GCE

Biology

Advanced GCE

Unit **F215:** Control, Genomes and Environment

Mark Scheme for June 2011

Question			Expected Answers	Marks	Additional Guidance
In ALL questions			**CREDIT AW FOR ALL** i.e. credit any alternatively worded statement that conveys the same sense as the mark point. If a particular word is essential and no other will do it is underlined. **IGNORE** wrong or vague statements unless **they directly contradict** a mark point. e.g. in Q1(a)(i) mark point 1: Therefore penalise *"plants eat sheep"* **(CON)** but ignore *'sheep absorb plants by phagocytosis'* (wrong) or *'sheep make use of plants'* (vague). **ACCEPT** incorrect spellings if they are recognisable **and** sound the same when pronounced, **even for underlined terms**.		

Question			Expected Answers	Marks	Additional Guidance
1	**(a)**	**(i)**	**1** (sheep / animals) ingest / consume / eat / feed on (grass / plants) **;** **2** digest / hydrolyse **,** (protein) to amino acids **;** **3** amino acids move **into ,** blood / cells **;** **4** synthesis of <u>proteins</u> / <u>translation</u> **;**	**3 max**	**2 ACCEPT** break down **IGNORE** enzymes **3 ACCEPT** amino acids are absorbed into **,** blood / cells **CREDIT** AW description of movement e.g. diffusion / active transport but **DO NOT CREDIT** movement by osmosis
1	**(a)**	**(ii)**	**1** death / leaf loss **;** **2** decomposition / decay **;** **3** excretion / urination / described **;** **4** egestion / defaecation / described **;**	**2 max**	**3 IGNORE** faeces in the context of mp3 but do not then credit mp4 as a description therefore *'excretion of faeces'* scores mp3 only **IGNORE** waste matter **4 IGNORE** waste matter

Question			Expected Answers	Marks	Additional Guidance
1	(a)	(iii)			Full marks can only be awarded if mp 4 awarded
			1 **C** is *Nitrosomonas* ; 2 **D** is *Nitrobacter* ;		**1 & 2 ACCEPT** "*they are 'Nitrosomonas and Nitrobacter'* = **2 marks** (correct order) *'they are Nitrobacter and Nitrosomonas'* = **1 mark** (wrong order)
			3 **C and D** are <u>nitrifying</u> bacteria ; *for mps 1 , 2 and 3* **internal max 2**		

			4 plants need nitrates to make ,
			      amino acids / protein(s) / enzymes / DNA / RNA /
			      nucleic acids / chlorophyll / cytoplasm / new cells ;
				3	4 **IGNORE** plants need nitrates to grow (as given in Q)
					
					 .

1	(a)	(iv)			**IGNORE** references to other letters throughout
			1 **E** continues / plants use nitrate ; 2 less / no , **B** / decay ; 3 less / no , **C** / **D** / recycling of nitrogen / nitrification ; 4 (cabbages) harvested / removed ;	3 max	2 **ACCEPT** cabbages do not rot down

Question			Expected Answers	Marks	Additional Guidance
1	(a)	(v)	1 legume / any named leguminous plant ;		1 **CREDIT** English or Latin name. Examples include but are not limited to: pea (*Pisum*) / bean (*Phaseolus* or *Vicia*) / vetch (*Vicia*) / soya (*Glycine*) / chickpea (*Cicer*) / peanut (*Arachis*) / alfalfa, lucerne or medick (*Medicago*) / clover or trefoil (*Trifolium*) / lupin (*Lupinus*) / *Leucaena / Cyamopsis / Sesbania* **IGNORE** names of non-leguminous plants, therefore *'plant legumes such as cucumbers'* scores mp 1
			2 *Rhizobium* / nitrogen-fixing bacteria (in root nodules) ; 3 *idea of converting* nitrogen gas / N$_2$, into , compounds / ammonium / ammonia / amino acids / protein (in plants) ; 4 plants ploughed in / plants left to decay / ref **B** / ref **C** / ref **D** ;	**3 max**	3 the nitrogen must be clearly gaseous **IGNORE** nitrite / nitrate (because not made in plant)
1	(b)		1 genetic resource / gene bank / have (different) alleles ; 2 for , genetic engineering / genetic modification / artificial selection / selective breeding / described ; 3 if conditions change / in the future ; 4 example of useful trait ; 5 to maintain , biodiversity / genetic diversity / (large) gene pool ;	**2 max**	**IGNORE** biotourism 1 **IGNORE** source of genes 3 **IGNORE** unless context is genetic 4 e.g. disease resistance (**not immunity**) / hardiness / more or better quality wool or meat An animal need **not** be named but if it is it should be a **farm animal** e.g. sheep / cows / goats / pigs / poultry 5 **CREDIT ORA** to prevent loss of genetic diversity **IGNORE** to prevent extinction / to increase biodiversity

