Published Mark Schemes for GCE AS Biology

Summer 2010

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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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ADVANCED SUBSIDIARY (AS)
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Biology

Assessment Unit AS 1

assessing

Module 1: Molecules and Cells

[AB111]

THURSDAY 3 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)** Two layers;
with circles outside and 'tails' inside; [2]

(b) **Any two from**
- stabilise/reduce fluidity of the membrane structure
- adhesive connections between cells
- used in cell recognition/antigens
- form transmembrane channels (hydrophilic/facilitated diffusion)
- for active uptake/carriers
- act as enzymes
- involved in signalling
- receptor sites/responses to various stimuli [2]

(c) Glycoprotein/carbohydrate/cholesterol/lipoprotein/glycolipid; [1] 5
Not just lipid

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

(b) C, B, D, A; [1]

(c) Centrioles present/asters obvious/no cell wall evident; [1]

(d) **Any two from**
- chromosomes not in homologous pairs/bivalent
- only two cells produced in stage A/not four cells produced/only one division
- no evidence of chiasmata *[allow description of chiasmata]* [2] 5

3 Maximising photosynthesis:

Any three from

- transparent upper epidermis allows light through to underlying palisade cells
- palisade mesophyll cells are tightly packed (to facilitate light absorption)
- palisade cells are densely packed with chloroplasts/chloroplasts are accumulated at the top of the palisade cells
- spongy mesophyll consists of loosely packed cells/creates air spaces/ facilitates gas exchange
- xylem provides water (for photosynthesis)
- stomata allow gas exchange
- thin to reduce distance for gas exchange
- large surface area to absorb more light [3]

Minimising transpiration:

Any two from

- stomata located on lower surface/away from source of radiation (heat)
- epidermal cells are covered with a (waterproof) waxy cuticle
- stomata close at night/during times when there is excessive water loss
- guard cells control closing of stomata [2] 5

4 **(a)** A: rough endoplasmic reticulum/ribosome;
B: mitochondria/cristae;
C: euchromatin; [3]

(b) Scale bar = 20 mm;
conversion to μm (× 1000) = 20 000 μm;

$$\text{magnification} = \frac{20\,000}{2} = \times\, 10\,000;$$

[3]

(c) Muscles; [1]

(d) **Any two from**

- glycogen is insoluble and so osmotically inactive/remain in the cell
- glycogen is highly branched and therefore compact/compact so takes up less space
- branching/numerous terminal ends facilitates hydrolysis [2]

Insist on property and function

(e) Starch/amylase/amylopectin; [1] 10

5 **(a)** **(i)** **Any two from**

- heating produces separate strands (of the DNA molecule)
- by breaking the hydrogen bonds (between the complementary bases)
- allowing both sides of the DNA molecule to act as a template [2]

(ii) Stops the two sides of the DNA rejoining/DNA polymerase cannot work on a template that is completely single stranded/marks the start and end of the region to be copied; [1]

(iii) Allows the primers to anneal to the single stranded DNA; [1]

(b) Composed of phosphate group, deoxyribose sugar;
and adenine, thymine, cytosine or guanine; [2]

(c) **(i)** Showing a staggered cut at the correct positions; [1]

(ii) Appropriate description of staggered (sticky) ends/unpaired bases at end (e.g. AATT or TTAA); [1]

(d) **Any three from**

- short length of nucleic acid with known/specific base/nucleotide sequence
- this is made radioactive/fluorescent
- sample DNA is broken into two single strands
- probe attaches to complementary bases on the DNA sample
- DNA fragment is located using X-ray film/ultraviolet light [3] 11

6 **(a)** **(i)** A blue filter transmits blue light/blue filter is at the opposite end of the spectrum/complementary to red;
blue light is absorbed by a red solution; [2]

(ii) Sufficient solution in the cuvette to ensure the light is intercepted/the cuvette is clean/no finger prints/same cuvette used/cuvette orientated in same way/ribbed sides of cuvette to side/other appropriate answer; [1]

(iii) A blank containing water only is used to set the percentage transmission to 100%/to reset the colorimeter;
a sample is placed in a cuvette and a reading of the percentage transmission is taken;
or
Red pigment absorbs light/affects transmission;
the more pigment in solution the lower the % transmission (or converse);
or
The more red pigment in solution the lower the % transmission;
use of calibration curve to determine the exact amount of pigment; [2]

