GCE Advanced Level

## MARK SCHEME for the November 2004 question paper

## 9700 BIOLOGY

9700/04

Paper 4 (Structured Question A2 Core), maximum raw mark 60

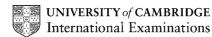
This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. This shows the basis on which Examiners were initially instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking 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*.

• CIE will not enter into discussion or correspondence in connection with these mark schemes.

CIE is publishing the mark schemes for the November 2004 question papers for most IGCSE and GCE Advanced Level syllabuses.

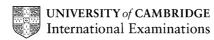


**Grade thresholds** taken for Syllabus 9700 (Biology) in the November 2004 examination.

	maximum	minimum mark required for grade:			
	mark available	А	В	E	
Component 4	60	45	40	23	

The threshold (minimum mark) for B is set halfway between those for Grades A and C. The threshold (minimum mark) for D is set halfway between those for Grades C and E. The threshold (minimum mark) for G is set as many marks below the F threshold as the E threshold is above it.

Grade A\* does not exist at the level of an individual component.



November 2004

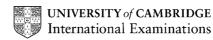
GCE A LEVEL

MARK SCHEME

## MAXIMUM MARK: 60

SYLLABUS/COMPONENT: 9700/04

BIOLOGY Paper 4 (Structured Question A2 Core)



Page 1		Mark Scheme Syllabu			
		A LEVEL – NOVEMBER 2004	9700	4	
1	(a) 1	chlorophyll absorbs mainly red and blue light;			
	2	light absorbed by antenna complex;			
	3	energy transferred;			
	4	reaction centres/P700/P680;			
	5	light energy excites electron(s)/reference passing to highe	r energy lev	vel;	
	6	electron lost from chlorophyll		3 max	
	(b) 1	water is split into H⁺ and OH⁻;			
	2	electron removed from OH <sup>-</sup> ;			
	3	to replace electron from photosystem/chlorophyll;			
	4	OH breaks down into O <sub>2</sub> and water;			
	5	$H^{+}$ used to form reduced NADP;			
	6	reference correct, balanced equation;		3 max	
	(c) 1	reference flow of electrons along ETC;			
	2	reference to pumping H <sup>+</sup> across membrane;			
	3	reference to $H^*$ /proton gradient across the thylakoid membrashed membrashed membrashed membrashed the thylakoid membrashed membr	orane;		
	4	flow of protons down gradient;			
	5	via ATPase/stalked particles;			
	6	formation of ATP from <u>ADP and P<sub>i</sub>;</u>			
	7	cyclic, electron returns to original photosystem;			
	8	non-cyclic, electron from PSII to PSI;		3 max	
	( <b>d)</b> ret	ference increased efficiency/short diffusion distance/close to	ogether;	1	

Total 10

Page 2		Mark Scheme	Syllabus	Paper		
		A LEVEL – NOVEMBER 2004	9700	4		
2	(a) 1	reference to Na <sup>+</sup> /K <sup>+</sup> pump;				
	2	active process/ATP used;				
	3	$Na^{+}$ (pumped) out and $K^{+}$ (pumped) in;				
	4	high Na <sup>+</sup> outside and high $K^+$ inside axon;				
	5	membrane slightly more leaky to $K^+$ /more $K^+$ leaks out the reference to some $K^+$ channels open;	an Na⁺ leaks	in/		
	6	inside more negative than outside;		3 max		
	(b) 1	reference stimulation;				
	2	opening of Na $^{+}$ channels;				
	3	Na⁺ diffuses in (across axon membrane);				
	4	inside more positive than outside/outside more negative t	han inside;			
	5	potential across the membrane changes;		3 max		
	(c) 1	reference to closing Na <sup>+</sup> channels;				
	2	opening of $K^+$ channels;				
	3	K⁺ diffuses out (across axon membrane);				
	4	(charge on the $K^{*}$ ) restores the membrane/resting potential;				
	5	reference to slight overshoot/hyperpolarisation;				
	6	reference $K^{+}$ channels close;		3 max		
	(d) 1	electrical vs chemical;				
	2	(impulses) along nerve cells vs (hormones) through blood	l;			
	3	rapid vs slow;				
	4	response immediate vs relatively slow;				
	5	responses short lived vs long lived;		3 max		
			Т	otal 12		

