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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary and Advanced Level

MARK SCHEME for the November 2004 question paper

9700 BIOLOGY

9700/02 **Paper 2 (Structured Questions AS), maximum mark 60**

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. This shows the basis on which Examiners were initially instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the *Report on the Examination*.

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Grade thresholds taken for Syllabus 9700 (Biology) in the November 2004 examination.

	maximum mark available	minimum mark required for grade:		
		A	B	E
Component 2	60	43	38	26

The thresholds (minimum marks) for Grades C and D are normally set by dividing the mark range between the B and the E thresholds into three. For example, if the difference between the B and the E threshold is 24 marks, the C threshold is set 8 marks below the B threshold and the D threshold is set another 8 marks down. If dividing the interval by three results in a fraction of a mark, then the threshold is normally rounded down.

November 2004

GCE A AND AS LEVEL

MARK SCHEME

MAXIMUM MARK: 60

SYLLABUS/COMPONENT: 9700/02

BIOLOGY
Paper 2 (Structured Questions AS)

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1 (a) (i) **A** - Golgi (body/apparatus)/dictyosome; **R** Golgi vesicles

B - (rough) endoplasmic reticulum/ER/RER; **R** SER

C - mitochondrion/mitochondrial, matrix/envelope; **3**

(ii) sieve plate(s); **1**

(iii) sucrose/amino acid(s)/named amino acid; **R** sugar, glucose **1**

(b) little/watery/peripheral, cytoplasm/no tonoplast/no vacuole/ few organelles/few ribosomes/so little resistance/AW e.g. easy transport/move more easily/minimum obstruction;

pores in sieve plate provide little resistance/permit continuous flow/allows movement/AW e.g. as above;

sieve plate braces/prevents cell bulging under pressure/collapsing;

plasmodesmata only between sieve tube element and companion cell allows pressure to build up;

plasmodesmata allows loading/AW e.g. sucrose to be transported in from companion/transfer cell;

(strong) cellulose walls prevent, excessive/too much, bulging/expansion;

mitochondria (and starchy plastids) for ATP, for repair/maintenance;

R reference to mitochondria in companion cells **3 max**

(c) sucrose/sugars/assimilates, are pumped/loaded (by companion cells);

reference to pumping H^+;

reference to co-transport/AW e.g. H^+ carry sucrose with them;

mitochondria provide, ATP for active transport; **2 max**

[Total 10]

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2 (a) -OH is below/AW (-H) on carbon (atom) 1;

A from sketch with C1 labelled **1**

(b) (i) (1-4) glycosidic; **R** 1, 6 glycosidic **R** oxygen bridge **1**

(ii) 1 -OH on free molecule and end of chain indicated;

2 water eliminated/removed/condensation reaction;

3 oxygen bridge/glycosidic bond drawn in correct position relative to chain;

4 between C1 and C4, must be labelled either side of glycosidic bond; **3**

M.P.2 and **M.P.4** can be taken from written account if no diagram

(iii) cellulose; **1**

(c) amylase breaks down/hydrolyses/acts on, starch to give maltose/reducing sugar;

R glucose

maltase/amylase, denatured/active sites disrupted/tertiary structure changed, when boiled/at high temperature;

maltase does not, break down/act on/digest/hydrolyse, starch;

reference to specificity/shape and fit/lock and key explained;

R no e-s formed

tube F is a control;

to show that there is no breakdown of starch without an enzyme **4 max**

[Total 10]

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R one word answers - need role/function

3 (a) ***calcium***

bone/teeth, formation/strengthening; **R** calcium in bone

R calcium for healthy bones and teeth

enamel/shell, formation/strengthening;

reference to muscle/nerve/synapse, function e.g. muscle contraction, generation of nerve impulse;

blood clotting;

calcium pectate, in cell wall/middle lamella;

spindle formation;

for fertilisation/fusion of egg and sperm;

iron

forms part of, haem/haemoglobin/myoglobin; **A** transport of oxygen in haemoglobin
A forms prosthetic group of haemoglobin

reference cytochrome(s)/electron carrier(s);

important in chlorophyll synthesis;

prosthetic group of some/named, enzymes/catalase;

potassium

activates enzymes;

cofactor in, photosynthesis/glycolysis;

reference to nerve/muscle, function e.g. conduction of nerve impulse, muscle contraction;

maintains osmotic balance/water potential of cells;

stomatal, opening/closure/turgidity of guard cells;

reference to Na^+/K^+ pump mechanism - qualified; **3**

(b) (i) L - urea; **A** ammonia/creatinine/uric acid/NH_3 **R** NH_4

M - nitrite (ions); **A** NO_2^- **R** NO_2 **2**

(ii) nitrification; **A** oxidation/chemosynthesis **1**

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(c) (i) 15 mg/20 hours; **A** 55-40/60-40, 55-40/20, 15/60-40

