OXFORD CAMBRIDGE AND RSA EXAMINATIONS

Advanced GCE

BIOLOGY F215 MS

Unit F215: Control, Genomes and Environment

Specimen Mark Scheme

The maximum mark for this paper is 100.

Question Number	Answer	Max Mark
1(a)(i)	*gene* length of DNA**;** codes for a (specific), polypeptide / protein / RNA**;** *max 1* *allele* alternative form of a gene**;** found at a, locus / particular position on, a chromosome**;** *max 1*	**[2]**
(a)(ii)	*assume allele refers to coat colour allele* (coat colour) gene / alleles, only on X chromosome**;** **A** *no (coat colour), gene / allele, on Y chromosome* male cats, XY / only have one X chromosome**;** males have only one (coat colour) allele / cannot have two (coat colour) alleles**;** need black and orange alleles for tortoiseshell colour**;**	**[2]**
(b)	parental genotypes $C^{r}C^{r}$ x $C^{w}C^{w}$ **;** gametes C^{r} , C^{w} **;** *F_1 genotypes <u>and</u> phenotypes 1 mark:* F_1 genotypes (all) $C^{r}C^{w}$ F_1 phenotypes (all) pink**;** *F_2 genotypes <u>and</u> phenotypes 1 mark:* gametes C^{r} , C^{w} C^{r} , C^{w} **;** F_2 genotypes $C^{r}C^{r}$ $C^{r}C^{w}$ $C^{r}C^{w}$ $C^{w}C^{w}$ F_2 phenotypes red pink (pink) white**;** F_2 ratio 1:2:1**;** *accept other symbols if key given.* *accept r and w as symbols without key.*	**[6]**
(c) (i)	65**;** 130**;** 65**;**	**[3]**

Question Number	Answer	Max Mark
(c) (ii)	0.138 + 0.007 + 0.061**;** *(or other suitable working)* 0.206 – 0.208**;** *2 marks for correct value if no working shown* *ecf for both marks but calculated value must be to three decimal places*	**[2]**
(c)(iii)	support, figure lower than 5.991 / figure lower than critical value**;** ***R** 'support' on its own.* *ecf applies if value in (ii) is incorrect*	**[1]**
(d)	named characteristic**;** named environmental factor**;** *(mark first answer only)*	**[2]**
(e)	1 ref to operon**;** 2 normally repressor substance bound to operator**;** 3 prevents RNA polymerase binding (at promoter) / prevents transcription**;** 4 lactose binds to repressor**;** 5 changes shape of protein molecule**;** 6 unable to bind (to operator)**;** 7 RNA polymerase binds (at promoter) / transcription occurs / genes switched on**;** 8 AVP**;** e.g. production of lactose permease / production of beta-galactosidase**;**	**max[5]**
	Total:	**[23]**
2(a)	a change in the genetic material**;** unpredictable / AW**;** extra detail**;** e.g. addition / substitution / deletion / frame shift / small part of chromosome / may code for different protein / may code for no protein	**[2]**

Question Number	Answer	Max Mark
(b)	*1 mark max for general effect of mutations:* mutation may give different, amino acid / primary structure**;** **A** *ref stop codon* some mutations alter, molecular shape / tertiary structure / binding**;** *max 3 for explaining data in Table:* so unable to, accept / transport, HCO_3^-**;** unable to bind ATP**;** so increase in acidity / decrease in pH**;** effect on mucus**;** effect on enzyme(s) /ref pH optimum of enzyme(s)**;** poor digestion of, protein / lipid / starch**;** AVP**;** e.g. some mutations, give some transport / have less effect. >33% (of norm) allows normal digestive function / < 6% [**A** *very low*] does not.	**max[4]**
	Total:	**[6]**
3(a)(i)	*award both marks for correct answer* 10 000 / 800 000 (x 100)**;** 1.25 / 1.3 / 1(%)**;**	**[2]**
(ii)	**R** *any reference to energy / light missing the plant* reflected (off plant) / only certain wavelengths of light can be, absorbed / used**;** ora absorbed by / hits, non-photosynthetic parts**;** e.g. bark passes through leaf / misses chlorophyll / misses chloroplasts**;** some is heat that is used in evaporation / respiration**;**	**max[2]**
(iii)	bacteria / named bacterium decomposer**;** (*Nitrobacter* , *Nitrosomonas*)	**[1]**