Question			Expected Answers	Marks	Additional Guidance
1	(c)	(i)	mutation / described ; selection / selection pressure / selective advantage ;	 2	1 **ACCEPT** new or different allele formed / DNA changed 2 **IGNORE** type of selection
1	(c)	(ii)	1 small **,** population / gene pool ; 2 ref. inbreeding / genetic drift ; 3 unusual diet / cannot eat grass / poisoned by grass / must eat seaweed ; 4 may not be commercially viable / expensive to keep ;	 2 max	1 **CREDIT** lack of genetic **,** variability / variety 2 **CREDIT** founder effect 3 Mark point must relate to diet
				20	

Question			Expected Answers	Marks	Additional Guidance
2	(a)	(i)	1 <u>instinct</u>ive ; 2 genetic / genetically determined / inherited ; 3 rigid / fixed pattern / inflexible ; 4 <u>stereotyp</u>ed / <u>stereotyp</u>ical ; 5 automatic / does not require thought / 　　　　　　　　　　　does not require learning ;	2 max	2 **IGNORE** born with it / present from birth 3 **ACCEPT** description. <u>Same</u> in all members of species or performed the <u>same</u> all the time
2	(a)	(ii)	1 (behaviour) chang<u>ed</u> / alter<u>ed</u> / learn<u>t</u> , by experience ; 2 ref. memory / association / reinforcement / practice ; 3 variable ;	2 max	1 **ACCEPT** taught by parents / learnt by watching others 'due to experience' is not enough. They need to refer to **_past_** experience. 3 **ACCEPT** description. Varies or is different in different members of a species or in one animal at different times

Question			Expected Answers	Marks	Additional Guidance
2	(b)				*Note -* **The question relates to animal behaviour that is, in broad terms, advantageous for survival.**
			general innate behaviour advantages		
		A1	rapid / automatic / correct **,** behaviour / response **;**		**A marks** can be awarded in the context of an example
		A2	*idea that* simple nervous system is enough **;**		
		A3	suits species with **,**		
			short lifespan / no parental care / solitary lifestyle **;**		
					E marks the **name** of the type of behaviour is **not needed**.
					Odd E numbers require the **animal to be identified** and the **behaviour described**.
					Even E numbers require an explanation of how the behaviour is **advantageous** e.g. to keep the animal in a suitable environment / to avoid predation or damage / to find food or a mate. Can be awarded even if corresponding odd **E** number has not been awarded.
			innate behaviour examples with specific advantages		
		E1	an escape reflex described in a named animal **;**		
		E2	advantage of this escape reflex explained **;**		
		E3	a taxis described in a named animal **;**		**E3 ACCEPT** motile protoctist e.g. *Euglena* / *Paramecium*
		E4	advantage of this taxis explained **;**		
		E5	a kinesis described in a named animal **;**		
		E6	advantage of this kinesis explained **;**		
			continued		*continued*

