

GCE

Biology

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

Advanced GCE

Mark Scheme for June 2014

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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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These are the annotations, (including abbreviations), including those used in scoris, which are used when marking

Annotation	Meaning of annotation
	Blank Page – this annotation must be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
	Tick
	Cross
	Unclear
	Benefit of doubt
	Effective evaluation
	Level 1
	Level 2
	Level 3
	Level 4
	Not answered question
	Own figure rule
	Noted but no credit given
	Too vague
	Omission

Question			Expected Answer	Mark	Additional Guidance
1	(a)	(i)	<p><i>discontinuous</i> gender / male and female / eye colour ;</p> <p><i>continuous</i> size / length / mass ;</p>	2	<p>Mark the first answer on each prompt line. If an additional answer is given that is incorrect or contradicts the correct answer, then = 0 marks</p> <p>Note: Suggestions must relate to visible characteristics of the frogs,</p> <p>ACCEPT sex IGNORE skin colour (as stated in Q)</p> <p>CREDIT example of a measurable characteristic (e.g. leg length, surface area, height, weight)</p>
1	(a)	(ii)	<p><i>idea of</i></p> <p>1 no / little , environmental effect for , (named example of) discontinuous variation / example given for discontinuous variation in (i) as ecf ;</p> <p>2 some / large , environmental effect for , (named example of) continuous variation / example given for continuous variation in (i) as ecf ;</p> <p>3 gender may be affected by , temperature / atrazine exposure ;</p>	2	<p>IGNORE examples of environmental factors</p> <p>ACCEPT discontinuous variation is only , genetic / due to alleles present</p> <p>Note: A comparative statement (e.g. ' environment has a <u>greater</u> effect on continuous variation') = 2 marks (mps 1 & 2) e.g ' no environment effect for discontinuous variation but it does affect continuous variation' = 2 marks (mps1 &2)</p>

Question			Expected Answer	Mark	Additional Guidance								
1	(a)	(iii)	<p>1 <i>idea that</i> offspring visibly different from , A / egg donor ;</p> <p>2 to show that the offspring produced were clones ;</p> <p>3 to show / identify , (genetic) parents (of clone) / B and C ;</p>	2 max	<p>ACCEPT brown frog for A</p> <p>2 'to show that cloning is successful' is not enough</p> <p>Note: 'To show that the offspring were clones as they are not the same as A.' = 2 marks (mps 1 & 2)</p>								
1	(b)	(i)	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>Genetic fingerprint number</th> <th>Letter of frog</th> </tr> </thead> <tbody> <tr> <td style="text-align: center;">1</td> <td style="text-align: center;">D</td> </tr> <tr> <td style="text-align: center;">2</td> <td style="text-align: center;">A</td> </tr> <tr> <td style="text-align: center;">3</td> <td style="text-align: center;">B</td> </tr> </tbody> </table> <p style="text-align: right;">;</p> <p style="text-align: right;">;</p> <p style="text-align: right;">;</p>	Genetic fingerprint number	Letter of frog	1	D	2	A	3	B	3	<p>Mark the first answer in each box. If an additional answer is given that is incorrect or contradicts the correct answer, then = 0 marks</p> <p>If no letters in the table <u>at all</u>, look at the diagram and award marks if the profiles are identified correctly.</p>
Genetic fingerprint number	Letter of frog												
1	D												
2	A												
3	B												
1	(b)	(ii)	<p>cytoplasm / mitochondria , came from A</p> <p>or</p> <p>mitochondria / (mitochondrial) DNA , in cytoplasm of A ;</p>	1	<p>If frog not identified correctly = 0 marks</p> <p>Must refer specifically to frog A</p> <p>Must refer specifically to frog A</p>								

Question			Expected Answer	Mark	Additional Guidance
1	(c)	(i)	<p><i>advantage</i> (genetically identical so) all react the same or genetic variable controlled ;</p> <p><i>disadvantage</i> expensive (to produce) or don't see varied response to drug like in real populations (of mice)</p> <p>or <i>idea that</i> clones (of mice) may have unknown health issue (which would affect responses) ;</p>	2	<p>Note that the question refers to the use of cloned or uncloned mice in testing – and NOT to humans.</p> <p>ACCEPT ora throughout</p> <p>IGNORE large numbers of clones produced IGNORE ref to animal welfare / religious objections IGNORE ref to validity</p> <p>ACCEPT 'no genetic diversity to affect results'</p> <p>ACCEPT 'rare allergies / adverse reactions , won't be seen'</p>

