OCR
RECOGNISING ACHIEVEMENT

GCE

Biology

Advanced GCE

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

Mark Scheme for June 2013

Oxford Cambridge and RSA Examinations

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

1. **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

**Quality of Written Communication*

Question			Answer		Marks	Guidance
1	(a)		reduce / slow, flow rate ; repeat process / run milk through again ; test for (named) sugars in milk ;		2	**ACCEPT** close tap for a time period **CREDIT** glucose, galactose, lactose, Benedict's test
	(b)	(i)	*any two from* hydrophobic / ionic bond, to (named), solid / support ; covalent bond / cross-link to, (named) substance; membrane separation ; (en)trap / encapsulate / suspend, in (named), matrix ;		2	**Mark as prose.** **IGNORE** ref to cross-linking agents **ACCEPT** 'insoluble material for solid. Suitable solids = clay, carbon, resin, glass, gold, ceramic beads. **CREDIT** **ad**sorption (but not absorption) **CREDIT** carrier bound. **CREDIT** cross-link them together. Suitable substances = other enzymes, collagen, cellulose. **ACCEPT** microcapsules Suitable matrix materials = collagen, cellulose, silica gel, hydrogel, but **DO NOT CREDIT** entangled / alginate
		(ii)	**1**	(enzyme) can be re-used so reduces cost ;	4	
			2	product, pure(r) / uncontaminated ;		**2 ACCEPT** product not mixed with enzyme
			3	reduced downstream processing costs ;		**3 ACCEPT** save money on purifying product
			4	(immobilised enzyme) works at high(er) temperature ;		**4 CREDIT** enzymes not denaturing at increased temperature **CREDIT** immobilised enzymes thermostable
			5	(immobilised enzyme) works in changed pH ;		**5 CREDIT** enzymes not denaturing in changed pHs
			6	reaction, can be faster / have higher yield , because can be done at higher temperature ;		**6** This explanation scores mp 4 and mp 6 (unless mp 4 already awarded).
				Total	**8**	

Question			Answer		Marks	Guidance
2	(a)	(i)	**C ;**		1	**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)	**D ;**		1	**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**
		(iii)	**B / E ;**		1	**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**
		(iv)	**E ;**		1	**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**
	(b)		**1**	muscles <u>contract</u>, in antagonistic (pairs) **;**	3	**1 CREDIT** biceps and triceps **or** flexor and extensor contract **IGNORE** context of direction of movement
			2	tendons, pull on bone / connect muscle to bone **;**		
			3	ligaments, hold bones together / prevent dislocation **;**		
			4	cartilage, reduces**,** friction / wear **;**		**4 ACCEPT** 'prevents' for reduces
			5	synovial membrane secretes fluid **;**		**5 ACCEPT** makes, produces but not 'releases'
			6	<u>synovial</u> fluid, is a lubricant / allows smooth movement **;**		**6 ACCEPT** prevents / reduces, friction

Question			Answer	Marks	Guidance
	(c)		**1** (two parts are) sympathetic **and** parasympathetic **;** **2** **S** has, short preganglionic neurone / long postganglionic neurone / ganglia near(er) spinal cord, **but P** has, long preganglionic neurone / short postganglionic neurone / ganglia near(er) organ **;** **3** **S** uses noradrenaline **but P** uses acetylcholine (at organ) **;** **4** **S,** fight / flight / stress, **but P**, rest / relaxation / calm **;** **5** **S** increases, heart rate / cardiac output / blood pressure, **but P** reduces this **;** **6** **S** increases , speed / rate / depth, of breathing, **but P** reduces this **;** **7** **S** increases airway diameter **but P** reduces it **;** **8** **S** increases blood flow to skeletal muscle **but P** increases blood flow to gut (smooth muscle) **;** **9** **S** for orgasm **but P** for sexual arousal **;** **10** **S** dilates pupils **but P** constricts pupils **;** **11** **S** makes liver release glucose, **but P** makes liver**,** store / take up, glucose **;** **12** **P** allows**,** <u>peristalsis</u> / digestion, **but S** reduces it **;**	7	**1** If BOTH names are wrong but begin with **S and P, DO NOT CREDIT** mp1 but allow ECF for mps 2-12 **2** **ACCEPT** tissue for organ **3** **CREDIT** norepinephrine for noradrenaline but **IGNORE** noradrenaline from adrenal gland and **IGNORE** references to ganglion here **6** **CREDIT** **S** increases ventilation rate and **P** slows it **8** **CREDIT** voluntary or striated for skeletal **IGNORE** ORA **11** **ACCEPT** correct reverse reasoning for glycogen **IGNORE** sugar 'liver' must be mentioned at least once **12** **IGNORE** **'**stops' for **S** but allow **S** inhibits
			QWC ;	1	Award **QWC** if **1 mark** awarded for organisation mps **1-3** and **2 marks** awarded for functions mps **4-11**
			Total	**15**	