Question			Expected Answers	Marks	Additional Guidance
2	**(b)**		*continued*		
			general learned behaviour advantages		
		A4	flexible / adaptable to **,** change / environment **;**		**A mark** can be awarded in the context of an example
			learned behaviour examples with specific advantages		**E marks** the **name** of the type of behaviour is **not needed**.
		E7	habituation described in a named animal **;**		**Odd E numbers** require the **animal to be identified** and the **behaviour described**.
		E8	advantage of this habituation explained **;**		**Even E numbers** require an explanation of how the behaviour is **advantageous** e.g. to conserve energy (habituation) / access care (imprinting) / access food / safety or other reward or survival need
		E9	imprinting described in a named animal **;**		
		E10	advantage of this imprinting explained **;**		
		E11	conditioning described in a named animal **;**		**E11** **ACCEPT** description of Pavlov's dogs for conditioning
		E12	advantage of this conditioning explained **;**		**E12** **IGNORE** ref. to Pavlov's dogs
		E13	latent learning described in a named animal **;**		
		E14	advantage of this latent learning explained **;**		
		E15	insight learning described in a named animal **;**		
		E16	advantage of this insight learning explained **;**	**10 max**	
			QWC – relating types of behaviour to advantages ;	**1**	**QWC =** any **description** mp **(odd E)** **PLUS** any **advantage** mp **(even E or A)** from **both** sections
				15	

Question			Expected Answers	Marks	Additional Guidance
3	(a)	(i)	DNA / gene / genetic , fingerprinting / profiling / analysis ; DNA / protein / gene , sequencing ; electrophoresis ;	1 max	IGNORE gene testing / gene probing / gene mapping / genome sequencing
3	(a)	(ii)	rarely / do not , produce seed / cross-pollinate / interbreed ; <u>only</u> reproduce asexually ;	1 max	
3	(a)	(iii)	<u>vegetative propagation</u> ;	1	IGNORE asexual reproduction (as given in the question)

3	(b)		1 genetically identical / little genetic variation ;
			2 all susceptible / none resistant , to <u>this</u> disease ;
			
			3 beetles , move / fly , from tree to tree
			                              or beetles are vector ;
			4 trees grow , in clonal patch / close together
			         or disease spreads through , suckers / roots
			         or connected by , suckers / roots ;
			5 the beetles <u>only</u> , live on / target , elm trees ;
			
			6 attempts at control contributed to spread ;
			7 as **more** trees became diseased then
			                    more tree surgery was necessary
			                    (contributing to spread of problem) ;
			8 as **more** trees became infected then
			         more , saws / equipment , were contaminated ;
				4 max	1 IGNORE clone
					2 IGNORE all susceptible to 'disease' in general. Only credit if **one particular** disease is implied
					         e.g. the / new / fungus / same , disease
					    DO NOT CREDIT immune instead of resistant
					
					3 IGNORE simple repetition of text 'beetles spread disease'

Question			Expected Answers	Marks	Additional Guidance

3	(c)	(i)	1 less / no , movement of water
			
			        or less / no , water reaches leaves ;
			
			 2 less / no ,
			     minerals / nitrate / phosphate / magnesium / iron ;
			
			 3 less / no , chlorophyll formation ;
			
			 4 chlorophyll breakdown / leaf senescence ;
				
				 2 max
					
					 2 **CREDIT** correct symbols NO_3^-, PO_4^{2-}, Mg^{2+}, Fe^{2+}, Fe^{3+}
					 IGNORE nutrients
					 IGNORE reference to other substances such as sugars

3	(c)	(ii)	1 less / no , photosynthesis ; 2 less / no , sugar(s) / amino acid(s) / assimilates / organic molecules ; 3 <u>roots</u> cannot , respire / do active transport / metabolise ; 4 the falling leaves carry the fungus ;	 **2 max**	 2 **CREDIT** named sugars, e.g. sucrose , glucose , hexose **IGNORE** nutrients / food

