OCR
RECOGNISING ACHIEVEMENT

GCE

Biology

Advanced Subsidiary GCE

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

Mark Scheme for June 2011

Oxford Cambridge and RSA Examinations

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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)					**IGNORE** 'nutrients/ minerals' throughout
			1	without fertiliser <u>yield</u> falls (over time) / fertiliser maintains <u>yield</u> / AW ;		**1** **ACCEPT** it / nitrate / nitrogen as AW for fertiliser **ACCEPT** fertiliser increases yield
			2	application of fertiliser replaces lost , nitrogen / nitrates ;		**2** **ACCEPT** it / nitrate / nitrogen as AW for fertiliser
			3	nitrogen / N, required for **,** amino acids / (named) protein / growth / (named) nucleic acids / (named) nitrogenous base ;		**3** **IGNORE** 'development' **IGNORE** fertiliser / nitrate / N_2
			4	*idea that* nitrogen / N / nitrate / $NO_3^{(-)}$, removed (from soil / system) by , plant / harvesting ;		**4** Answers must refer to depletion (from soil) 'used' alone does not imply depletion
			5	*idea of* denitrification ;		
			6	nitrates / $NO_3^{(-)}$, are soluble ;		
			7	nitrates / $NO_3^{(-)}$, are **,** leached / washed from soil ;	3 max	

Question			Expected Answers		Mark	Additional Guidance
1	(c)					**ACCEPT** 'tolerance' as AW for resistance If candidates write 'immunity' penalise once and then ecf
			1	natural selection **;**		
			2	insecticide is the **,** selective agent / selection pressure **;**		
			3	*idea of* mutation / (genetic) variation **;**		**3** **DO NOT CREDIT** idea of insecticide or natural selection *causing* mutation **DO NOT CREDIT** variation that could be environmental
			4	random / naturally occurring **;**		
			5	resistant survive / non-resistant die **;**		**5** **ACCEPT** AW for resistant, e.g. 'the ones with the mutation'
			6	(resistants will) pass on , allele / mutation , for resistance (to offspring) **;**		**6** **ACCEPT** gene for resistance **IGNORE** 'pass on resistance / trait'
			7	higher proportion of / more , resistant individuals in population **;**		**7** **CREDIT** refs to increased allele / gene frequency **ACCEPT** 'the whole population becomes resistant'
			8	*idea that* resistance allele confers resistance only to a small dose of insecticide **;**	**4 max**	
				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)	**P1**	*idea of* different samples have different concentrations of, catalase / enzyme ;		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
			One of			
			M1	source the extract for the whole experiment from a single source ;		**M1 ACCEPT** 'from same plant'
			M2	thorough , mixing , required before use ;		
			M3	filter / purify , extract ;		
			M4	*idea of* using , known / standard , concentration of enzyme ;		
			M5	commercial source of catalase ;	2	

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)			**IGNORE** explanations
		1	rate , rises / increases , initially ;		1 **DO NOT CREDIT** if 'rate' not stated for this mp only
		2	peak at / maximum at / highest at / decrease after, 40(^{o}C) ;		2 **ACCEPT** optimum
		3	(overall) fall more rapid than rise ;		3 Look for a comparative statement
		4	*idea that* before peak / after peak , temperature increase has increasing effect on rate ;		4 **ACCEPT**, e.g., line is steeper between 30 and 40 than between 10 and 20.
		5	comparative figures to support any point ;		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	no , reaction / oxygen produced , at 60(^{o}C) ;	4 max	6 **ACCEPT** rate is 0 at 60
2	(c)	(ii)	2 ;	1	**IGNORE** units
2	(c)	(iii)	temperature ; maximum / peak / V_{max} ; denatured ; active ;	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)		**1** insoluble ; **2** does not , change / affect , water potential / Ψ , of cell ; **3** can be , broken down / hydrolysed / built up , quickly / easily ; **4** lots of branches for enzymes to attach ; **5** compact ; **6** (therefore) high energy content for mass / energy dense / AW ;		3 max	**2** **ACCEPT** osmotically inactive / AW **3** Answers must contain the idea of ease or speed of breakdown **IGNORE** broken up Answers must imply density, e.g. 'it is compact and so stores a lot of energy' = 2 marks

Question			Expected Answers		Mark	Additional Guidance
3	(c)	(i)	α /alpha , glucose ;		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** **ACCEPT** 'α'
3	(c)	(ii)	**1** **2** **3** **4**	respiratory substrate / used for respiration ; source of / releases / provides, energy ; formation of ATP ; conversion into named compound ;	1 max	**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** **DO NOT CREDIT** any answer that clearly states that glucose **is** energy, **makes** energy, **produces** energy or **creates** energy **1** **ACCEPT** used in respiration **ACCEPT** 'releases energy for respiration' **2** **IGNORE** used for energy **4** e.g. starch / cellulose / polysaccharide / disaccharide / glycogen / protein / lipid / sucrose / maltose / fructose / fat
3	(c)	(iii)	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** **ACCEPT** F **IGNORE** triglyceride / fat / lipid / haemoglobin

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Mark</th><th>Additional Guidance</th></tr>
<tr><td>3</td><td>(d)</td><td></td><td>
<table>
<tr><th>glycogen</th><th>cellulose</th><th></th></tr>
<tr><td>no hydrogen bonding</td><td>hydrogen bonding</td><td></td></tr>
<tr><td>α / alpha , glucose</td><td>β / beta , glucose</td><td>;</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><td>;</td></tr>
<tr><td>branched</td><td>not branched / linear / straight</td><td>;</td></tr>
<tr><td>no , fibres / fibrils</td><td>fibres / fibrils</td><td>;</td></tr>
<tr><td>granules</td><td>no granules</td><td>;</td></tr>
<tr><td>all glucose units in same orientation</td><td>adjacent glucose units in opposite orientation</td><td>;</td></tr>
</table>
</td><td>3 max</td><td>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
<table><tr><td>α-glucose in a branched chain</td><td>β-glucose in a straight chain</td></tr></table>= 2 marks