Question			Expected Answer	Mark	Additional Guidance								
1	(c)	(ii)	<p>1 <i>idea to produce</i> , elite / best , animals ;</p> <p>2 <i>idea to save / preserve</i> , endangered animals ;</p> <p>3 grow / produce (spare) , stem cells / tissues / organs ;</p> <p>4 AVP ;</p>	2	<p>IGNORE ref research into disease (as given in Q)</p> <p>IGNORE ref to cost</p> <p>1 ACCEPT example / desirable characteristics</p> <p>2 ACCEPT recreating extinct animals</p> <p>3 ACCEPT ref to named example of , tissue / organ</p> <p>4 e.g. pet cloning / cloning GM animals / animals for xenotransplantation</p>								
1	(d)		<table border="1"> <thead> <tr> <th>Individuals</th> <th>% of alleles shared</th> </tr> </thead> <tbody> <tr> <td>David and John</td> <td>100 ;</td> </tr> <tr> <td>Anne and Lisa</td> <td>50 ;</td> </tr> <tr> <td>Sarah and Lisa</td> <td>50 ;</td> </tr> </tbody> </table>	Individuals	% of alleles shared	David and John	100 ;	Anne and Lisa	50 ;	Sarah and Lisa	50 ;	3	<p>Mark the first answer in each box. If an additional answer is given that is incorrect or contradicts the correct answer, then = 0 marks</p>
Individuals	% of alleles shared												
David and John	100 ;												
Anne and Lisa	50 ;												
Sarah and Lisa	50 ;												
			Total	17									

Question		Expected Answer	Mark	Additional Guidance
2	(a)	(belong to the) same <u>genus</u> ;	1	
2	(b) (i)	<p>1 not much / little / some , competition / niche overlap ;</p> <p><i>reasons for little competition</i></p> <p>2 use / feed on , different sized flowers / different depth of flowers ;</p> <p>3 vary in proportions of pollen <u>and</u> nectar they collect ;</p> <p>4 fly / live / active / feed / visit flowers , at different times ;</p> <p><i>reason for competition</i></p> <p>5 <i>idea that</i> fly / live / active / feed / visit flowers , overlaps there must be competition ;</p> <p>6 AVP ;</p>	4 max	<p>This mark is for a stand alone statement DO NOT CREDIT no competition IGNORE competition unqualified / inter / intra</p> <p>2 CREDIT correct comparative description or use of data e.g. <i>B. pratorum</i> feed on , bigger / longer / deeper , flowers or <i>B. pratorum</i> 7.4(mm) <u>and</u> <i>B. terrestris</i> 6.3(mm)</p> <p>3 CREDIT correct description e.g. <i>B. pratorum</i> mostly pollen and nectar <u>and</u> <i>B. terrestris</i> mostly nectar only or comparison of 2 species using table data IGNORE 'different amounts' of pollen and nectar</p> <p>4 CREDIT correct description of difference e.g. <i>B. pratorum</i> peak in June <u>and</u> <i>B. terrestris</i> in July or <i>B. pratorum</i> appear in earlier in the year or comparison of 2 species using graph data</p> <p>5 CREDIT correct description from data e.g. both compete for food between May and September / both collect pollen only from same % flowers</p> <p>6 e.g. use / feed on , different <u>species</u> of flowers</p>

Question			Expected Answer	Mark	Additional Guidance
2	(b)	(ii)	<p>1 <i>idea of isolation / isolating mechanism / barrier ;</i></p> <p>2 seasonal (difference) / temporal (difference) / males and queens (in different populations) produced in different months / breeding (in different populations) in different months ;</p> <p>3 behavioural (difference) / visit different (types of) flowers / feed at different times / feed on different food types ;</p> <p>4 different flower locations / different (micro)habitats ;</p> <p>5 <i>idea that gene flow restricted / no gene flow (between populations) ;</i></p> <p>6 different adaptations / specialisation / niche partitioning ;</p>	3 max	<p>2 CREDIT example of seasonal / temporal (e.g. <i>B. pratorum</i> has its peak number of workers in June and <i>B. terrestris</i> in July)</p> <p>3 CREDIT 'different mating rituals'</p> <p>5 must refer to gene /allele</p> <p>6 IGNORE speciation (as implied in Q) - can be mistaken for specialisation</p>

