OCR
RECOGNISING ACHIEVEMENT

GCE

Biology

Advanced GCE

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

Mark Scheme for January 2012

Oxford Cambridge and RSA Examinations

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All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

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
/	alternative and acceptable answers for the same marking point
(1)	separates marking points
not	answers which are not worthy of credit
reject	answers which are not worthy of credit
ignore	statements which are irrelevant
allow	answers that can be accepted
( )	words which are not essential to gain credit
__	underlined words must be present in answer to score a mark
ecf	error carried forward
AW	alternative wording
ora	or reverse argument

Scoris Annotations

Annotation	Meaning
✓	correct response
×	incorrect response
bod	benefit of the doubt
nbod	benefit of the doubt **not** given
ECF	error carried forward
^	information omitted
I	ignore
R	reject

Highlighting is also available to highlight any particular points on the script.

The following questions should be annotated with ticks to show where marks have been awarded in the body of the text: **2 (e) (i), 3 (c) (i), 3 (d), 4 (b), 6 (e)**

Subject-specific Marking Instructions

1. The Comments box
   The comments box will be used by your PE to explain their marking of the practice scripts for your information. Please refer to these comments when checking your practice scripts.
   You should only type in the comments box yourself when you have an additional object of the type described in Appendix B of the Handbook for Assistant Examiners and Subject Markers.
   Please do not use the comments box for any other reason.
   Any questions or comments you have for your Team Leader should be communicated by phone, SCORIS messaging system or e-mail.

2. Please send a brief report on the performance of the candidates to your Team Leader (Supervisor) by the end of the marking period. The Assistant Examiner's Report Form (AERF) can be found on the Cambridge Assessment Support Portal. This should contain notes on particular strengths displayed, as well as common errors or weaknesses. Constructive criticisms of the question paper/mark scheme are also appreciated.

Question			Answer	Marks	Guidance
1	(a)	(i)	tyrosinase ;	1	**First Answer (**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)**.**
		(ii)	phenylketonuria / PKU ;	1	**Mark the First Answer**
	(b)		*both have an* amine / amino / NH_2 ; COOH / carboxyl / carboxylic ;	2	**DO NOT CREDIT** if formula given does not match name **DO NOT ACCEPT** ammonia, amide
	(c)		**1** low / less / no, thyroid hormones ; **2** less (aerobic) respiration ; **3** less, ATP produced / energy ; **4** slow(er) metabolism / low(er) (B)MR ; **5** low body temperature ; **6** AVP ;	3 max	**DO NOT CREDIT** no respiration / ATP eg sleep more, get tired quickly, poor muscle tone, mental retardation
	(d)	(i)	homozygous ;	1	**Mark the First Answer** **IGNORE** dominant / recessive
		(ii)	*genotype* combination of alleles ; possessed by organism ; *allele* alternative / mutant, form / version ; of, a gene ;	4	**ACCEPT** *idea of* **all** alleles or '**the**' alleles (suggesting all) **ACCEPT** *idea of* eg that a, person has / you have / of an individual / cell *'all my alleles'* = 2 marks **ACCEPT** altered, different (form / version) **CREDIT** DNA if qualified, eg at a locus / codes for X

Question			Answer	Marks	Guidance
	(e)		population, not large / (too) small **;** not randomly-mating / matings arranged **;**	2	
	(f)		natural / artificial / directional, selection **;** genetic drift **;** mutation **;** migration / AW **;**	2 max	**Mark the first two suggestions only** **ACCEPT** selection pressure, selective breeding, selective advantage
			Total	**16**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>2</td><td>(a)</td><td></td><td>husky in Fig. 2.2 has
ears, laid back / held low / not upright ;
pupils, dilated / bigger ;
different / tensed / lower, posture ;
hair (on neck) standing up / hackles raised ;
mouth open / showing teeth / teeth bared / snarling / tongue withdrawn ;
tail standing up / held high ;</td><td>3 max</td><td>CREDIT correct non-subjective visible differences wherever they appear (read as prose)
IGNORE causes

DO NOT CREDIT eyes dilated</td></tr>
<tr><td></td><td>(b)</td><td></td><td>
<table>
<tr><td>organ</td><td>calm mammal</td><td>frightened mammal</td></tr>
<tr><td>heart ;</td><td>rate slow / small force ;</td><td>rate fast / great force ;</td></tr>
<tr><td>lungs ;</td><td>breathing, slow / shallow ;</td><td>breathing, fast / deep ;</td></tr>
<tr><td>(skeletal) muscle / arteries to muscle ;</td><td>less, active / blood flow ;</td><td>more, active / blood flow ;</td></tr>
<tr><td>liver ;</td><td>glucose → glycogen / glucose taken up ;</td><td>glycogen → glucose / glucose released ;</td></tr>
<tr><td>gut / named part of gut ;</td><td>peristalsis / secretions / digestion / blood flow to gut, occurring ;</td><td>no / less, peristalsis / secretions / digestion / blood flow to gut ;</td></tr>
</table>
</td><td>6 max</td><td>CREDIT first correct answer per box if not contradicted later. No requirement for calm and frightened comments to be opposites.