Question			Expected Answers	Marks	Additional Guidance
3	**(d)**	**1**	cut plant material into **,** explant<u>s</u> / small piece<u>s</u> **;**		**1 DO NOT CREDIT** a single cutting
		2	example of part of plant used e.g. leaf / stem / root / bud / meristem / dividing region at tip of plant **;**		
		3	sterilise explant **;**		
		4	(with) bleach / sodium hypochlorite / alcohol **;**		
		5	place on **,** agar / growth medium **;**		**5 CREDIT** place in aerated solution
		6	containing **,** glucose / amino acids / nitrates / phosphates **;**		**6 IGNORE** polymers / carbohydrates
		7	callus **or** mass of **,** undifferentiated / totipotent **,** cell<u>s</u> **;**		**7 DO NOT CREDIT** description of single cell
		8	high auxin **and** cytokinin (for callus formation) **;**		
		9	subdivide callus / sub-culturing **;**		**9 IGNORE** ref. single cells
		10	treat to induce **,** roots / shoots **;**		
		11	<u>change</u> plant hormone ratio **;**		**11 CREDIT** description , e.g. high auxin to give roots or (relatively) high cytokinin to give shoots (auxin : cytokinin ratio = 100 : 1 for roots, 4 : 1 for shoots, or similar figures)
		12	transfer to **,** greenhouse / soil / less controlled environment / non-sterile environment **;**		
		13	ref. aseptic conditions (anywhere within stages 5-11) **;**	**6 max**	**13** Do not award for sterilising explant (which is mp3)
			QWC – described in logical sequence of steps ;	**1**	**Award QWC for sequence of marks as follows:** either mp 1 or 2 **then** 1 mark from mps 5 – 8 **then** 1 mark from mp 9 - 12

Question			Expected Answers	Marks	Additional Guidance
3	(e)				**CREDIT** the first answer on each prompt line
			advantages		
			1 quick ;		**1 IGNORE** ref. large numbers alone
			2 disease-free / virus-free , stock created ;		
			3 plants have same feature / uniform plants created ;		**3** refers to plant phenotype e.g. plants , grow at same rate / grow to same height
			4 can reproduce infertile plants ;		
			5 can reproduce plants that are hard to grow from seed ;		
			6 create whole plants from GM cells ;		
			7 production , not determined by seasons / at any time / anywhere in the world ;		
			8 (plantlets small) can be transported easily / grown in small space ;		
			9 can save rare species from extinction ;		
			disadvantages		
			10 expensive / labour intensive , process ;		
			11 process can fail due to microbial contamination ;		
			12 all offspring susceptible to *same* , pest / disease / named environmental factor (e.g. drought) ;		**12 IGNORE** all are susceptible to disease in general (as in 3b)
			13 no / low / little , genetic variation ;	**4**	**13 IGNORE** loss of alleles
				22	

Question			Expected Answers	Marks	Additional Guidance
4	(a)	(i)	57 / 57.3 ; ;	2	**Award 2 marks for a correct answer** **ACCEPT** 57.25 for 2 marks If answer is incorrect then allow 1 working mark for 655 – 280 or for seeing 375 anywhere in the working

4	(a)	(ii)	*description (D)*
			 D1 number of , waders / birds , decrease (in area 2) ;
			 D2 (numbers decrease) in , all / four , species ;
			 D3 unlike / different to ,
			 area 1 / where hedgehogs absent ;
			 D4 (area 1) two species increase /
			 only two species decrease ;
			 D5 quote any two % change figures ;
			
			 explanation (E)
			 E1 hedgehogs are , secondary consumers / 'predators' ;
			 E2 hedgehogs , stop birds breeding /
			 reduce offspring (one year) ;
			 E3 *idea of* fewer , new adults / breeders (next year) ;
			 E4 *idea of* more deaths than 'births' ;
				6 max	**D1** **CREDIT** 'it' as number **ACCEPT** 'amount'
					 D2 **CREDIT** the four names if all said to decrease
					
					 D4 **CREDIT** lapwing and redshank increase /
					 only dunlin and snipe decrease
					 D5 Percentage change figures:
					                   area 1 area 2
					 lapwing +24 -31
					 redshank +51 -41
					 dunlin -31 -56
					 snipe -10 -57
					      Look for ecf from 4(a)(i) if snipe in area 2 incorrect
					
