



GCE

Biology

Advanced Subsidiary GCE

Unit **F212**: Molecules, Biodiversity, Food and Health

Mark Scheme for June 2011

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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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Question		Expected Answers		Mark	Additional Guidance
1	(a)		photosynthesis ; starch ; nucleic acids ; monomers ; cellulose ;	5	Mark the first answer in each space. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks ACCEPT minor mis-spellings
1	(b)	1 without fertiliser <u>yield</u> falls (over time) / fertiliser maintains <u>yield</u> / AW ; 2 application of fertiliser replaces lost , nitrogen / nitrates ; 3 nitrogen / N, required for , amino acids / (named) protein / growth / (named) nucleic acids / (named) nitrogenous base ; 4 <i>idea that</i> nitrogen / N / nitrate / NO ₃ ⁽⁻⁾ , removed (from soil / system) by , plant / harvesting ; 5 <i>idea of</i> denitrification ; 6 nitrates / NO ₃ ⁽⁻⁾ , are soluble ; 7 nitrates / NO ₃ ⁽⁻⁾ , are , leached / washed from soil ;	1 ACCEPT it / nitrate / nitrogen as AW for fertiliser ACCEPT fertiliser increases yield 2 ACCEPT it / nitrate / nitrogen as AW for fertiliser 3 IGNORE 'development' IGNORE fertiliser / nitrate / N ₂ 4 Answers must refer to depletion (from soil) 'used' alone does not imply depletion	3 max	

Question		Expected Answers	Mark	Additional Guidance
1	(c)	<p>1 <u>natural selection</u> ;</p> <p>2 insecticide is the , selective agent / selection pressure ;</p> <p>3 <i>idea of</i> mutation / (genetic) variation ;</p> <p>4 random / naturally occurring ;</p> <p>5 resistant survive / non-resistant die ;</p> <p>6 (resistants will) pass on , allele / mutation , for resistance (to offspring) ;</p> <p>7 higher proportion of / more , resistant individuals in population ;</p> <p>8 <i>idea that</i> resistance <u>allele</u> confers resistance only to a small dose of insecticide ;</p>	4 max	<p>ACCEPT 'tolerance' as AW for resistance If candidates write 'immunity' penalise once and then ecf</p> <p>3 DO NOT CREDIT idea of insecticide or natural selection <i>causing</i> mutation DO NOT CREDIT variation that could be environmental</p> <p>5 ACCEPT AW for resistant, e.g. 'the ones with the mutation'</p> <p>6 ACCEPT gene for resistance IGNORE 'pass on resistance / trait'</p> <p>7 CREDIT refs to increased allele / gene frequency ACCEPT 'the whole population becomes resistant'</p>
Total			[12]	

Question		Expected Answers	Mark	Additional Guidance
2	(a)	(enzymes are) proteins / used in metabolism / used in named metabolic pathway ; alter rate of (chemical) reaction / lowers activation energy / provides alternative route for reaction / is not changed / is not used up ;	2	ACCEPT 'used in reactions , in organisms / in the body' IGNORE 'biological / enzyme / in nature' ACCEPT does not take part in reaction Note 'speed up metabolic reactions' = 2 marks
2	(b) (i)	time ;	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 IGNORE 'how long' IGNORE correct units
2	(b) (ii)	<p>P1 <i>idea of</i> different samples have different concentrations of, catalase / enzyme ;</p> <p>One of</p> <p>M1 source the extract for the whole experiment from a single source ;</p> <p>M2 <u>thorough</u> , mixing , required before use ;</p> <p>M3 filter / purify , extract ;</p> <p>M4 <i>idea of</i> using , known / standard , <u>concentration of</u> enzyme ;</p> <p>M5 commercial source of catalase ;</p>	2	The M mark can be awarded without a correct P mark P1 Look for the idea of variation within the sample (e.g. different amounts) CREDIT examples of lack of uniformity such as: breakage of cells / surface area / mixing / disruption of lysosomes / changes to enzyme shape (caused by blending process) / presence of other substances interfering with reaction IGNORE refs to celery being a poor source of catalase M1 ACCEPT 'from same plant'

