OCR
RECOGNISING ACHIEVEMENT

GCE

Biology

Advanced GCE

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

Mark Scheme for June 2012

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Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Annotations

Annotation	Meaning
	Correct answer
	Incorrect response
	Benefit of Doubt
	Not Benefit of Doubt
	Error Carried Forward
	Given mark
	Underline (for ambiguous/contradictory wording)
	Omission mark
	Ignore
	Correct response (for a QWC question)
	QWC* mark awarded
	First Answer

Subject-specific Marking Instructions

FA in guidance column means**: Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks.** Apply the same reasoning where the instruction is to mark the first 2 suggestions.

ACCEPT incorrect spellings if they are recognisable **and also** sound the same when pronounced. This **includes** underlined words. If a wrong spelling does not pass these two criteria, read on and **IGNORE** it.
Example - in 1 (a) describing fur pattern, **ACCEPT** "wildcat is stryped" but **IGNORE** "wildcat is stripped" and read on in case other information about fur colour or pattern does get the mark. Similarly **IGNORE** "absorption" in 1 (e) (ii) but read on in case correct description (of adsorption) is given.

CREDIT AW FOR ALL, i.e., credit any alternatively worded statement that conveys the same sense as the mark point. If a particular word or term is essential and no other will do it is underlined.

IGNORE additional vague information or statements that are incorrect but irrelevant, and read on as if this information was not there, unless it **directly contradicts a listed mark point,** in which case the wrong 'statement' contradicts the right one, and negates the mark (use annotation **CON**). The exception to this rule is if the instruction is **FA** or **Mark first 2 answers.**

Question			Answer	Mark	Guidance
1	(a)		*a **difference** is stated relating to* fur length **;** pattern / colour, of fur **;** eye colour **;** temperament / tameness **;** face shape **;**	max 2	**Mark the first 2 suggestions (see point 12 above)** For **each** mark point **CREDIT** ***EITHER*** a paired comparison referring to **both** cats and identifying which has which feature, e.g. "the wildcat has green eyes and the Persian has blue" but allow top / bottom, Fig. 1.1 / 1.2, first and second cat, etc, as identifiers, ***OR*** a reference to only one cat but using a **comparative** adjective ending in '-er' such as "**shorter** fur on wildcat", "second one looks **tamer**" or "second one is **more** tame", or, conversely, "wildcat looks **less** fierce". **IGNORE** use of the word different. e.g. "they have different coloured fur" if there is no further statement about how they differ. **IGNORE** answers that do not attempt to describe a difference at all, e.g. "fur length". **IGNORE** albino

Question			Answer	Mark	Guidance
	(b)	(i)	selective breeding / artificial selection **;**	1	**FA (see guidance on page 2)** **IGNORE** evolution **DO NOT CREDIT** natural selection or speciation
		(ii)	(named type of) mutation / production of new alleles **;** sexual reproduction / meiosis / independent assortment / crossing-over **;**	1	**FA** **ACCEPT** substitution / insertion / base deletion / gene mutation / random mutation as named types of mutation **DO NOT ACCEPT** chromosome mutation, discontinuous variation
	(c)	(i)	(recessive) epistasis **;**	1	**FA** **DO NOT ACCEPT** dominant epistasis or codominance
		(ii)	**BBDD ;** **BBDd ;** **BbDD ;** **BbDd ;**	4	**CREDIT** answers written in any order but look for and tick off answers in the order given
		(iii)	*homozygous* (individual / cat / genotype with) 2 identical, alleles / version of the gene / forms of the gene **;** *gene locus* position / place / location**,** of, gene / allele, on chromosome **;**	1 1	**ACCEPT** both, pair or idea of (same on) each for 2 idea **ACCEPT** same for identical and **CREDIT** description such as "both alleles either recessive or dominant" **DO NOT CREDIT** *genes* for alleles **DO NOT CREDIT** *similar* for identical or same **CREDIT** "where / whereabouts the gene is on the chromosome" **CREDIT** DNA molecule for chromosome and **ACCEPT** DNA strand

