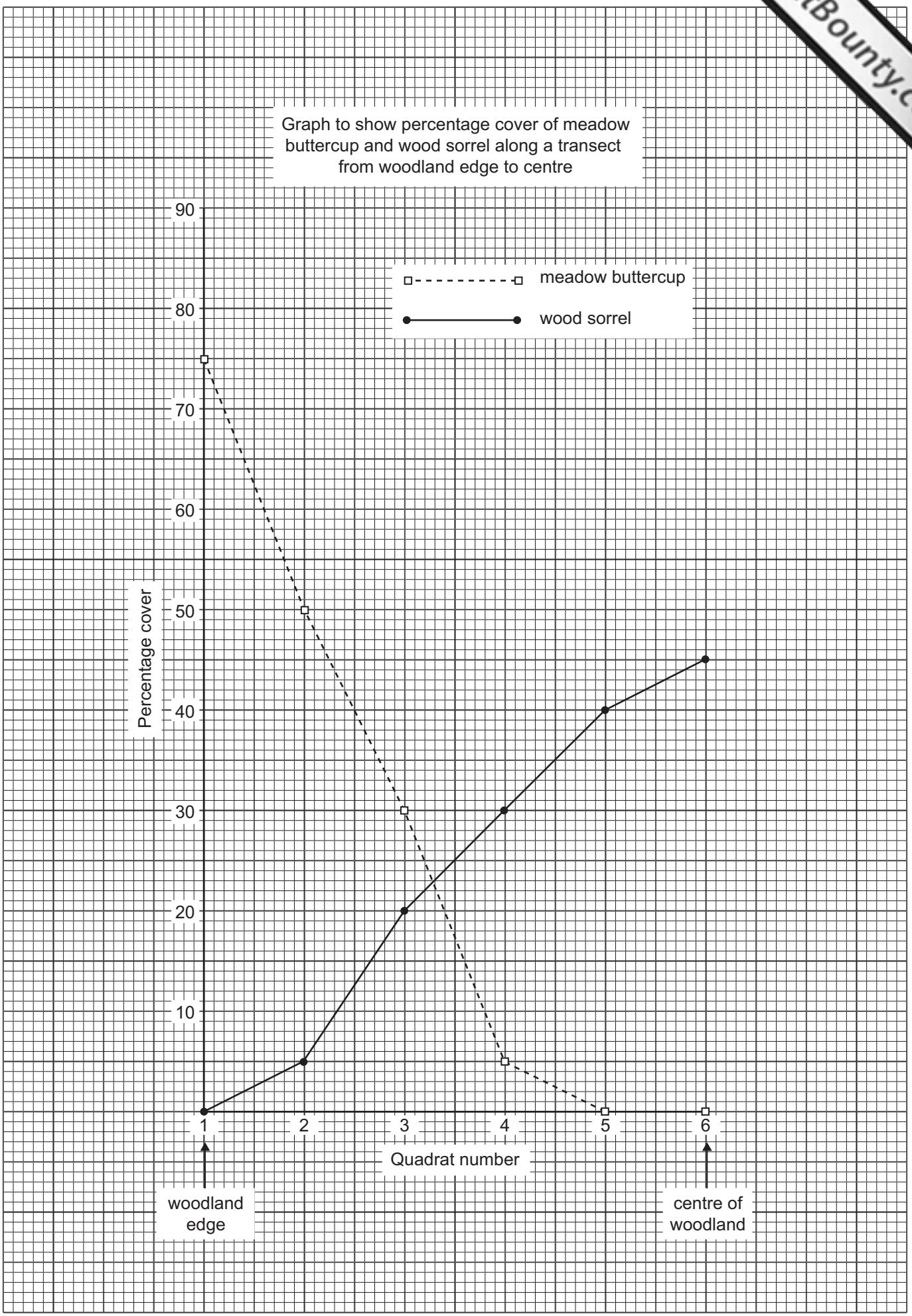
(b) (i) Environmental gradient/zonation of vegetation; [1]

(ii) It may be difficult to identify individual plants due to their spreading nature/it takes better account of total biomass/plants may be of different size; [1]

(c) (i) Caption;
selection of graph, line graph/kite diagram/bar chart;
scaling of the graph (using the graph paper to maximal effect) and quadrat number as the independent variable along the *x*-axis;
axes labelled with annotations to show edge and centre of woodland;
points accurately plotted and joined with straight line/kites accurately constructed;
lines/kites identified with key/labels; [6]
Caption must include both species and area of shading

(ii) Wood sorrel is not very abundant at the woodland edge, but becomes more abundant as you move towards the centre of the woodland;
meadow buttercup is abundant at the woodland edge, but decreases in abundance as you approach the centre of the woodland; [2]

