

MARKSCHEME

May 2005

BIOLOGY

Higher Level

Paper 2

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

Mark Allocation

Candidates are required to answer **ALL** questions in Section A total **[32 marks]** and **any TWO** questions in Section B **[20 marks]** each. Maximum total = **[72 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 penalising them for what they have not achieved or what they have got wrong.
- ♦ Remember that many candidates are writing in a second language. Effective communication is more important than grammatical accuracy.
- ♦ 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 HL P2 carry a mark total of **[20]**. Of these marks, **[18]** are awarded for content and **[2]** for the quality of construction of the answer.
- ◆ Two aspects are considered:
 - expression of relevant ideas with clarity
 - structure of the answers.
- ◆ **[1]** quality mark is to be awarded when the candidate satisfies **EACH** of the following criteria. Thus **[2]** 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 **[2]** marks for the quality of construction (and vice versa).
- ◆ The important point is to be consistent in the awarding of the quality points. For **sample scripts for moderation** the reason why quality marks have been awarded should be stated.
- ◆ Indicate the award of quality marks by writing **Q2, Q1** or **Q0** in **red** at the end of the answer.

SECTION A

1. (a) loggerheads / *Caretta caretta* [1]
- (b) all three species nest over the same range of latitudes on the same beaches/areas;
 density of loggerheads is greatest and leatherbacks is lowest;
 similar relative densities/numbers on the different beaches / latitudes;
 all three had most nests on Jupiter;
 more loggerheads at northern end of range / } (Do not accept answers giving
 around 28 (°N) / on Melbourne; } the range 26-28 or 26-30.) [2 max]
- (c) artificial lighting of beaches; (*Reject if human activity or other factors are also varied.*)
 lighting of an area/some areas/beaches but not others (at the same time);
 keep other variables constant / use similar areas/beaches;
 measure nesting density / number of nests per kilometre; (*Reject count nests unqualified.*) [2 max]
- (d) turtles (only) nest opposite / behind / in front of apartment blocks;
Do not accept answers only relating to tall buildings.
 turtles nest close to the buildings;
 no / few nests opposite gaps between buildings; (*Do not accept converse.*)
 light from inland penetrates between buildings;
 greater density of nests opposite tall(er) buildings;
 tall(er) buildings cast more shade / block more light; (*Do not accept larger buildings.*)
 more nests by Whitehall South / Stratford Arms and fewer by Villa del Mar / Arvita; [4 max]
- (e) more variation in direction with more light / direction more random with more light;
 hatchlings change direction more with more light / go in circles with more light;
 mean direction closer to direction of ocean } (Do not accept comments on whether
 with less light / go straight to ocean with less } the hatchlings reach the ocean or not.) [2 max]
 light;
- (f) light / moonlight / starlight from ocean / moon / stars reflected off ocean / darkness from inland [1]
Only accept answers referring to light or dark.
- (g) (i) light inhibits nesting/egg laying by females;
 artificial light prevents the hatchlings from finding the ocean;
 light increases risk of detection by predators;
 turtles nest further up the beach so further for hatchlings to reach ocean; [2 max]
- (ii) any method outlined to prevent / reduce artificial light reaching the beach [1]

