GCE Advanced Level

MARK SCHEME for the November 2004 question paper

9700 BIOLOGY

9700/06

Paper 6 (Options), maximum raw mark 40

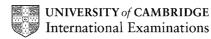
This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. This shows the basis on which Examiners were initially instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking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

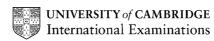
CIE is publishing the mark schemes for the November 2004 question papers for most IGCSE and GCE Advanced Level syllabuses.



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

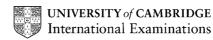
GCE A LEVEL

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				
			9700	6
O	PTION 1	MAMMALIAN PHYSIOLOGY		
1	(a) (i)	A sclera;		
		B rod (cell)/receptor cell;		
		C bipolar, cell/neurone;		
		D ganglion cell; ½ marks rounded up		2
	(ii)	absorbs light after it has passed through, retina/rods ar	nd cones;	
		prevents, reflections within the eye/distortion/unclear in	nage;	
		contains melanin/pigmented;		
		(blood) to supply oxygen/glucose, to retina/AW;		max 2
	(iii	each cone cell connects to one ganglion cell (only);		
		so, impulses/information, from each (cone) cell kept se	parate;	
		several rod cells connect to the same ganglion cell;		
		so, impulses/information, from several rod cells are poo	oled;	
		so greater resolution/AW (from cones);		
		watch for ecf from (i)		max 3
	(b) (i)	(red and blue light) stimulate, different cone cells;		
		brain interprets, action potentials/impulses, from each t	ype of cell diffe	erently;
		action potentials/impulses, from B cell seen as blue ligh	nt <i>or</i> ditto for R	
				max 2
	(ii)	only one type of rod cell;		
		rod cells contain (only), one pigment/rhodopsin;		
		rod cell pigment/rhodopsin, absorbs/sensitive to light, c wave-lengths/AW;	over wide range	e of
		(signals from) rod cells cannot give information about c between different colours;	olour/cannot d	istinguish max 2

Pa	age 2	Mark Scheme A LEVEL – NOVEMBER 2004	Syllabus 9700	Paper 6
	(c) (i) <u>sex linked;</u>	9700	0
	(0) (
		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 <u>allele;</u>		max 3
		or v.v. for women		
	(ii) opsin is a protein/genes code for protein structure;		1
				Total 15
2	(a) Z	Ines closer together;		
	á	actin filaments, touching/almost touching/slightly overlapping;		
	â	all filaments approximately the same length as in figure 1.2;		3
	(b) (myosin) heads form, cross-bridges/links, with actin;		
	(myosin heads) tilt;		
	r	noving actin filaments along;		
	ł	neads release and reset;		
	/	ATP binds to myosin head;		
	r	nyosin head acts as ATPase;		
	/	ATP provides energy for release;		
	ļ	ATP hydrolysed (by ATPase on myosin heads);		max 4
		AVP;		
	(c) t	riceps contracts;		
	k	oones of lower arm move downward/arm extends, (pulling on t	the myofibril);	2
				Total 9
3	(a) a	any sensible working;		
		.7 (%);		2
		nepatic portal vein;		1
	. , .	• • • *		

Page 3	Mark Scheme	Syllabus	Paper
	A LEVEL – NOVEMBER 2004	9700	6

(c) from cholesterol;

(inside) hepatocytes;

secreted into bile canaliculi;

AVP;

(d) presence of hydrophilic and hydrophobic groups;

allow dispersal of tiny fat droplets into, water/digestive juices *or* decrease surface tension;

emulsify, fats/lipids;

larger/increased, surface area, for action of/contact with, lipase;

increase (rate of), digestion/hydrolysis/fatty acids and glycerol production; max 3

AVP; (detail)

4 (a) cerebellum

coordination of movement;

control of, balance/posture;

control of precision of movements involving voluntary muscle;

learning complex motor tasks;

medulla oblongata

controls/increases, breathing;

controls/increases, heart rate;

control of, blood pressure/vasodilation and vasoconstriction; max 3

max 4

max 2

Total 8

max 3

(ii) average 68 + 64 + 66/3 = 66;
$66 \times 10^7 / 5 = 1.32 \times 10^8;$

accurately;

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

large variation in numbers counted;

uneven distribution of viral particles in sample;

small number result in greater statistical errors/AW;

(10⁻⁸) pipetting errors/diluting errors;

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

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

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

OPTION 2 MICROBIOLOGY AND BIOTECHNOLOGY

(ii) build-up of, plaques/tangles; (containing), tau protein/amyloid;

Mark Scheme

A LEVEL – NOVEMBER 2004

destroys/damages, neurones;

(b) (i) cerebrum/cerebral cortex/hippocampus;

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

37 °C inhibits desired;

AVP;

Page 4

max 2

Paper

6

Syllabus

9700

1

2

max 3

Р	age 5		Mark Scheme	Syllabus	Paper			
		A LEVE	EL – NOVEMBER 2004	9700	6			
	(c) n	o deaths until day 3/4/A	W;					
	n	o more deaths after day	/ 12;					
	fa	astest death rate betwee	en day 4 and 6/AW;					
	n	ot many people die;						
	fi	gures;			max 2			
	(d) (i	(d) (i) definition; (pathogens transmitted, from person to person/animal to animal)						
		detail;			2			
	(i	i) use of, air flow hood/	laminar flow cabinet;					
		air purified before rel	ease;					
		by a filter/air purifiers	• ,					
		negative pressure lab	DS;					
		air moves into labs;						
		smooth surfaces/crev	vice free;					
		autoclaves/sterilising	equipment;					
		air lock systems;						
		showers;			max 4			
					Total 15			
2	(a) D	NA	chitin/glucans					
	v	iruses	absent					
	b	acteria/prokaryotes	absent					
	1/	₂ marks rounded up			3			
	(b) b	acteria replicate indepe	ndently/bacteriophage requires, hos	t/cell. for rep	lication:			

