UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level

MARK SCHEME for the November 2004 question paper

9700 BIOLOGY

9700/06

Paper 6 (Options), maximum raw mark 40

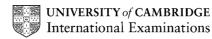
This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. This shows the basis on which Examiners were initially instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking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

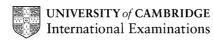
CIE is publishing the mark schemes for the November 2004 question papers for most IGCSE and GCE Advanced Level syllabuses.



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

	maximum	minimum	mark required	for grade:
	mark available	А	В	E
Component 6	40	30	26	17

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

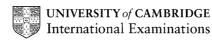
GCE A LEVEL

MARK SCHEME

MAXIMUM MARK: 40

SYLLABUS/COMPONENT: 9700/06

BIOLOGY Paper 6 (Options)



Page 1		Mark Scheme	Syllabus	Paper
		A LEVEL – NOVEMBER 2004	9700	6
OPTION	1 M/	AMMALIAN PHYSIOLOGY		
1 (a) (i)	A	sclera;		
	В	rod (cell)/receptor cell;		
	С	bipolar, cell/neurone;		
	D	ganglion cell; ¹ / ₂ marks rounded up		2
(ii) ab	sorbs light after it has passed through, retina/rods and	cones;	
	pre	events, reflections within the eye/distortion/unclear imag	ge;	
	со	ntains melanin/pigmented;		
	(bl	ood) to supply oxygen/glucose, to retina/AW;		max 2
(ii	i) ea	ch cone cell connects to one ganglion cell (only);		
	so	, impulses/information, from each (cone) cell kept sepa	rate;	
	se	veral rod cells connect to the same ganglion cell;		
	so	, impulses/information, from several rod cells are poole	d;	
	so	greater resolution/AW (from cones);		
	Wá	atch for ecf from (i)		max 3
(b) (i)	(re	ed and blue light) stimulate, different cone cells;		
	bra	ain interprets, action potentials/impulses, from each typ	e of cell diffe	erently;
	ac	tion potentials/impulses, from B cell seen as blue light o	or ditto for R	cell; max 2
(ii	i) on	ly one type of rod cell;		
	roo	d cells contain (only), one pigment/rhodopsin;		
		d cell pigment/rhodopsin, absorbs/sensitive to light, ove ave-lengths/AW;	r wide range	of
	•	gnals from) rod cells cannot give information about colo tween different colours;	our/cannot di	stinguish max 2

Ρ	age 2	Mark Scheme		Paper
		A LEVEL – NOVEMBER 2004	9700	6
	(c) (i	<u>sex linked;</u>		
		colour blindness, (allele/trait), is recessive;		
		men have only one copy of this, allele/gene;		
		as they have only one X chromosome;		
		no possible masking effect from another allele;		max 3
		or v.v. for women		
	(i	i) opsin is a protein/genes code for protein structure;		1
				Total 15
2	(a) Z	lines closer together;		
	а	ctin filaments, touching/almost touching/slightly overlapping;		
	а	I filaments approximately the same length as in figure 1.2;		3
	(b) (r	nyosin) heads form, cross-bridges/links, with actin;		
	(r	nyosin heads) tilt;		
	r	oving actin filaments along;		
	h	eads release and reset;		
	A	TP binds to myosin head;		
	r	iyosin head acts as ATPase;		
	A	TP provides energy for release;		
	A	TP hydrolysed (by ATPase on myosin heads);		max 4
	A	VP;		
	(c) tr	iceps contracts;		
	b	ones of lower arm move downward/arm extends, (pulling on t	the myofibril);	2
				Total 9
3	(a) a	ny sensible working;		
	1	7 (%);		2
	(b) h	epatic portal vein;		1

P	age		Syllabus	Paper
		A LEVEL – NOVEMBER 2004	9700	6
	(c)	from cholesterol;		
		(inside) hepatocytes;		
		secreted into bile canaliculi;		max 2
		AVP;		
	(d)	presence of hydrophilic and hydrophobic groups;		
		allow dispersal of tiny fat droplets into, water/digestive juices tension;	<i>or</i> decrease	surface
		emulsify, fats/lipids;		
		larger/increased, surface area, for action of/contact with, lipas	se;	
		increase (rate of), digestion/hydrolysis/fatty acids and glycero	I production;	max 3
		AVP; (detail)		
4	(a)	cerebellum		Total 8
		coordination of movement;		
		control of, balance/posture;		
		control of precision of movements involving voluntary muscle	;	
		learning complex motor tasks;	n	nax 3
		medulla oblongata		
		controls/increases, breathing;		
		controls/increases, heart rate;		
		control of, blood pressure/vasodilation and vasoconstriction;	m	ax 3

max 4

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

- (b) (i) cerebrum/cerebral cortex/hippocampus;
 - (ii) build-up of, plaques/tangles;