2. (a) I: is the plasma membrane/cell (surface) membrane/phospholipid bilayer; [2]
 II: is the mesosome;
- (b) size of drawing divided by magnification / figures using this equation; *(units not required)*
Award [1] for working even if length measurement is incorrect.
 1.41 (\pm 0.02) μm ; *(units required)* [2]
Accept answers given in m, cm, mm and nm.
- (c) protection / support / maintains shape / prevents bursting [1]
- (d) bacterium/bacteria/prokaryote;
reason: [1 max]
 as no nuclear membrane / no nucleus;
 as no mitochondria / membrane bound organelles;
 as mesosomes / small size / circular DNA; *(Do not accept naked DNA or no histone.)* [2 max]
Reject reasons if cell type is incorrectly identified.
3. (a) metabolic pathways/metabolic reactions/metabolism/anabolism and catabolism [1]
- (b) (i) salivary gland / pancreas;
 pH 7.5 (\pm 0.5);
 lipase; *(accept lipidase)*
 pancreas; [4]
- (ii) ionic bonds / polar bonds broken / disrupted / charge distribution altered;
 ionization of amino / carboxyl groups altered;
 conformation / shape of enzyme / active site altered / tertiary structure altered;
 enzyme denatured; [2 max]
- (c) inhibitor binds (to the enzyme) away from the active site / at allosteric site;
 shape / (intramolecular) bonding / conformation of the protein / enzyme is altered;
 shape / properties of active site altered;
substrate no longer fits the active site / no enzyme-substrate/ES complex formed;
 no enzyme activity / works more slowly (until the inhibitor dissociates); [3 max]
Award [1 max] if competitive inhibition is described.

SECTION B

4. (a) tRNA is composed of one chain of (RNA) nucleotides;
tRNA has a position/end/site attaching an amino acid; (*Reject tRNA contains an amino acid.*)
at the 3' terminal / consisting of CCA / ACC;
tRNA has an anticodon;
anticodon of three bases which are not base paired / single stranded / forming part of a loop;
tRNA has double stranded sections formed by base pairing;
double stranded sections can be helical;
tRNA has (three) loops (sometimes with an extra small loop);
tRNA has a distinctive three dimensional / clover leaf shape; **[5 max]**
Accept any of the points above if clearly explained using a suitably labelled diagram.
- (b) carboxyl and amine groups shown as part of a molecule;
alpha/central carbon atom with carboxyl and amine groups } (*Reject if any extra carbon atoms are shown.*)
bonded to it correctly;
radical and hydrogen also bonded correctly to (alpha) carbon;
label indicates peptide bond forms between } (*Accept even if the structure of these groups is shown incorrectly.*)
–COOH and –NH₂ groups / label indicates } **[4 max]**
peptide bond forms between groups labelled as }
amine and carboxyl groups;
- (c) 5' to 3' (direction of movement along mRNA);
subunit of) ribosome binds to mRNA;
moves along mRNA until it reaches the start codon / AUG / translation starts at AUG;
tRNA binds to ribosome / mRNA;
large subunit binds to small subunit;
two tRNAs bound to ribosome at the same time;
binding of tRNA with anticodon complementary to codon on mRNA;
tRNAs carry an amino acid;
anticodon / codon codes for an amino acid;
amino acid linked by a peptide bond to the polypeptide / to another amino acid;
ribosome moves on along the mRNA;
tRNA displaced and another attaches to vacant binding site;
stop codon reached;
polypeptide/protein is released / tRNA and mRNA detached from ribosome;
ribosome splits into (large and small) subunits; **[9 max]**

(Plus up to [2] for quality)

5. (a) shows how organisms are related / to distinguish between organisms / compare organisms;
helps us to cope with the huge number of different organisms;
makes it easier to collect / store / find information about organisms;
makes it easier to find useful organisms (*e.g.* plants containing drugs);
makes it easier to identify organisms / find their scientific name;
allows predictions to be made (about characteristics of members of a group);
traces possible evolutionary links / identifies common ancestry;
identifies homologous structures;

[4 max]

- (b) name of dicotyledonous plant;
Do not accept tree, pondweed, any monocots, conifers, ferns.

Award [1] for each of the following structures clearly drawn and correctly labelled, up to [4 max].

root / roots; (*Shown forming a branching network joined to the stem.*)

stem / stems;

leaf / leaves;

axillary bud drawn in leaf axil;

terminal bud drawn at tip of stem;

flower / inflorescence / named part of flower;

[5 max]

- (c) roots have a large/increased surface area (in relation to their volume);
branching/lateral roots (increases the surface area);
root hairs increase the surface area;
cortex cell walls (increase the surface area);
water is absorbed by osmosis;
solute concentration inside the root is higher than in the soil / outside;
due to active transport of ions into the root;
apoplastic and symplastic transport across the root;
apoplastic route is through the cell walls (and intercellular spaces);
symplastic route is through the cytoplasm (and plasmodesmata);
water has to pass through cytoplasm of endodermis / Casparian strip blocks walls;
water movement in xylem due to pulling force / transpiration pull;
cohesion between water molecules;