Question			Answers	Mark	Guidance
		(iv)	seal : blue : chocolate : lilac **;** 1 : 1 : 1 : 1 **;**	2	**IGNORE** absence of colons (:) **CREDIT** phenotypes all correct in any order **ACCEPT** dark brown for seal **ACCEPT** light brown for chocolate **ACCEPT** ratio of 1 : 1 : 1 : 1 as stand alone mark, even if only one, two or three colours stated for phenotypes **DO NOT CREDIT** fractions, percentages or decimals **CREDIT** ecf for ratio **only** if four colours stated e.g. "seal, lilac, chocolate, chocolate" (no mark) followed by ecf "1:1:2"
	(d)	(i)	*type of behaviour* innate / instinct(ive) / reflex **;** *characteristic* automatic **;** stereotyped / always performed in the same way **;** no previous experience necessary / not learned **;** genetic(ally programmed) / AW **;**	1 max 1	**FA for each prompt line** **IGNORE** maternal (as given in question) **IGNORE** instinctive in characteristic section **ACCEPT** same in all members of the species **ACCEPT** unlearned, not taught **ACCEPT** inherited

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td></td><td></td><td>(ii)</td><td>1 whether kittens, survive / breed ;

2 whether <u>alleles</u>, change in frequency / passed on / kept ;

3 correct reference to selection / how selection acts ;

4 AVP ;

5 AVP ;</td><td>max 2</td><td>Markpoints 1–3 are linked within 4 possible contexts. ‘It’ refers to good mothering behaviour in the domestic environment (with people helping at the birth of kittens). Or candidates might say what would happen to the good behaviour patterns in the wild. Alternatively, the answer might focus on bad mothering behaviour (not licking the kittens), in either environment.
<table>
<tr><th></th><th>domestic</th><th>in the wild</th></tr>
<tr><td>good mothering</td><td>1 kittens do, survive / breed

2 alleles not necessarily, passed on / kept

3 not selected for</td><td>1 kittens do, survive / breed

2 alleles, increase / passed on / kept

3 selected for</td></tr>
<tr><td>bad mothering</td><td>1 kittens do, (still) survive / breed

2 alleles, increase / passed on / kept

3 not selected against</td><td>1 kittens do not, survive / breed

2 alleles, decrease or alleles not, passed on / kept

3 selected against</td></tr>
</table>
e.g. linkage (4) of poor mother, genes / alleles, with desirable alleles selected for in domestic cats (5)
OR
<u>genetic drift</u> (4) in small population (5)
OR
pleiotropic / multi-effect genes (4) with a desirable effect and this side effect (5)</td></tr>
</table>

Question			Answer	Mark	Guidance
1	(e)	(i)	**1** inbreeding **/** small or decreasing, gene pool **;** **2** homozygous recessive (genotypes) **;** **3** gene / allele **,** for desired characteristic on same chromosome as problem, gene / allele **;** **4** selecting for one trait (unintentionally) selects for another **;** **5** breeders select for looks not health **;** **6** weaker selection against less healthy animals (than in wild) **;**	max 2	**ACCEPT** decreasing genetic variation **IGNORE** interbreeding **CREDIT** good and bad genes, linked / show linkage
		(ii)	**1** entrapment / alginate beads / cellulose network **;** **2** a**d**sorption / carrier bound **or** stuck to **,** porous carbon / clay / resin / glass **;** **3** covalent bonding **or** cross-linking enzymes to each other and to clay (using glutaraldehyde) **;** **4** membrane separation **or** enzyme and substrate either side of partially permeable membrane **;**	max 2	**Mark the first 2 answers** **ACCEPT** encapsulation, inclusion **IGNORE** a**b**sorption
			Total	**21**	

Question			Answer	Mark	Guidance
2	(a)	(i)	**T** mitochondrion / mitochondria **;** **U** Z line **;** **V** myofibril**;**	3	**FA** for each line **ACCEPT** nucleus **CREDIT** zwischenscheibe line **CREDIT** myofilaments **ACCEPT** actin **and** myosin
		(ii)	sarcomere **;**	1	**FA** **DO NOT CREDIT** 'sacromere' (section 12 spelling rules apply)
		(iii)	energy storage **;** hydrolyses / breaks down **,** to glucose **;** (glucose / glycogen, for) respiration / to make ATP **;** glycogen insoluble / glucose would exert osmotic effect **;**	max 2	**IGNORE** just 'provides energy' or source **ACCEPT** converted to glucose, provides glucose
		(iv)	1.2 / 1.3 **; ;**	2	**Correct answer = 2 marks** If answer is incorrect then **ALLOW 1 mark** for correct working - 52 mm **or** 52 000 µm **or** 5.2 cm ÷ 42 000 If answer is not correctly rounded to 1dp **ALLOW 1 mark** for unrounded answers, e.g.for 52 mm - 1.238095 **or** 1.23 **ACCEPT** measurements in range 51–53 mm and corresponding unrounded figures - 1.21428 or 1.21 or 1.261904 **or** 1.26