ACCEPT ‘α’ and ‘b’

ACCEPT helical / spiral / coiled vs linear / straight
DO NOT CREDIT α-helix</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>[16]</td><td></td></tr>
</table>

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

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	make antibodies (against influenza **,** virus / antigen) **;**		**4** **IGNORE** 'reproduce antibodies' **IGNORE** 'release antibodies'
			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 viruses / 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	correct detail of inhibition method that does not contradict stated type of inhibition ;		**2** e.g. fits or binds to active site / complementary shape to active site / competes for the active site **OR** fits into allosteric site or site other than active site **/** changes shape of active site
			3	prevents , substrate binding to active site / formation of enzyme-substrate complex / formation of ESC ;	2 max	**3** **IGNORE** substrate binding to enzyme
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 , other cells ; *idea of* treating , 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)	both rise (between 1920 and 1960) **;** men started smoking before, ca. 1900 / women's smoking started increasing after 1920 - 1925 **;** similar levels of smoking (in men and women) by 1990 **;** smoking in men **,** levelled off / plateaued **OR** smoking in women continues to rise **;**	**2 max**	Needs direct comparison in single statement **ACCEPT** comparative statement, e.g. 'women started smoking later than men' **ACCEPT** 5000 in both by the end of the 1980s **DO NOT CREDIT** if plateau described before 1940
5	(a)	(ii)	(positive) correlation / similar pattern **,** between smoking and lung cancer **;** *idea that* increase in incidence of lung cancer lags behind increase in smoking **;** *idea of* once smoking has levelled off there is a corresponding levelling off in incidence of lung cancer **;** *idea of* men always smoking more and men having higher rates of cancer **; ora**	**2**	**ACCEPT** similar shaped graphs **IGNORE** 'as smoking increases, so does lung cancer' **ACCEPT** followed by **ACCEPT** if answer implies levelling off at same time

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

Question			Expected Answers	Mark	Additional Guidance
5	(c)				**Mark the first answer on each numbered line.**
			1 mouth / tongue / throat / oesophageal **,** cancer **;**		**1 ACCEPT** <u>secondary</u> cancers
			2 <u>chronic</u> bronchitis / COPD **;**		**2 DO NOT CREDIT** smoker's cough
			3 emphysema / COPD **;**		**3 CREDIT** COPD once only
			4 <u>ath</u>erosclerosis **;**		
			5 thrombosis **;**		**5 IGNORE** thrombus
			6 coronary heart disease / CHD / angina / heart attack / myocardial infarction / MI **;**		**6 IGNORE** cardiovascular disease / hypertension / chronic heart disease
			7 stroke **;**		
			8 peripheral vascular disease / <u>arterio</u>sclerosis **;**		
				max 3	
			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*** *idea of* fossils show changes over time ; ***2*** *idea that* there are methods to date fossils ; ***3*** *idea of* simplest / most different from modern , species / AW , in oldest rocks ; ***4*** *idea of* showing , links / relationships , between , groups / species / organisms / taxa ; ***5*** many fossils organisms no longer exist ; ***6*** *idea of* compare 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)				**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**
			X phosphate ;		**DO NOT CREDIT** PO_4 or 'phosphate , molecule / backbone' **IGNORE** group
			Y deoxyribose ;		**DO NOT CREDIT** deoxyribulose **IGNORE** (pentose) sugar
			Z thymine ;	3	**DO NOT CREDIT** incorrect spelling **IGNORE** (nitrogenous) base / T

Question			Expected Answers		Mark	Additional Guidance
7	(b)					**CREDIT** answers from clearly labelled diagram **IGNORE** anything after it becomes clear that a candidate is ***describing*** transcription
			1	semi-conservative (replication) **;**		
			2	(double) helix**,** 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 template (for the formation of a new molecule) **;**		
			5	free (DNA) nucleotides (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	DNA 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
					6 max	
			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)		**1** different species **;** **2** different genus **;** **3** genetically incompatible **;** **4** (may have) different number of chromosomes **;** **5** physical / behavioural **,** reason for reproductive incompatibility **;**	**2 max**	**3 ACCEPT** 'DNA sufficiently different' **IGNORE** refs to meiosis **4 IGNORE** refs to meiosis **5** e.g. eggs remain unfertilised / different incubation patterns **IGNORE** refs to fertility of offspring
8	(b)	(i)	Convention (on) International Trade (in) Endangered Species **;**	**1**	**ACCEPT** Commission / Conference / Congress **ACCEPT** Trading **DO NOT CREDIT** Conservation / Countries
8	(b)	(ii)	**1** regulate / monitor **,** trade in selected **,** species / animals / plants / animal products **;** **2** *idea of* ensuring trade does not put wild populations at risk **;** **3** *idea of* prohibiting commercial trade in wild plants **;** **4** *idea of* allowing trade in artificially propagated plants **;** **5** *idea of* allowing trade in less endangered species subject to permit **;**	**2 max**	**Mark the first two answers only.** **IGNORE** trafficking throughout (as in stem) **1 ACCEPT** idea of species being on a list **ACCEPT** endangered **ACCEPT** prevent **IGNORE** illegal **IGNORE** animals / plants unqualified **3 ACCEPT** endangered plants

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** method to monitor population ; **5** raise public awareness / educate local population / educate collectors ; **6** method to prepare animals for survival in wild ; **7** *idea of* gradual introduction, e.g via semi-wild habitat ;		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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