(containing), tau protein/amyloid;

destroys/damages, neurones;

less acetylcholine secreted;

cause probably part genetic;

also environmental factors/e.g. (ageing/severe blows to head/high levels of aluminium in diet); max 3

AVP;

Total 8

max 2

1

OPTION 2 MICROBIOLOGY AND BIOTECHNOLOGY

1 (a) growth/presence, of pathogenic microorganisms/pathogens/AW;

grow better at, (temperatures close to) 37 °C/body temperature;

reference 25 °C as optimum temperature of the desired/non pathogenic bacterium/ 37 °C inhibits desired;

suitable enzyme reference;

(b) (i) (10⁻⁶) too many to count accurately/plaques overlapping not possible to count accurately;

large variation in numbers counted;

uneven distribution of viral particles in sample;

(10⁻⁸) pipetting errors/diluting errors;

small number result in greater statistical errors/AW; max 3

(ii) average 68 + 64 + 66/3 = 66;

 $66 \times 10^7 / 5 = 1.32 \times 10^8;$

Paper	Syllabus	Mark Scheme		Page 5
6	9700	EL – NOVEMBER 2004	A LEV	
		W;	deaths until day 3/4/A	(c) no
		[,] 12;	more deaths after da	no
		en day 4 and 6/AW;	test death rate betwe	fast
			many people die;	not
max 2			ires;	figu
imal)	n/animal to an	s transmitted, from person to per	definition; (pathogen	(d) (i)
2			detail;	
		aminar flow cabinet;	use of, air flow hood	(ii)
		ease;	air purified before rel	
		,	by a filter/air purifiers	
		os;	negative pressure la	
			air moves into labs;	
		ice free;	smooth surfaces/cre	
		equipment;	autoclaves/sterilising	
			air lock systems;	
max 4			showers;	
Total 1				
		chitin/glucans	A	(a) DN
		absent	ises	viru
		absent	cteria/prokaryotes	bac
3			narks rounded up	½ r

(b) bacteria replicate independently/bacteriophage requires, host/cell, for replication;

bacteria possess own enzymes/protein synthesising machinery; ora;

bacteria divide by binary fission/bacteriophage do not produce by binary fission/idea of 2 v lots;

prophage phase for bacteriophage;

max 2

Page 6	Mark Scheme	Syllabus	Paper
	A LEVEL – NOVEMBER 2004	9700	6
(c) gr	am negative thinner peptidoglycan;		
w	th lipopolysaccharide/lipoprotein outer layer;		:
			Total
(a) 1	mouse injected with, specific/suitable, antigen;		
2	mouse killed 2 - 3 weeks later;		
3	spleen (removed);		
4	lymphocytes extracted;		
5	by centrifuge;		
6	myeloma cells/AW;		
7	use of, a fusogen/polyethylene glycol;		
8	cultured on agar plates, to prevent unfused cell growth;		
9	hybrid cells tested for antibody production;		
10	antibody producing cells cloned;		
1 [.]	large scale (fermentation);		max
• •	orescent – aid in imaging target/makes target visible/way t tigen;	o find, target	cell/
at	ach to, target cell/cancer cells/antigen on cells;		
ra	dioactive – kill cells/does not kill normal cells;		;
<i>,</i> , ,			
(c)	C F G H E	D	
	¹ / ₂ marks rounded up	1	:

Total 10

Page 7	Mark Scheme	Syllabus	Paper
	A LEVEL – NOVEMBER 2004	9700	6

4 (a) batch only for 2° metabolites/continuous for 1° and 2° ;

batch fermentation

microorganisms grown in same medium/no more nutrients added;

until certain optical density reached/stationary phase reached/no more product formed/sufficient product formed (and then harvested);

three stages of growth curve;

continuous culture

fresh medium added;

to maintain log growth phase;

cells harvested throughout;

(b) co-selection;

spontaneous/random/existing, mutation of gene;

increased use of penicillin;

gives selective advantage;

kills all except resistant types;

population of bacteria become mainly resistant;

increased horizontal transmission;

more opportunity to pass on plasmid;