IGNORE steady, regular, normal with respect to calm mammal
CREDIT reasonable figures for heart and breathing rates
CREDIT AW such as stroke volume, cardiac output (of heart), tidal volume, ventilation rate (of lungs).
ACCEPT named muscle(s)
ACCEPT ecf across table for structures that are not organs, eg bronchioles

CREDIT brain, bladder in first column for 1 mark

CREDIT arterioles constricted for less blood flow (context gut in frightened mammal)

CREDIT named secretions, eg saliva, gastric juice.</td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td>(c)</td><td></td><td>
<table>
<tr><th></th><th>calm mammal
Fig. 2.1</th><th>frightened mammal
Fig. 2.2</th></tr>
<tr><td>division</td><td>parasympathetic ;</td><td>sympathetic ;</td></tr>
<tr><td>neuro-transmitter</td><td>acetylcholine / ACh ;</td><td>noradrenaline / NA
norepinephrine / NE ;</td></tr>
</table>
</td><td>4</td><td>First Answer in each box (0 marks if additional answer contradicts)

DO NOT CREDIT adrenaline for noradrenaline
CREDIT ecf for second line if name matches NS division stated</td></tr>
<tr><td></td><td>(d)</td><td></td><td>adrenal (glands) ;
(adrenal) medulla ;</td><td>2</td><td>First Answer (0 marks if additional answer contradicts)
DO NOT CREDIT medulla oblongata or medulla alone</td></tr>
<tr><td></td><td>(e)</td><td>(i)</td><td>1 adrenaline binds to receptor ;

2 complementary / specific, fit / shape ;

3 G protein activated ;
4 adenyl(ate) cyclase activated ;

5 ATP converted to cAMP ;

6 cAMP activates, proteins / enzymes ;
7 by, altering 3D structure / phosphorylation ;</td><td>4 max</td><td>IGNORE neurones
ACCEPT attaches to
DO NOT ACCEPT detected by, recognised by

IGNORE stimulated (mps 3, 4 6)
CREDIT AW eg made active, caused to work (3,4,6)

ACCEPT named enzymes eg kinases</td></tr>
<tr><td></td><td>(e)</td><td>(ii)</td><td>idea that one / named, molecule causes, production / activation of, many others ;

idea that this multiplying effect is repeated at, next / every / later step ;
idea of recycling / temporary binding, of cAMP ;</td><td>2</td><td>ACCEPT 1 adrenaline → many cAMP molecules
1 molecule causes many responses (in cell)
CREDIT idea of amplification / cascade effect
IGNORE chain reaction, domino effect</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>21</td><td></td></tr>
</table>

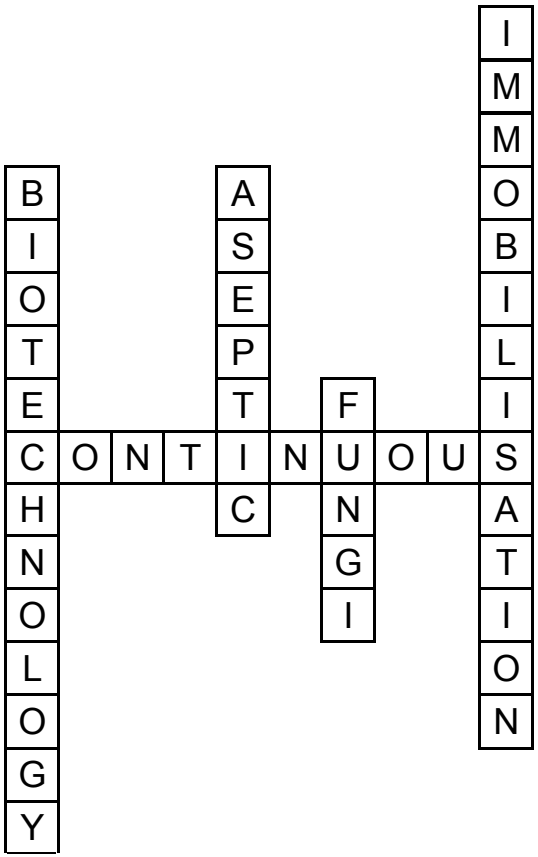
Question			Answer	Marks	Guidance
3	(a)	(i)	ecology ;	1	**First Answer**
		(ii)	abiotic ;	1	**First Answer**
		(iii)	ecosystem ;	1	**First Answer**
	(b)		(interspecific) competition ; species 1 and species 2 named ; description of interaction ; trophic / predator-prey / predation / parasitism / grazing / herbivory ; species 1 and species 2 named ; description of interaction ; mutualistic / mutualism ; species 1 and species 2 named ; description of interaction ;	6	**Mark the first suggestion on each numbered line only, max 3 for each, therefore max 6 overall.** **ACCEPT** English or scientific names for species (genus name alone acceptable and does not need capital letter) and accept phonetic spelling. **DO NOT ACCEPT** intraspecific eg eat, same / named, food OR occupy same niche *'Red and grey squirrels compete for the same food'* = 3 marks **IGNORE** grass, worms, **ACCEPT** symbiosis / symbiotic / commensalism **IGNORE** legumes and nitrogen-fixing bacteria if no species identified eg could include pollination, seed dispersal