Question			Expected Answers	Mark	Additional Guidance
2	(b)	(iii)	repeat / replicate ; compare replicate values / identify anomalous results ; mean / range / standard deviation / error bars / % error ; compare results with , others / book / internet , values / results ;	2 max	e.g compare replicates with Table 2.1 IGNORE average Must contain the idea of other investigators ACCEPT 'look up normal values on the internet'
2	(c)	(i) 1 2 3 4 5 6	1 <u>rate</u> , rises / increases , initially ; 2 peak at / maximum at / highest at / decrease after, <u>40</u> (°C) ; 3 (overall) fall more rapid than rise ; 4 <i>idea that</i> before peak / after peak , temperature increase has increasing effect on rate ; 5 comparative figures to support any point ; 6 no , reaction / oxygen produced , at 60(°C) ;	4 max	IGNORE explanations 1 DO NOT CREDIT if 'rate' not stated for this mp only 2 ACCEPT optimum 3 Look for a comparative statement 4 ACCEPT , e.g., line is steeper between 30 and 40 than between 10 and 20. 5 Two temperatures and two rates, with units . Or calculated difference with appropriate units, e.g. rate doubles between 10 and 20°C or $Q_{10} = 2$ 6 ACCEPT rate is 0 at 60
2	(c)	(ii)	2 ;	1	IGNORE units
2	(c)	(iii)	temperature ; maximum / peak / V_{max} ; <u>denatured</u> ; <u>active</u> ;	4	Mark the first answer for each letter. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks ACCEPT kinetic energy / KE ACCEPT optimum / optimum temperature IGNORE descriptions
Total				[16]	

Question			Expected Answers	Mark	Additional Guidance
3	(a)	(i)	D ; A ; F ;	3	Mark the first answer for each letter. If an additional answer is given then = 0 mark
3	(a)	(ii)	B ; E ; F ; F ;	4	Mark the first answer for each letter If an additional answer is given then = 0 marks
3	(b)		<p>1 insoluble ;</p> <p>2 does not , change / affect , water potential / Ψ , of cell ;</p> <p>3 can be , broken down / hydrolysed / built up , quickly / easily ;</p> <p>4 lots of branches for <u>enzymes</u> to attach ;</p> <p>5 compact ;</p> <p>6 (therefore) high energy content for mass / energy dense / AW ;</p>	3 max	<p>2 ACCEPT osmotically inactive / AW</p> <p>3 Answers must contain the idea of ease or speed of breakdown IGNORE broken up</p> <p>Answers must imply density, e.g. 'it is compact and so stores a lot of energy' = 2 marks</p>

Question			Expected Answers	Mark	Additional Guidance
3	(c)	(i)	α / <u>alpha</u> , glucose ;	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>ACCEPT 'a'</p>
3	(c)	(ii)	<p>1 respiratory substrate / used for respiration ;</p> <p>2 source of / releases / provides, energy ;</p> <p>3 formation of ATP ;</p> <p>4 conversion into named compound ;</p>	1 max	<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 any answer that clearly states that glucose is energy, makes energy, produces energy or creates energy</p> <p>1 ACCEPT used in respiration ACCEPT 'releases energy for respiration'</p> <p>2 IGNORE used for energy</p> <p>4 e.g. starch / cellulose / polysaccharide / disaccharide / glycogen / protein / lipid / sucrose / maltose / fructose / fat</p>
3	(c)	(iii)	D ;	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>ACCEPT F IGNORE triglyceride / fat / lipid / haemoglobin</p>