AVP;

(c) penicillin production very low when no sugar present;

penicillin production higher with lower sugar levels;

use of figures;

steeper rise after 6 days, with 1 g dm⁻³ glucose compared to 2g dm⁻³ glucose;

plateau mark;

max 3

max 2

max 3

Total 8

Page 8	Mark Scheme A LEVEL – NOVEMBER 2004	Syllabus 9700	Paper 6
	3 GROWTH, DEVELOPMENT AND REPRODUCTION	5700	0
. ,	enzymes from acrosome digest path through follicle cells;		
	sperm attach to receptors in zona pellucida;		
	another) enzyme from acrosome digests path through zona;		
:	sperm and oocyte (cell surface/plasma) membranes fuse;		
	<u>enzymes</u> released from, lysosomes/cortical granules, thicken sperm-proof/prevent polyspermy;	zona/make	zona
	nale and female (pro)nuclei fuse;		max 4
	AVP;		
(b)	changes, gene/DNA, base sequence;		
	codes for protein with different amino acid/acids;		
	codes for protein with amino acid(s) missing;		
	protein has different, <u>tertiary</u> structure/ <u>3D</u> shape;		
	protein has different, R groups/affinity;		
,	wrong, shape/charge, for (ion channel) function;		max 3
(c)	i) (fusion of egg and sperm) outside the organism;		
	in sterile/nutrient, medium;		
	ʻin glass'/in Petri dish/in test tube;		max 2
	ii) sperm from mutant mice cannot fertilise intact eggs;		
	sperm from mutant mice can fertilise eggs with zona remo	oved;	
	but less well than sperm from normal mice;		
	use of comparative figures; (81% v. 0%/76% v. 62%)		
	sperm from normal mice less successful when zona remo eggs);	oved (than w	ith intact max 4
	iii) affects rate of movement/high rate of movement needed f fertilisation;	for successfi	l
	180 μm s ⁻¹ v. 60 μm s ⁻¹ /normal 3 times faster;		
	ion (sensible suggestion of ion) needed, to trigger movem zona pellucida;	ent/for pene	etration of max 2
			Total 1

P	age 9		Mark Scheme	Syllabus	Paper
			A LEVEL – NOVEMBER 2004	9700	6
2	(a) p	bern	nanent/irreversible;		
	ir	ncre	ase in dry mass;		2
	(b) (i	i) 3	3/718;		
		(.05/0.046;		2
	(i	ii) c	lecreases (with age);		
		c	lecrease slows (with age);		
		r	eference plateau;		
		r	eference figures;		max 3
	(i	iii) p	lot mean increase in volume per 5 year period;		
		6	gainst, age/years (in correct context);		2
					Total 9
3	(a) (i	i) A	synergid;		
		E	embryo sac;		
		0	fusion nucleus/fused polar nuclei;		
			A diploid/endosperm, nucleus		
		[antipodal cell;		2
			½ marks rounded up		
	(i	ii) f	emale gamete		
		f	uses with one male, gamete/nucleus;		
		t	o give diploid zygote;		
		(future) embryo;		max 2
		5	tructure C		
		f	uses with one male, gamete/nucleus;		
		t	o give triploid nucleus;		
		(future) endosperm;		max 2

Page 10	Mark Scheme	Syllabus	Paper
	A LEVEL – NOVEMBER 2004	9700	6
(b) do	es consist of 4 haploid cells;		
nue	cleus F same DNA content as nucleus E ;		
ref	erence diploid endosperm/endosperm not triploid, after fer	tilisation;	
ref	erence no information re other two nuclei;		max 2
			Total 8
4 (a) (i)	(presence of) water; ® 'moisture'		
	(presence of) oxygen;		
	suitable/optimum, temperature;		
	appropriate, light intensity/wavelength;		max 3
(ii)	scarification/description;		
	prechilling/stratification/description; ® vernalisation		
	exposure to fire;		
	leaching/washing away, inhibitor;		max 2
	AVP;		
(iii	gibberellin/gibberellic acid (GA); @ cytokinin		1
	(GA) stimulates production of, hydrolytic enzymes/amylas	se;	
	detail enzyme action;		
	(GA) stimulates, protein synthesis/growth;		
	(GA) switches on genes;		
	reference other growth regulator/inhibitor;		max 2
			Total 8