0.75 (mg h^{-1}); **2**

(ii) ions/minerals/nitrates in batch P are absorbed (only) by diffusion; } } **A**

no/limited/less, energy for active absorption/transport; } converse } for

because (cyanide) inhibits, respiration (must be linked to explanation)/ATP synthesis; } batch N }

ions in batch N are absorbed by active transport (and diffusion);

(idea of) after 10 hours no concentration gradient in P;

as rate of assimilation/use = rate of absorption (so concentration in plant remains constant);

active transport continues in N against a concentration gradient (after 10 hours);

reference to appropriate figs (linked to an <u>explanation</u> of different absorption rates);

4 max

(iii) no ions in distilled water; **R** low ions

concentration gradient out of the roots;

ions lost by diffusion;

ions, used in amination/amino acid synthesis/protein synthesis;

A ions assimilated **R** used/utilised **2 max**

[Total 14]

4 (a) Q - cell wall; **R** cellulose cell wall

R - flagellum; **A** flagella

S - (loop/circular) DNA; **A** nucleoid

R plasmid **R** chromosome **3**

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(b) nucleus/nuclear membrane/nuclear envelope/linear DNA/chromosome/ nucleolus;

mitochondrion; **A** mitochondria

lysosome(s);

endoplasmic reticulum/fixed/larger/80S, ribosomes;

Golgi (apparatus/body);

centriole(s);

R membrane based organelles **3 max**

(c) (i) *Mycobacterium*;

(**A** *M. tuberculosis*/*M. bovis*) **1**

(ii) (infected) person, sneezes/coughs/sputum/spitting/breathes out;

aerosol/droplets, in the air/moist air, inhaled/breathed in by (uninfected person); **2**

(d) bacteria enter cells in lungs/hidden from immune system;

antibiotics kill/destroy/reduce growth/AW, of bacteria;

> 1 antibiotic used, to combat/avoid development of resistance;

makes sure that all bacteria are killed;

prevents leaving a reservoir of infection/AW; **3 max**

[Total 12]

5 (a) *measure*

disappearance of substrate; **A** measure conc. of substrate

appearance of product; **A** measure conc. of products **2**

(b) active over a wide range of pH/AW e.g. whole range/pH 1-9;

increasing activity as pH increases to, optimum/pH 5;

decreasing activity as pH increases, above optimum/> pH 5;

optimum is, between pH 4 to 5.5/pH 5; **A** any figure between 4-5.5 **3**

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(c) (idea of) some enzymes active/all enzymes partly active; **1**

low pH equivalent to high H^+ ion concentration;

(so) enzymes (partly) denatured;

reference to tertiary structure affected;

reference to hydrogen/ionic bonds, disrupted/broken;

(so) active sites changed e.g. no longer complementary to substrate;

(detail) affect on R groups of amino acids (in active site);

(therefore) (few) enzyme-substrate complexes formed; **3 max**

(c) curve same shape with same optimum (at pH 5 - between 2.0 and 3.0 units on y axis);

lower (starting at pH 1 and finishing at pH 9 without touching x axis); **2**

(e) similar/same shape to, substrate/organic phosphates;
R similar structure

occupies/binds/combines/fits into, active site; **R** inhibitor competes with substrate for active site

so blocking/preventing, entry of substrate; (therefore) decreased rate of product/ e-s complex/phosphate, formation (at low substrate concentrations);

inhibitor molecules, not permanently bound to active site/bind briefly;

reference effect of concentration of substrate e.g. inhibitor less effective at high concentrations of substrate

A from sketch graph if given **3 max**

[Total 14]

TOTAL 60

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