Question		Expected Answers	Mark	Additional Guidance																		
3	(d)	<table border="1"> <thead> <tr> <th>glycogen</th> <th>cellulose</th> </tr> </thead> <tbody> <tr> <td><i>no hydrogen bonding</i></td> <td><i>hydrogen bonding</i></td> </tr> <tr> <td>α / alpha , glucose</td> <td>β / beta , glucose</td> </tr> <tr> <td>1,4 <u>and</u> 1,6-glycosidic bonds or 1,6-glycosidic bonds present</td> <td>1,4-glycosidic bonds (only) or 1,6-glycosidic bonds not present</td> </tr> <tr> <td>branched</td> <td>not branched / linear / straight</td> </tr> <tr> <td>no , fibres / fibrils</td> <td>fibres / fibrils</td> </tr> <tr> <td>granules</td> <td>no granules</td> </tr> <tr> <td>all glucose units in same orientation</td> <td>adjacent glucose units in opposite orientation</td> </tr> </tbody> </table>	glycogen	cellulose	<i>no hydrogen bonding</i>	<i>hydrogen bonding</i>	α / alpha , glucose	β / beta , glucose	1,4 <u>and</u> 1,6-glycosidic bonds or 1,6-glycosidic bonds present	1,4-glycosidic bonds (only) or 1,6-glycosidic bonds not present	branched	not branched / linear / straight	no , fibres / fibrils	fibres / fibrils	granules	no granules	all glucose units in same orientation	adjacent glucose units in opposite orientation		<p>Comparative statements must be made on the same line Award 1 mark for each correct side by side comparison. ALLOW two valid comparisons in the same pair of boxes, e.g</p> <table border="1"> <tr> <td>α-glucose in a branched chain</td> <td>β-glucose in a straight chain</td> </tr> </table> <p>= 2 marks</p> <p>ACCEPT 'a' and 'b'</p> <p>ACCEPT helical / spiral / coiled vs linear / straight DO NOT CREDIT α-helix</p>	α-glucose in a branched chain	β-glucose in a straight chain
glycogen	cellulose																					
<i>no hydrogen bonding</i>	<i>hydrogen bonding</i>																					
α / alpha , glucose	β / beta , glucose																					
1,4 <u>and</u> 1,6-glycosidic bonds or 1,6-glycosidic bonds present	1,4-glycosidic bonds (only) or 1,6-glycosidic bonds not present																					
branched	not branched / linear / straight																					
no , fibres / fibrils	fibres / fibrils																					
granules	no granules																					
all glucose units in same orientation	adjacent glucose units in opposite orientation																					
α-glucose in a branched chain	β-glucose in a straight chain																					
Total			3 max [16]																			

Question			Expected Answers	Mark	Additional Guidance
4	(a)	(i)	<p>1 the elderly / older people ;</p> <p>2 'at risk' children / young people ;</p> <p>3 pregnant women ;</p> <p>4 those with compromised immune systems ;</p> <p>5 those with chronic diseases ;</p> <p>6 health workers ;</p> <p>7 poultry workers / pig farmers ;</p>	2 max	<p>Mark the first answer on each numbered line.</p> <p>1 ACCEPT ref to any age over 50</p> <p>2 ACCEPT the young / infants / babies IGNORE refs to age</p> <p>4 ACCEPT weak ACCEPT e.g. with AIDS / HIV / on immunosuppressant drugs / ref cancer</p> <p>5 ACCEPT e.g. heart conditions / lung conditions / asthma / diabetes</p> <p>7 ACCEPT other professions working with animals, e.g. vets</p>
4	(a)	(ii)	<p>different <u>strains</u> of the <u>virus</u> / <u>virus</u> mutates (each year) ;</p> <p>(new strains have) different <u>antigens</u> ; <i>idea that <u>antibody</u> produced , needs to match new strain / antigen ; ora</i></p>	2 max	<p>IGNORE 'different types' or 'virus changes' or 'different strands'</p> <p>ACCEPT (influenza) pathogen</p> <p>CREDIT antigenic shift / drift ora original antibody does not match new antigen</p>

Question			Expected Answers		Mark	Additional Guidance
4	(a)	(iii)	secondary response , starts earlier / has shorter delay before response ; ora secondary response , more rapid / faster ; ora secondary response , higher / produces more antibodies ; ora		2 max	Mark the first <u>two</u> differences IGNORE answers, e.g. 'size of response' or 'response is faster' that do not refer to a feature of the secondary or primary response CREDIT 'shorter lag time' ACCEPT steeper ACCEPT bigger IGNORE 'secondary response lasts longer' as this is not clear from graph
4	(a)	(iv)	1	recognise , virus / antigen / pathogen ;	3 max	1 ACCEPT description of recognition IGNORE find / detect
			2	produce a clone ;		2 ACCEPT ref to clonal expansion ACCEPT 'divide by mitosis to produce large numbers'
			3	can , change to / form , plasma cells (on infection) ;		4 IGNORE 'reproduce antibodies' IGNORE 'release antibodies'
			4	make antibodies (against influenza , virus / antigen) ;		
			5	responsible for secondary response / destroy virus before symptoms appear ;		5 IGNORE refs to speed of response unqualified
			6	can , change to / form , named T-cell ;		

