

MARKSCHEME

May 2003

BIOLOGY

Standard Level

Paper 2

*This markscheme is **confidential** and is the property of the International Baccalaureate and must **not** be reproduced or distributed to any other person without the authorization of IBCA.*

General Marking Instructions

Subject Details: **Biology SL Paper 2 Markscheme**

Mark Allocation

Candidates are required to answer **ALL** questions in Section A total **[30 marks]** and **ONE** question in Section B **[20 marks]**. Maximum total = **[50 marks]**.

General

A markscheme often has more specific points worthy of a mark than the total allows. This is intentional. Do not award more than the maximum marks allowed for part of a question.

When deciding upon alternative answers by candidates to those given in the markscheme, consider the following points:

- ◆ Each marking point has a separate line and the end is signified by means of a semicolon (;).
- ◆ An alternative answer or wording is indicated in the markscheme by a “/”; either wording can be accepted.
- ◆ Words in (...) in the markscheme are not necessary to gain the mark.
- ◆ The order of points does not have to be as written (unless stated otherwise).
- ◆ If the candidate’s answer has the same “meaning” or can be clearly interpreted as being the same as that in the mark scheme then award the mark.
- ◆ Mark positively. Give candidates credit for what they have achieved, and for what they have got correct, rather than penalizing them for what they have not achieved or what they have got wrong.
- ◆ Occasionally, a part of a question may require a calculation whose answer is required for subsequent parts. If an error is made in the first part then it should be penalized. However, if the incorrect answer is used correctly in subsequent parts then **follow through** marks should be awarded. Indicate this with “**ECF**”, error carried forward.
- ◆ Units should always be given where appropriate. Omission of units should only be penalized once. Indicate this by “**U-1**” at the first point it occurs. Ignore this, if marks for units are already specified in the markscheme.
- ◆ Do not penalize candidates for errors in significant figures, unless it is specifically referred to in the markscheme.

Section B

Extended response questions - quality of construction

- ◆ Extended response questions for SL P2 carry a mark total of 20. Of these marks, *[18 marks]* are awarded for content and *[2 marks]* for the quality of construction of the answer.
- ◆ Two aspects are considered:
 - expression of **relevant** ideas with clarity
 - structure of the answers.
- ◆ **ONE** quality mark is to be awarded when the candidate satisfies **EACH** of the following criteria. Thus **TWO** quality marks are awarded when a candidate satisfies **BOTH** criteria.

Clarity of expression:

The candidate has made a serious and full attempt to answer all parts of the question and the answers are expressed clearly enough to be understood with little or no re-reading.

Structure of answer:

The candidate has linked relevant ideas to form a logical sequence in at least two parts [(a), (b), etc.] of the question.

- ◆ It is important to judge this on the overall answer, taking into account the answers to all parts of the question. Although, the part with the largest number of marks is likely to provide the most evidence.
- ◆ Candidates that score very highly on the content marks need not necessarily automatically gain the two points for the quality of construction (and vice versa).
- ◆ The important point is to be consistent in the awarding of the quality points.

SECTION A

1. (a) as the diameter of the molecule increases the permeability / relative ability to move decreases (*accept converse*);
the relationship is logarithmic / non-linear / negative;
for molecules above 0.6 (± 0.1) nm relative ability to move changes little / for molecules below 0.6 (± 0.1) nm relative ability to move changes rapidly; **[2 max]**
- (b) “U-1” rule applies.
- (i) 10 mmol cm⁻³ cells hr⁻¹ (*accept values within ± 5*); **[1]**
- (ii) 370 mmol cm⁻³ cells hr⁻¹ (*accept values within ± 10*); **[1]**
- (c) (i) glucose uptake in facilitated diffusion levels out whereas uptake in simple diffusion does not level out / continues to rise;
glucose uptake increases in both;
glucose uptake is higher in facilitated diffusion (than in simple diffusion);
glucose uptake in simple diffusion is constant / linear whereas in facilitated diffusion uptake increases rapidly at the beginning / increase is not constant; **[3 max]**
- (ii) little / no change in glucose uptake;
most / all (protein) channels in use; **[2]**
2. (a) a gene / trait / allele carried on a sex chromosome / X and Y/X/Y; **[1]**
- (b) recessive;
evidence from the pedigree;
e.g. 2nd generation–2 and 3 do not have the condition but have one child who does; **[2]**
- (c) (i) X^aY (where a = condition); **[1]**
- (ii) X^AX^a or X^AX^A where A = normal, a = condition (*must have both*); **[1]**
(*If upper case letter and lower case letter are reversed then the ECF rule applies.*)