Question			Answer	Marks	Guidance
3	(a)		metaphase **I and** metaphase **II ;** prophase **I ;** anaphase **II ;** telophase **II ;** anaphase **I ;**	5	**Mark the first answer on each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**
	(b)		to, **halve** chromosome number / **reduce from** 2n **to** n **;** to separate homologous pairs (of chromosomes) **and** sister chromatids **;** because, DNA (previously) replicated / chromosomes are two chromatids at start **;**	2	**IGNORE** all references to mitosis **CREDIT 'from** diploid **to** haploid' **ACCEPT 'from** 46 **to** 23 chromosomes' **IGNORE** halve, genetic material / DNA **ACCEPT** genetic, material / information
	(c)	(i)	sequence / order, of bases / nucleotides **;**	1	**CREDIT** base pairs **DO NOT CREDIT** amino acid sequence
		(ii)	different, primary / secondary / tertiary, structure **;** (protein) shorter due to, deletion / stop codon **OR** longer due to, insertion / duplication **;** (protein) unchanged due to, silent mutation / non-coding DNA altered **;** (function is) lost / worse / better **;**	3	**ACCEPT** different <u>sequence</u> or <u>order</u> of amino acids **ACCEPT** different 3D folding or 3D shape for 'silent' **CREDIT** 'neutral' or a description of more than one triplet coding for one amino acid **IGNORE** different / altered function **ACCEPT** idea that change is harmful
			Total	**11**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>4</td><td>(a)</td><td></td><td>
<table>
<tr><th>biological principle</th><th>letter</th></tr>
<tr><td>artificial selection</td><td>E</td></tr>
<tr><td>predator-prey interaction</td><td>G</td></tr>
<tr><td>apical dominance</td><td>B</td></tr>
<tr><td>nitrogen fixation and nitrification</td><td>D</td></tr>
<tr><td>reproductive cloning</td><td>A / F</td></tr>
<tr><td>positive chemotaxis</td><td>H</td></tr>
<tr><td>decomposition</td><td>C / D</td></tr>
<tr><td>commercial use of plant hormones</td><td>F</td></tr>
</table>
;
</td><td>8</td><td>Award 1 mark per row.

Mark the first answer in each box. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</td></tr>
<tr><td></td><td>(b)</td><td></td><td>respiration / decomposition / decay / ripening ;

<u>interspecific competition</u> ;

(positive) <u>phototrop</u>ism ;

<u>succession</u> ;</td><td>4</td><td>Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks

ACCEPT metabolism / metabolic reactions

DO NOT CREDIT negative phototropism
DO NOT CREDIT trophism (as ambiguous with trophic)</td></tr>
</table>

Question			Answer	Marks	Guidance
	(c)		*animals = primary consumers* **1** keep animals, warm / indoors **;** **2** reduce animal movement **;** **3** feed animals high, protein / energy, food **;** **4** vaccination / (routine) antibiotics, for animals **;** **5** selective breeding / genetic engineering**,** for improved animals **;** **6** slaughter just before, mature / full size **;**	3	**2 ACCEPT** zero grazing idea **3 ACCEPT** growth-enhancing food additives **4 IGNORE** hormones **5 ACCEPT** description of improvement, e.g. disease resistant, faster-growing, higher yielding
			Total	**15**	

