OCR
RECOGNISING ACHIEVEMENT

GCE

Biology

Advanced Subsidiary GCE

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

Mark Scheme for January 2011

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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Question			Expected Answer	Mark	Additional Guidance
1	(a)	(i)	human immunodeficiency virus / HIV **;**	1	**DO NOT CREDIT** if there is any ref to AIDS
1	(a)	(ii) 1	(infective agent), in blood / body fluids **;**	2 max	**1 ACCEPT** any infective agent even if incorrect as question asks for *mode of transmission*
		2	*idea of:* used needles are contaminated **; ora**		**2 ACCEPT** e.g. 'used needles are infected' **2 ACCEPT** e.g. 'new needles are sterile' **2 DO NOT CREDIT** 'dirty' / 'clean' needles
		3	reduces chance of sharing needles **; ora**		**3 IGNORE** 'prevents' / 'stops'
1	(b)	(i)	amino acid(s) **;** nucleotide(s) **;**	2	*Answers must be on correct line* **ACCEPT** phonetic spelling for both **DO NOT CREDIT** if ref to DNA / 'nucleosides' **ACCEPT** 'ribonucleotides'
1	(b)	(ii) 1	reverse transcriptase in (host) nucleus **;**	2 max	
		2	viral DNA, (inserted) in (host), chromosome / DNA **;**		
		3	*idea of:* (viral) RNA / mRNA produced / transcribed **;**		
		4	(to) code for / make / translate, viral proteins **;**		**4 IGNORE** 'different protein'

Question			Expected Answer	Mark	Additional Guidance
1	(c)	(i)			**Mark the first three answers only regardless of which line they are on**
		1	not vaccinated against TB **;**		**1 IGNORE** general refs to lack of medical care
		2	weakened immune system **;**		
		3	(lifestyle) e.g. poor diet / lack of protein / malnourished / smoking / alcoholism **;**		**3 DO NOT CREDIT** 'alcohol' unqualified **IGNORE** 'poor health'
		4	homelessness **;**		
		5	poor ventilation (of housing) / AW **;**		
		6	overcrowding **;**		
		7	close contact with people from / visiting, area where TB is common **;**		**7 ACCEPT** area where those with TB are not quarantined
		8	close / prolonged, contact with individual(s) with TB **;**		
		9	consumption of milk or beef, from infected cattle / in developing countries **;**		
				3 max	

Question			Expected Answer	Mark	Additional Guidance
	(c)	(ii)			
		1	cytokine / interleukin / receptor has, specific / unique, shape ;		**1 DO NOT CREDIT** 'cytokine is specific to receptor' as this is implied in question
		2	(cytokine / interleukin), binds / attaches / bonds to / fits into, receptor ;		
		3	receptor on (cell surface) membrane (of B lymphocyte) ;		**3 DO NOT CREDIT** 'antibodies' (on cell surface)
		4	(receptor and cytokine have) <u>complementary</u> <u>shapes</u> ;		
		5	<u>activates</u> / <u>stimulates</u>, clonal expansion / <u>mitosis</u> ;	3 max	**5 ACCEPT** activates / releases 2nd messenger
			Total	**13**	

Question			Expected Answer	Mark	Additional Guidance
2	(a)	(i)	blue-black / black / dark blue **;**	1	**ACCEPT** dark purple / purplish-blue **DO NOT CREDIT** blue or purple unqualified by darkness **ACCEPT** acceptable colour change
2	(a)	(ii)		2	**CREDIT** marking points from clearly labelled diagram max 1 if incorrect charges are on atoms
		1	between oxygen and hydrogen (atoms) **;**		**1 DO NOT CREDIT** molecules / ions
		2	(between) electronegative / δ^-, and electropositive / δ^+ **;**		**2 DO NOT CREDIT** ions / + and – **2 ACCEPT** slight / partial (negative / positive), charge
2	(a)	(iii)		2 max	**IGNORE** refs to denaturation
		1	hydrogen / H, bonds break **;**		
		2	helix, lost / unravels / AW **;**		**2 ACCEPT** spiral / coil
		3	iodine, released / no longer in complex / AW **;**		**3 ACCEPT** no longer contained in helix