Ρ	age	3		M	ark Schem	е		Syllabus	Paper
				A LEVEL	– NOVEME	BER 2	2004	9700	4
3	(a)	1	no increa	se below 40 a	u;				
		2	(most) rap	oid production	above 60 a	au;			
		3	correct re	ference to Fig	IS.;				2 max
	(b)	1	glucose to	o pyruvate/gly	colysis;				
		2	pyruvate	to lactate;					
		3	reference	lactate dehyd	lrogenase;				
		4	in absend	e/shortage of	oxygen to <u>i</u>	muso	les;		
		5	pyruvate	acts as a hydi	ogen accer	otor;			
		6	reduced I	NAD to NAD/N	IAD regene	rated	1;		3 max
	(c)			ust be oxidise	d;				
		2	extra oxy	gen required;					
		3	this is the	oxygen debt;	linked	to p	oint 2		3
	(d)	mc	ore anaerol	bic respiration	/insufficient	toxy	gen supply;		1
									Total 9
4	(a)	Α	H <sup>N</sup> H <sup>S</sup> ;						
		С	H <sup>s</sup> H <sup>s</sup> ;						1
	(b)	pa	rental geno	o <i>type</i> H <sup>ℕ</sup>	H <sup>s</sup>	Х	H'	<sup>v</sup> H <sup>s</sup>	;
		ga	metes	$H^N$	H <sup>s</sup>	I	Η <sup>N</sup>	H <sup>s</sup>	;
		off	spring						
			notypes enotypes	H <sup>N</sup> H <sup>N</sup> (normal)	H <sup>N</sup> H <sup>S</sup> (carrier)		H <sup>N</sup> H <sup>S</sup> (carrier)	H <sup>s</sup> H <sup>s</sup> anaemia <i>identified</i>	;
		pro	bability = 1	1⁄4/0.25/25%;					4
		Re	ject X Y re	ferences					
		Pe	nalise onc	e for use of di	fferent sym	bols	(in <b>(b)</b> )		Total 5

Page 4		Mark Scheme	Syllabus	Paper	
		A LEVEL – NOVEMBER 2004	9700	4	
5	(a) 1	pools separate fish;			
	2	reference to geographic isolation/allopatric;			
	3	prevent interbreeding AW;			
	4	no gene flow/AW;			
	5	conditions different in the different pools;			
	6	different characteristics selected for in the different pools;			
	7	reference genetic drift;		4 max	
	(b) 1	conditions remain the same within each pool;			
	2	idea of extreme phenotypes selected against/do not survive;			
	3	only those fish well adapted to conditions in each pool survive;			
	(c) 1	reference competition between species/niche and competitive exclusion;			
	2	reduction in number of species/not all species will survive;			
	3	species restricted to different areas;			
	4	all/most species survive;			
	5	one species likely to be better adapted than all the other s	pecies;		
	6	reference hybridisation/interbreeding/no interbreeding;			
		1 and 2 linked			
		3 and 4 linked		2 max	
				Total 9	

Page 5	Mark Scheme	Syllabus	Paper
	A LEVEL – NOVEMBER 2004	9700	4

- 6 (a) Describe the main features of the Krebs Cycle. [9]
  - (b) Explain the role of NAD in aerobic respiration. [6]
  - (a) 1 matrix;
    - 2 of mitochondrion;
    - 3 acetyl CoA combines with oxaloacetate;
    - 4 to form citrate;
    - **5** 4C to 6C;
    - 6 decarboxylation/produce CO<sub>2</sub>;
    - 7 dehydrogenation/oxidation;
    - 8 2CO<sub>2</sub> released;
    - 9 reduced NAD produced; accept reduced coenzyme for one mark annotate 9/10
    - 10 reduced FAD produced;
    - **11** ATP produced;
    - 12 series of steps/intermediates;
    - 13 enzyme catalysed reactions;
    - 14 oxaloacetate regenerated;
    - 15 AVP;
  - (b) 16 coenzyme;
    - 17 for dehyrogenase;
    - 18 reduced;
    - **19** carries electrons;
    - **20** and protons/H<sup>+</sup>/H/hydrogen; **R** H<sub>2</sub>/hydrogen molecules
    - **21** from Krebs cycle;
    - **22** and from glycolysis;
    - 23 to cytochromes/electron transfer chain;
    - **24** reoxidised/regenerated;
    - **25** ATP produced;
    - **26** 3/2.5 (molecules of ATP) per reduced NAD;
- 6 max

9 max

Total 15

Page 6	Mark Scheme	Syllabus	Paper
	A LEVEL – NOVEMBER 2004	9700	4

- 7 (a) Describe the use of recombinant DNA technology in the synthesis of human insulin by bacteria [9]
  - (b) Explain the advantages of treating diabetics with human insulin produced by genetic engineering [6]
    - 1 mRNA coding for insulin/isolate gene for human insulin;
    - 2 from beta cells of islets of Langerhans/pancreas;
    - 3 reference to reverse transcriptase;
    - 4 to cDNA;
    - 5 reference PCR/DNA polymerase/double strand;
    - 6 reference sticky ends/AW;
    - 7 use of vector/virus/plasmid;
    - 8 reference endonuclease/restriction enzymes;
    - 9 to cut plasmid;
    - 10 reference DNA ligase to join DNA;
    - **11** inserted into suitable host cell/E.coli/bacteria;
    - 12 reference method of insertion;
    - 13 identification of modified bacteria;
    - **14** reference growth/culture of engineered bacteria in fermenters; **9 max**
  - (b) 15 constant/reliable supply all year round/unlimited supply;
    - 16 less risk of contamination/infection;
    - 17 identical to insulin produced in the body;
    - 18 less/no risk of allergic reaction;
    - **19** does not stimulate the immune system;
    - **20** fewer side effects;
    - 21 can be produced without the killing of animals/ethical reason;
    - 22 cheaper/easier to extract and purify;
    - 23 more available/large amount;
    - 24 more rapid response;

Total 15