Question			Expected Answers		Mark	Additional Guidance
4	(b)	(i)	(antibiotics) are, not effective against <u>viruses</u> / effective (only) against bacteria (and fungi / protozoa) ;		1	ACCEPT antibiotics do not kill viruses IGNORE viruses are resistant to antibiotics ACCEPT correct ref to detail of antibiotic action, e.g. 'antibiotics attack cell wall which is not present in influenza (virus)'
4	(b)	(ii)	1	Tamiflu [®] is , competitive / non-competitive inhibitor ;	2 max	2 e.g. fits or binds to <u>active site</u> / complementary shape to <u>active site</u> / competes for the <u>active site</u> OR fits into allosteric site or site other than active site / changes shape of <u>active site</u> 3 IGNORE substrate binding to enzyme
		2	correct detail of inhibition method that does not contradict stated type of inhibition ;			
		3	prevents , substrate binding to active site / formation of enzyme-substrate complex / formation of ESC ;			
4	(b)	(iii)	fewer , viruses / pathogens , produced ; fewer , viruses / pathogens , (in droplets) when , sneezing / coughing ; (as) viruses / pathogens , cannot leave cell ; (so) cannot , infect / spread to , <u>other cells</u> ; <i>idea of treating</i> , large / proximate , population ;		2 max	IGNORE herd immunity / ring vaccination
4	(c)		(plants) already identified as likely to have , medicinal properties / few side effects / AW ; reduces , time / effort , in finding , plants / active chemicals ; (possibly) reduces cost ;		2 max	ACCEPT 'known / proven to work' ACCEPT reduced time for testing
Total					[16]	

Question			Expected Answers	Mark	Additional Guidance
5	(a)	(i)	<p><u>both rise</u> (between 1920 and 1960) ;</p> <p>men started smoking before, ca. 1900 / women's smoking started increasing after 1920 - 1925 ;</p> <p>similar levels of smoking (in men and women) by 1990 ;</p> <p>smoking in men , levelled off / plateaued</p> <p>OR</p> <p>smoking in women continues to rise ;</p>	2 max	<p>Needs direct comparison in single statement</p> <p>ACCEPT comparative statement, e.g. 'women started smoking later than men'</p> <p>ACCEPT 5000 in both by the end of the 1980s</p> <p>DO NOT CREDIT if plateau described before 1940</p>
5	(a)	(ii)	<p>(positive) correlation / similar pattern , between smoking and lung cancer ;</p> <p><i>idea that</i> increase in incidence of lung cancer lags behind increase in smoking ;</p> <p><i>idea of</i> once smoking has levelled off there is a corresponding levelling off in incidence of lung cancer ;</p> <p><i>idea of</i> men always smoking more and men having higher rates of cancer ; ora</p>	2	<p>ACCEPT similar shaped graphs</p> <p>IGNORE 'as smoking increases, so does lung cancer'</p> <p>ACCEPT followed by</p> <p>ACCEPT if answer implies levelling off at same time</p>