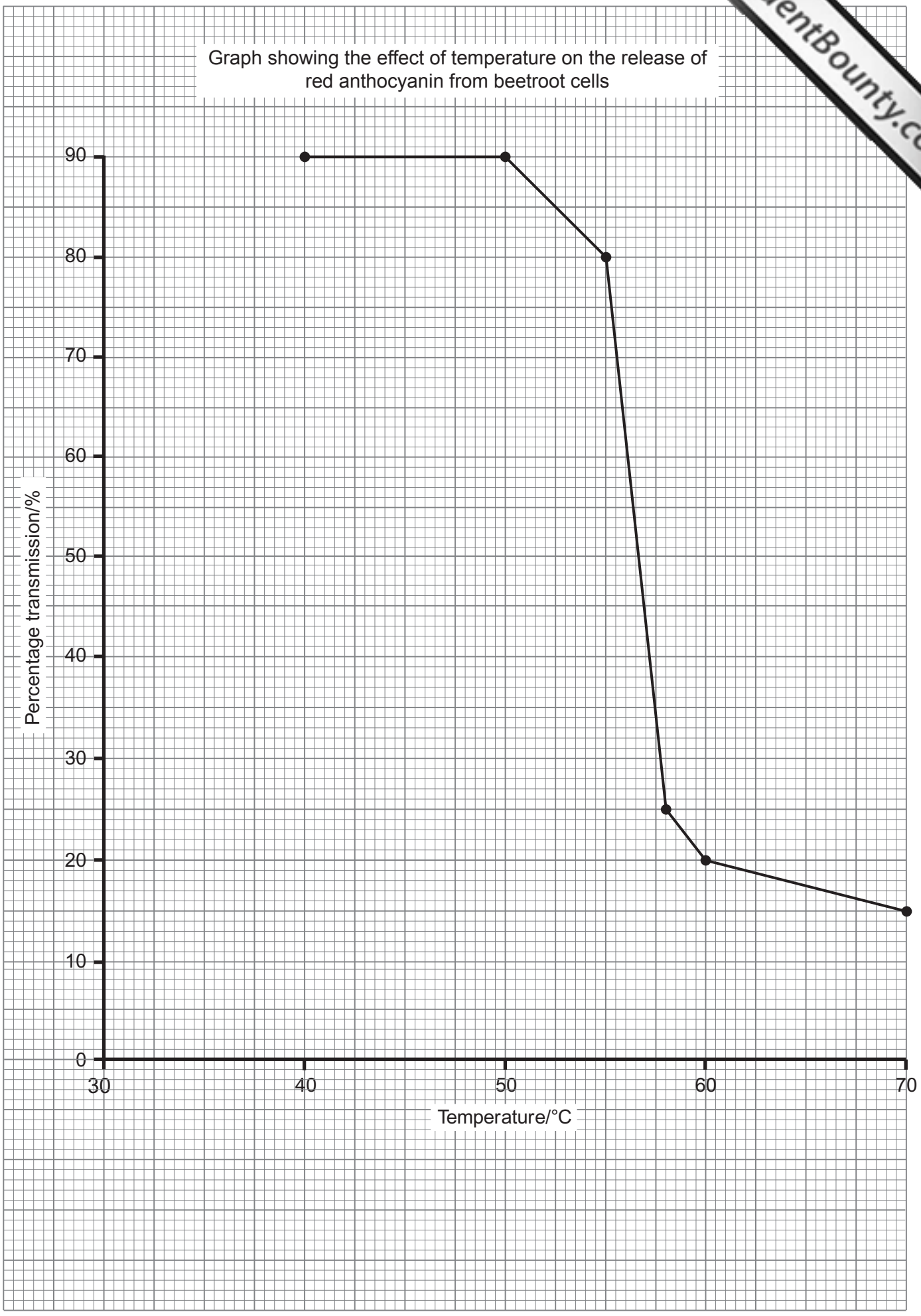
(b) Caption *[caption must refer to temperature, pigment and tissue]*;
scaling of the graph (using the graph paper to maximal effect) and temperature as the independent variable along the *x*-axis;
labels and units of measurement shown;
points accurately plotted;
and joined with short straight lines; [5]

(c) **(i)** Below 50 °C/55 °C transmission remains the same (no pigment is released);
as temperature increases transmission is reduced (pigment is released); [2]

(ii) **Any two from**

- release of red pigment reduces % transmission/is greater at higher temperature
- membrane integrity maintained up to 55 °C
- above 55 °C, the membrane becomes permeable to the pigment
- possibly due to denaturation of membrane proteins
- increase fluidity of phospholipids
- other appropriate response [2]

14



7 **(a)** **(i)** Partially close the iris diaphragm/use a diffusing filter/use a lower powered bulb/use a dimmer switch/addition of a stain/move light source further away/other appropriate response; [1]

(ii) The cell membrane/protoplast will be detached from the cell wall; [1]

(b) The vacuole/cytoplasm shrinks; [1]

(c) **(i)** Onion cells –1680 to –1700 kPa;
Elodea –650 to –700kPa; [2]
Insist on negative sign

(ii) At 50% plasmolysis (incipient plasmolysis) the mean pressure potential is zero;
so solute potential (of tissue) is equal to water potential (of the immersing solution); [2]