					 E1 **IGNORE** hedgehogs eat eggs as given in question
					
					 E3 Look for idea of future / knock-on effect

Question			Expected Answers	Marks	Additional Guidance
4	(a)	(iii)			**Mark the first suggestion on each numbered line. Award 1 mark for a factor and a further mark for a related explanation**
			1 plenty of / enough , food / birds' eggs / space ;		**1 CREDIT** little competition for food
			2 breed rapidly / breed successfully / young survive ;		
			3 no / few , predators ;		
			4 few die (young / before breeding) ;		
			5 *idea that* hedgehogs are introduced species ;		
			6 invasive / fill vacant niche / not reached carrying capacity ;		
			7 these hedgehogs restricted to island ;		
			8 cannot , emigrate / leave island (so numbers build up) ;	**4 max**	
4	(b)		*idea that the following may be ethically wrong*		**CREDIT ORA** *idea preventing these is ethically right* **IGNORE** 'right to life' and 'playing God'
			1 killing hedgehogs ;		
			2 letting hedgehogs , kill / decrease number of , waders ;		**2 CREDIT ORA** need to conserve waders
			3 introducing hedgehogs to island (upset the ecosystem) ;		
			4 catching / moving , hedgehogs might cause suffering ;		**4** *'the other methods are cruel'* = 1 mark (mp 4) *'moving hedgehogs elsewhere causes problem somewhere else'* = 1 mark (mp 4)
			5 doing nothing ;	**3 max**	**5 CREDIT ORA** idea of human responsibility
				15	

Question			Expected Answers	Marks	Additional Guidance
5	(a)		1 methionine 2 arginine 4 threonine 5 tryptophan ; ;	2	**AWARD** 2 marks if all four correct **AWARD** 1 mark if two or three correct **AWARD** 0 marks if only one correct **IGNORE** incorrect spelling if meaning is clear
5	(b)		<u>translation</u> ; <u>ribosome</u> / <u>rough</u> ER / <u>RER</u> ;	2	**IGNORE** ER alone **DO NOT CREDIT** smooth ER
5	(c)		messenger / m ; RNA / ribonucleic acid ;	2	$m\mathcal{RNA}$' = 2 marks **IGNORE** incorrect 'r' or 't' prefix for 2nd mark
5	(d)		UAA **and** UAG **and** UGA ; do not code for an amino acid / no matching tRNA ;	2	**NEED** all 3 for one mark **ACCEPT** do not code for anything **ACCEPT** no , matching / complementary , anticodon
5	(e)		neutral / silent / substitution / point ;	1	
				9	

Question	Expected Answers	Marks	Additional Guidance
6 (a)	*somatic* changes / uses , body cells ; change cannot be passed to offspring ; cures / alleviates , genetic disease in one individual ; short-lived / repeat treatments needed ; *germ line* changes / uses , gametes / zygote / embryo / reproductive tissue ; banned ;	2 max	**ORA** germ line changes could be passed to offspring **ACCEPT** sperm / eggs

6 (b)	*central*
	CI brain and spinal cord ;
	C2 intermediate neurones ;
	C3 has , coordinating role / many synapses ;
	
	peripheral **max 3**
	P1 <u>nerves</u> , from sense organs / to muscles / to glands ;
	P2 sensory **and** motor , neurones / nerve cells ;
	
	P3 role in , sensing stimuli / controlling effectors
	      or conducting impulses, to / from ,
	         CNS / brain / spinal cord ;
	P4 includes , somatic / autonomic /
	        sympathetic / parasympathetic ;
		4 max	**For full marks needs at least 1 C mark**
			
			C2 CREDIT relay / internuncial / bipolar
			C3 IGNORE processing
			
			P1 IGNORE effectors
			P2 DO NOT CREDIT if intermediate included
			    DO NOT CREDIT nerves
			