Question Number	Answer	Max Mark
(iv)	*take the first 2 answers:* death / dead remains**;** excretion**;** **R** *waste products* egestion**;** other suitable method**;** e.g. insects moulting hatched eggs moulting (fur / feathers) **R** *leaves*	**[2]**
(b)	*Primary consumers are eating and…* producers have, cell walls / cellulose**;** ora difficult to digest / much material, wasted / egested**;** energy used by gut microorganisms**;** ora much material cannot be eaten (by primary consumer)**;** ora	**[3]**
	Total:	**[10]**
4(a)(i)	plasmid cut by restriction enzyme**;** at specific sequence**;** same enzyme as used to cut (insulin) gene**;** sticky ends / described**;** ref. complementary sticky ends**;** ligase seals (sugar-phosphate) backbone / AW**;**	**max[4]**
(ii)	*credit any two from the following:* 1 antibiotic resistance (gene) introduced and survivors have plasmid**;** 2 fluorescent marker (gene) introduced and glowing bacteria have plasmid**;** 3 identify bacteria producing insulin using antibodies**;**	**[2]**

Question Number	Answer	Max Mark
(b)	*referring to pig insulin:* ethical / religious, reasons**;** incompatibility / lack of tolerance / immune response**;** ora not exactly the same as / less effective than, human insulin**;** ora *referring to human insulin from bacteria:* engineered insulin is cheaper**;** ora greater supply of engineered insulin**;** ora	**[1]**
4(c)	*allow max 5 for following:* <u>transcription</u>**;** DNA unzips / H bonds break**;** exposing required, gene / sequence of bases**;** RNA nucleotides align with DNA**;** U with A, A with T, C with G, **and** G with C**;** RNA polymerase**;** mRNA formed (using DNA strand as template)**;** leaves nucleus through pore**;** *allow max 5 for following:* <u>translation</u>**;** mRNA attaches to ribosome**;** tRNA brings amino acid (to, ribosome / mRNA)**;** each tRNA attached to specific amino acid**;** tRNA binds to mRNA using complementary, base triplet / anticodon**;** peptide bond formed between amino acids**;** DNA / mRNA, (nucleotide / base) sequence determines sequence of amino acids**;** AVP**;** e.g. 2, base triplets / codons, in ribosome **AVP; e**.g. ref. to : start / stop, codons polysomes large and small subunit in ribosome Mg^{2+}	**[10]**
	Total	**[17]**
5(a)	from below / ventral / AW**;** **A** *idea of brain being seen from below* **R** *upside down, looking upwards*	**[1]**

Question Number	Answer	Max Mark
(b)(i)	*reject choice of answers, accept any reasonable spelling* **A** cerebrum / cerebral hemisphere / cerebral cortex / frontal lobe**;** ignore refs to right or left **R** *incorrect lobe* **B** pituitary (gland)**;** **R** *hypothalamus* **C** cerebellum**;** **D** medulla (oblongata)	**[4]**
(b)(ii)	control of breathing**;** control of heart rate**;** control of circulation**;** control of swallowing / salivation / vomiting reflex**;**	**[2]**
(c)	*If blood hormone concentration rises* inhibits output of trophic hormones by pituitary gland**;** which inhibits output of hormones by endocrine glands**;** blood hormone concentration falls to normal levels**;** ref. negative feedback**;** *ORA*	**max[2]**
	Total:	**[9]**
6(a)	(apical / terminal) bud is source of auxin**;** auxin inhibits growth of side shoot / ora**;** remove bud and auxin concentration drops**;** (this allows) cell division / elongation to take place**;** *ecf – marking points 2 and 3 if growth regulator or hormone used instead of auxin*	**max[3]**
(b)	*award two marks if correct answer (80%) is given* *award one mark for calculation if answer is not correct* (90 – 50 = 40) 40 / 50 x 100**;** 80%**;;**	**[2]**
(c)	no growth until day, 8 / 10**;** auxin moves out of paste / AW**;** inhibits growth**;** growth occurs after, 8 / 10, days**;** because auxin, levels fall / 'used up'**;**	**[3]**
	Total:	**[8]**

