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UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2009 question paper for the guidance of teachers

9700 BIOLOGY

9700/42 Paper 42 (Theory 2), maximum raw mark 100

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Section A

Question			Expected Answers	Marks
1				

process or feature	kingdom				
	Prokaryotae	Protoctista	Fungi	Plantae	Animalia
80s ribosomes	✗	✓	✓	✓	✓
cell walls contain chitin	✗	✗	✓	✗	✗ ;
circular DNA	✓	✗	✗	✗	✗ ;
endoplasmic reticulum		✓	✓	✓	✓ ;
most species unicellular	✓	✓	✗	✗	✗ ;
autotrophic	✓	✓	✗	✓	✗ ;
heterotrophic	✓	✓	✓	✗	✓ ;

one mark for each correct row

if there are any blanks in a row then award no marks for that row

[6]

[Total: 6]

2	**(a)**		*isolating mechanism* - geographical / mountains / physical barrier **;** *type of speciation* – allopatric **;**	[2]
	(b)	1	mouse populations separated by mountains **;**	
		2	no, breeding / gene flow, between populations **;**	
		3	mutations occur **;**	
		4	different selection pressures / different (environmental) conditions **;**	
		5	genetic change **;** e.g. different alleles selected for / change in allele frequency / change in gene pool / advantageous alleles passed **on ;**	
		6	(results in) different chromosome numbers **;**	
		7	genetic drift **;**	
		8	(different populations ultimately) cannot interbreed **;** **R** different species	[5 max]
				[Total: 7]

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3	**(a)**	**(i)**	condensation ;	[1]
		(ii)	1. autolysins ; 2. make holes in cell walls ; 3. in, growing / developing, bacteria ; 4. (antibiotic), inhibits / acts on, (another) enzyme ; 5. so peptidoglycan chains cannot link up / stops cross-links forming ; 6. cell wall becomes weaker / AW ; 7. turgor of cell not resisted (by cell wall) / AW ; 8. cell bursts ;	[4 max]
		(iii)	(glycoprotein) peptidase ; R other peptidase	[1]
	(b)		viruses have no cell wall ;	[1]
	(c)		*assume gram+ unless otherwise stated*	
		1	(gram+) penicillin can reach, cell wall / peptidoglycan, directly /AW / (gram-) ora ;	
		2	(gram-) outer membrane provides protection (from penicillin) / (gram+) ora ;	
		3	(gram+) more % peptidoglycan in wall (so greater effect from penicillin) / (gram-) ora ;	[2 max]

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	(d)		*accept antibiotic for penicillin and bacteria for S. pneumoniae throughout*	
		1	increase in resistance (throughout time period) ;	
		2	paired figs + units ;	
		3	overuse / misuse, of penicillin ;	
		4	some *S. pneumoniae* survive ;	
		5	mutation (in *S. pneumoniae)* ;	
		6	resistance, gene / allele ;	
		7	resistance passed to other bacteria ; e.g. plasmid transfer	
		8	resistant strain, multiplies ; *idea of many produced*	
		9	beta – lactamase produced ;	
		10	breaks down penicillin ;	
			point 7 accept vertical or horizontal transfer *point 8 accept vertical transfer only*	[5 max]
				[Total: 14]
4	**(a)**	**(i)**	1. yield for sorghum is greater than yield for wheat (in any soil type) ;	
			2. yield for wheat is better in HWC soil / little difference in yield for sorgham ;	
			3. paired figs ; *only award if linked correctly to mp 1 or mp2*	
			4. sorghum is adapted to live in arid environment / AW ;	
			5. and 6. *any two of the following* ;;	

feature	function
extensive / deep, root system	maximises water absorption
curled leaves / leaves small surface area / wazy leaves / bulliform leaf cells / hinged leaf cells / reduced stomata numbers / stomata in pits	reduces water loss
high silica content / more sclerenchyma / more strengthening tissue	reduces wilting

[4 max]

