



GCE

Biology

Advanced GCE

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

Mark Scheme for June 2011

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Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk

Question			Expected Answers	Marks	Additional Guidance
1	(a)	(iii)	<p>1 C is <i>Nitrosomonas</i> ;</p> <p>2 D is <i>Nitrobacter</i> ;</p> <p>3 C and D are <u>nitrifying</u> bacteria ; for mps 1 , 2 and 3 internal max 2</p> <p>4 plants need nitrates to make , amino acids / protein(s) / enzymes / DNA / RNA / nucleic acids / chlorophyll / cytoplasm / new cells ;</p>	3	<p>Full marks can only be awarded if mp 4 awarded</p> <p>1 & 2 ACCEPT <i>“they are ‘<u>Nitrosomonas</u> and <u>Nitrobacter</u>’ = 2 marks</i> (correct order)</p> <p><i>‘they are <u>Nitrobacter</u> and <u>Nitrosomonas</u>’ = 1 mark</i> (wrong order)</p> <p>4 IGNORE plants need nitrates to grow (as given in Q)</p>
1	(a)	(iv)	<p>1 E continues / plants use nitrate ;</p> <p>2 less / no , B / decay ;</p> <p>3 less / no , C / D / recycling of nitrogen / nitrification ;</p> <p>4 (cabbages) harvested / removed ;</p>	3 max	<p>IGNORE references to other letters throughout</p> <p>2 ACCEPT cabbages do not rot down</p>

Question			Expected Answers	Marks	Additional Guidance
1	(a)	(v)	<p>1 legume / any named leguminous plant ;</p> <p>2 <i>Rhizobium</i> / nitrogen-fixing bacteria (in root nodules) ;</p> <p>3 <i>idea of converting</i> nitrogen gas / N₂ , into , compounds / ammonium / ammonia / amino acids / protein (in plants) ;</p> <p>4 plants ploughed in / plants left to decay / ref B / ref C / ref D ;</p>	3 max	<p>1 CREDIT English or Latin name. Examples include but are not limited to: pea (<i>Pisum</i>) / bean (<i>Phaseolus</i> or <i>Vicia</i>) / vetch (<i>Vicia</i>) / soya (<i>Glycine</i>) / chickpea (<i>Cicer</i>) / peanut (<i>Arachis</i>) / alfalfa, lucerne or medick (<i>Medicago</i>) / clover or trefoil (<i>Trifolium</i>) / lupin (<i>Lupinus</i>) / <i>Leucaena</i> / <i>Cyamopsis</i> / <i>Sesbania</i> IGNORE names of non-leguminous plants, therefore <i>'plant legumes such as cucumbers'</i> scores mp 1</p> <p>3 the nitrogen must be clearly gaseous IGNORE nitrite / nitrate (because not made in plant)</p>
1	(b)		<p>1 genetic resource / gene bank / have (different) alleles ;</p> <p>2 for , genetic engineering / genetic modification / artificial selection / selective breeding / described ;</p> <p>3 if conditions change / in the future ;</p> <p>4 example of useful trait ;</p> <p>5 to <u>maintain</u> , biodiversity / genetic diversity / (large) gene pool ;</p>	2 max	<p>IGNORE biotourism</p> <p>1 IGNORE source of genes</p> <p>3 IGNORE unless context is genetic</p> <p>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</p> <p>5 CREDIT ORA to prevent loss of genetic diversity IGNORE to prevent extinction / to increase biodiversity</p>

Question			Expected Answers	Marks	Additional Guidance
1	(c)	(i)	mutation / described ; <u>selection</u> / <u>selection</u> pressure / <u>selective</u> 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)	<p>1 <u>instinctive</u> ;</p> <p>2 genetic / genetically determined / inherited ;</p> <p>3 rigid / fixed pattern / inflexible ;</p> <p>4 <u>stereotyped</u> / <u>stereotypical</u> ;</p> <p>5 automatic / does not require thought / does not require learning ;</p>	2 max	<p>2 IGNORE born with it / present from birth</p> <p>3 ACCEPT description. <u>Same</u> in all members of species or performed the <u>same</u> all the time</p>
2	(a)	(ii)	<p>1 (behaviour) <u>changed</u> / <u>altered</u> / <u>learnt</u> , by experience ;</p> <p>2 ref. memory / association / reinforcement / practice ;</p> <p>3 variable ;</p>	2 max	<p>1 ACCEPT taught by parents / learnt by watching others 'due to experience' is not enough. They need to refer to <i>past</i> experience.</p> <p>3 ACCEPT description. Varies or is different in different members of a species or in one animal at different times</p>