3. (a) (i) capture–mark–release–capture / capture–recapture / cohort method; [1]
- (ii) *To receive full marks there must be reference to the use of Lincoln index / similar equation.*
capture animals;
mark / tag animals;
release again;
recapture after an appropriate time period *e.g.* next night, a few nights later;
use of Lincoln Index equation / similar type of equation;
or
count the number of pits made by a bandicoot in a night;
count the total number of pits made in a night;
estimate the number of bandicoots based on number of pits made in a night; [3 max]
- (b) primary consumer / second trophic level;
feeds on plant material;

secondary consumer / third trophic level;
feeds on invertebrates; [2 max]
4. (a) Q: anaerobic respiration / fermentation;
R: aerobic respiration / Krebs's (citric acid) cycle; [2]
- (b) A: pyruvate / 3-oxopropanoate;
D: carbon dioxide; [2]
- (c) mitochondrion; [1]
5. (a) the skin / mucous membranes act as a physical barrier;
skin has several layers of tough / keratinised cells;
the skin is dry discouraging the growth and reproduction of pathogens;
skin / mucous membranes hosts natural flora and fauna which compete with pathogens;
the enzyme lysozyme is present on the skin's surface to break down pathogens;
the pH of skin / mucous membranes is unfavourable to many pathogens;
skin is a continuous layer;
mucus traps pathogens / sticky; [3 max]
Award [2 max] if both skin and mucous membrane not mentioned.
- (b) antibiotics block metabolic pathways in bacteria / inhibit cell wall formation / protein synthesis;
viruses use host cell metabolic pathways / do not possess a cell wall and so are not affected by antibiotics;
antibiotics are not used to treat viral diseases because they are ineffective and may harm helpful bacteria; [2 max]
No credit for answers that state antibiotic means against life nor for the statement that viruses are not alive.

SECTION B

6. (a) easy to prepare a sample for;
living material can be viewed / living processes (e.g. cytoplasmic streaming) can be seen;
colour images can be seen;
relatively portable;
relatively cheap;
larger field of view; **[3 max]**
- (b) *Award [1] per difference.*
plant cells:
have cell walls, animal cells do not;
have plastids / chloroplasts, animal cells do not;
have a large central vacuole, animal cells do not;
store starch, animal cells store glycogen;
have plasmodesmata, animal cells do not;
animal cells:
have centrioles, plant cells do not;
have cholesterol in the cell membrane, plant cells do not;
plant cells are generally have a fixed shape / more regular whereas animal cells are more rounded; **[6 max]**
- (c) *phospholipid structure*
hydrophobic tail / hydrophilic head;
head made from glycerol and phosphate;
tail made from two fatty acids;
saturated / unsaturated fatty acid (in tail);
arrangement in membrane
phospholipids form a bilayer;
heads face outside the membrane / tails face inside the membrane / hydrophobic interior / hydrophilic exterior of membrane;
A suitable annotated diagram may incorporate all or many of the above points. Award [5 max] for a suitable diagram that is labeled correctly.
phospholipids held together by hydrophobic interactions;
phospholipids layers are stabilized by interaction of hydrophilic heads and surrounding water;
phospholipids allow for membrane fluidity / flexibility;
fluidity / flexibility helps membranes to be (functionally) stable;
phospholipids with short fatty acids / unsaturated fatty acids are more fluid;
fluidity is important in breaking and remaking membranes (e.g. endocytosis / exocytosis);
phospholipids can move about / move horizontally / “flip flop” to increase fluidity;
hydrophilic / hydrophobic layers restrict entry / exit of substances; **[9 max]**