(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) gra	m negative thinner peptidoglycan;		
wit	n lipopolysaccharide/lipoprotein outer layer;		2
			Total 7
3 (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;		
11	large scale (fermentation);		max 4
	prescent – aid in imaging target/makes target visible/way to igen;	o find, target	cell/
atta	ach to, target cell/cancer cells/antigen on cells;		
rac	ioactive – kill cells/does not kill normal cells;		3
(c)	C F G H E	D	
	¹ / ₂ marks rounded up		3

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

Р	age	8	Mark Scheme A LEVEL – NOVEMBER 2004	Syllabus 9700	Paper 6
OI	ρτιο	N 3	GROWTH, DEVELOPMENT AND REPRODUCTION		
1	(a)	en	zymes from acrosome digest path through follicle cells;		
		spe	erm attach to receptors in zona pellucida;		
		(ar	other) enzyme from acrosome digests path through zona;		
		spe	erm and oocyte (cell surface/plasma) membranes fuse;		
			<u>zymes</u> released from, lysosomes/cortical granules, thicken erm-proof/prevent polyspermy;	zona/make	zona
		ma	le and female (pro)nuclei fuse;		max 4
		AV	Ρ;		
	(b)	cha	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;		
		wro	ong, 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);	ved (than w	ith intact max 4
		(iii	affects rate of movement/high rate of movement needed f fertilisation;	or successf	ul
			180 μ m s ⁻¹ v. 60 μ m 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 15

Р	Page 9			Mark Scheme A LEVEL – NOVEMBER 2004	Syllabus 9700	Paper 6
2	(a)	per	rma	nent/irreversible;		
	i	inc	rea	se in dry mass;		2
	(b)	(i)	33	/718;		
			0.0	05/0.046;		2
		(ii)		creases (with age);		
				crease slows (with age);		
				erence plateau;		
				erence figures;		max 3
		(111)		t mean increase in volume per 5 year period;		-
			ag	ainst, age/years (in correct context);		2
•		<i>.</i>				Total 9
3	(a)	(1)		synergid;		
			B	embryo sac;		
			С	fusion nucleus/fused polar nuclei;		
			_	diploid/endosperm, nucleus		
			D	antipodal cell;		2
		<i></i>	,	½ marks rounded up		
		(11)		nale gamete		
				ses with one male, gamete/nucleus;		
				give diploid zygote;		
				ture) embryo;		max 2
				ucture C		
				ses with one male, gamete/nucleus;		
				give triploid nucleus;		
			(TU	ture) endosperm;		max 2

Page	10	Mark Scheme	Syllabus	Paper
		A LEVEL – NOVEMBER 2004	9700	6
(b)) do	es consist of 4 haploid cells;		
	nu	cleus F same DNA content as nucleus E ; (a) <i>figures</i>		
	ref	erence diploid endosperm/endosperm not triploid, after fert	ilisation;	
	ref	erence no information re other two nuclei;		max 2
				Total 8
4 (a)) (i)	(presence of) water; ® 'moisture'		
		(presence of) <u>oxygen;</u>		
		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);		1
		(GA) stimulates production of, hydrolytic enzymes/amylas	e;	
		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 A LEVEL – NOVEMBER 2004	Syllabus 9700	Paper 6
OPTION 4	APPLICATIONS OF GENETICS		
1 (a) cha	anges, gene/DNA, base sequence;		
coo	les for protein with different amino acid/acids;		
COC	les 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;		
wro	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);	ved (than wit	h intact max 4
(iii)	affects rate of movement/high rate of movement needed f fertilisation;	or successful	
	180 μ m s ⁻¹ v. 60 μ m s ⁻¹ /normal 3 times faster;		
	ion (sensible suggestion of ion) needed, to trigger movem zona pellucida;	ent/for penet	ration of max 2
(c) (i)	DNA different, mass/lengths or A, lighter/shorter, than C (or <i>vice versa</i>));
	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 ha	alf the 1
			Total 15

Pa	age 12	Mark Scheme A LEVEL – NOVEMBER 2004	Syllabus 9700	Paper 6			
2	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;					
	ide	a many generations;					
	ba	ck cross to parent for alleles of background genes;		max 4			
	(b) (i)	distance apart/spore filtration, in mixed planting;					
		(mono) much greater/20% v. 1.2%, for sticky rice, becaus	e not resista	nt;			
		(mono) double/2.3% v. 1%, for hybrid rice, even though m	ore resistan	t;			
		(mono) whole crop genetically similar/ora;		max 2			
	(ii) in monoculture plants genetically similar so any successful strain can at						
		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;						
	sto	re 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	e 13	Mark Scheme	Syllabus	Paper
		A LEVEL – NOVEMBER 2004	9700	6
(0	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	a) tris	omy 21/three chromosomes 21;		
	as	a result of non-disjunction;		
	tra	nslocation;		
	pa	rt of 21 onto another chromosome;		
	de	ail chromosome (13, 14 or 15/group D);		
	tog	ether with two chromosomes 21;		max 3
(1	b) de	ection of, specific allele/genetic disease/haplotype ;		1
(0	c) (i)	$\frac{(323-152)}{323}$ x 100 or $\frac{(32+36+42+61)}{323}$ x 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