Question		Expected Answers	Marks	Additional Guidance
2	(b)	<p><i>general innate behaviour advantages</i></p> <p>A1 rapid / automatic / correct , behaviour / response ; A2 <i>idea that</i> simple nervous system is enough ; A3 suits species with , short lifespan / no parental care / solitary lifestyle ;</p> <p><i>innate behaviour examples with specific advantages</i></p> <p>E1 an escape reflex described in a named animal ; E2 advantage of this escape reflex explained ;</p> <p>E3 a taxis described in a named animal ; E4 advantage of this taxis explained ;</p> <p>E5 a kinesis described in a named animal ; E6 advantage of this kinesis explained ;</p> <p style="text-align: right;"><i>continued</i></p>		<p>Note - The question relates to animal behaviour that is, in broad terms, advantageous for survival.</p> <p>A marks can be awarded in the context of an example</p> <p>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.</p> <p>E3 ACCEPT motile protocist e.g. <i>Euglena / Paramecium</i></p> <p style="text-align: right;"><i>continued</i></p>

Question		Expected Answers	Marks	Additional Guidance
2	(b)	<p>continued</p> <p><i>general learned behaviour advantages</i></p> <p>A4 flexible / adaptable to , change / environment ;</p> <p><i>learned behaviour examples with specific advantages</i></p> <p>E7 habituation described in a named animal ; E8 advantage of this habituation explained ;</p> <p>E9 imprinting described in a named animal ; E10 advantage of this imprinting explained ;</p> <p>E11 conditioning described in a named animal ; E12 advantage of this conditioning explained ;</p> <p>E13 latent learning described in a named animal ; E14 advantage of this latent learning explained ;</p> <p>E15 insight learning described in a named animal ; E16 advantage of this insight learning explained ;</p> <p>QWC – relating types of behaviour to advantages ;</p>	<p>10 max</p> <p>1</p>	<p>A mark can be awarded in the context of an example</p> <p>E marks the name of the type of behaviour is not needed.</p> <p>Odd E numbers require the animal to be identified and the behaviour described.</p> <p>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</p> <p>E11 ACCEPT description of Pavlov’s dogs for conditioning E12 IGNORE ref. to Pavlov’s dogs</p> <p>QWC = any description mp (odd E) PLUS any advantage mp (even E or A) from both sections</p>
			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)	<p>1 less / no , movement of water or less / no , water reaches leaves ;</p> <p>2 less / no , minerals / nitrate / phosphate / magnesium / iron ;</p> <p>3 less / no , chlorophyll formation ;</p> <p>4 chlorophyll breakdown / leaf senescence ;</p>	2 max	<p>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</p>
3	(c)	(ii)	<p>1 less / no , photosynthesis ;</p> <p>2 less / no , sugar(s) / amino acid(s) / assimilates / organic molecules ;</p> <p>3 <u>roots</u> cannot , respire / do active transport / metabolise ;</p> <p>4 the falling leaves carry the fungus ;</p>	2 max	<p>2 CREDIT named sugars, e.g. sucrose , glucose , hexose IGNORE nutrients / food</p>

