RECOGNISING ACHIEVEMENT

GCE

Biology

Advanced GCE

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

Mark Scheme for June 2011

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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)	**1 C** is *Nitrosomonas* **;** **2 D** is *Nitrobacter* **;** **3 C and D** are nitrifying 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**	**Full marks can only be awarded if mp 4 awarded** **1 & 2 ACCEPT** "*they are 'Nitrosomonas and Nitrobacter'* = **2 marks** (correct order) *'they are Nitrobacter and Nitrosomonas'* = **1 mark** (wrong order) **4 IGNORE** plants need nitrates to grow (as given in Q) .
1	(a)	(iv)	**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**	**IGNORE** references to other letters throughout **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)				**IGNORE** biotourism
			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**	**1 IGNORE** source of genes **3 IGNORE** unless context is genetic **4** e.g. **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** instinctive **;** **2** genetic / genetically determined / inherited **;** **3** rigid / fixed pattern / inflexible **;** **4** stereotyped / stereotypical **;** **5** automatic / does not require thought / does not require learning **;**	**2 max**	**2** **IGNORE** born with it / present from birth **3** **ACCEPT** description. Same in all members of species or performed the same all the time
2	(a)	(ii)	**1** (behaviour) changed / altered / learnt **,** 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 **;** only reproduce asexually **;**	**1 max**	
3	(a)	(iii)	vegetative propagation **;**	**1**	**IGNORE** asexual reproduction (as given in the question)
3	(b)		**1** genetically identical / little genetic variation **;** **2** all susceptible / none resistant **,** to this 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 only **,** 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 **,** explants / small pieces **;**		**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 **,** cells **;**		**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	change 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)		*advantages* **1** quick **;** **2** disease-free / virus-free **,** stock created **;** **3** plants have same feature / uniform plants created **;** **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) **;** **13** no / low / little **,** genetic variation **;**	**4**	**CREDIT** the first answer on each prompt line **1 IGNORE** ref. large numbers alone **3** refers to plant phenotype e.g. plants **,** grow at same rate / grow to same height **12 IGNORE** all are susceptible to disease in general (as in 3b) **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)	**1** plenty of / enough **,** food / birds' eggs / space **;** **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**	**Mark the first suggestion on each numbered line. Award 1 mark for a factor and a further mark for a related explanation** **1 CREDIT** little competition for food
4	(b)		*idea that the following may be ethically wrong* **1** killing hedgehogs **;** **2** letting hedgehogs **,** kill / decrease number of **,** waders **;** **3** introducing hedgehogs to island (upset the ecosystem) **;** **4** catching / moving **,** hedgehogs might cause suffering **;** **5** doing nothing **;**	**3 max**	**CREDIT ORA** *idea preventing these is ethically right* **IGNORE** 'right to life' and 'playing God' **2 CREDIT ORA** need to conserve waders **4** *'the other methods are cruel'* = 1 mark (mp 4) *'moving hedgehogs elsewhere causes problem somewhere else'* = 1 mark (mp 4) **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)		translation **;** ribosome / rough ER / RER **;**	**2**	 **IGNORE** ER alone **DO NOT CREDIT** smooth ER
5	(c)		 messenger / m **;** RNA / ribonucleic acid **;**	**2**	*'mRNA'* = 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** nerves **,** 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* homologous chromosomes pair up / bivalents form **;** chiasmata / crossing-over / recombination **;**	**2**	**CREDIT** reverse arguments for prophase 2 **ACCEPT** description e.g. non-sister chromatids 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 **;**	**3 max**	**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
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 **;**	**3**	**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 $q = \sqrt{0.1445}$ 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
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