Question			Expected Answer	Mark	Additional Guidance
2	(b)	1	take samples at a range of times / AW ;		
		B2	same volumes (of solutions) added / removed (each time) ;		**B2** must be in context of Benedict's test rather than reaction mixture
		B3	heat with, Benedict's (solution) / $CuSO_4$ and NaOH ;		**B3 DO NOT CREDIT** boil / warm **B3 DO NOT CREDIT** if Benedict's added to the mixture at the beginning
		B4	(use of) excess Benedict's ;		
		B5	changes to, green / yellow / orange / brown / (brick) red ;		
		C6	remove precipitate / obtain filtrate ;		**C6 CREDIT** description of method e.g. filtering / centrifuging / decanting
		C7	colorimeter ;		
		8	calibrate / zero, using, a blank / water / (unreacted) Benedict's ;		**8 IGNORE** 'control'
		9	use (red / orange) filter ;		**9 DO NOT CREDIT** if colour of filter is incorrect
		T10	reading of, transmission / absorbance **OR** mass of precipitate ;		**T10 ACCEPT** 'measure how much light, does / does not, pass through'
		11	more transmission / less absorbance, of filtrate, **OR** greater mass ppt, = more maltose present ; **ora**		**11** if unfiltered Benedict's / precipitate is **clearly indicated** as being present **in sample**, **ACCEPT** 'less transmission / more absorbance, = more maltose present' **11 DO NOT CREDIT** if precipitate is added to colorimeter
		12	using, standard / known, concentrations (of maltose) ;		**12 CREDIT** 'serial dilutions'
		13	(obtain) calibration curve ;		
		14	plot, transmission / absorbance / mass of ppt, against (reducing sugar) concentration ;		
		15	use graph to read off concentration of maltose / AW ;	**6 max**	
			QWC – correct sequence ;	**1**	1 of mps **B2 to B5**, *then* mp **C6 or C7**, *then* mp **T10**

<table>
<tr><th colspan="3">Question</th><th>Expected Answer</th><th>Mark</th><th>Additional Guidance</th></tr>
<tr><td>2</td><td>(c)</td><td>(i)</td><td>1 increases / greater / faster ;
2 reaction completed in / plateaus after / concentration is 100% after, 3.5 minutes ;
3 figures with units to support mp 1 ;</td><td>2 max</td><td>1 ACCEPT any time between 3.45 and 3.55 min.

3 two maltose concentrations (+ or – chloride) for a given time or two times (+ or – chloride) for given maltose concentration.
3 ACCEPT calculated difference
3 DO NOT CREDIT if ‘%’ and ‘min.’ not given
3 ACCEPT any concentration within ± 1 % and time within ± 0.05 min.</td></tr>
<tr><td></td><td></td><td></td><td colspan="4">
<table>
<tr><th rowspan="2">Presence or absence of chloride ions</th><th colspan="9">The percentage concentration of maltose (%) present every half a minute</th></tr>
<tr><th>0.0 min</th><th>0.5 min</th><th>1.0 min</th><th>1.5 min</th><th>2.0 min</th><th>2.5 min</th><th>3.0 min</th><th>3.5 min</th><th>4.0 min</th></tr>
<tr><td>Chloride ions present</td><td>0</td><td>24</td><td>54</td><td>70</td><td>80</td><td>88</td><td>95</td><td>100</td><td>100</td></tr>
<tr><td>Chloride ions absent</td><td>0</td><td>12</td><td>20</td><td>29</td><td>36</td><td>40</td><td>45</td><td>48</td><td>50</td></tr>
<tr><td>Difference in maltose concentration When chloride ions are either present or absent</td><td>0</td><td>12</td><td>34</td><td>41</td><td>44</td><td>48</td><td>50</td><td>52</td><td>50</td></tr>
</table>
Allow a + /- 1% for any concentration of maltose and a +/- 2% for the difference in maltose concentrations
</td></tr>
<tr><td>2</td><td>(c)</td><td>(ii)</td><td>1 (acts as a) cofactor ;
2 (Cl^-) binds to, enzyme / amylase / amylose / substrate ;
3 enzyme substrate complex / ESC, forms more, easily / quickly ;</td><td>2 max</td><td>1 IGNORE ‘coenzyme’