Question			Expected Answer	Mark	Additional Guidance						
2	(c)	(i)	<table border="1"> <thead> <tr> <th>Observation</th> <th>Type of behaviour</th> </tr> </thead> <tbody> <tr> <td>The time taken for a worker bee to collect food from a flower decreases with practice.</td> <td>learned (behaviour) / learning / operant conditioning / trial and error ;</td> </tr> <tr> <td>All bumble bees start at the bottom of a vertical spike of flowers and work upwards.</td> <td>innate / instinctive ;</td> </tr> </tbody> </table>	Observation	Type of behaviour	The time taken for a worker bee to collect food from a flower decreases with practice.	learned (behaviour) / learning / operant conditioning / trial and error ;	All bumble bees start at the bottom of a vertical spike of flowers and work upwards.	innate / instinctive ;	2	<p>Mark the first answer in each box. If an additional answer is given that is incorrect or contradicts the correct answer, then = 0 marks</p> <p>ACCEPT taxis / example of taxis eg chemotaxis IGNORE inherited / genetically determined DO NOT CREDIT kinesis</p>
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The time taken for a worker bee to collect food from a flower decreases with practice.	learned (behaviour) / learning / operant conditioning / trial and error ;										
All bumble bees start at the bottom of a vertical spike of flowers and work upwards.	innate / instinctive ;										
2	(c)	(ii)	<p><i>Idea that better / more efficient , at , finding / getting , food ;</i></p> <p>AVP ;</p>	1 max	<p>ACCEPT more food can be collected less , time / energy , spent looking for food easier to find food e.g. ref to reduces competition from other colonies</p>						
2	(d)	(i)	reverse transcriptase ;	1	<p>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</p> <p>DO NOT CREDIT DNA (reverse) transcriptase</p>						

Question			Expected Answer	Mark	Additional Guidance
2	(d)	(ii)	<p>1 <u>mRNA</u> binds to , (gene) probes / cDNA / ssDNA , by complementary base pairing ;</p> <p>2 <i>idea that the more active the gene the more mRNA produced ;</i></p> <p>3 during transcription ;</p> <p>4 more fluorescence indicates more mRNA (bound) ;</p>	3 max	<p>1 DO NOT CREDIT in the context of the gene probe binding to DNA</p> <p>3 IGNORE translation</p>
2	(d)	(iii)	<p>1 dopamine linked to , ADHD / addiction / risk-taking / adventurous behaviour / hyperactivity / erratic behaviour (in humans) ;</p> <p>2 <i>idea of common mechanism in bees and humans (for adventurous behaviour) ;</i></p> <p>3 <i>idea that as they are different organisms the mechanisms may not be comparable (even though apparently similar) ;</i></p> <p>4 AVP ;</p>	3 max	<p>1 IGNORE ref to schizophrenia / Parkinson's This mark is for the effect of the <i>chemical</i> dopamine, not the dopamine receptors alone.</p> <p>2 e.g. both have , DRD4 / dopamine receptors e.g. dopamine has the same effect in both</p> <p>4 e.g. other genes also involved in , bee / human , behaviour</p> <p>Note: 'both have dopamine receptors which are linked to adventurous behaviour' = 1 mark (mp 2 only) 'both have dopamine receptors and dopamine is linked to adventurous behaviour' = 2 marks (mps 2 & 1)</p>
			Total	18	

Question			Expected Answer	Mark	Additional Guidance
3	(a)	(i)	<p><i>seedlings / coleoptiles have same</i></p> <p>S1 age ; S2 height / length ; S3 mass ; S4 genotype / genome ;</p> <p>S5 species ;</p> <p><i>procedure has same</i></p> <p>P1 same volume of solution applied ;</p> <p>P2 (named) feature of growth medium ;</p> <p>P3 watering regime ;</p> <p>P4 light , intensity / wavelength / duration ;</p> <p>P5 temperature ;</p>	3 max	<p>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</p> <p>S2 IGNORE size / surface area / width S3 IGNORE size / weight S4 ACCEPT same genetic makeup IGNORE same genes</p> <p>For all P points IGNORE light <i>direction</i> (as this is an independent variable)</p> <p>P1 IGNORE ref to concentration of solution ACCEPT <i>idea of consistency</i> in application of J and K</p> <p>P2 e.g. type / pH / fertiliser (applied) / minerals / ions IGNORE nutrients</p> <p>P3 e.g. volume of water / time of watering</p> <p>P4 e.g. distance from light source</p>