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

Question		Expected Answers	Marks	Additional Guidance
3	(e)	<p><i>advantages</i></p> <p>1 quick ;</p> <p>2 disease-free / virus-free , stock created ;</p> <p>3 plants have same feature / uniform plants created ;</p> <p>4 can reproduce infertile plants ;</p> <p>5 can reproduce plants that are hard to grow from seed ;</p> <p>6 create whole plants from GM cells ;</p> <p>7 production , not determined by seasons / at any time / anywhere in the world ;</p> <p>8 (plantlets small) can be transported easily / grown in small space ;</p> <p>9 can save rare species from extinction ;</p> <p><i>disadvantages</i></p> <p>10 expensive / labour intensive , process ;</p> <p>11 process can fail due to microbial contamination ;</p> <p>12 all offspring susceptible to <i>same</i> , pest / disease / named environmental factor (e.g. drought) ;</p> <p>13 no / low / little , genetic variation ;</p>	4	<p>CREDIT the first answer on each prompt line</p> <p>1 IGNORE ref. large numbers alone</p> <p>3 refers to plant phenotype e.g. plants , grow at same rate / grow to same height</p> <p>12 IGNORE all are susceptible to disease in general (as in 3b)</p> <p>13 IGNORE loss of alleles</p>
			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)	<i>description (D)</i> 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 ; <i>explanation (E)</i> 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)	<p>1 plenty of / enough , food / birds' eggs / space ;</p> <p>2 breed rapidly / breed successfully / young survive ;</p> <p>3 no / few , predators ;</p> <p>4 few die (young / before breeding) ;</p> <p>5 <i>idea that</i> hedgehogs are introduced species ;</p> <p>6 invasive / fill vacant niche / not reached carrying capacity ;</p> <p>7 these hedgehogs restricted to island ;</p> <p>8 cannot , emigrate / leave island (so numbers build up) ;</p>	4 max	<p>Mark the first suggestion on each numbered line. Award 1 mark for a factor and a further mark for a related explanation</p> <p>1 CREDIT little competition for food</p>
4	(b)		<p><i>idea that the following may be ethically wrong</i></p> <p>1 killing hedgehogs ;</p> <p>2 letting hedgehogs , kill / decrease number of , waders ;</p> <p>3 introducing hedgehogs to island (upset the ecosystem) ;</p> <p>4 catching / moving , hedgehogs might cause suffering ;</p> <p>5 doing nothing ;</p>	3 max	<p>CREDIT ORA <i>idea preventing these is ethically right</i> IGNORE 'right to life' and 'playing God'</p> <p>2 CREDIT ORA need to conserve waders</p> <p>4 '<i>the other methods are cruel</i>' = 1 mark (mp 4) '<i>moving hedgehogs elsewhere causes problem somewhere else</i>' = 1 mark (mp 4)</p> <p>5 CREDIT ORA idea of human responsibility</p>
				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	<i>mRNA</i> ' = 2 marks IGNORE incorrect 'r' or 't' prefix for 2 nd 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)	<p><i>somatic</i> changes / uses , body cells ; change cannot be passed to offspring ; cures / alleviates , genetic disease in one individual ; short-lived / repeat treatments needed ;</p> <p><i>germ line</i> changes / uses , gametes / zygote / embryo / reproductive tissue ; banned ;</p>	2 max	<p>ORA germ line changes could be passed to offspring</p> <p>ACCEPT sperm / eggs</p>
6	(b)	<p><i>central</i> C1 brain and spinal cord ; C2 intermediate neurones ; C3 has , coordinating role / many synapses ;</p> <p><i>peripheral</i> max 3 P1 <u>nerves</u> , from sense organs / to muscles / to glands ; P2 sensory and motor , neurones / nerve cells ;</p> <p>P3 role in , sensing stimuli / controlling effectors or conducting impulses, to / from , CNS / brain / spinal cord ; P4 includes , somatic / autonomic / sympathetic / parasympathetic ;</p>	4 max	<p>For full marks needs at least 1 C mark</p> <p>C2 CREDIT relay / internuncial / bipolar C3 IGNORE processing</p> <p>P1 IGNORE effectors P2 DO NOT CREDIT if intermediate included DO NOT CREDIT nerves</p> <p>P3 IGNORE messages / signals / information</p>
6	(c)	<p><i>prophase 1</i> <u>homologous chromosomes</u> pair up / <u>bivalents</u> form ; <u>chiasmata</u> / crossing-over / recombination ;</p>	2	<p>CREDIT reverse arguments for prophase 2</p> <p>ACCEPT description e.g. <u>non-sister chromatids</u> exchange , (matching sections of) DNA / alleles / genetic material</p>
			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)	<p><i>yes (for first statement)</i></p> <p>1 first statement true / correlation exists ;</p> <p>2 number of black ladybirds increase , from 100m to 300m / until 300m ;</p> <p>3 400m number decrease but % black increases ;</p> <p><i>no (for second statement)</i></p> <p>4 correlation not proof of causation / no proof of causal link / second statement not (necessarily) true ;</p> <p>5 another (named) factor could be involved ;</p>	3 max	<p>If candidates argues 'yes' exclusively, can only be awarded mps 1-3</p> <p>If candidate answers 'no' exclusively, can only be awarded mps 4 & 5</p> <p><i>Note percentage of black ladybirds increases as you go up the hill = 2 marks (mps 2 & 3)</i></p> <p>5 CREDIT could be due to distance from town / more or less predation high up / camouflage / warning colours</p>
7	(c)	(i)	<p>only expressed , when homozygous / in absence of dominant (allele) ;</p> <p>not expressed when heterozygous / expression masked by dominant (allele) ;</p>	1 max	<p>DO NOT CREDIT gene</p> <p>IGNORE letters / genotypes</p> <p>ACCEPT only seen in phenotype when it is present in 'double dose'</p>

Question			Expected Answers	Marks	Additional Guidance
7	(c)	(ii)	<p>1 $q^2 = 296 / 346$ or $0.85 / 0.855 / 0.86$;</p> <p>2 $q = \sqrt{\text{previous answer}}$ or $0.92 / 0.93$;</p> <p>3 $p = 1 - \text{previous answer}$ or $0.08 / 0.07$;</p>		<p>1 DO NOT CREDIT calculation or figure unless it has been indicated as q^2</p> <p>2 ACCEPT ecf</p> <p>3 ACCEPT ecf</p> <p>Note If both p and q are correct = 3 marks <i>If p and q not given to 2 decimal places then penalise 1 mark and then apply ecf</i></p> <ul style="list-style-type: none"> • 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) <p><i>e.g. if black allele wrongly assumed to be recessive</i> $q = 0.38$ or $q = \sqrt{0.1445}$ give mp 2 as ecf $p = 0.62$ or $p = 1 - 0.38$ give mp 3 as ecf</p> <p><i>e.g. if answer given as</i> $q = 0.85$ and $p = 0.15$ give mp 3</p> <p>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</p>
				3	
				11	

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

14 – 19 Qualifications (General)

Telephone: 01223 553998

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