Question			Answer	Marks	Guidance
	(c)	(i)	auxin / IAA ; (positive) phototropism ; plants / shoots, bend towards light ; etiolation / plants grow taller ; climbing plants climb, up / over, other plants ; (positive) thigmotropism / sense of touch ; grow roots towards, water / minerals ; allelopathy / description ;	4 max	**IGNORE** other named hormones **IGNORE** apical dominance **DO NOT ACCEPT** phototrophic / thigmotrophic (but penalise once) **IGNORE** move, grow **IGNORE** nutrients
		(ii)	less auxin / auxin production stopped ; apical dominance, stopped / removed ; side shoots grow / lateral buds develop / ora ; plant becomes bushy ;	3 max	 **CREDIT** axillary buds **IGNORE** side leaves

Question			Answer	Marks	Guidance
	(d)		**1** tape measure / rope, laid **;** **2** line / belt, <u>transect</u> **;** **3** continuous / interrupted / AW **;** **4** (use quadrat to) record percentage cover of plants **;** **5** (use quadrat with) ACFOR scale **;** **6** point quadrat use described **;** **7** use of key to identify species **;** **8** data recording sheets prepared in advance **;** QWC – sequencing of steps in procedure **;**	5 max 1	 **3** record all species touching line = continuous line quadrats end to end = continuous belt OR at selected intervals only = interrupted **4 ACCEPT** description = number of squares with species (>half covered) **5 DO NOT ACCEPT** record abundance One point from **1 - 3** before a point from **4** to **8**
			Total	**22**	

Question			Answer	Marks	Guidance
4	(a)		**D ;** **C ;** **J / M / N ;** **J / K / L ;** **J / K / M ;**	5	**First Answer**

Question			Answer	Marks	Guidance
	(b)		*'Golden Rice™'* **B1** reduce vitamin (A) deficiency in named area / ora **;** **B2** reduce, eye problems / blindness **;** **C1** reduce rice <u>genetic</u>, diversity / variation **;** **C2** clone may suffer from one, disease / environmental change **;** **C3** hybridisation with wild rice / spread genes to wild populations **;** **C4** seeds expensive / need to be bought each year **;** **C5** rice may not grow in all areas where needed **;** **C6** *idea of* doubts whether vitamin A content sufficient **;** **4 max** *Somatic Gene Therapy* **B3** cure / reduce symptoms / better quality of life / less medication**;** **B4** cystic fibrosis / SCID / Parkinson's / thalassaemia / LCA **;** **B5** extend lifespan / saves lives **;** **C7** <u>virus</u> vector may cause (viral) disease **;** **C8** procedure may be, invasive / dangerous / painful / stressful **;** **C9** temporary / needs to be repeated / limited success **;** **C10** immune system / rejection, problems **;** **C11** animal testing concerns **;** **4 max** *Either Section* **C12** antibiotic resistance gene transfer to pathogenic bacteria **;** **C13** unknown effects / cause mutation **;** **QWC** – balanced account **;** **1 max**	9 max	**B1** eg Asia / developing world / area where rice is staple diet **C1 ACCEPT** contributes to genetic erosion **C3 ACCEPT** superweeds idea **C4 CREDIT** idea of economic exploitation **B3 DO NOT ACCEPT** treat (as in question) **B4** eg single gene recessive conditions, cancer *concerns* **IGNORE** references to embryo research, designer babies and germline gene therapy **C8** eg bone marrow removal and replacement **C12 IGNORE** idea of resistant viruses **C13 ACCEPT** cause cancer (in context of gene therapy) Award if 1 **C** mark and 1 **B** mark have been awarded for **both** examples
			Total	**14**	