Question			Expected Answer	Mark	Additional Guidance
3	(a)	(ii)	<p><i>idea that shows the response without treatment</i></p> <p>or</p> <p><i>idea that allows the , effect of the treatment / results / groups , to be , compared ;</i></p>	1	<p>IGNORE improves validity / fair test (as an explanation is required) ‘to show the effects of J and K’ is not enough</p> <p>CREDIT ‘observations’ for treatments</p>
3	(a)	(iii)	<p>ONLY CREDIT mark points in context of results, and not in context of general roles of auxin and gibberellin</p> <p><i>J is auxin because</i> A1 inhibition of development of (lateral) buds (in group 2) ; A2 <u>growth</u> of , coleoptiles / group 5 , towards light ;</p> <p><i>K is gibberellin because</i> G1 <u>greater</u> increase in , height / stem length (in group 3) ; G2 causes growth of (lateral) buds (in group 3) ;</p>	3 max	<p>J must be identified correctly for A marks to be awarded</p> <p>K must be identified correctly for G marks to be awarded</p> <p>A1 CREDIT (group2) results show apical dominance A2 CREDIT (group 5) results show positive phototropism IGNORE plant (as all are plants)</p> <p>G1 CREDIT greater elongation G2 CREDIT (group 3) results do not show apical dominance</p>
3	(b)	(i)	protein ;	1	<p>ACCEPT glycoprotein IGNORE polypeptide / channel / carrier / transport</p>
3	(b)	(ii)	(synaptic) <u>cleft</u> ;	1	<p>IGNORE gap IGNORE neuromuscular</p>
3	(b)	(iii)	acetylcholine esterase / ACh esterase ;	1	<p>ACCEPT phonetic spelling and ignore upper/lower case</p> <p>IGNORE AChE</p>

Question		Expected Answer	Mark	Additional Guidance
3	(c)	<p>mitochondria ;</p> <p>oxidative phosphorylation ;</p> <p>lactate ;</p> <p>creatine phosphate / phosphocreatine ;</p> <p>(cross-)bridge / (cross-)link ;</p> <p>myosin (head) ;</p>	6	<p>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</p> <p>ACCEPT mitochondrion DO NOT CREDIT mitochondrial matrix</p> <p>IGNORE electron transport chain (as not a stage)</p> <p>ACCEPT lactic acid</p> <p>DO NOT CREDIT creatinine</p> <p>DO NOT CREDIT bond ACCEPT phonetic spelling</p>
Total			16	

Question			Expected Answer	Mark	Additional Guidance
4	(a)	(i)	3 ;	1	IGNORE triplet
4	(a)	(ii)	4 ³ or 4 x 4 x 4 or 4 x 4 ² ;	1	
4	(a)	(iii)	Several, triplet(s) / codon(s) , code for one amino acid ; (some are used as) start / stop / termination ; <i>idea that</i> mutation may , not result in change in amino acid / have a neutral effect / result in silent mutation ;	2 max	Must be clear that base combination is a group of 3 bases IGNORE degenerate DO NOT CREDIT makes/ produces/ creates , amino acids DO NOT CREDIT deletion / insertion (as would create frame shift)
4	(a)	(iv)	adenine / A and cytosine / C and guanine / G ;	1	Mark the first 3 answers. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks DO NOT CREDIT adenosine DO NOT CREDIT cysteine DO NOT CREDIT glycine

Question		Expected Answer	Mark	Additional Guidance
4	(b)	<p><i>transcription</i></p> <p>1 DNA / gene , copied / transcribed , into mRNA ;</p> <p>2 free / activated , (RNA) nucleotides / (RNA) nucleoside triphosphates ;</p> <p>3 (line up by) complementary base-pairing / described ;</p> <p>4 (to) one / template / reference / sense , (DNA) strand ;</p> <p>5 (catalysed by) RNA polymerase ;</p> <p><i>translation</i></p> <p>6 (mRNA moves to) ribosomes ;</p> <p>7 tRNA (molecules) bind to mRNA ;</p> <p>8 <u>anticodon</u>(s) , match / pair with / bind to , codons ;</p> <p>9 specific / correct , amino acid attached to tRNA ;</p> <p>10 formation of <u>peptide</u> bond between amino acids;</p>	6 max	<p>Marks may be awarded from an annotated diagram</p> <p>1 IGNORE 'used to make'</p> <p>2 DO NOT CREDIT DNA nucleotides</p> <p>3 CREDIT 'A-T, C-G and A - U'</p> <p>4 ACCEPT 'non-coding' for 'template'</p> <p>5 DO NOT CREDIT in context of breaking H bonds</p> <p>6 CREDIT translation occurs at ribosomes Note: tRNA anticodons bind to mRNA codons = 2 marks (mps 7 & 8)</p> <p>10 DO NOT CREDIT dipeptide / polypeptide , bond</p>
		QWC ;		1
Total			12	

