UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level

MARK SCHEME for the June2005 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*.

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Grade thresholds taken for Syllabus 9700 (Biology) in the June 2005 examination.

	maximum mark available	minimum mark required for grade:		
		A	B	E
Component 4	60	43	37	21

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.

June 2005

GCE A LEVEL

MARK SCHEME

MAXIMUM MARK: 60

SYLLABUS/COMPONENT: 9700/04

BIOLOGY
Paper 4 (Structured Question A2 Core)

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Question			Marks
1	(a)	a nucleotide ;	
		with <u>three</u> phosphate groups ;	
		an organic / nitrogenous base / adenine ;	
		a pentose sugar / ribose ;	
		ref. ester linkages / covalent bonds ;	**3 max**
	(b)	synthesized from ADP and P_i ;	
		soluble molecule ;	
		diffuses rapidly / transported easily ;	
		on hydrolysis / removal of (third) phosphate ;	
		energy released / 30.5 kJ (mol^{-1}) ;	
		ref.(idea) intermediary (between energy yielding and energy requiring reactions) ;	**3 max**
	(c)	oxidative phosphorylation ;	
		$NADH_2$ to, cristae / inner membrane ;	
		oxidised to NAD ;	
		ref. transfer of electrons to electron carriers / ETC ;	
		H^+ pumped into intermembrane space ;	
		ref. to H^+ gradient ;	
		H^+ (diffuses) through ATP synthase / stalked particle ;	
		results in ADP and P_i to ATP ;	
		ref. chemiosmosis ;	
		ref. substrate level phosphorylation ;	**4 max**
			Total: 10

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Question				Marks
2	(a)		metaphase 1 / (late) prophase 1 ; **R** early / middle	1
	(b)	1	ref. (homologous chromosomes) pairing / synapsis ;	
		2	ref. to chiasma / crossing over ;	
		3	exchange of genetic material ;	
		4	between non-sister chromatids / AW ;	3 max
	(c)	1	breakage of linkage groups / ref. new linkage groups ;	
		2	may have different alleles ;	
		3	creates new combinations of alleles ;	
		4	when sister chromatids separate ;	2 max
	(d)		ref. idea of random orientation at metaphase I and II / random alignment of homologous chromosomes on spindle equator ;	
			subsequently leads to independent assortment ;	
			2^n possible combinations when n is number of chromosome pairs ;	
			ref. to chromosome mutation qualified ;	
			extra detail ;	
			ref. gametes haploid (so can fuse) ;	
			random fusion of gametes ;	
			N.B. 3 sets of 2/3 marks	4 max
				Total: 10

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Question			Marks
3	(a)	idea of energy conversion (linked to receptor) ;	
		Na^+ in / AW ;	
		depolarization ;	
		receptor / generator potential ;	
		ref. to threshold ;	
		(therefore) action potential / wave of depolarisation ;;	**3 max**
	(b)	(in / from) CNS / brain / spinal cord ;	
		ref. to synapse with intermediate / relay neurone ;	
		ref. to neuromuscular junction / (neuro)transmitter released ;	
		ref. response ;	**3 max**
	(c)	ref. synapses ;	
		vesicles containing transmitter only found on preSM ;	
		receptors for transmitter only found on postSM ;	
		ref. to refractory period / hyperpolarisation ;	**2 max**
			Total: 8

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Question			Marks
4	(a)	**A** epidermal cell ;	
		B guard cell ;	**2**
	(b)	allows carbon dioxide into leaf ;	
		as rest of leaf covered with waxy / waterproof cuticle ;	
		down concentration gradient / diffuses ; *for **either** O_2 **or** CO_2*	
		controls water (vapour) loss ;	
		ref. to faster diffusion through small pores / edge effect ;	
		oxygen out ;	**4 max**
	(c)	ref. to chloroplasts ;	
		sausage shaped / AW ;	
		joined only at ends ;	
		unevenly thickened walls / thick above and below / thin furthest from the pore ;	
		ref. vacuole ;	**2 max**
			Total: 8

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Question			Marks
5	(a)	stroma of chloroplast ;	1
	(b)	combines with (5C compound) RuBP ; to form unstable 6C compound / forms 2 molecules of (3C) GP ; ref. enzyme / rubisco ;	2 max
	(c)	reduced NADP and ATP ; (ATP is) source of energy ; (reduced NADP is for) reduction of GP(PGA) to triose phosphate (TP) ; ref. use of ATP in regeneration of RuBP ; ref. to source of phosphate / phosphorylation ;	3 max
	(d)	RuBP, accumulates / goes up ; due to reduced combination with CO_2 / AW ; *in either RuBP or GP, not both* GP, goes down / not as much being formed ; due to conversion to TP ;	3 max
			Total: 9

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Question			Marks
6	(a)	*auxin = IAA*	
	1	auxin produced in apical bud / AW ;	
	2	diffuses down stem ;	
	3	active transport (cell to cell) ;	
	4	role of plasmodesmata ;	
	5	also in phloem ;	
	6	(auxin) inhibits growth of lateral buds ;	
	7	plant grows up instead of branching out ;	
	8	removal of apical bud allows lateral buds to grow ;	
	9	AVP ; e.g. auxin concentrated in lateral bud / auxin in low amounts in lateral bud	
	10	AVP ; e.g. correct ref to effect of ABA / cytokinins	**6 max**
	(b) 11	seed absorbs water ;	
	12	by osmosis ;	
	13	gibberellin produced by embryo plant ;	
	14	passes to aleurone layer ;	
	15	switches on / activation, transcription enzyme genes / AW ;	
	16	storage proteins broken down to amino acids ;	
	17	stimulates synthesis / release of amylase ;	
	18	amylase diffuses / moves into endosperm ;	
	19	breaks down / hydrolyses starch to maltose ;	
	20	maltose to glucose ;	
	21	glucose diffuses / moves into embryo plant ;	
	22	provides source of energy for growth of embryo plant ;	**9 max**
			Total: 15

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Question				Marks
7	(a)	1	ref. continuous / discontinuous variation ;	
		2	genetic / inherited variation ;	
		3	variation in phenotype / characteristics / AW ;	
		4	(can be due to) interaction of genotype and environment ;	
		5	e.g. of characteristic that influences survival ;	
		6	ref. intraspecific competition / struggle for existence ;	
		7	those with favourable characteristics survive / AW ;	
		8	pass on favourable characteristics to offspring ;	
		9	those with disadvantageous characteristics die ;	**6 max**
	(b)	10	ref. to definition of species ;	
		11	ref. <u>allopatric</u> ;	
		12	geographical isolation ;	
		13	ref. to examples e.g. islands / lakes / mountain chains / idea of barrier ;	
		14	ref. to example organism ;	
		15	ref. to populations prevented from interbreeding ;	
		16	isolated populations subjected to different selection pressures / conditions ;	
		17	over time sufficient differences to prevent interbreeding ;	
		18	ref. <u>sympatric</u> ;	
		19	ref. to reproductive isolation ;	
		20	ref. behavioural barriers (within a population) ;	
		21	e.g. day active / night active ;	
		22	correct ref. to gene pool ;	
		23	change in allele frequencies ;	**9 max**
				Total: 15

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