

**Biology**

Advanced GCE **2805/02**

Application of Genetics

# **Mark Scheme for June 2010**

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Question			Expected Answers	Marks
1	(a)	(i)	AAIi AAli Aall Aali ; <i>minus 1 for each of first 2 mistakes or omissions</i> <b>A</b> A-I- for 1 mark	2
		(ii)	AAii Aaii ;	1
	(b)		<p>parents blue x white ;  gametes AI ai ;  F1 Aali blue ;</p> <p>F1 x F1 gametes AI Ai al ai x same ; <b>A</b> off Punnett square</p> <p>F2 Punnett square genotypes ;; <i>minus 1 for each of first 2 mistakes</i></p> <p>phenotypes ;;</p> <p>ratio 9 blue-flowered : 3 purple flowered : 4 white flowered ;</p>	max 8

Punnett square

gametes	AI	Ai	al	ai
AI	AAIi blue	AAIi blue	AaIi blue	AaIi blue
Ai	AAIi blue	AAii purple	Aaii blue	Aaii purple
al	AaIi blue	AaIi blue	aaIi white	aaIi white
ai	AaIi blue	Aaii purple	aaIi white	aaIi white

	(c)	(i)	gives one extra amino acid ; shape of protein altered ; ref. 1° structure and, folding / bonding ; ref. 3D shape / 3° structure ;	max 2
		(ii)	no longer accepts ion / ion does not fit / channel blocked / AW ; no longer accepts ATP / ATP does not fit ; no longer changes shape ; cannot embed in membrane ;	max 2
				<b>[Total:15]</b>

Question			Expected Answers	Marks
2	(a)	(i)	gradual process / AW ; to achieve homozygosity / AW ; best in each generation interbred ; ref. to artificial selection ; ref. to several traits involved / may be, additive / polygenic ;	max 2
		(ii)	ref. to mitosis ; chromosomes replicated ; failure of, spindle / cell division ; colchicine / other method ;	max 2
		(iii)	self-pollination prevented ; pollination by foreign pollen prevented ; pollen transfer ; practical detail ;	max 2
		(iv)	3n ; meiosis fails ; ref. to synapsis / homologous pairs ;	max 2
	(b)	(i)	sterile explant ; sterile nutrient (medium) ; ref. to plant growth regulators ; <u>callus</u> ; subdivided ; medium with different plant growth regulators ; plantlets / embryoids ; hardening medium / sterile soil ; AVP ; e.g. appropriate plant growth regulators	max 5
		(ii)	callus can be divided ; large numbers of (genetically) identical plants ; <b>A</b> clone in short time / process is faster ; bulk up sterile hybrid ; bulk up master lines ; no need for making more 4n ;	max 2
				<b>[Total:15]</b>

Question		Expected Answers	Marks
3	(a)	<p>inbreeding depression ;  loss of, viability / fertility / yield / fitness / vigour ;  deleterious recessive alleles, expressed / homozygous / accumulate ;  reduced genetic, variation / diversity ;  increased homozygosity / decreased heterozygosity ;  genetic erosion / loss of alleles / reduced gene pool ;</p>	max 3
	(b)	<p>deleterious alleles removed / ora ;  by (natural) selection ;  no artificial selection ;  now, natural inbreeders / tolerant of inbreeding ;  sites sampled not genes but 'junk' having no effect on viability ;  AVP ; e.g. length of reign of <math>\alpha</math> male / length of time to maturity means fathers do not mate with daughters</p>	max 2
	(c)	<p>source of genetic variation ;  <u>alleles</u> ;  for <u>future</u> use ;  in changed circumstances ;  e.g. changed circumstance ; climate / disease / etc</p>	max 3
	(d)	<p>1 (donor) female treated with, hormone / named hormone ;  2 to <b>superovulate</b> ;  3 surrogate treated with, hormone / named hormone ;  4 to, <b>synchronise</b> cycle / prepare uterus ;  5 donor female, <b>artificially inseminated</b> / mated ;  6 embryos washed from, uterus / female ;  7 <b>oocytes</b> removed from donor female ;  8 <b>IVF</b> ;  9 embryos, subdivided / <b>cloned</b> ;  10 embryos, sexed / genetically tested ;  11 inserted unto surrogate via, <b>catheter</b> / <b>syringe</b> ;  12 may not be same breed ;  13 may not be same species / use of <b>portmanteau</b> ;</p>	max 6
		<b>QWC - clear, well organised using specialist terms ;</b>	1
			<b>[Total:15]</b>