Question			Expected Answer	Mark	Additional Guidance										
5	(a)	(i)	<p>1 lag phase / slow increase (in , population / number / percentage) , at start / initially / day 0 - 1 / during day 1 ;</p> <p>2 log phase / exponential increase / rapid increase , day 1 - 3 ;</p> <p>3 <u>rate of increase</u> , slows / less steep , days 3 - 4 / during day 3 ;</p> <p>4 stationary phase / population levels off / population stays at 100% , at end / finally / remaining days / days 4 - 6 ;</p> <p>5 comparative figures quoted with 2 x-y readings ;</p>		<p>IGNORE explanations ACCEPT ‘the population grows’ or ‘it grows’ (rather than increase) DO NOT CREDIT ‘yeast grow(s)’</p> <p>1 ACCEPT days 0 - 0.9 ACCEPT lasts 1 day</p> <p>2 ACCEPT days 0.9 - 3.5</p> <p>3 ACCEPT days 3.3 - 3.6</p> <p>4 ACCEPT after day 3.5 - 4</p> <p>5 Each unit must be quoted at least once</p> <table border="1" data-bbox="1406 938 1957 1149"> <thead> <tr> <th>Time (days)</th> <th>Yeast (% final population)</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>24</td> </tr> <tr> <td>1</td> <td>32</td> </tr> <tr> <td>3</td> <td>90</td> </tr> <tr> <td>3.5 - 6</td> <td>100</td> </tr> </tbody> </table> <p>Take care to distinguish between an increase in percentage (by either quoting the figures for the days or by calculating the difference) and a <i>percentage increase</i>.</p>	Time (days)	Yeast (% final population)	0	24	1	32	3	90	3.5 - 6	100
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0	24														
1	32														
3	90														
3.5 - 6	100														
				4 max											

Question			Expected Answer	Mark	Additional Guidance
5	(a)	(ii)	<p>1 sugar converted to ethanol ;</p> <p>2 in <u>anaerobic respiration</u> ;</p> <p>3 sugar , undergoes glycolysis / converted to pyruvate ;</p> <p>4 pyruvate , loses carbon dioxide / decarboxylated / forms ethanal ;</p> <p>5 reduced NAD giving hydrogen to <u>ethanal</u> ;</p> <p>6 <i>idea of</i> NAD being , regenerated / recycled , (so) glycolysis continues ;</p> <p>7 correct ref to , pyruvate decarboxylase / ethanol dehydrogenase ;</p>	3 max	<p>CREDIT glucose / maltose / maltotriose for 'sugar'</p> <p>2 IGNORE fermentation</p> <p>5 CREDIT NADH₂ / NADH (+H⁺) / red NAD</p>
5	(a)	(iii)	<p><i>ethanol is</i> produced in , all yeast growth phases / all of the time</p> <p>or</p> <p>production of ethanol increases as yeast population increases</p> <p>or</p> <p><i>idea that</i> ethanol is a normal (metabolic waste) product (of yeast) ;</p>	1	<p>IGNORE ref to ethanol not being a secondary product</p> <p>CREDIT 'produced during normal growth'</p> <p>CREDIT follows growth curve for yeast</p> <p>IGNORE waste unqualified</p>