Question			Answer	Mark	Guidance
2	(b)		*A band* stays the same / no change **;** *H zone* decreases / shorter / smaller **;** *I band* decreases / shorter / smaller **;**	3	**ACCEPT** disappears
	(c)			max 5	'Fewer' not needed to award mps 1 to 5 but is required twice for QWC. **ACCEPT** less / decreased for 'fewer'. **ACCEPT** mps 1-5 if event described said not to occur at all but don't award QWC green spot for this.
			1 (***fewer***) Ca^{2+} / calcium ions, bind to troponin **;**		**1 IGNORE** 'reduced ability of Ca^{2+} to bind' for QWC
			2 (***fewer***) troponin (proteins) change shape **;**		**2** "Troponin does not change shape as much" gets mp 2 but not QWC
			3 (***fewer***) tropomyosin (proteins) move aside **;**		
			4 (***fewer***) binding sites on actin available **;**		**4 ACCEPT** thin filament for actin **ACCEPT** actin-myosin binding sites or binding sites for myosin heads, available / exposed
			5 (***fewer*** actin-myosin) cross bridges / links, form / AW **;**		
			6 power stroke ***reduced*** / AW **;**		**6 IGNORE** reduction in force of contraction **DO NOT ACCEPT** fewer power strokes
			7 actin filaments pulled past myosin with ***less*** force **;**		**7 IGNORE** reduction in force of contraction
			8 ref. pH and denaturing of proteins **;**		**8 ACCEPT** description e.g. "H^+ changes protein's 3D structure" and allow reference to enzyme or to ATPase
			QWC – at least **two** given mark points also indicate idea in bold italics **;**	1	
			Total	**17**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Mark</th><th>Guidance</th></tr>
<tr><td>3</td><td>(a)</td><td></td><td>DNA (combined) from (two) , sources / organisms ;</td><td>1</td><td>ACCEPT DNA, contains / has inserted in it, DNA or gene from, other / another, organism / species
ACCEPT foreign for idea of other source</td></tr>
<tr><td></td><td>(b)</td><td></td><td>
<table>
<tr><th>application of genetic modification</th><th>vector</th></tr>
<tr><td>goats making spider silk protein</td><td>BAC / YAC / virus / liposome ;</td></tr>
<tr><td>somatic gene therapy for a recessive human genetic disorder</td><td>virus / liposome ;</td></tr>
<tr><td>plants that express a bacterial toxin that kills insects feeding on them</td><td>Agrobacterium tumefaciens/ (Ti) plasmid / liposome ;</td></tr>
<tr><td>bacteria that produce a human protein for therapeutic use</td><td>BAC / (bacterio)phage / plasmid ;</td></tr>
</table>
</td><td>4</td><td>FA in each box

DO NOT CREDIT microinjection / electroporation / gene gun (as they are not vectors)

IGNORE tumour forming bacterium</td></tr>
</table>

Question			Answer	Mark	Guidance
3	(c)		**1** somatic / adult, cell / nucleus **;** **2** fused with / injected into **;** **3** empty / enucleate **,** egg cell **;** **4** from another goat **;** **5** *idea of* electric shock / electrostimulation **;** **6** this cell or embryo, grown on **,** in vitro / in tied oviduct **;** **7** (early) embryo / blastocyst **,** split **;** **8** *idea that* embryos replaced in **,** surrogate mothers / other females **;** **9** AVP **;**	max 5	**1 ACCEPT** differentiated or body cell or example, e.g. skin cell, udder cell **2 ACCEPT** inserted / placed. If term use is "electrofused" gets mp 2 and mp 5 **4 ACCEPT** named (A, B) or numbered goats **5** "electrofused" gets mp 2 and mp 5 **6 ACCEPT** in petri dish / test tube culture **7 ACCEPT** description of an embryo being split, even if produced by wrong method (IVF) **8 IGNORE** host mothers **9** e.g. further detail of any stage of process correct ref. to haploid / diploid **,** nuclei