(Plus up to [2] for quality)

7. (a) *Features and their significance may include:*
surface tension – allows some organisms (e.g. insects) to move on water’s surface;
polarity / capillarity / adhesion – helps plants transport water;
transparency – allows plants to photosynthesise in water / allows animals to see;
(excellent) solvent – capable of dissolving substances for transport in organisms;
(excellent) thermal properties (high heat of vaporization) – excellent coolant;
ice floats – lakes / oceans do not freeze, allowing life under the ice;
buoyancy – supports organisms;
structure – turgor in plant cells / hydrostatic skeleton;
habitat – place for aquatic organisms to live;
involved in chemical reactions in organisms; [6 max]
Each feature or property must be related to living organisms in order to receive a mark.
- (b) diagram of peptide bond drawn;
condensation / dehydration synthesis: water produced (when two amino acids joined);
hydrolysis: water needed to break bond;
dipeptide → amino acids - hydrolysis occurs;
amino acids → dipeptide - condensation occurs; [4 max]
- (c) *Examples and application:*
pectinase;
obtained from citrus fruits / tomatoes / apples;
used in fruit juice production;
breaks down pectin allowing cells to separate;
assisting in juice formation;
juice formed is clear;
high juice yield using enzyme;
- 2nd enzyme:*
name;
source;
use;
mode of action;
advantage of using enzyme;
details of enzyme use; [8 max]
- Possible second example could be meat tenderising – papain from papaya fruit / bromelain from the pineapple plant, biological washing powders – amylases / proteases / lipases, glucose biosensors – glucose oxidase / peroxidase, cheese making – rennin, high fructose syrups – glucose isomerase, breadmaking – fungal amylases / fungal proteases, DNA profiling – DNA ligase, etc.*

(Plus up to [2] for quality)

8. (a) *Award [1] for every two of the following structures clearly drawn and labelled correctly.*
- mouth;
 - esophagus;
 - stomach;
 - small intestine;
 - large intestine/colon;
 - anus;
 - rectum;
 - sphincters;
 - salivary glands;
 - liver;
 - pancreas;
 - gall bladder;
- [4 max]**

- (b) *Award [1] per role.*
- Examples of specific enzymes:*
- protease / trypsin / pepsin / chymotrypsin / other named protease digest proteins into polypeptides / dipeptides / amino acids / peptides;
 - lipase digest lipids into glycerol / fatty acids;
 - amylase digest polysaccharides into disaccharides / monosaccharides;
- Enzymes must match products.*
- speed up / catalyze reactions / increased efficiency;
 - lower the (activation) energy required for digestive reactions to occur;
 - occurs at body temperature;
 - require optimum pH;
 - enzymes are specific;
 - digestive enzymes carry out hydrolytic processes;
- [6 max]**

- (c)
- pancreatic cells monitor blood glucose;
 - insulin / glucagon is a hormone;
 - low glucose level induces production of glucagon;
 - α -cells of pancreatic islet produce glucagon;
 - glucagon stimulates the liver to break glycogen into glucose;
 - glucagon leads to increase in blood glucose;
 - absorption of glucose from digestive tract causes glucose levels to rise (after meals);
 - high level of blood glucose induces production of insulin;
 - β -cells of pancreatic islet produce insulin;
 - insulin stimulates uptake of glucose into cells (muscles);
 - insulin stimulates uptake of glucose into liver / storage of glucose as glycogen in liver;
 - insulin leads to decrease in blood glucose;
 - homeostatic monitoring of blood glucose levels is constantly happening;
 - skipping meals can cause blood glucose levels to drop;
 - in diabetes mellitus blood insulin low / target cells insensitive;
 - blood glucose regulation is an example of negative feedback;
 - adrenaline leads to increased blood glucose levels;
- [8 max]**

(Plus up to [2] for quality)