Question			Expected Answer	Mark	Additional Guidance
5	(a)	(iv)	<p>1 sugar <u>concentration</u> falls too low ;</p> <p>2 pH falls too low / conditions become too acidic / decrease in pH causes enzymes to denature ;</p> <p>3 high ethanol <u>concentration</u> , damages / poisons / inhibits , yeast ;</p>	2 max	<p>1 ACCEPT very low sugar concentration / sugar concentration decreases as used up</p> <p>2 ACCEPT very low pH / very acidic DO NOT CREDIT 'falls and rises'</p> <p>3 ACCEPT high ethanol <u>concentration</u> kills yeast</p>
5	(b)		<p>1 glucose can , be used / enters glycolysis , directly / without being broken down (first) ;</p> <p>2 maltose, must , be <u>hydrolysed</u> / have <u>glycosidic</u> bonds broken ;</p> <p>3 enzyme / maltase , only made when , needed / maltose present / glucose running out ;</p> <p>4 enzyme induced / gene(s) switched on ;</p> <p>5 transcription <u>and</u> translation / protein synthesis , takes time ;</p> <p>6 maltotriose requires, more (2) <u>hydrolysis</u> (reactions) / breaking of more (2) <u>glycosidic</u> bonds or enzyme to break down maltotriose made last ;</p>	3 max	<p>ACCEPT 'monosaccharide' for glucose and 'disaccharide' for maltose and 'trisaccharide' for maltotriose throughout</p> <p>1 IGNORE ref to glucose being used first / at start / immediately (as stated in Q)</p>

Question		Expected Answer	Mark	Additional Guidance
5	(c)	<p><i>advantages of using yeast</i></p> <p>A1 less energy required ;</p> <p>A2 does not need , high temperature / 300^oC / high pressure ;</p> <p>A3 can use waste material (as a substrate) ;</p> <p>A4 substrate is , sustainable / grown each year ;</p> <p>A5 process does not use up , oil reserves / fossil fuels ;</p> <p>A6 product is carbon neutral / no carbon footprint ;</p> <p>A7 AVP ;</p> <p><i>disadvantages of using yeast</i></p> <p>D1 time consuming / takes several days ;</p> <p>D2 needs , downstream processing / purification of product ;</p> <p>D3 is killed by product ;</p> <p>D4 can (only) use batch method ;</p> <p>D5 aseptic / sterile , conditions required ;</p> <p>D6 AVP ;</p>	5 max	<p>CREDIT statements relating to yeast method only IGNORE statements relating to chemical method IGNORE ref to cost</p> <p>A2 ACCEPT works well at low , temperatures / pressures</p> <p>A3 CREDIT example e.g. sugar cane waste</p> <p>A6 IGNORE ref to global warming / greenhouse gases</p> <p>A7 e.g. yeast is readily available / easily accessible / yeast is in plentiful supply / yeast has simple growth requirements / process is less hazardous</p> <p>D1 ACCEPT slower rate of reaction</p> <p>D2 ACCEPT need to separate ethanol from yeast</p> <p>D3 ACCEPT is inhibited by product</p> <p>D5 ACCEPT more likely to become contaminated</p> <p>D6 e.g. concentration of ethanol produced is limited</p>
		QWC ;		1
Total			19	

Question		Expected Answer	Mark	Additional Guidance												
6	(a)	<table border="1"> <thead> <tr> <th>Explanation</th> <th>Letter</th> </tr> </thead> <tbody> <tr> <td>One gene with two alleles. The alleles show codominance.</td> <td>A ;</td> </tr> <tr> <td>One gene with two alleles, located on an autosome (gene not sex linked). One allele is dominant and the other is recessive.</td> <td>E ;</td> </tr> <tr> <td>Two genes for two different characteristics on two different chromosomes.</td> <td>D ;</td> </tr> <tr> <td>A sex linked gene with a dominant and a recessive allele.</td> <td>B ;</td> </tr> <tr> <td>Epistasis, where two genes interact to affect one phenotypic character.</td> <td>C ;</td> </tr> </tbody> </table>	Explanation	Letter	One gene with two alleles. The alleles show codominance.	A ;	One gene with two alleles, located on an autosome (gene not sex linked). One allele is dominant and the other is recessive.	E ;	Two genes for two different characteristics on two different chromosomes.	D ;	A sex linked gene with a dominant and a recessive allele.	B ;	Epistasis, where two genes interact to affect one phenotypic character.	C ;	5	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
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Epistasis, where two genes interact to affect one phenotypic character.	C ;															