[9 max]

(Plus up to [2] for quality)

6. (a) gene is a heritable factor / unit of inheritance;
gene is composed of DNA;
gene controls a specific characteristic / codes for a polypeptide/protein;
allele is a form of a gene;
alleles of a gene occupy the same gene locus/same position on chromosome;
alleles differ (from each other) by one / a small number of base(s) / base pair(s); **[4 max]**
- (b) multiple alleles means a gene has three or more alleles / more than two alleles;
ABO blood groups / other named example of multiple alleles;
ABO gene has three alleles / equivalent for other example;
 $I^A I^B$ and i shown (at some point in the answer) / equivalent for other example;
Accept other notation for alleles if clear.
any two of these alleles are present in an individual;
homozygous and heterozygous genotype with phenotypes (shown somewhere);
all six genotypes with phenotypes given (shown somewhere);
example / diagram of a cross involving all three alleles; **[5 max]**
- (c) linked genes occur on the same chromosome / chromatid;
genes (tend to be) inherited together / not separated/do not segregate independently;
non-Mendelian ratio / not 9:3:3:1 / 1:1:1:1;
real example of two linked genes;
Award [1] for each of the following examples of a cross between two linked genes.
key for alleles involved in the example of a cross;
homozygous parental genotypes and phenotypes shown;
 F_1 genotype and phenotype shown / double heterozygote genotype and phenotype;
possible F_2 genotypes and phenotypes shown;
recombinants identified;
recombinants due to crossing over;
in prophase I of meiosis;
diagram / explanation of mutual exchange of parts of chromatids during crossing over; **[9 max]**

(Plus up to [2] for quality)

7. (a) *Award [1] for each of the following structures clearly drawn and correctly labelled.*
cortex shown at the edge of kidney;
medulla shown inside the cortex (with pyramids);
pelvis shown on the concave side of the kidney;
ureter shown connecting with the pelvis / on concave side / hilum;
renal artery shown connected to the concave / pelvis side / away from cortex;
renal vein shown connected to the concave / pelvis side / away from cortex; **[5 max]**
- (b) *Accept answers referring to blood flow to the kidney instead of in the renal artery and blood flow from the kidney instead of in the renal vein.*
more oxygen in the renal artery / less in the renal vein / oxygenated versus deoxygenated;
less carbon dioxide in the renal artery / more in the renal vein;
more urea in the renal artery / less in the renal vein;
more ammonia / ethanol / toxins / hormones in the renal artery / less in the renal vein;
Reject answers for the points above if "none" instead of "less" is indicated.
more salt/NaCl /Na⁺/ Cl⁻ ions (in total) in renal artery than in renal vein;
more water (in total) in renal artery than in renal vein;
lower salt concentration / higher water concentration in vein than in artery with ADH; **[4 max]**
- (c) arteries carry blood away from the heart / to tissues;
arteries have thick walls to withstand high pressure / prevent bursting;
arteries have muscle fibres to generate the pulse / help pump blood / even out blood flow;
arteries have elastic fibres to help generate pulse / allow artery wall to stretch/recoil;
capillaries allow exchange of O₂ / CO₂ / nutrients / waste products from tissues/cells;
capillaries have a thin wall to allow (rapid) diffusion / movement in / out;
capillaries have pores / porous walls to allow phagocytes / tissue fluid to leave;
capillaries are narrow so can penetrate all parts of tissues / bigger total surface area;
veins carry blood back to the heart / from the tissues;
veins have thinner walls because the pressure is low / to allow them to be squeezed;
veins have fewer muscle / elastic fibres because there is no pulse / because pressure is low;
veins have valves to prevent backflow; **[9 max]**

(Plus up to [2] for quality)