Question		Expected Answers	Mark	Additional Guidance
5	(b)	<p>1 tar / (cigarette) smoke , contains <u>carcinogens</u> / is <u>carcinogenic</u> ;</p> <p>2 benzopyrene / formaldehyde / other e.g. ;</p> <p>3 enters , lung / epithelial , <u>cells</u> ;</p> <p>4 <i>idea that</i> destroyed cilia prevent removal of , carcinogens / tar , which then have greater contact time with epithelial cells ;</p> <p>5 enters nucleus / in contact with DNA ;</p> <p>6 causes <u>mutation</u> ;</p> <p>7 proto-oncogenes to oncogenes ;</p> <p>8 uncontrollable , cell division / mitosis ;</p> <p>9 formation of , tumour / mass of cells ;</p> <p>10 no , programmed cell death / apoptosis ;</p>	5 max	<p>1 IGNORE cigarettes</p> <p>5 'contact with DNA' needs to be stated not implied</p> <p>6 IGNORE description</p> <p>7 ACCEPT switching on (proto)oncogenes</p> <p>8 ACCEPT cell multiplication</p> <p>IGNORE growth</p> <p>IGNORE ref to speed of cell division</p> <p>9 ACCEPT lump (of cells)</p>
		<p>QWC ~ showing link between smoking and lung cancer ;</p>	1	<p>1 mark awarded from mps 1 to 5</p> <p>and 1 mark awarded from mps 6 to 10</p>

Question		Expected Answers	Mark	Additional Guidance
5	(c)	<p>1 mouth / tongue / throat / oesophageal , cancer ;</p> <p>2 <u>chronic</u> bronchitis / COPD ;</p> <p>3 emphysema / COPD ;</p> <p>4 <u>a</u>therosclerosis ;</p> <p>5 thrombosis ;</p> <p>6 coronary heart disease / CHD / angina / heart attack / myocardial infarction / MI ;</p> <p>7 stroke ;</p> <p>8 peripheral vascular disease / <u>a</u>rteriosclerosis ;</p>	max 3	<p>Mark the first answer on each numbered line.</p> <p>1 ACCEPT <u>secondary</u> cancers</p> <p>2 DO NOT CREDIT smoker's cough</p> <p>3 CREDIT COPD once only</p> <p>5 IGNORE thrombus</p> <p>6 IGNORE cardiovascular disease / hypertension / chronic heart disease</p>
		Total	[13]	

Question			Expected Answers	Mark	Additional Guidance
6	(a)	(i)	3 parts to body ; head + thorax + tail ; segmented ; lateral spines / spines from both sides of head ; thorax / tail , similar shape ;	3 max	Mark the first answer on each numbered line. ACCEPT wherever seen ACCEPT 'a lateral spine' ACCEPT description of thorax / tail shape
6	(a)	(ii)	anterior spine (from head) on A ; longer lateral spines on B ; less rounded / AW , head on B ; any other reasonable difference ; ;	2 max	Mark the first answer on each numbered line. Answers must state either species A or species B ACCEPT ora throughout e.g. (greater) fusion of tail segments in B grooves around edge of head in B outline of tail section (more) curved in A A has more segments CREDIT any clear description of a difference
6	(b)		1 <i>idea of fossils</i> show changes over time ; 2 <i>idea that</i> there are methods to date fossils ; 3 <i>idea of simplest / most different</i> from modern , species / AW , in oldest rocks ; 4 <i>idea of showing</i> , links / relationships , between , groups / species / organisms / taxa ; 5 many fossils organisms no longer exist ; 6 <i>idea of compare</i> DNA extracted from some fossils ;	2 max	2 ACCEPT it is possible to date fossils 4 ACCEPT ref to common ancestor of two species Answers could refer to links between species A and species B
Total				[7]	

Question		Expected Answers	Mark	Additional Guidance
7	(a)	<p>X phosphate ;</p> <p>Y <u>deoxyribose</u> ;</p> <p>Z <u>thymine</u> ;</p>	3	<p>Mark the first answer for each letter. 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 PO₄ or 'phosphate , molecule / backbone' IGNORE group</p> <p>DO NOT CREDIT deoxyribulose IGNORE (pentose) sugar</p> <p>DO NOT CREDIT incorrect spelling IGNORE (nitrogenous) base / T</p>