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		(ii)	number of seeds sown ; density of seeds sown / area of plot ; minerals / fertilisers ; wind / shelter ; soil pH;	[2 max]
	(b)		1. ref. bundle sheath cells; 2. light independent stage occurs / RuBP found (in bundle sheath cells) ; 3. RuBP / rubisco, kept away from, air / oxygen ; 4. by mesophyll cells ; 5. limits uptake of O_2 / maintains high CO_2 concentration (in bundle sheath cells) ; 6. enzymes / PEP carboxylase, have high optimum temperature ; 7. approx 45^0C ; 8. not denatured ;	[4 max]
				[Total: 10]
5	**(a)**		**A** – Leydig cell / interstitial cell ; **B** – (wall of) seminiferous tubule ;	[2]
	(b)	**(i)**	1 ;	[1]
		(ii)	*mark first two answers* E ; **A** secondary spermatocyte F ; **A** spermatid spermatozoan ;	[2 max]
		(iii)	cells grow in size / cells grow larger ;	[1]
	(c)	1 2 3	ATP production / provides energy ; **R** produces energy (for) movement of flagellum ; **R** tail (for) production of acrosomal enzymes ;	[2 max]

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	(d)	**(i)**	1. infectious disease causes damage ; **A** mumps / Chlamydia / STDs 2. lower sperm count / absence of sperm ; 3. damaged / abnormal / immobile / lazy , sperm ; 4. blocked sperm ducts / lack of seminal fluid ; 5. named genetic condition ; e.g. CF 6. autoimmune reaction to sperm ; 7. reduced testosterone ; 8. effect of chemical damage ; e.g. chemotherapy / hormones in drinking water	[3 max]
		(ii)	(fertilisation of) <u>oocyte</u> by sperm ; in glass dish ; **A** appropriate glassware **R** test tube AVP ; e.g. sperm injected into oocyte	[2 max]
		(iii)	1. ovulation less likely ; 2. (older) <u>oocytes</u> less likely to be fertilised / <u>oocytes</u> less viable ; 3. implantation less likely (in uterus of older woman) ; 4. miscarriage rate increases (with age) ; 5. (as) lower concentration of hormones / unbalanced hormones (in older woman) / start of menopause ; 6. (as) genetic defects / mutations, increase (with age) ;	[3 max]
				[Total: 16]
6	**(a)**	**(i)**	*ignore refs to function* <u>islets of Langerhans</u> ; scattered throughout pancreas / AW ; alpha and beta cells ; blood supply (to carry hormones away) ;	[3 max]
		(ii)	<u>globular protein</u> ;	[1]

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	(b)	1	it is identical to human insulin / fits membrane receptor on (target) cells ;	
		2	(more) rapid response ;	
		3	no / fewer, rejection problems / side effects / allergic reactions ;	
		4	ref. to ethical / moral / religious, issues ;	
		5	cheaper to produce in large volume / unlimited availability ; **R** cheap to produce	
		6	less risk of, transmitting disease / infection ;	
		7	good for people who have developed tolerance to <u>animal</u> insulin ;	[3 max]
				[Total: 7]
7	**(a)**		parents, carriers / heterozygous ; child homozygous recessive ; ¼ / 0.25 / 25%, chance ; mutation ;	[3 max]
	(b)	**(i)**	gene technology / genetic engineering / description ;	[1]
		(ii)	<u>glucagon</u> ;	[1]
		(iii)	low <u>blood</u> <u>glucose</u> concentration / during or after exercise ; **R** sugar	[1]
	(c)		foreign / non-self / cell recognition ; stimulates immune response / AW ;	[1 max]
	(d)		*parental genotypes* L^ML^N x L^ML^N *gametes* L^M or L^N L^M or L^N ; *parental genotypes and gametes for one mark* *offspring genotypes* L^ML^M L^ML^N L^ML^N L^NL^N ; *offspring phenotypes* MM MN MN NN ;	[3]
			*penalise once for omission of **L***	

