

MARKSCHEME

November 2006

BIOLOGY

Standard Level

Paper 2

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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.
- ◆ Words that are underlined are essential for 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 markscheme 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.
- ◆ 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.
- ◆ Units should always be given where appropriate. Omission of units should only be penalized once. 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] 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 within at least two parts [(a), (b), etc.] of the question.

- ◆ It is important to mark 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*).

SECTION A

1. (a) (i) 48 (± 1) [1]
- (ii) 22:00 hours (evening) / 10 pm (*units required*) [1]
- (b) greatest number leaving in early morning / 6:00 hours/6 am;
 reduces during midday / early afternoon / general decline from 6:00-16:00 hours/
 6 am-4 pm;
 increases slightly in evening / after 18:00 hours/6 pm / 18:00-20:00 hours/6 pm-10 pm; [2 max]
- (c) (strongest) current to colony (so difficult to leave);
 current brings in food;
 long way to feeding grounds / long time feeding;
 all/many out at sea hunting;
 penguins resting; [2 max]
- (d) $(3.75 \text{ ms}^{-1} - 1.0) = 2.75 (\pm 0.50) \text{ ms}^{-1}$ (*units required*) [1]
- (e) slow/uniform (with some peaks) when looking for prey/fish;
 (faster when) chasing / catching prey/fish;
 (slow in) moments of rest;
 (faster when) escaping predators; [2 max]
- (f) 15 400 joules/J / 15.4 kilojoules/kJ (*units required*) [1]
- (g) can escape faster from predators in sea;
 avoid human activity on land;
 body more adapted to swimming / less adapted to walking; { Accept any valid adaptation looking
 for concept, not necessarily term.
 temperature on land could be more extreme;
 may feed while swimming; { Do not accept "faster to swim"
 unless qualified with valid reason. [1 max]
- (h) mitochondria provide ATP (from aerobic respiration);
 (swimming) muscles require a lot of energy; [2]

2. (a) *directly:*
 by production of oxygen / measuring the volume/number of bubbles of gas produced; } *Do not accept "production of gas".*
 by measuring the uptake of carbon dioxide;
 changes in pH;
- indirectly:*
 by measuring the increase in biomass;
 by measuring the production of glucose / starch / other suitable molecule; [3 max]
Award [2 max] if only indirect measurements or direct measurements are addressed.
Apply ECF if direct and indirect is confused for more than one method.
- (b) (cell) respiration;
 energy storage (as glycogen/fat)/ energy source;
 synthesis of glycoproteins / nucleic acids / some amino acids; [2 max]
- (c) (i) I: (primary) producer / autotroph;
 IV: tertiary consumers / fourth level consumer; [2]
Award [0] for "first" and "fourth".
- (ii) 10 000-20 000 [1]
3. (a) diagram with ribose/deoxyribose/sugar, phosphate and base labelled and connected;
 correct linkage and spatial arrangement (with labels) *e.g.* phosphate linked to sugar/
 deoxyribose and base to sugar/deoxyribose; [2]
Any shapes are acceptable, emphasis is on correct linkages.
- (b) (i) codominance / incomplete/partial dominance [1]
- (ii) $C^R C^W$ / RW / other suitably defined symbols [1]
- (iii) grid with gametes shown correctly (C^R and C^W / other);
 all offspring genotypes shown; [2]
- (iv) 1 red:2 pink:1 white / 25 % red : 50 % pink : 25 % white; [1]
- (c) fewer children with genetic disease / can prevent genetic disease;
 lower long-term health costs;
 frequency of harmful alleles reduced;
 allows early diagnosis/detection/confirmation of genetic disease;
 treatment can start for genetic disease;
 prepare (psychologically) parents for affected children;
 can predict (probability of) genetic disease; [2 max]

SECTION B

Remember, up to TWO “quality of construction” marks per essay.

4. (a) Award [1] for any of the following clearly drawn and correctly labelled.
 plants taking in CO₂ (making carbohydrates) in photosynthesis;
 animals eating plants;
 animals / plants giving off CO₂ by (cell) respiration;
 decomposers / micro-organisms giving off CO₂ by (cell) respiration;
 fossilization of plant / animal parts / store carbon as fossil fuels;
 factories/cars giving off CO₂ through combustion of fossil fuels;
 (dead) plants/animals to decomposers/saprotrophs; [5 max]
- (b) inhalation means air entering;
external intercostal muscles contract;
 diaphragm contracts/flattens/moves downwards;
 thorax volume increases;
 creates pressure difference / lower pressure in thorax/lungs / correct reference to Boyle's Law;
 air enters lungs / inhales air by nose and mouth; [5 max]
Accept any of the above points if clearly explained in a labelled diagram.
- (c) *causes: [2 max]*
 increased CO₂ levels (from combustion of fossil fuels by cars/transport);
 increased methane levels (from intensified animal farming / rice (paddy/padi) fields);
 increased CFCs levels (from sprays / industrial processes);
 increased burning of forests / urbanization;
 reduced use of N-fertilizers (NO₃⁻ etc.);
- effects: [3 max]*
 higher levels of greenhouse gases increase the retention of heat reflected from earth;
 cause increased temperatures of atmosphere / global warming;
 increase water evaporation / droughts / crop losses;
 increase melting of polar ice / glaciers / release of trapped methane;
 increased levels of sea / possible flooding of coastal areas;
 changing weather patterns / climatic extremes;
- controls: [3 max]*
 international measures to reduce combustion of fossil fuels (e.g. Kyoto convention);
 reduce use of cars / combustion motors / smaller cars / drive less / lower speed limits / mass transit;
 reduce energy consumption / use low energy light bulbs / use better insulation in houses / increase use of electric cars;
 increased protection / restoration of ecosystems / reforestation;
 alternative energy sources (e.g. wind, solar, waves, nuclear);
 eat local food;
 feasible suggestion to increase photosynthesis/reduce CO₂ (e.g. spreading of nutrients in ocean to induce algae growth); [8 max]