Question		Expected Answers	Mark	Additional Guidance
7	(b)	1 <u>semi-conservative</u> (replication) ;	6 max	CREDIT answers from clearly labelled diagram IGNORE anything after it becomes clear that a candidate is describing transcription
		2 (double) <u>helix</u> , untwists / uncoils / unwinds / unravels ;		2 IGNORE straightens DO NOT CREDIT α -helix
3 hydrogen bonds (between bases) break ;	3 IGNORE unzips			
4 each strand acts as the <u>template</u> (for the formation of a new molecule) ;				
5 free (DNA) <u>nucleotides</u> (align with exposed bases) ;	5 IGNORE in cytoplasm			
6 complementary base pairing / purine to pyrimidine ;	6 IGNORE A to T / C to G (as given in Q) ACCEPT base pair rule			
7 hydrogen bonds (re)form ;				
8 sugar-phosphate backbone forms / adjacent nucleotides join ;	8 CREDIT formation of phosphodiester bond			
9 <u>DNA</u> polymerase joins , backbone / strands ;	9 ACCEPT in context of H bonds forming			
10 each new molecule has 1 old and 1 new strand ;	10 DO NOT CREDIT half old and half new strand			
11 AVP ;	11 e.g. correct ref to , (DNA) helicase (in context of unwinding or unzipping) / (DNA) ligase (in context of joining Okazaki fragments or role in backbone formation) / leading or lagging strand / 3' / 5' / antiparallel / activation of free nucleotides / 3 H bonds between C and G / 2 H bonds between A and T / Okazaki fragments / proof reading			
		QWC ~ events in correct sequence so long as no ref to transcription / translation , seen ;	1	1 mark from mps 2 to 4 then 1 mark from mps 5 to 7 then mp 8 or 9
Total			[10]	

Question		Expected Answers	Mark	Additional Guidance
8	(a)	<p>1 different species ;</p> <p>2 different genus ;</p> <p>3 genetically incompatible ;</p> <p>4 (may have) different number of chromosomes ;</p> <p>5 physical / behavioural , reason for reproductive incompatibility ;</p>	2 max	<p>3 ACCEPT 'DNA sufficiently different'</p> <p>IGNORE refs to meiosis</p> <p>4 IGNORE refs to meiosis</p> <p>5 e.g. eggs remain unfertilised / different incubation patterns</p> <p>IGNORE refs to fertility of offspring</p>
8	(b) (i)	Convention (on) <u>International Trade</u> (in) <u>Endangered Species</u> ;	1	<p>ACCEPT Commission / Conference / Congress</p> <p>ACCEPT Trading</p> <p>DO NOT CREDIT Conservation / Countries</p>
8	(b) (ii)	<p>1 regulate / monitor , <u>trade</u> in selected , species / animals / plants / animal products ;</p> <p>2 <i>idea of ensuring <u>trade</u> does not put <u>wild populations</u> at risk ;</i></p> <p>3 <i>idea of prohibiting <u>commercial trade</u> in wild plants ;</i></p> <p>4 <i>idea of allowing <u>trade</u> in <u>artificially</u> propagated plants ;</i></p> <p>5 <i>idea of allowing <u>trade</u> in less endangered species subject to permit ;</i></p>	2 max	<p>Mark the first two answers only.</p> <p>IGNORE trafficking throughout (as in stem)</p> <p>1 ACCEPT idea of species being on a list</p> <p>ACCEPT endangered</p> <p>ACCEPT prevent</p> <p>IGNORE illegal</p> <p>IGNORE animals / plants unqualified</p> <p>3 ACCEPT endangered plants</p>

F212

Mark Scheme

June 2011

Question		Expected Answers	Mark	Additional Guidance
8	(c)	unrelated / AW, individuals ; health ; of reproductive age ; selecting individuals of opposite sex (for breeding) ; select higher proportion of females ;	2 max	ACCEPT idea of individuals with sufficiently different genes ACCEPT 'whether they are healthy (or not)' ACCEPT fertility of individuals
8	(d)	1 bird(s) healthy / quarantine before release ; 2 adequate (natural) food supply / provide food (if necessary) ; 3 protected reserve / no hunting / no poaching / legal protection ; 4 <u>method</u> to monitor population ; 5 raise public awareness / educate local population / educate collectors ; 6 <u>method</u> to prepare animals for survival in wild ; 7 <i>idea of gradual introduction, e.g via semi-wild habitat ;</i>	3 max	1 IGNORE refs to ongoing health monitoring 3 ACCEPT ref to controlling predators 4 e.g. tag birds 5 ACCEPT involve local population 6 e.g. raise with minimal human contact, predator awareness training ACCEPT teaching it to find food
Total			[10]	

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