Question			Answer	Mark	Guidance
3	(d)		*advantages* **A1** all offspring will inherit the, (silk) gene / foreign DNA **;** **A2** all offspring female **;** **A3** certain / all make **,** silk / milk / product **;** **A4** faster / many obtained in a short time **;** **A5** avoid mating risks **;** **max 3 advantages** *disadvantages* **D1** no genetic variability (in population) / AW **;** **D2** (so makes goats) more susceptible to**,** environmental factors / (infectious) disease **;** **D3** cloned animals may, have shorter life spans / be less healthy **;** **D4** *idea that* cloning success rate is very poor **;** **D5** (more) expensive / needs (more) technology / (more) labour intensive **;** **max 3 disadvantages**	5 max	**IGNORE** disadvantages of breeding given in the first (advantages of cloning) section, i.e. **DO NOT CREDIT** reverse arguments **A5 ACCEPT** idea of physical damage or disease transfer **IGNORE** advantages of breeding given in the second (disadvantages of cloning) section, i.e. **DO NOT CREDIT** reverse arguments **D1 ACCEPT** they are all genetically identical **D2 IGNORE** disease if stated to be genetic
			Total	**15**	

Question			Answer	Mark	Guidance
4	(a)		*fungal* long cells / hyphae OR multinucleate OR chitin cell wall **;**	1	**FA for each microorganism** **IGNORE** prokaryotic / eukaryotic (as given in question)
			bacterial free DNA / DNA not in a nucleus OR circular DNA (molecule) OR naked DNA / no histones OR peptidoglycan / murein, cell wall OR smaller / 70S / 18nm, ribosomes **;**	1	**ACCEPT** no nucleus / nuclear envelope **IGNORE** loop, plasmids, nucleoid
	(b)		disease-causing (organism) **;**	1	**IGNORE** harmful, infection

Question			Answer	Mark	Guidance
4	(c)		*What is biotechnology?* **1** large-scale / industrial / commercial use (of living organisms / enzymes) **;**	7 max	
			2 to produce **,** food / named example **;**		**2** e.g. cheese / yogurt / beer / wine / cider / vinegar / soya sauce / mycoprotein / etc.
			3 detail of **,** microbe / enzyme **,** involved **;**		**3** e.g. *Lactobacillus* / yeast / *Fusarium* / etc. **IGNORE** wrong kingdom
			4 to produce **,** drugs / named example **;**		**4** e.g. antibiotic / penicillin / augmentin / insulin
			5 detail of **,** microbe / enzyme **,** involved **;**		**5** e.g. *Penicillium* **IGNORE** wrong kingdom
			6 to make **,** (useful) enzymes / biogas / calcium citrate / for bioremediation / for water treatment / for microbial mining **;**		**6** e.g. detergent enzymes, pectinase, sewage treatment, blue technology
			Advantages of microorganisms **7** fast, growth / reproduction / products **;**		
			8 microbes can be genetically engineered **;**		**8** **ACCEPT** in context of example mps **1 - 6**
			9 processes occur at low **,** temperatures / pressures **;**		
			10 low **,** temp / pressure **,** cheaper / safer **,** to maintain **;**		**10** **CREDIT** less energy used for low, temp /pressure
			11 products **,** pure / easy to separate **;**		**11** **ACCEPT** little downstream processing
			12 grow on unwanted, food / nutrients **;**		**12** **ACCEPT** named e.g. whey, starch waste.
			13 AVP **;** **QWC** – balanced account **;**	1	**13** e.g. no animal welfare issues Award QWC if 2 marks awarded from mps **1** – **6** **and** 2 marks awarded from mps **7** – **13**
			Total	**11**	