2 ACCEPT binds to, active site

3 ACCEPT description</td></tr>
</table>

Question			Expected Answer	Mark	Additional Guidance
2	(c)	(iii)			**Mark the first three answers only regardless of which line they are on** **DO NOT CREDIT** refs to, time
		1	temperature **;**		
		2	pH **;**		
		3	enzyme / amylase / chloride, <u>concentration</u> **;**		**3 IGNORE** 'amount' or 'volume' **3 DO NOT CREDIT** 'concentration' unqualified
		4	substrate / starch / amylose, <u>concentration</u> **;**		**4 IGNORE** 'amount' or 'volume' **4 DO NOT CREDIT** 'concentration' unqualified
		5	constant / regular, stirring **;**		
		6	(fixed) <u>volume</u> of solution (removed each time for sampling) **;**		
				3 max	
			Total	**19**	

Question			Expected Answer	Mark	Additional Guidance
3	(a)	(i)			**ACCEPT** reference to numbers rather than breeding success throughout
		1	(all), sub-arctic / all 4 named sub-arctic, species / birds, show decrease **;**		**1** sub-arctic species = snow bunting + Lapland bunting + ptarmigan + dotterel
		2	(all / most), other / non sub-arctic / all 4 named non sub-arctic, species / birds, show, increase / no change **;**		**2** non sub-arctic species = red grouse + wheatear + meadow pipit + ring ouzel
		3	greater change / AW (in breeding success), in sub-arctic than in non sub-arctic species **;**		
		4	comparative figs (in 1970 **AND** 2000) **;**		**4** number of young for one sub-arctic and one non sub-arctic species in 1970 and 2000 (or calculated subtraction between the two years) **4 DO NOT CREDIT** if figures are not from 1970 and 2000
				3	

species	number of young raised per year		
	1970	**2000**	**difference in number of young raised between 1970 and 2000**
Snow bunting*	78	2	Down 76
Lapland bunting*	7	0	Down 7
Ptarmigan*	1280	876	Down 404
Red grouse	890	962	Up 72
Wheatear	209	231	Up 22
Meadow pipit	23	82	Up 59
Ring ouzel	23	26	Up 3
Dotterel*	45	35	Down 10

Question			Expected Answer	Mark	Additional Guidance
3	(a)	(ii)			
		1	climate change / global warming **;**		**1 IGNORE** greenhouse effect **1 DO NOT CREDIT** 'it is too warm' or 'it is not cold enough' without reference since 1970
		2	(environmental) change too rapid for adaptation **;**		
		3	change in, flora / plants / food supply / insects / prey / predators / human activity **;**		**3 ACCEPT** camouflage no longer appropriate / reduction in size of habitats
		4	disease (that affects sub-arctic species more than others) **;**		
		5	sub-arctic species, less well-adapted than / have been outcompeted by, non sub-arctic species / AW **;**		**5 ACCEPT** ora
				2 max	
3	(b)	(i)	the number of species present (in a habitat) **;**	**1**	**DO NOT CREDIT** range / amount

Question			Expected Answer	Mark	Additional Guidance
3	(b)	(ii)			**Mark the first <u>three</u> suggestions**
		1	*idea of:* unbiased method to selecting sampling <u>area</u> **;**		**1 ACCEPT** e.g. random selection of, areas / coordinates OR use of transect **1 IGNORE** 'random sampling' unqualified
		2	sample many times / AW, and calculate mean / average **;**		
		3	standardised sweeping procedure **;**		**3** e.g. same type of movement / same length of time same number of sweeps **3 ACCEPT** sample at same time of day **3 IGNORE** same collector **3 IGNORE** refs to using alternative collecting techniques in order to collect more insect species
		4	ensure insects do not escape (before being identified) **;**		**4 ACCEPT** use of pooter
		5	method to prevent recounting **;**		**5** if ref to mark-release-recapture, **IGNORE** 'release and recapture' and look for idea for preventing recounting
		6	sample at different times of, day / month / year / weather conditions **;**		
				3 max	