(iii) The onion cells store sugars;
while *Elodea* may store insoluble starch;
or
Onion cells store sugars;
which are soluble/decrease solute potential;
or
Elodea lives in fresh water;
which has a high solute potential/high water potential; [2]

(d) *Elodea* cells become dehydrated/lose water/become plasmolysed; [1] 10

Section A **60**

Section B

8 Any thirteen points

First graph:
Independent variable:
- temperature

Description of trends:
- at low temperatures, an increase in temperature causes an increase in activity
- activity reaches a maximum at the optimum temperature/at high temperatures the enzyme activity decreases rapidly

Explanation:
- at lower temperatures, an increase in temperature causes enzyme and substrate to move more quickly/to have greater kinetic energy so that they collide more frequently/form more enzyme-substrate complexes
- at higher temperatures, bonds that maintain enzyme structure (tertiary structure of protein) are broken/the specific shape of the active site is altered

Second graph:
Independent variable
- pH

Description of trends:
- activity is at a maximum at the optimum pH
- an increase or decrease in pH causes a decrease in enzyme activity

Explanation:
- at optimum pH the shape of the active site best facilitates the attachment of the substrate/at non-optimal pH the substrate attaches less readily
- ionic bonds in the tertiary structure/charges in R-groups may be disrupted with changes in pH

Third graph:
Independent variable:
- substrate/enzyme concentration

Description of trends:
- at low concentrations, an increase in concentration increases enzyme activity
- at high concentrations, an increase in concentration does not cause a further increase in enzyme activity/activity levels off/enzyme becomes the limiting factor (for substrate concentration)

Explanation:
- an increase in concentration increases the chance of collisions between enzyme and substrate/enzyme-substrate complexes being formed
- at high substrate concentrations, the enzymes are fully saturated by substrate molecules and the rate cannot increase any more/at high enzyme concentrations, levelling-off only occurs if the substrate is not in excess (i.e. is limited) [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.

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
2010

Biology

Assessment Unit AS 2

assessing

Module 2: Organisms and Biodiversity

[AB121]

WEDNESDAY 16 JUNE, MORNING

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 A Prokaryotae/Monera [*not bacteria*];
B Protoctista [*not protists, not protozoa*];
C Plantae;
D Fungi;
E Animalia; [5] 5

2 Use of herbicides:
Any two from
- removal of weed/native/non-crop plant species [*not kill plant species*]
- food plants for animal species removed/negative effect on food chains
- herbicides may be toxic for some animal species [2]

Use of artificial fertilisers:
Causes soil erosion/poor soil crumb structure/poor soil aeration (drainage)/acidification of the soil;
influencing range of soil animals/plants;
or
Promotes the growth of selected/crop plant species;
loss of plants adapted to nutrient poor soils;
or
Fertiliser run-off in waterways/eutrophication;
death of aquatic plant/animal species; [2] 4

3 **(a)** Thrombin;
fibrinogen;
fibrin; [3]

(b) Polymorphs engulf any bacteria/phagocytosis at the site; [1] 4

4 (a) Any two from

- allow expansion when blood is forced out of the heart
- and recoil to maintain pressure (during ventricular diastole) [*not contracting*]
- development of a pulse wave [*insist on this terminology*] [2]

(b) Any two from

- the smooth muscle contracts to restrict blood flow into the organ
- when relaxed the artery is dilated and more blood flows into the organ
- this provides control of the distribution of the blood
- to match the needs of the organs during period of activity/inactivity [2]

(c) Any two from

- blood in the veins has little pressure
- the valves prevent backflow
- when the veins are squeezed by the surrounding muscles/due to gravity [2] 6

5 (a) All data included;
caption fully explains the table contents (2 groups, pulse rates, recovery/ exercise);
logical construction either reading across columns down rows;
row/column heading explanatory;
time units within headings provided; [5]

A table recording the pulse rates of two athletes and two non-athletes during a two minute recovery period after exercise

	Pulse rate per 30 s after 200 m run			
	at 0 to 30 s	**at 30 to 60 s**	**at 60 to 90 s**	**at 90 to 120 s**
Athletes	**75** **78**	**55** **53**	**40** **42**	**30** **28**
Non-athletes	**71** **67**	**64** **58**	**58** **46**	**39** **41**

(b) The athletes had the higher pulse rates:
They ran faster/were more active during the running/more muscle mass;

The largest decrease in pulse:
The athletes recover faster/fitter;

The athletes had the lower pulse rates after $1\frac{1}{2}$ minutes:
The athletes had the lower resting pulse rate/their larger hearts pump out more blood with each pulse/heart more efficient (larger stroke volume)/ non-athletes have yet to recover;

More appropriate to compare percentage fall in pulse rates:
The initial pulse rates are different; [4] 9