Question			Answer	Mark	Guidance
5	(a)	(i)	succession **;**	1	**FA** **IGNORE** primary / secondary
		(ii)	mineral content **;** acidity / pH **;** water depth**;**	2	**FA**
	(b)		*similarity* chlorophyll breaks down / leaves change colour **;** *differences* (bog) minerals stay in plant / (forest) minerals in soil **; ora** decomposers / fungi / bacteria **,** not**,** present **/** active in bog **;** **ora for forest**	1 2	**FA for similarity** **Mark first two answers for differences** **ACCEPT** named mineral ions in words or correct symbols **ACCEPT** decomposers / fungi / bacteria, break down leaves in forest
	(c)		decomposers / named decomposers, not, present / active **;** waterlogging reduces, air / oxygen **;** acidity / low pH **,** stops (decay) enzymes working **;**	2 max	**ACCEPT** (soil), bacteria / fungi / microbes can't survive or few can survive **CREDIT** waterlogging produces anaerobic conditions
	(d)		bog / habitat / ecosystem, takes a long time to form / hard to replace **;** loss of, biodiversity / rare species **;**	2	**ACCEPT** peat bogs maintain biodiversity
			Total	**10**	

Question			Answer	Mark	Guidance
6	(a)	(i)	larger territory / greater distance between neighbours = lower predation **;**	1	**ACCEPT** ora - smaller territory / smaller distance = higher predation **DO NOT CREDIT** descriptions wrong way round
		(ii)	**1** great tit numbers, oscillate / rise and fall **;** **2** (weasel predation) helps keep great tit numbers stable **;** **3** predation (by weasels) is density–dependent **;**	2 max	**IGNORE** weasel population size **ACCEPT** keeps great tit numbers moderate
	(b)	(i)	*two areas* as a control / for comparison / to see the effect of removal of starfish **;** *same size* to make test, valid / fair / unbiased **;**	2	**IGNORE** reliable, precise, accurate **CREDIT** 'as a valid control' = 2 marks
		(ii)	interspecific competition **;** (competition from) **,** barnacles / mussels **;** for**,** algae / space **;** barnacles / mussels **,** no longer eaten by starfish **;**	2 max	**IGNORE** intraspecific competition **ACCEPT** description e.g. barnacles / mussels, eat food of, limpets / chitons **IGNORE** food
		(iii)	sponges outcompeted (by **,** barnacles / mussels) **;** less, prey / food / sponges, for nudibranchs to eat **;** *idea of* specialist feeder **;**	2 max	**IGNORE** 'sponge population decreases' alone (as given in question) **CREDIT** nudibranchs **only** feed on sponges
			Total	**9**	

Question			Answer	Mark	Guidance
7	(a)	(i)	polar **and** brown bear **;**	1	
		(ii)	*no because* one, more closely related to / in same group as **,** raccoons **and** one **,** to / with**,** bears / AW **;**	1 max	**DO NOT CREDIT** answer if in context of yes
	(b)	(i)	knowledge **,** tentative / uncertain / subject to change **;** to re-test / check, hypotheses / results **;**	2	**IGNORE** incomplete, new technology **IGNORE** to validate
		(ii)	**1** *idea that* haemoglobin could be **,** an adaptation (to the environment) / an adaptive feature **;** **2** *idea that* low oxygen partial pressure is selective agent **or** both subject to the same selection pressure **;** **3** (haemoglobin of both) has high oxygen affinity / dissociation curve shifted to left **;** **4** convergence / similarity not due to shared ancestry **;**	3 max	**3** **ACCEPT** haemoglobin can uptake O_2 at low partial pressure **4** **ACCEPT** description e.g. "changes happen to both independently" **IGNORE** "red and giant panda may not be closely related" (as given in question)

Question			Answer	Mark	Guidance
	(c)		**step 2** PCR / polymerase chain reaction **;** **step 3** genetic modification / genetic engineering **;** **step 4** electrophoresis **;**	3	**FA on each line** **ACCEPT** gene cloning / transformation **ACCEPT** (gel) chromatography
	(d)		triplet code **or** 3 bases = 1 amino acid **;** 525 **;** 3 bases are **,** stop / (chain) termination **,** codon **;**	3	**DO NOT CREDIT** triplet makes amino acid
	(e)	(i)	ox **;**	1	**FA**
		(ii)	**1** genetic code is degenerate **;** **2** more than 1**,** triplet / codon**,** for same amino acid **;** **3** silent / neutral, mutations **;** **4** *idea that* DNA, changes more than / is more different to, protein **;**	3 max	**1** **ACCEPT** redundant **2** **DO NOT CREDIT** 'make' the same amino acid **4** **ACCEPT** polypeptide / amino acid sequence **ACCEPT** nucleotide sequence for DNA
			Total	**17**	

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