Page 11	Mark Scheme	Syllabus	Paper
	A LEVEL – NOVEMBER 2004	9700	6
OPTION 4	APPLICATIONS OF GENETICS		
1 (a) ch	anges, gene/DNA, base sequence;		
CO	des for protein with different amino acid/acids;		
CO	des for protein with amino acid(s) missing;		
pro	tein has different, <u>tertiary</u> structure/ <u>3D</u> shape;		
pro	tein has different, R groups/affinity;		
Wr	ong, shape/charge, for (ion channel) function;		max 3
(b) (i)	(fusion of egg and sperm) outside the organism;		
	in sterile/nutrient, medium;		
	'in glass'/in Petri dish/in test tube;		max 2
(ii)	sperm from mutant mice cannot fertilise intact eggs;		
	sperm from mutant mice can fertilise eggs with zona remo	oved;	
	but less well than sperm from normal mice;		
	use of comparative figures; (81% v. 0%/76% v. 62%)		
	sperm from normal mice less successful when zona remo eggs);	wed (than w	ith intact max 4
(iii	affects rate of movement/high rate of movement needed f	for successfi	IL
	180 μm s ⁻¹ v. 60 μm s ⁻¹ /normal 3 times faster;		
	ion (sensible suggestion of ion) needed, to trigger movem zona pellucida;	ent/for pene	tration of max 2
(c) (i)	DNA different, mass/lengths or A, lighter/shorter, than C (or vice versa	a);
	lighter/shorter, lengths move faster/ora;		
	in <u>electrophoresis;</u>		
	across gel;		max 3
(ii)	heterozygote has both, <u>alleles</u> /lengths of DNA <i>or</i> (heteroz amount of each;	:ygote) has h	half the 1
			Total 15

Page 12		Mark Scheme	Syllabus	Paper			
		A LEVEL – NOVEMBER 2004	9700	6			
2	(a) interbreed sticky rice with, hybrid/resistant, rice;						
	practical detail;						
	pro	oduce/collect, seed and grow;					
	se	ect plants with <u>both</u> sticky rice and resistance;					
	inte	erbreed these and select best;					
	idea many generations;						
	ba		max 4				
	(b) (i)	distance apart/spore filtration, in mixed planting;					
	(mono) much greater/20% v. 1.2%, for sticky rice, because not resist						
		(mono) double/2.3% v. 1%, for hybrid rice, even though m	nore resistan	ıt;			
		(mono) whole crop genetically similar/ora;		max 2			
	(ii) in monoculture plants genetically similar so any successful strain can attack						
		no such selective advantage in mixed planting;					
		reference strains produced by mutation;		max 2			
				Total 8			
3	(a) to	prevent/high risk of, extinction;					
	to	maintain genetic diversity;					
	to counteract inbreeding depression; store of <u>alleles;</u>						
	for	future use;					
	in	changed environment; (a) e.g. of change – biotic or abiotic					
	in,	selective breeding/genetic engineering;		max 3			
	(b) fro	zen/-20 °C;					
	dri	ed/5% water;					

reference storage conditions; e.g. low humidity/sealed/labelled containers/high CO₂ concentration (although not actually used); max 2

Page 13		3	Mark Scheme	Syllabus	Paper		
			A LEVEL – NOVEMBER 2004	9700	6		
	(c)	c) to ensure/maintain/test for, viability;					
		tes	t every 5 years;				
		ne	w seed collected/grow, when germination falls below 85%;				
		AV	P; e.g. reference selective pressures whilst growing;		max 2		
					Total 7		
4	(a)	tris	omy 21/three chromosomes 21;				
		as	a result of non-disjunction;				
		tra	nslocation;				
		pai	t of 21 onto another chromosome;				
		det	ail chromosome (13, 14 or 15/group D);				
		tog	ether with two chromosomes 21;		max 3		
	(b)	det	ection of, specific allele/genetic disease/haplotype ;		1		
	(c)	(i)	$\frac{(323-152)}{323} \times 100 \text{ or } \frac{(32+36+42+61)}{323} \times 100;$				
			53(%)/52.9(%);		2		
		(ii)	A to D increasingly successful/D highest/D higher than A,	B and C;			
			D almost twice as good as A;				
			none, very successful/100%;				
			correct percentage calculation for A/D;;		max 3		
		(iii)	use more than one test;		1		
					Total 10		