			P3 IGNORE messages / signals / information

6 (c)	*prophase 1* <u>homologous</u> <u>chromosomes</u> pair up / <u>bivalents</u> form ; <u>chiasmata</u> / crossing-over / recombination ;	2	**CREDIT** reverse arguments for prophase 2 **ACCEPT** description e.g. <u>non-sister chromatids</u> exchange , (matching sections of) DNA / alleles / genetic material
		8	

Question			Expected Answers	Marks	Additional Guidance
7	(a)	(i)	1 sweep netting / sweep vegetation with a net ; 2 beating / beat trees and bushes ; 3 pooter / pooting / described ;	1 max	2 **ACCEPT** fogging 3 **ACCEPT** pitfall traps / described

7	(a)	(ii)	*idea of* ladybirds not evenly distributed /
			                  some parts of hill different /
			                  more representative ;
			
			lets <u>reliability</u> be assessed / anomalies identified ;
				1 max	**ACCEPT** description
					      e.g. could be more ladybirds one side than another
					
					ACCEPT increases reliability
					IGNORE accuracy / precision / removes anomalies

7	(b)	(i)	**M1** (calculate) % / proportion / ratio ; **E1** as different total numbers at each site ; **or** **M2** (draw) bar chart / kite diagram ; **E2** pictorial data easier to understand ;	2 max	**M1** **IGNORE** χ^2 **M2** **IGNORE** histogram / line graph

Question			Expected Answers	Marks	Additional Guidance

7	(b)	(ii)	*yes (for first statement)*
			1 first statement true / correlation exists **;**
			2 number of black ladybirds increase **,**
			           from 100m to 300m / until 300m **;**
			3 400m number decrease **but** % black increases **;**
			
			no (for second statement)
			4 correlation not proof of causation /
			       no proof of causal link /
			       second statement not (necessarily) true **;**
			5 another (named) factor could be involved **;**
					If candidates argues 'yes' exclusively, can only be awarded mps 1-3
					If candidate answers 'no' exclusively, can only be awarded mps 4 & 5
					
					Note *percentage of black ladybirds increases as you go up the hill* = 2 marks (mps 2 & 3)
					
					5 **CREDIT** could be due to distance from town /
					           more **or** less predation high up /
					           camouflage / warning colours

				3 max	

7	(c)	(i)	only expressed , when homozygous /
			           in absence of dominant (allele) **;**
			not expressed when heterozygous /
			           expression masked by dominant (allele) **;**
				1 max	**DO NOT CREDIT gene**
					IGNORE letters / genotypes
					
					ACCEPT only seen in phenotype when it is present in 'double dose'

Question			Expected Answers	Marks	Additional Guidance
7	(c)	(ii)	**1** $\underline{q}^2$ = 296 / 346 or 0.85 / 0.855 / 0.86 ; **2** q = √previous answer or 0.92 / 0.93 ; **3** p = 1 – previous answer or 0.08 / 0.07 ;		**1 DO NOT CREDIT** calculation or figure unless it has been indicated as q^2 **2 ACCEPT ecf** **3 ACCEPT ecf** ***Note*** **If both p and q are correct = 3 marks** *If p and q not given to 2 decimal places* then penalise 1 mark and then apply ecf • If the 2 final answers add up to 1 give mp 3, then look for evidence of mps 1 or 2 in the working • If the 2 final answers do not add up to 1, look for evidence of mps 1, 2 & 3 in the working • Award the working mark(s) if method correct, even if subsequent calculation incorrect (e.g. *1 – 0.54 = 0.56* could get mp 3 for '1 – previous answer' even though 0.56 is the incorrect answer for the calculation) *e.g. if black allele wrongly assumed to be recessive* *q = 0.38* or *q = √0.1445* give mp 2 as ecf *p = 0.62* or *p = 1 – 0.38* give mp 3 as ecf *e.g. if answer given as* *q = 0.85 and p = 0.15* give mp 3 They will not get mp 1 as they think that 296/346 = q (rather than q^2) and so will not square root it so they won't get mp 2
				3	
				11	

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