Question	Answer	Marks	Guidance
5		5	**CREDIT** asepsis for aseptic (3 down)
	Total	**5**	

Question			Answer	Marks	Guidance
6	(a)	(i)	artificial selection / selective breeding ;	1	**First Answer**
		(ii)	*idea that* males can father many offspring / mate several females ; *idea that* females produce only a few offspring ; (so) more females (than males) needed to maintain numbers (each generation) ; (20% females chosen as) inbreeding / genetic problems, if breeding population is too small ; (5% males chosen as) selection pressure stronger if fewer (tamest) are used ;	2 max	**IGNORE** artificial insemination eg one litter at a time
	(b)		**1** (mostly) genetic ; **2** as can be selected for / selective breeding increases frequency ; **3** allele(s) for tameness ; **4** (from) mutation ; **5** query role of environment / learning ; **6** ref. DRD4 / dopamine receptor ;	3 max	**DO NOT CREDIT** if environment also given as cause **IGNORE** genetic drift **DO NOT CREDIT** if environment given as main cause **ACCEPT** query about experimental method, eg was environment controlled for?

Question			Answer	Marks	Guidance
	(c)		*linkage* tameness genes and genes for these traits <u>on same chromosome</u> ; (so) inherited together ; *epistasis* (product of) one gene affects expression of another ; via enzyme pathway ; *inbreeding* (hidden / masked) recessive alleles ; selected for, as well / unintentionally ; more chance homozygous as, small gene pool / parents related ; *genetic drift* random / chance (which alleles, present / passed on) ; (effect stronger because) small breeding population ;	2	**First Answer** Look for the two mark points relevant to the first word of the four on offer that the candidate has chosen. **ACCEPT** idea of (recessive)allele inherited from both parents because, they are closely-related / small gene pool / reduced genetic diversity
	(d)		**1** <u>geographic</u> ; **2** wolves avoid human settlements / dogs confined by humans ; **3** <u>behavioural</u> ; **4** detail / description ; **5** <u>mechanical</u> ; **6** idea of different size of wolves and some small dogs ; **7** gamete incompatibility ; **8** possibility of different chromosome numbers ; **9** <u>seasonal / temporal</u> ; **10** different breeding, seasons / times ;	3 max	**IGNORE** reproductive isolation **4** eg differences in, pheromones / courtship **6 ACCEPT** different genitalia **10 CREDIT** *the idea that* dogs breed all year round / wolves breed once a year

Question			Answer	Marks	Guidance
	(e)		*biological species concept* **1** (members of same species) need can interbreed to produce fertile offspring **;** **2** not all dog breeds can do this therefore not same species **;** **3** dog and wolf can so they should be same species **;** *phylogenetic species concept* **4** *idea that* dogs and wolves monophyletic group / tip of phylogeny **;** **5** genetic differences, between dogs and wolves small **;** **6** gene flow between wolves → big dogs → little dogs / analagous to ring species **;** **7** (PSC) one species (with a lot of phenotypic variation) **;**	4 max	**4 ACCEPT** share a common ancestor **5 CREDIT** question of how much DNA difference needed to classify as separate species
			Total	**15**	

Question			Answer	Marks	Guidance
7	(a)		homeotic / regulatory, (gene) ; contains, 180 bp / homeobox, sequence ; that codes for homeodomain (on protein) ; (gene product) binds to DNA ; initiates transcription / switch genes, on / off ; control of, development / body plan ;	2	**IGNORE** *hox* **CREDIT** controls gene expression, ref. transcription factor(s) **ACCEPT** description, eg polarity, segmentation, position of limbs
	(b)		these genes very important ; mutation would, have big effects / alter body plan ; many other genes would be affected / knock-on effects ; mutation likely to be, lethal / selected against ;	2 max	**ACCEPT** example, eg no arms **CREDIT** selected against in context of survival, not reproduction **DO NOT CREDIT** ora, not beneficial so not selected for
	(c)		protein synthesis / transcription and translation ; respiration ; DNA replication ; mitosis ; cytokinesis ; apoptosis ; differentiation / gene switching ;	2 max	**Mark the first two suggestions only** **IGNORE** growth **ACCEPT** programmed cell death
	(d)		fungi / plants ;	1	
			Total	**7**	

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