Question			Expected Answer	Mark	Additional Guidance
3	(b)	(iii)			
		1	(measures), abundance / numbers, of individuals in each species ;		
		2	species evenness is more quantitative than species richness ; **ora**		
		3	high(er) species evenness indicates high(er) biodiversity ; **ora**		
		4	low species evenness indicates, dominance by / high abundance of, one / few, species ; **ora**		
		5	used to calculate (Simpson's) Index of Diversity ;		
		6	example used to illustrate explanation of mp 3 or 4 ;	3 max	**6** e.g. "Two areas have the same number of species. One with 90% of 1 species has less biodiversity than one where all species have an abundance of 5-20%"
			Total	**12**	

Question			Expected Answer	Mark	Additional Guidance
4	(a)	1	free from, disease / illness **;**		**1 ALLOW** infection **CREDIT** 'not just the absence of disease'
		2	physical **and** mental **and** social wellbeing / AW **;**		**2 DO NOT CREDIT** 'state' / 'condition'
		3	good nutrition **;**		**3 ACCEPT** balanced diet
		4	suitably housed **;**	**2 max**	**4 ACCEPT** ref to economic wellbeing

Question			Expected Answer	Mark	Additional Guidance
4	(b)				**Mark first F mark on line and assume explanation relates to that** **ACCEPT** named example(s) of pathogen or parasite **CREDIT E** marks if a reasonable, but non-creditworthy, attempt at an **F** mark has been made, e.g. 'lining of nasal passages' for **F2**
		F1	skin ;		
		E1	*idea of:* physical barrier to prevent entry of microorganisms ;		**E1 ACCEPT** 'pathogens cannot pass through cells' **E1 ACCEPT** antibacterial effects of sebum or sweat **E1 DO NOT CREDIT** physical barrier unqualified
		F2	mucous membrane(s) / goblet cells ;		
		E2	(produce) mucus to trap, pathogens / parasite ;		
			OR		
		F2	mucus ;		
		E2	traps pathogens ;		
		F3	cilia / ciliated epithelium ;		
		E3	remove, pathogen / parasite, laden / AW, mucus ;		
		F4	blood clotting ;		
		E4	prevents, pathogens / parasite, entering bloodstream ;		
		F5	ear wax / nasal hairs ;		
		E5	traps, pathogens / parasite ;		
		F6	lysozyme / tears / nasal secretions / saliva ;		**F6 IGNORE** lysosome(s)
		E6	kills bacteria / contains antibacterial agent ;		**E6 ACCEPT** contains antibodies
		F7	gastric juice / stomach acid ;		**F7 ACCEPT** 'enzymes in the stomach' or 'acid in vagina'
		E7	kills, pathogens / parasite ;		
				4 max	

Question			Expected Answer	Mark	Additional Guidance
4	(c)	(i)			
		1	lives, on / in / in contact with, **and** harms <u>host</u> **;**		**1** living on / in must be stated, cannot be implied from feeding **1 IGNORE** 'live off'
		2	takes nutrition from / feeds on (host) **;**		
		3	warmth **;**		**3 ACCEPT** 'incubate'
		4	protection / safe place / AW **;**		
		5	allows transmission / spread, to a new host / AW **;**		**5 ACCEPT** 'distributed' / 'passed on' as implies new host
				4 max	
4	(c)	(ii)			
		1	wash / clean / disinfect / sterilize, hands **;**		
		2	not, scratching / touching, of anus **;**		**2 ACCEPT** method to prevent scratching e.g. cutting nails **2 IGNORE** 'wash anus'
		3	drugs to, kill / remove, parasite / eggs **;**		**3 DO NOT CREDIT** 'antibiotics' **3 IGNORE** 'anti-bacterial'
				2 max	
			Total	**12**	

Question			Expected Answer	Mark	Additional Guidance
5	(a)			6	**Award** 1 mark for each correct row **DO NOT CREDIT** if more than one letter in a box

statement	DNA only (**D**) or RNA only (**R**) or both DNA and RNA (**B**)	
contains thymine	**D**	
contains ribose	**R**	;
consists of 2 chains connected to each other with hydrogen bonds	**D**	;
has a sugar-phosphate backbone	**B**	;
has 4 different nitrogenous bases	**B**	;
contains a pentose sugar	**B**	;
is found in the nucleus and cytoplasm	**R**	;