Question			Expected Answer	Mark	Additional Guidance
6	(b)	(i)	$q^2 = 15 \div 60$ or 0.25 ; $q = \sqrt{0.25}$ or 0.5 ; (p =) 0.5 ;	3	<p>Correct answer (0.5) = 3 marks even if no working shown</p> <p>No mark for incorrect q^2 value but apply ecf afterwards</p> <p>ALLOW ecf from candidates q^2 value (likely to be 0.87 or 0.9 (if candidate's $q^2 = 0.75$))</p> <p>ALLOW ecf for p from candidate's calculated q value, (if q value between 0 and 1)</p> <p>IGNORE % values given for p (e.g. 50 % for 0.5)</p>
6	(b)	(ii)	<p><i>in the pet shop</i></p> <p>1 population is , small / not (sufficiently) large ;</p> <p>2 not all members of the population are breeding ;</p> <p>3 <i>idea that</i> mating is not random ;</p> <p>4 <i>idea that</i> migration / emigration / immigration , is occurring ;</p> <p>5 <i>idea that</i> the non-brown rabbits could be colours other than white ;</p>	2	<p>IGNORE ref to (natural) selection / mutation (as these do not apply to the 'artificial' population in the pet shop)</p> <p>IGNORE 'albinos are infertile'</p>
Total				10	

Question		Expected Answer	Mark	Additional Guidance
7	(a)	<p>1 pioneers arrive , before climax / earlier ; ora</p> <p>2 pioneer communities subject to , greater / more , change / succession / replacement ; ora</p> <p>3 pioneer community (usually) has , less / lower , biodiversity ; ora</p> <p>4 <i>idea that</i> pioneer community is (often) less , stable / self-sustaining ; ora</p> <p>5 pioneer community has lower biomass ; ora</p> <p>6 AVP ;</p>	2 max	<p>Note: All mark points are comparative</p> <p>1 CREDIT pioneers arrive first / climax arrive last</p> <p>6 e.g. species in pioneer community better adapted to (named) abiotic factor(s) and those in climax community better adapted to (named) biotic factor(s)</p>

Question		Expected Answer	Mark	Additional Guidance
7	(b)	<p>1 decomposition is break down , dead matter / waste</p> <p>or</p> <p>decomposition is conversion of <u>organic</u> matter to inorganic ;</p> <p>2 denitrification is conversion of <u>nitrates</u> to nitrogen (gas) ;</p> <p>3 decomposition increases , mineral / <u>nitrate</u> , supply and denitrification reduces , mineral / <u>nitrate</u> , supply ;</p>	2 max	<p>1 IGNORE putrefication</p> <p>1 CREDIT for inorganic: carbon dioxide / CO₂ / water / H₂O / ammonium compounds / ammonium ions / NH₄⁺</p> <p>IGNORE ammonia / NH₃</p> <p>2 CREDIT correct formulae (NO₃⁻ and N₂) DO NOT CREDIT nitrogen oxides</p> <p>3 CREDIT decomposition returns , mineral / <u>nitrate</u>, to soil and denitrification removes mineral / <u>nitrate</u>, to soil</p>
7	(c)	<p>1 conservation maintains , ecosystem / biodiversity / species / habitats</p> <p>or</p> <p>conservation involves , active / sustainable , management of , ecosystem / resource / habitat ;</p> <p>2 preservation leaves , ecosystems / habitats , undisturbed ;</p>	2	<p>IGNORE environment for MP1 and 2</p> <p>ACCEPT named resource</p> <p>ACCEPT unchanged/ not disrupted / no physical intervention</p> <p>IGNORE ref to preservation in any context other than that of conservation/preservation</p>

Question		Expected Answer	Mark	Additional Guidance
7	(d)	<p>1 nitrogen fixation is the conversion of (atmospheric) nitrogen into , ammonia / ammonium compounds / ammonium ions ;</p> <p>2 nitrification is the conversion of , ammonia / ammonium compounds / ammonium ions , into nitrite / nitrate ;</p> <p>3 correct ref to microorganisms involvement in both processes ;</p>	<p>2 max</p>	<p>1 CREDIT $N_2 / NH_3 / NH_4^+$</p> <p>2 CREDIT NH_3 / NH_4^+ CREDIT NO_2^- / NO_3^- DO NOT CREDIT nitrate to nitrite</p> <p>3 e.g. nitrogen fixation involves , <i>Rhizobium</i> / <i>Azotobacter</i> / <i>Nostoc</i> and nitrification involves , <i>Nitrosomonas</i> / <i>Nitrobacter</i></p>
		Total	8	

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