(iii) Wood sorrel is adapted to live in low light conditions, while meadow buttercup is not/edaphic features in woodland suits wood sorrel, but not meadow buttercup/any other appropriate answer; [1] 14



6 **(a)** A: ventricular systole;
B: ventricular diastole/atrial systole; [2]
insist on name of stape not by description

(b) Diagram A (shows the semi-lunar valves open);
the semi-lunar valves are open at 0.15 s and close at 0.39 s (shown in the graph); [2]

(c) **(i)** A–V valves close; [1]

(ii) Semi-lunar valves open; [1]

(iii) The A–V valves have chordae tendinae attached to the ventricular wall; so cannot be forced open by "blowing inside out" when the pressure increases in the ventricles/the increasing pressure puts more tension on the chordae tendinae to keep the A–V valve tightly closed; [2]

The semi-lunar valves are pockets on the artery walls;
the increasing pressure within the contracting ventricle causes the semi-lunar valves to be pushed flush against the artery wall; [2]

(d) Between 0 and 0.05 seconds the atrium is contracting so the decreasing volume causes an increase in pressure;
at 0.2 seconds the relaxed atrium is beginning to fill with blood, but the A–V valves are still closed; [2] 12

7 (a) (i) Any two from

- there is a reduction in soot
- reduction in sulphur dioxide
- levels of both pollutants remain low from 1970 onwards (reference to data)
- reduction in the black form of the moth [2]

(ii) Any two from

- the black form of the moth is decreasing (from 1980, reference to data)
- suggesting the speckled form is now more likely to be camouflaged
- low sulphur dioxide levels (from 1970) (reference to data)
- the lichen grows when sulphur dioxide levels reduced (stops lichen destruction) [2]

(b) Any two from

- the lichen grows slowly
- the soot was only slowly removed from the tree bark
- the black form remains camouflaged during this period
- there were few speckled forms in the population to breed
- sulphur dioxide levels had only significantly decreased by 1980 (still decreasing during 1970 to 1980)
- other appropriate response [2]

(c) Any two from

- changes in the frequencies are due to environmental changes
- speckled form is favoured in unpolluted environments/dark form is favoured in polluted areas
- differential survival influences future population [2] 8

8	(a)	(i)	Both have a non-protein prosthetic group attached to the polypeptide chain(s);	[1]	
		(ii)	The percentage of total air pressure exerted by oxygen;	[1]	
	(b)	(i)	Myoglobin stores O_2;	[1]	
		(ii)	**Any two from** ● working muscle has a high rate of respiration ● myoglobin only releases oxygen in conditions of very low ppO_2 ● providing more oxygen to the working muscle/allowing aerobic respiration to continue	[2]	
	(c)	(i)	C; during exercise, respiration produces CO_2; which causes the Bohr shift/causes the curve to move to the right;	[3]	
		(ii)	At 6 kPa the ppO_2 is 70%; at 2 kPa the ppO_2 is 14%, a difference of 56% **[Values used should be those in (i) above, and the difference consequential to the values selected]**	[2]	10
			Section A		**60**

Section B

9 (a) Any three from

- transpiration is the evaporation of water/water loss from the aerial parts of a plant
- by evaporation from the moist surfaces of mesophyll cells
- drawn up to the leaf via the xylem/drawn across the leaf by the apoplast pathway
- and the subsequent diffusion from sub-stomatal air spaces out of the leaf
- stomatal pores are the main site of water loss in the leaf with a small amount of water being lost via cuticular evaporation [3]

(b) Ten points to include at least three from each section

Temperature:
- an increase in temperature causes an increase in transpiration
- at higher temperatures the water molecules gain more kinetic energy
- as a result it is easier for the water to evaporate from the mesophyll surfaces
- and diffusion out of the leaf is faster
- high temperature causes water stress/wilting of the leaf

Humidity:
- an increase in humidity causes a decrease in transpiration
- the concentration gradient between the outside air and the air inside the leaf decreases/diffusion shells builds up
- there is no diffusion without a diffusion gradient
- water will then not evaporate from the mesophyll cell surfaces
- as water vapour builds up in the sub-stomatal air space

Wind speed:
- an increase in air speed over the leaf causes an increase in transpiration
- the concentration gradient between the outside air and the air inside the leaf increases/diffusion shells dispersed/water vapour blown away from leaf
- maintaining a large (steep) diffusion gradient
- water evaporates rapidly into the sub-stomatal air spaces in a suitable ambient temperature

- stomatal pores close to conserve water **[Allow once in either section]** [10]

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.

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