(Plus up to [2] for quality)

5. (a) *Award [1] for any of the following clearly drawn and correctly labelled.
Award [2 max] if two or more eukaryotic structures are given and if a nucleus is included award [0].*
cell wall / capsule / slime wall/layer;
plasma/cell membrane;
mesosome,
cytoplasm;
ribosomes;
nucleoid / naked DNA;
flagella;
pili;
plasmid;
size stated 1 to 10 μm ; **[4 max]**
- (b) two cell divisions / reduction-division / diploid to haploid / meiosis I and meiosis II;
produce four (haploid) cells;
for production of sex cells/gametes/spores;
daughter cells are different from parent cells;
homologous chromosomes / two chromatids pair up;
line-up on equator;
(spindle fibres) pull homologous chromosomes to opposite poles;
two haploid cells are formed;
second division/like mitosis, separates chromatids to opposite poles; **[6 max]**
Accept any of the above points if clearly explained in a labelled diagram.
- (c) FSH stimulates (in first few/five days) follicle development (in ovary);
(FSH stimulates) follicles to secrete estrogen, (positive feedback);
low levels of estrogen initially inhibit FSH (and LH) secretion;
rapid increase in estrogen stimulates FSH / LH production, (positive feedback);
estrogen also starts to repair / thicken endometrium/uterine lining;
LH stimulates ovulation;
LH causes follicle to produce less estrogen (negative feedback) / more progesterone (positive feedback);
LH stimulates follicle to become corpus luteum;
corpus luteum secretes (more estrogen and) large level of progesterone (positive feedback);
estrogen and/or progesterone stimulate thickening of endometrium / uterus lining;
estrogen and/or progesterone inhibit FSH and LH secretion (by negative feedback);
estrogen and/or progesterone levels fall after day 21-24 if no embryo / fertilization;
lower concentrations of estrogen and/or progesterone allow disintegration of endometrium / menstruation occurs;
FSH secretion begins a new cycle; **[8 max]**
Award [6 max] if only three hormones are explained.

(Plus up to [2] for quality)

6. (a) Award [1] for any of the following clearly drawn and correctly labelled.

- phospholipids (bilayer);
- hydrophilic heads and hydrophobic tails;
- intrinsic/integral proteins/protein channels;
- glycoproteins/receptor proteins/glycolipids on outside;
- cholesterol embedded in membrane;
- extrinsic/peripheral proteins;
- thickness size 10 nm (0.1 μm);

[5 max]

(b) Award [1] for each correct row, up to [5 max].

Aerobic respiration	Anaerobic respiration
occurs in mitochondria	occurs in cytoplasm;
requires O ₂	occurs without O ₂ ;
both produce pyruvate from glucose (glycolysis);	
uses fatty acids/lipids/amino acids	doesn't use fatty acids;
(Krebs cycle) produces CO ₂ and H ₂ O	(fermentation) produces ethanol /CO ₂ (in yeast) ;
(Krebs cycle) produces CO ₂ and H ₂ O	(fermentation) produces lactate in animals (humans) ;
NADH produced in both;	
large amount of ATP (36 per glucose molecule) produced	small amount of ATP (2 per glucose molecule) produced;

[5 max]

(c) messenger / mRNA attaches to ribosome (small unit);
 many ribosome/polyribosomes bind to same mRNA;
 carries codons / triplet of bases each coding for one amino acid;
 transfer / tRNA each have specific anticodon;
 triplet of bases for specific amino acid;
 tRNA carries specific amino acid;
 tRNA binds to ribosomes;
 to corresponding triplet base / codon;
 a second tRNA binds to next codon;
 two amino acids bind together;
 in a peptide linkage;
 first tRNA detaches;
 ribosome moves along mRNA;
 another tRNA binds to next codon;
 continues until polypeptide / protein formed to stop codon;
 stop codon has no corresponding tRNA/amino acid / causes release of polypeptide;

[8 max]

(Plus up to [2] for quality)