Question			Expected Answer	Mark	Additional Guidance
5	(b)	(i)			
		1	(information used to) decide which, group / taxon, organism / species / named example, fits in ;		**1** answers must refer to the information provided by the study of DNA, rather than simply the job of taxonomists**,** e.g. **ACCEPT** 'it can be used to put organisms into groups' **1 IGNORE** 'for classification' unqualified – look for idea of: groups **1 CREDIT** ref to belonging to same taxonomic group, e.g. 'to see if it belongs in the genus *Homo*'
		2	compare the proportion of (different) bases ;		**2 IGNORE** 'examine proportion of bases' **2 CREDIT** idea for looking at similarities / differences
		3	compare the DNA / genes / sequence of bases ;		**3 IGNORE** 'examine sequence of bases' **3 CREDIT** idea for looking at similarities / differences
		4	*idea of:* the more similar the, DNA / genes, the closer the relationship / AW ;	**2 max**	**4** Must contain reference to similarity of DNA
5	(b)	(ii)			**Mark the first <u>two</u> suggestions** **IGNORE** ref to genetics as DNA is 'biochemical'
		1	fossil record ;		
		2	anatomy / physiology / behaviour ;		**2 ACCEPT** AW for anatomy, e.g. observable / physical features / cell structure **2 ACCEPT** AW for physiology, e.g. method of reproduction
		3	embryology / AW ;	**2 max**	
5	(c)		**J** ; **T** ;	**2**	**DO NOT CREDIT** names

Question			Expected Answer	Mark	Additional Guidance
5	(d)	(i)			
		1	no DNA from living specimens in Wales analysed ;		
		2	population (may have) evolved / mutations have occurred / genetic variation, (since 1948) ;		**2 ACCEPT** description of evolved **2 DO NOT CREDIT** 'evolution' unqualified by context of pine marten population
				1 max	
5	(d)	(ii)			**ACCEPT** animals as AW for pine martens throughout answer
		1	(introduced) pine martens might not be adapted to local conditions / AW ;		**1 ACCEPT** not adapted to the habitat **1 DO NOT CREDIT** 'used to'
		2	(local) habitat, might have changed / is no longer suitable (for any pine martens) / AW ;		
		3	introduced, pine martens, might outcompete native, population / pine martens ;		**3 ACCEPT** introduced pine martens might kill native / Welsh pine martens **3 IGNORE** 'compete' unqualified
		4	introduced pine martens might bring disease ;		
		5	Welsh pine marten would lose its, distinctiveness / identity, because of interbreeding ;		
				1 max	
			Total	**14**	

Question			Expected Answer	Mark	Additional Guidance
6	(a)	(i)	genes / genetic / mutation ; environment(al) ;	2	**Mark the first answer on each line** **IGNORE** inherited / DNA
6	(a)	(ii) 1 2 3 4	no defined categories ; range of values / intermediate values ; influenced by, environment / many genes / genes and environment ; quantitative / has to be measured / cannot be counted ;	3 max	 **2 ACCEPT** ref to bell-shaped curve / binomial distribution **3 ACCEPT** any ref to 3 or more genes **4 ACCEPT** metric
6	(a)	(iii)	B ;	1	**DO NOT CREDIT** if more than one letter is given
6	(a)	(iv) 1 2 3 4	growth too rapid ; increased susceptibility to, disease / named abnormality ; inbreeding ; reduces gene pool / genetic variation / genetic diversity ;	2 max	 **2** e.g. bone / skeletal abnormalities or low immunity **3 DO NOT CREDIT** if implies inbreeding causes mutations **4 IGNORE** refs to biodiversity

Question			Expected Answer	Mark	Additional Guidance
6	(a)	(v)			
		1	maintain biodiversity ;		
		2	aesthetic (reasons) / tourism ;		
		3	ethical (reasons) ;		**3 ACCEPT** religious
		4	part of a food chain / web ;		**4 ACCEPT** food source for local population
		5	maintain / increase <u>gene pool</u> ;		
		6	genetic resource / availability to breed with domestic chickens ;		**6 CREDIT** description, e.g. 'source of desirable genes' or 'source of genetic variation' **6 ACCEPT** specific example of genetic resource e.g. disease resistance / strong bones / longevity / heat tolerance / idea of domesticating wild population
				2 max	