Question			Answer	Marks	Guidance
5	(a)	(i)	*idea of* tentative / uncertain / developing / advancing / improving / dynamic **;**	1	**IGNORE** change(s), changing, changeable (as given in question)
		(ii)	**1** conservation / keep rare plants / save endangered plants **;** **2** gene bank **OR** genetic resource / store of alleles **;** **3** teaching / education **;** **4** leisure / amenity / visitor attraction / aesthetic value **;**	2	**Read as prose.** **1 ACCEPT** prevent extinction / maintain biodiversity **3 IGNORE** 'research' (as given in question)
	(b)	(i)	to**,** amplify / make (many) copies of**,** DNA **;** (range of) different lengths **;**	2	**IGNORE** refs. to single stranded / coding strand / template strand **CREDIT** idea of, chain terminating / dideoxy, nucleotides attaching at different points along sequence
		(ii)	to put DNA pieces in size order **;** to read, base sequence / order of bases **;**	2	**IGNORE** speed or rate of movement, look for distance or position or pattern, e.g. shortest / lightest / smallest**,** lengths first or lighter move further and heavier move less far **DO NOT CREDIT** 'put genome back in order'
		(iii)	to cut (genome DNA) into, small(er) / 750 bp, fragments **;** to cut, vectors / BACs / plasmids, (for gene library) **;**	2	**ACCEPT** fragment size in range 500-1000 base pairs

Question			Answer	Marks	Guidance
	(c)		genome, too big / very large ; accuracy better / fewer errors (with small fragments) ; divide job over, time / different labs ;	2	**ACCEPT ORA** only, small sections / 750bp, can be sequenced (at a time) **CREDIT ORA** large sections sequenced less accurately **ACCEPT** otherwise would take too long / be unmanageable / be impractical **IGNORE** ref to efficiency
	(d)	(i)	1 160 000 ; ;	2	**Correct answer = 2 marks (no units)** **CREDIT** 1.16 million **or** 1.16 x 10^6 If answer incorrect, **award 1 mark** for 870 (million) ÷ 750 **AWARD** 1 max correct answer has inappropriate units (e.g. 1 160 000 Mbp = 1 mark)
		(ii)	(monkey flower) has, smaller genome / fewer Mbp DNA ; fewer lab hours / fewer staff needed / quicker / cheaper ;	2	**Read as prose.** **ACCEPT ORA** but must be comparative **IGNORE** refs to chromosome number **ACCEPT ORA** but must be comparative
		(iii)	larger (in size) ;	1	**ACCEPT** bigger / plumper / juicier

Question			Answer	Marks	Guidance
	(e)		*phylogenetic approach* no need to test for interbreeding **;** ref. common ancestor / <u>monophyletic</u> groups **;** can apply to organisms that reproduce asexually **;** can apply to, extinct organisms / fossils **;**	2	**ORA** for biological species concept – (importance of members of same species) (inter)breeding to give fertile offspring **IGNORE** clades **ORA** for biological species concept – doesn't apply to asexually reproducing organisms **ORA** for biological species concept – doesn't apply to, extinct organisms / fossils
			Total	**18**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>6</td><td>(a)</td><td>(i)</td><td>
<table>
<tr><th></th><th>Discontinuous</th><th>Continuous</th></tr>
<tr><td>Species identified by letter</td><td>S and T ;</td><td>R ;</td></tr>
</table>
</td><td>2</td><td></td></tr>
<tr><td></td><td></td><td>(ii)</td><td>statement 1 in S and T only ;
statement 8 in S and T only ;

statements 2 and 3 in R only ;
statement 5 in R only ;

statements 4 and 7 in T only ;
statement 6 in S only ;</td><td>6</td><td>
<table>
<tr><th>Species</th><th>Statement number(s)</th></tr>
<tr><td>R</td><td>2 3 5</td></tr>
<tr><td>S</td><td>1 6 8</td></tr>
<tr><td>T</td><td>1 4 7 8</td></tr>
</table>
</td></tr>
</table>