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	(e)		Canadian Inuit, allele frequencies / L^ML^N ratio, different from others ; high frequency of L^M / low frequency of L^N , compared to other populations ; **R** just highest L^M / lowest L^N less outbreeding / more inbreeding ; AVP; e.g. L^M has selective advantage in Inuit environment	[3 max]
				[Total: 13]
8	**(a)**	1	stomata ;	
		2	air spaces (between cells) ;	
		3	thin cell walls ;	
		4	moist internal walls ;	
		5	<u>thin</u> leaf ;	
		6	cylindrical palisade cells ;	
		7	large surface area of, palisade / mesophyll, cells ;	[4 max]
	(b)		$0.0025 / 2.5 \times 10^{-3}$; **A** 0.003 only if 0.0025 in answer	[1]
	©	1	photosynthesis takes place ;	
		2	oxygen is produced ;	
		3	collects, inside disc / on surface of disc ;	
		4	disc, less dense / more buoyant ;	[3 max]
	(d)		<u>rate</u> of photosynthesis increases as light intensity increases ; paired data quotes from columns 2 and 4 ;	[2]
	(e)	1	light intensity no longer limiting ;	
		2	<u>carbon dioxide</u>, concentration / rate of diffusion, now limiting ;	
		3	temperature, too high / denatures enzymes ;	[2 max]
				[Total: 12]

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Section B: only one question to be answered.

9	**(a)**	1	acetyl CoA combines with oxaloacetate ;	
		2	to form citrate ;	
		3	4C to 6C ;	
		4	decarboxylation / CO_2 released ;	
		5	dehydrogenation / oxidation / release of hydrogen ;	
		6	reduced NAD produced / NAD accepts hydrogen ;	
		7	reduced FAD produced / FAD accepts hydrogen ;	
		8	ATP produced ;	
		9	substrate level phosphorylation ;	
		10	series of, steps / intermediates ; **A** many named steps off a diagram	
		11	enzyme catalysed reactions ;	
		12	oxaloacaetate regenerated ;	
		13	occurs in mitochondrial matrix ;	[9 max]
			accept diagram	
	(b)	14	coenzyme ;	
		15	for dehydrogenase ;	
		16	<u>reduced</u> ;	
		17	carries, electrons <u>and</u> protons / hydrogen / NAD	
		18	<u>from</u> Krebs cycle ;	
		19	and glycolysis ;	
		20	<u>to</u> ETC / electron carrier chain / oxidation ;	
		21	reoxidised / regenerated hydrogen removed ;	
		22	ATP produced ;	[6 max]
				[Total: 15]

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10	**(a)**	1	action potential / depolarisation, reaches presynaptic membrane ;	
		2	(Ca^{2+}) channels open in presynaptic membrane / presynaptic membrane becomes more permeable to (Ca^{2+}) ; **R** calcium / Ca / Ca^{+}	
		3	Ca^{2+} (flood) into presynaptic, neurone / knob ; **R** membrane	
		4	(this causes) vesicles of, acetylcholine / ACh ;	
		5	(to) move towards presynaptic membrane / (to) fuse with presynaptic membrane;	
		6	ACh released into synaptic cleft / exocytosis of ACh ;	
		7	ACh diffuses across (cleft) ;	
		8	ACh binds to receptor (proteins) / AW ;	
		9	on postsynaptic membrane ;	
		10	proteins change shape / channels open ;	
		11	sodium ions (rush) into postsynaptic neurone ; **R** membrane	
		12	postsynaptic membrane depolarised ;	
		13	action potential / nerve impulse ;	
		14	action of acetylcholinesterase ;	[9 max]
	(b)	15	ensure one-way transmission;	
		16	receptor (proteins) only in postsynaptic, membrane / neurone ; *ora*	
		17	vesicles only in presynaptic neurone ; *ora*	
		18	adaptation / ACh amount reduces due to overuse of synapse ;	
		19	wide range of responses ;	
		20	due to interconnection of many nerve pathways ;	
		21	inhibitory synapses affect other synapses ;	
		22	involved in memory / learning ;	
		23	due to new synapses being formed ;	
		24	summation / discrimination ;	[6 max]
				[Total: 15]

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