Question Number	Answer	Max Mark
7(a)(i)	*max 1 for meaning of term* attached to an insoluble material / AW**;** *max 2 for description* (micro)encapsulation / (trapped) in alginate beads**;** adsorption / stuck onto, collagen / clays / resin / (porous) glass**;** cross linkage / covalent / chemical, bonding to, cellulose / collagen fibres**;** gel entrapment / trapped inside gel e.g. silica (lattice / matrix)**;** partially permeable membrane (polymer) microspheres**;**	**[3]**
(ii)	*any three from the following:* urine can be processed / no problem of removing urine / AW**;** pure / drinkable / useable, water produced**;** **A** water recycled space saving / less water needs to be taken into space**;** payload limit / weight reduction / AW**;** no problem in separating enzyme from products / product not contaminated**;** ref. to longer shelf-life of enzyme**;** no need to take more enzymes into space / enzymes reusable **;** **A** enzymes recoverable AVP**;** e.g. larger surface area of enzyme exposed, more stable at extremes, ref. to ease of use (of bioreactor)	**[3]**
(b)(i)	adding / using, water to break, bond / ester bond, (in molecule)**;** **A** breakdown into smaller molecules	**[1]**
(ii)	matrix, protects / stabilises, enzyme / lipase**;** functions, at optimal rate / more efficiently, at higher temperature / 45 ^{o}C**;** **A** *greater activity / AW* ref. to soluble lipase begins to denature (reducing activity)**;** ora functions, at optimal rate / more efficiently, at lower pH**;** ref. to presence of fatty acids changing pH**;** ref. to ionic bonds breaking (in soluble lipase) **;** ora AVP **;** e.g. ref to industrial uses ref to effect on R groups	**max[4]**
	Total:	**[11]**

Question Number	Answer	Max Mark
8(a)	starts with previously uncolonised area / bare ground / bare rock / AW**;** ref to pioneer species / named pioneer**;** series of recognisable, seres / stages**;** progresses to, climax / final equilibrium stage**;**	**max[2]**
(b)	stabilise environment**;** soil development / increase humus / organic material**;** change soil pH**;** hold more water**;** release more minerals or nutrients / increase N content or fix N / hold ions**;** form microhabitat / reduce exposure / provide shelter / reduce erosion**;**	**max[3]**
(c)	*any two from following:* grazing**;** burning**;** mowing / application of fertilizer / application of selective herbicide**;** exposure to wind**;** grass able to continue to grow (linked to a statement above)**;**	**[2]**
(d)	increases**;** plants at later stages are large / plants in early stages are small**;** trees / shrubs. are woody, appear later in succession**;**	**[2]**

Question Number	Answer	Max Mark
(e)	*max 1 mark from following:* **1** economic definition of sustainable**;** e.g. similar quantities of timber can be harvested year on year **2** grants for planting forests / management schemes **;** **3** planting to ensure sustainable harvest rate**;** *max 3 marks for planting strategy:* **4** trees not planted too closely together**;** **5** support young trees to prevent damage e.g. from grazing animals**;** **6** species planted that are suitable for prevailing conditions / native spp**;** **7** softwood sp. / conifers / named conifer / fast growing sp. planted**;** **8** deciduous broadleaved species around edges for aesthetic reasons**;** **9** creates different habitats / named habitat / protected habitats/ some fallen trees left to rot**;** *max 3 marks for felling/cropping strategy:* **10** ref. to clear felling having negative effects e.g. soil erosion**;** **11** only mature trees removed / selective felling / individual trees**;** **12** some clearings / rides / glades in woodland / strip felling**;** **13** control of, pests / diseases / fire prevention**;** **14** ref to coppicing / pollarding**;** **15** (deciduous trees) regrow from base/ idea of rotation/ cycle**;** **16** standards / large trees not coppiced, as encourages biodiversity**;**	**[7]**
	Total:	**[16]**
	Paper Total	**[100]**

Assessment Objectives Grid (includes QWC)

Question	AO1	AO2	AO3	Total
1(a)(i)	2			**2**
1(a)(ii)		2		**2**
1(b)		6		**6**
1(c)(i)		3		**3**
1(c)(ii)		2		**2**
1c(iii)		1		**1**
1(d)	2			**2**
1(e)		5		**5**
2(a)	2			**2**
2(b)		4		**4**
3(a)(i)		2		**2**
3(a)(ii)		2		**2**
3(a)(iii)	1			**1**
3(a)(iv)	2			**2**
3(b)		3		**3**
4(a)(i)	4			**4**
4(a)(ii)			2	**2**
4(b)		1		**1**
4(c)	10			**10**
5(a)		1		**1**
5(b)(i)	2	2		**4**
5(b)(ii)	2			**2**
5(c)	2			**2**
6(a)		3		**3**
6(b)		2		**2**
6(c)		3		**3**
7(a)(i)	1		2	**3**
7(a)(ii)		3		**3**
7(b)(i)	1			**1**
7(b)(ii)		2	2	**4**
8(a)	2			**2**
8(b)	2	1		**3**
8(c)		2		**2**
8(d)		2		**2**
8(e)	4	3		**7**
Totals	**39**	**55**	**6**	**100**
Targets	**36**	**54**	**10**	**100**

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