Question			Expected Answers	Marks
4	(a)		<p><i>HaeIII</i> no, target site / sequence, inverted ; <b>A</b> 'not correct' ref. antiparallel DNA strands / AW ; active site of enzyme only fits one way round ;</p> <p><i>HpaII</i> yes, target site / sequence, correct / can be any base outside target sequence ;</p>	<p>max 2</p> <p>1</p>
	(b)	(i)	<p>cuts plasmid with 'sticky ends' / -GC CG- ; human gene must be cut with, same enzyme / <i>HpaII</i> ; or given same sticky ends ; <u>complementary</u> , (sticky) ends / bases ; ends then H-bond ; A to T / C to G ; ref. action of ligase ;</p>	max 4
		(ii)	<p>cuts with 'blunt ends' ; must be given sticky ends ; examples of nucleotides ; <i>nucleotides with C or G</i> ref. enzyme / terminal transferase ; human gene given complementary ends ;</p>	max 3
	(c)	(i)	<p>treatment of a genetic, disorder / condition ; by altering a patient's, genotype / genome ; <b>A</b> genes by adding a, useful / normal, allele ; ref. delivery system ; by inactivating an undesirable (AW) allele ; only for recessive diseases at present ;</p>	max 3
		(ii)	<p><i>benefit</i> new blood vessels grow (in damaged heart muscle) ; more oxygen reaches heart muscle ; other sensible comment re damaged heart muscle ; AVP ; must be something to do with transport system</p> <p><i>hazard</i> allele may insert within another, gene / cell, and disrupt its function / with unknown consequences / with damaging consequences ; may insert in, gonad / named, and be passed to offspring with unknown consequences / etc. ; vector may cause damage ; AVP ; e.g. ref to foreign antigen and immune response</p>	<p>max 1</p> <p>max 1</p>
				<b>[Total:15]</b>

Question			Expected Answers	Marks
5	(a)	1	random / chance ;	<p>max 7</p> <p>1</p>
		2	mutation ;	
		3	detail mutation ;	
		4	ref. (R-) plasmid ;	
		5	<u>natural selection</u> ;	
		6	antibiotic, is selective agent / exerts selective pressure ;	
		7	resistants survive / susceptibles die ; <b>R</b> 'immune'	
		8	selective advantage ;	
		9	e.g. breakdown of antibiotic / alternative metabolic pathway / method of expelling antibiotic ;	
		10	offspring inherit mutation / vertical transmission ;	
		11	horizontal transmission / named method of horizontal transmission ;	
		12	detail of horizontal transmission ;	
		13	AVP ; e.g. ref. multiple resistance	
			<b>QWC - legible text with accurate spelling, punctuation and grammar ;</b>	
	(b)	(i)	use from 1 - 7 days, not significantly different / very slightly different, from no use ; percentage of resistant colonies increases with length of time of antibiotic use ; ref. to comparative figures one of which must be 8-14 / > 14 ;	max 2
		(ii)	exposure before experimental period ; passed from other people ; who had used a $\beta$ -lactam ; multiple resistance ; so selected by use of other antibiotic ;  mutation occurs ; previously existing normal level of resistance in bacterial population ;	max 3
	(c)		<i>two of</i> use antibiotic only when necessary ; use only when appropriate (not for viruses) ; prescription only ; avoid wide spectrum / use only specific ; ensure patients complete course ; take out of use (very doubtful effect) ; use different antibiotic(s) ; stop use as growth promoter for livestock ; international agreement / reduce black market ;  <b>A</b> do not use for more than 7 days, in a year / at a time ;	max 2
				<b>[Total:15]</b>

Question			Expected Answers	Marks
6	(a)	1 2 3 4 5 6 7 8 9 10 11	dominant allele ; autosomal / chromosome 4 ; not truly Mendelian (ref to extension of 'stutter' and appearance of symptoms) ; inheritance from male and female different (juvenile onset more likely associated with paternal inheritance) ; unstable gene ; stutter / triplet repeat / CAG repeat ; sufferers have, 37 - 100 / > 37, repeats ; stutter size increases with generations ; age of onset inversely proportional to length of repeat ; heterozygotes suffer ; 1 in 2 chance of passing to offspring ;	max 5
	(b)		no normal mice fail test ; failure of HD mice reduced in environmentally-enriched cages ; (only) 14% environmentally-enriched HD mice fail test ; at 15 weeks ; plateau to end / AW ; increasing numbers of standard HD mice fail test with time ; 100% at, 19 / 20, weeks ;	max 4
	(c)		suggests, physiotherapy / stimulation / activity / AW ; may, delay onset / reduce mental deterioration ; R 'decrease symptoms'	2
	(d)		advantage ; e.g. knowledge of future outcome detail ; e.g. can manipulate reproduction / delay onset by activity / can have AID  disadvantage ; e.g. foreknowledge of incurable disease / no cure / no treatment detail ; e.g. if young man is positive so is his father insurance problems employment problems	2      2
				[Total:15]



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