Question	Answer	Marks	Guidance
(b)	*collection* **1.** named equipment for collecting from, dogs / fields **;** **2.** get**,** large number / over 100 (fleas) **;** **3.** use several, dogs / fields **;** **4.** *idea of* random sampling (dogs / field) **;** *testing* **5.** (named) container **;** **6.** correct dose / range (of concentrations)**,** tested **;** **7.** control without flea killer **;** **8.** delivery method described **;** *processing* **9.** leave for set time **;** **10.** count number of, dead / live**,** fleas (after testing) **;** **11.** calculate percentage (frequency) of**,** alive / dead / resistant / non-resistant **;**	6	**1 CREDIT** pooter, forceps, tweezers, pipette, (flea) comb, sweep net, sticky traps, light traps (in correct context) **5 CREDIT** tank, jam jar, boiling tube, petri dish. **6 ACCEPT** 'dose according to manufacturer's instructions' **IGNORE** same, volume / concentration **8** e.g. flea-killer sprayed / left to evaporate from cotton wool / fed in blood or food **9 ACCEPT** leave for same amount of time **10 IGNORE** how many were left, how many were resistant **IGNORE** identify – must be counting number
	QWC ;	1	Award if the **first mark point awarded in each section** is ***in the correct section order***: collection **1 to 4** **then** testing **5 to 8** **then** obtaining and processing results **9 to 11** *e.g. if the first mark of each section is awarded in the wrong order (such as mp 1, then mp 10, with nothing from the testing section inbetween)* ***then do not award QWC***
	Total	**15**	

Question			Answer	Marks	Guidance
7	(a)	(i)	(both) to, avoid / counter, (abiotic) stress **;**	2	**Mark the first 2 reasons** **CREDIT** to avoid named stressors e.g. cold, heat, dryness, humidity or unfavourable conditions **only CREDIT** descriptions relevant to both animals (avoiding a stressor) **and** to plants (closing stomata, wintering underground, etc). **IGNORE** survival and dangers unqualified
			(both) to avoid, being eaten / predation **;**		**only CREDIT** descriptions relevant to both animals (being consumed, being preyed upon) **and** to plants (being grazed, herbivory).
			(both) to access resources **;**		**only CREDIT** descriptions relevant to both animals (get food) **and** plants (obtain light, minerals, water)
		(ii)	*all points must show a clear comparison between mammals (M) and plants (P)* **1** (M) made in endocrine glands **versus** (P) made in many plant tissues **;** **2** (M) move in blood **versus** (P) move, in xylem / in phloem / from cell to cell **;** **3** (M) act on**,** a few / specific / target, tissues **versus** (P) act on most tissues / can act in cells where produced **;** **4** (M) act more rapidly **; ORA**	3	**2(P) ACCEPT** diffusion / through plasmodesmata, for 'from cell to cell'. **ACCEPT** by translocation / in transpiration stream **IGNORE** mass flow **4** must be comparative e.g. respond fast**er** in mammals
	(b)	**(i)**	inherited / passed to offspring / passed (down) from parents **;** (caused by) mutation / allele **;**	2	**ACCEPT** in context of condition or gene

Question			Answer	Marks	Guidance
		(ii)	gene / allele ; (DNA) ligase ; transgenic / transformed ; antibiotic(s) ; (gene / DNA / fluorescent / radioactive) probe ;	5	**Mark the first answer on each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **ACCEPT** recombinant / GE / GM **CREDIT** named antibiotic e.g. ampicillin, tetracycline
	(c)		fat soluble / non-polar / uncharged / hydrophobic ; (so can move directly through) phospholipid bilayer ;	2	**ACCEPT** through phospholipids / through phospholipid membrane **DO NOT CREDIT** through pores

Question	Answer	Marks	Guidance
(d)	**EITHER** **1** *(lac)* repressor protein **;** **2** (repressor protein) changes shape when bound to lactose **;** **3** (with lactose) lifts off operator allowing, transcription / gene expression / binding of RNA polymerase to promoter **; ORA** **4** β-galactosidase / enzyme(s) / structural gene(s) **;** **OR** **5** homeotic / homeobox / hox (genes) **;** **6** gene product / protein / transcription factor**,** binds to DNA **;** **7** gene product / protein**,** starts transcription / is a transcription factor **;** **8** many genes affected / controls body plan **;**	4	**Mark the first example.** **3 ORA** without lactose the protein binds to the operator stopping, transcription / gene expression / binding of RNA polymerase to promoter **DO NOT CREDIT** mp 3 if ref. made to DNA polymerase or DNA replication **4 CREDIT** lactose permease **6 CREDIT** homeobox domain / homeodomain, binds to DNA **7 ACCEPT** controls **/** regulates **/** stops**,** transcription **8 CREDIT** controls**,** development / segmentation
	Total	**18**	

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