Question			Expected Answer	Mark	Additional Guidance
6	(b)	(i)			**Mark the first two answers only**
		1	reduces / prevents (infectious) disease **;**		**1 IGNORE** illness
		2	prevent, problems / named problem, with gut **;**		**2** e.g. diarrhoea
		3	digest food more, efficiently / easily / quickly **;**		
		4	greater proportion of, food / energy, can contribute to growth **;**		**4 ACCEPT** faster growth as AW for contribute to growth **4 IGNORE** larger chickens
		5	reduce risk of transmitting, pathogens / named pathogen, to humans **;**	**2 max**	**5 ACCEPT** 'meat less likely to be infected with bacteria'
6	(b)	(ii)			
		1	(antibiotic) resistant, pathogens / bacteria **;**		**1 ACCEPT** microorganisms / microbes **1 IGNORE** germs **1 DO NOT CREDIT** immune
		2	antibiotics kill useful, bacteria **;**		**2 DO NOT CREDIT** if any ref to viruses
		3	*idea of:* antibiotic passing into human food **;**	**1 max**	
			Total	**13**	

Question			Expected Answer	Mark	Additional Guidance
7	(a)				**CREDIT** marking points from a clearly labelled diagram
		1	sequence / chain, of amino acids **;**		**1 IGNORE** polypeptide
		2	(amino acids) joined by peptide bonds **;**		
			secondary		
		S1	alpha / α, helix **;**		
		S2	small regions of, beta / β, pleated sheet / fold **;**		
		S3	hydrogen / H, bonds **;**		**S3** Must be in context of secondary structure
			tertiary		
		T1	secondary structure / helix / polypeptide chain, undergoes further, coiling / folding **;**		**T1 ACCEPT** polypeptide chain folds further
		T2	*3 bonds / interactions from:* disulfide / ionic / hydrogen / hydrophobic or hydrophilic **;**		**T2 IGNORE** if clearly in context of secondary or quaternary structures **T2** H bond must be in context of tertiary structure
		T3	hydrophilic R groups on outside (of molecule) / hydrophobic R groups on inside (of molecule) **;**		
			quaternary		
		Q1	4, polypeptides / subunits **;**		
		Q2	2, alpha / α, chains **and** 2, beta / β, chains **;**		'contains 2 α and 2 β polypeptides' = 2 marks (Q1 and Q2)
		Q3	1 haem (group) per polypeptide / 4 haems (per molecule) **;**		**Q3 IGNORE** protein in ref to 1 haem (group) per polypeptide
		3	prosthetic group (is) haem, (which) contains Fe^{2+} **;**		**3 ACCEPT** iron ion / Fe^{+} / Fe^{3+} **3 DO NOT CREDIT** iron / Fe unqualified
				6 max	
			QWC - correct refs to secondary, tertiary and quaternary structure **;**	**1**	1 **S** mark and 1 **T** mark and 1 **Q** mark

Question			Expected Answer	Mark	Additional Guidance
7	(b)				Assume answer refers to collagen unless stated If the answer mentions only collagen, assume that the candidate thinks any features mentioned also apply to haemoglobin.
			(collagen has)		
		1	amino acid, chain / sequence ;		**1 IGNORE** polypeptide **1 IGNORE** repeating units
		2	peptide bonds ;		
		3	helical / helix ;		**3 DO NOT CREDIT** if candidate refers to collagen having an α helix
		4	*3 bonds / interactions from:* disulfide / ionic / hydrogen / hydrophobic or hydrophilic ;		
		5	quaternary structure ;		**5 IGNORE** primary /secondary / tertiary
		6	more than one polypeptide / subunit ;		**6 ACCEPT** polypeptides but **DO NOT CREDIT** 3 polypeptides if number in haemoglobin not specified
				4 max	
			Total	**11**	

Question			Expected Answer	Mark	Additional Guidance
8		1	antibodies ;		**ACCEPT** minor mis-spellings so long as word can not be confused with another word in the list
		2	natural ;		
		3	artificial ;		
		4	natural ;		
		5	antigen ;		
		6	vaccination ;	6	
			Total	**6**	

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