6 (a) Any three from

- stomatal pores (allow for direct diffusion of CO_2 into the leaf interior)
- sub-stomatal air spaces (greatly speeds up CO_2 diffusion)
- thinness of leaf reduces the diffusion distance between the atmosphere and mesophyll
- mesophyll provides a large surface area
- diffusion gradient maintained by photosynthetic mesophyll cells/ chloroplasts [3]

(b) So that atmospheric air could have no effect on the indicator solution/only air in the tube can react with the indicator; [1]
Not just leakage

(c) Control experiment to confirm that any change in the hydrogen carbonate indicator is due to the presence of the leaf/not due to light degradation of the indicator/could change with time;
Not just control/for comparison [1]

(d) Carbon dioxide has been added to the experimental tube;
suggesting that respiration is occurring at a faster rate than photosynthesis; [2]
Not just that it is respiring only

(e) 8 arbitrary units;
at this light intensity the rate of respiration and photosynthesis are equal;
as the carbon dioxide levels have not changed in the tube; [3] 10

7 (a) (i) Both tissues are found within (a ring of) vascular bundles;
xylem on the inside phloem on the outside (of each bundle); [2]

(ii) Any two from

- the tube cells are joined end to end/forming continuous structures through the plant
- their end walls are perforated/forming sieve plates
- associated with companion cells
- there is a little cytoplasm (metabolically active tissue)/few organelles/ no nucleus/plasmodesmata link the tube cells with the companion cells
- microtubules pass through pores in the sieve plate/between sieve tubes
- thick secondary cell walls remain unlignified [2]

(b) (i) Any two from

- the strengthened walls will not collapse
- under tension/negative pressure (as water is pulled up the stem by transpiration)
- lignified xylem provides support for the whole plant

Not just strength/support [2]

(ii) Any two from

- it requires time for the vessels to become fully lignified
- rings and spirals allow for stretching/elongation
- in young stems which are still growing
- the larger older vessels must be able to withstand greater tension
- older stems provide more support for branches/leaves/inflorescence [2]

(iii) Pits allow water to flow out to surrounding tissues/lateral diffusion;
Not osmosis [1] 9

8 **(a)** **(i)** Fields with areas left unsown;
produces the most chicks overall/late chicks; [2]

(ii) **Any two from**

- for the widely spaced and normal spaced drills most chicks are produced early (in the breeding season)/late broods less successful
- there is little difference between the widely spaced drills and unsown plots in the production of early chicks
- the normal spaced drills produce the most early chicks/early broods similar for all three/late broods more variable
- widely spaced sowing is the least successful strategy overall
- other appropriate trends

[*need to differentiate small and major differences in the data*] [2]

(b) The fields with unsown areas have more insects;
and therefore more food for the chicks/skylarks are insectivores; [2]

(c) **(i)** The both strategies value is 12.4;
the increase 12.4 – 4.0 = 8.4;
percentage increase (8.4 ÷ 4.0) × 100 = 210%; [3]

(ii) The number of each species;
Simpson's Index requires a species list/total number of species/total number of birds;
[2]

(iii) After changes, the index would be lower;
indicating an increase in biodiversity; [2] 13

Section A **60**

Section B

9 **(a)** Increasing surface area increases the diffusion rate;
a large (steep) concentration gradient increases the rate of diffusion;
decreasing diffusion distance increases diffusion rate/increased diffusion distance reduces the effectiveness of a large surface area and large diffusion gradient; [3]

(b) **Any 10 from**

Large surface area for the exchange surface is achieved by:
- large numbers of alveoli
- spherical shape of the alveoli/sacculation of their sacs
- extensive network of blood capillaries
- the presence of surfactant prevents collapse of the alveoli (which would reduce surface area)
- large surface area of red blood cells to pick up oxygen
- red blood cells have a large surface area due to their biconcave disc structure

Large (steep) concentration gradient is maintained by:
- ventilation of the lungs 'freshens' the air in the alveoli
- increases concentration of oxygen in the alveolus/decreases carbon dioxide concentration
- blood brought back to the alveolus has a low concentration of oxygen/ high concentration of carbon dioxide
- this allows diffusion of oxygen into blood/carbon dioxide out of the blood
- additionally there is a rich blood supply
- blood loaded with oxygen is quickly removed/haemoglobin has a high affinity for oxygen (at rich partial pressure of oxygen in the lung) *(allow converse for carbon dioxide)*

Short diffusion distance is achieved by:
- single layer of cells lining the alveolus/capillary
- squamous (flattened) epithelium of the alveoli (reduces the thickness of the walls)
- squamous endothelium of the capillaries reduces the thickness of the walls
- capillaries and alveolar walls being very close to each other
- red blood cells within the capillary are close to the endothelial cells

[10]

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1 mark:
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Section B | **15**

Total | **75**