OCR
RECOGNISING ACHIEVEMENT

GCE

Biology

Advanced Subsidiary GCE

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

Mark Scheme for January 2012

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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Annotations

Annotation	Meaning
	Correct answer
	Incorrect response
	Benefit of Doubt
	Not Benefit of Doubt
	Error Carried Forward
	Given mark
	Underline (for ambiguous/contradictory wording)
	Omission mark
	Ignore
	Correct response (for a QWC question)
	QWC* mark awarded

Question			Answer	Marks	Guidance
1	(a)	(i)	N ;	1	**IGNORE** nitrogen **DO NOT CREDIT** n or N_2
1	(a)	(ii)	polypeptide / protein ;	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** peptide
1	(a)	(iii)	*name* peptide (bond / link) ; ***plus any two from ...*** *description of formation* between, amine group (of one amino acid) and carboxyl group (of another) ; H (from amine) combines with OH (from carboxyl) ; condensation (reaction) **OR** water, lost / eliminated / produced / created / AW ;	3 max	Maximum two marks for description. Name must be given to award 3 marks. **ACCEPT** marking points from diagram where amine and carboxyl groups are clearly labelled. **Mark writing first then look at diagram**. If diagram contradicts creditable text award maximum one mark for description. **DO NOT CREDIT** dipeptide **ACCEPT** phonetic spellings of amine and carboxyl **ACCEPT** 'carboxylic acid' and 'amino' **DO NOT CREDIT** amide / carbonyl

Question			Answer	Marks	Guidance
1	(b)	(i)		8 max	Annotate property (number 1) marks with ✓ **1** symbol to help distinguish marks for QWC
					All marks are stand alone
			V1 high latent heat of vaporisation / large amount of energy required to change from liquid to gas / AW **;**		**V1 ACCEPT** 'large amount of heat needed…"
					V1 ACCEPT 'high latent heat of evaporation'
			V2 evaporation is (efficient) cooling mechanism / AW **;**		**V2 ACCEPT** 'evaporation removes heat from body'
			V3 example of cooling in living organism **;**		**V3** e.g. sweating, panting, transpiration (as cooling)
					'high latent heat of evaporation means sweat cools you down' = 3 marks
			H1 high specific heat capacity / large amount of energy needed to, raise / change, temperature **;**		**H1 ACCEPT** 'water / it, is thermally stable'
					H1 ACCEPT 'water is slow to change temperature'
					H1 CREDIT 'the temperature of the sea does not change much'
			H2 (thermally) stable environment for, aquatic / named aquatic, organisms **;**		**H2** 'thermally' can be inferred from previous statement
			H3 (aquatic) organisms use less energy on temperature control **;**		
			H4 (internal) temperature of organisms changes only slowly **;**		
			H5 (biological) reactions / enzymes / metabolism, function(s) correctly **;**		**H5 IGNORE** 'organisms function correctly'
			F1 ice, is less dense than water / floats **;**		**F1 ACCEPT** 'maximum density is at 4°C'
			F2 (surface of) ice provides habitat for, organisms / named organism **;**		**F2** e.g. 'polar bears on ice'

Question			Answer	Marks	Guidance
			I1 water (beneath ice), insulated / remains liquid / doesn't freeze **;**		
			I2 (aquatic) organisms, do not freeze / can still swim **;**		**I2 IGNORE** unqualified references to survival **I2 ACCEPT** gametes / AW, can be dispersed
			S1 (effective) solvent **;**		
			S2 medium for reactions / (internal) transport medium / able to dilute toxic substances **;**		
			C1 cohesion / adhesion **;**		
			C2 example of cohesion / adhesion, in living organism **;**		**C2** e.g. transpiration stream / apoplast movement **C2 ACCEPT** descriptions
			T1 surface tension **;**		
			T2 habitat for (named) invertebrates **;**		**T2 ACCEPT** insects **IGNORE** animals
			P1 transparent **;**		
			P2 allows underwater photosynthesis **;**		**P2 ACCEPT** other example of transparency linked to survival, e.g. eyes
			D1 idea of high density **;**		**D1 IGNORE** references to viscosity
			D2 allows flotation / support **;**		
			U organisms can still obtain, oxygen / (named) minerals / food / carbon dioxide, from water **;**		**U** not linked to a single property and so cannot contribute to **QWC** **U IGNORE** nutrients / nutrition

Question			Answer	Marks	Guidance
			QWC: a property mark (with number 1) and a survival mark with the same letter seen twice.	1	e.g. H1 and H3 **and** S1 and S2

Question			Answer		Marks	Guidance
1	(b)	(ii)			3 max	**Mark the first answer on each prompt line.**
			1	protein <u>secondary</u> structure / α-helix / β-pleated sheet **;**		
			2	(protein) <u>tertiary</u> structure **;**		
			3	between polypeptide chains in (named) quaternary structure **;**		**3** e.g. between adjacent chains in collagen **CREDIT** 'protein / named protein / enzyme' OR 'between amino acid R-groups' once **ONLY if <u>none</u> of mps 1-3 have been awarded**
			4	(between chains of) cellulose **;**		**4 IGNORE** macrofibrils
			5	(between, strands of / bases in) DNA **;**		
			6	AVP **; ; ;**		**6** e.g. between mRNA and tRNA binding between enzyme and substrate (coiling of) amylose between DNA and mRNA during transcription
				Total	**17**	

Question			Answer		Marks	Guidance
2	(a)				2 max	**Mark the first answer on each prompt line.** **ACCEPT** ora throughout
			1	nucleus / nuclei **;**		**1 ACCEPT** 'DNA not free'
			2	other named organelle / membrane bound organelles **;**		**2** e.g. mitochondria / Golgi / etc **2 ACCEPT** compartmentalized organelles **2 ACCEPT** don't have a mesosome
			3	linear chromosomes **;**		
			4	DNA, associated with / AW, histones / protein **;**		**4 ACCEPT** 'DNA not naked'
			5	80S / 22nm / large, ribosomes **;**		
			6	large cells / AW **;**		
			7	no cell wall **;**		
2	(b)		capital letter on, specific name / Vivax **;**		1 max	**Mark the first answer** **ACCEPT** ora for what student should have typed
			not italicised / not underlined **;**			**ACCEPT** 'the parasite is Plasmodium falciparum / malariae / ovale' if candidate uses capital 'P' and lower case 'f / m / o'
2	(c)	(i)			3 max	**IGNORE** references to stages of life-cycle **Max 2 if virus / bacterium appears anywhere**
			1	(mosquito), is <u>vector</u> **;**		
			2	*Plasmodium* / parasite, present in (mosquito), saliva / salivary gland **;**		
			3	*idea that* infected mosquito, feeds on / bites, human **;**		**3 IGNORE** case of initial 'P' **3** Must be in context of transmission from mosquito **to** human
			4	*Plasmodium* / parasite, passes (from saliva) to blood **;**		**4** 'blood' can be inferred, e.g. from refs to anticoagulant **4 IGNORE** ref to parasite in blood after liver

Question			Answer	Marks	Guidance
2	(c)	(ii)	destruction of a species is, morally / ethically, wrong **;** might cause unintended health problems in humans **;** might harm, other / unintended, species **;** *idea of* bioaccumulation / biomagnification **;**	1 max	**Mark the first suggestion** **IGNORE** 'might enter human food' unqualified Answers must imply idea of harm

Question			Answer		Marks	Guidance
2	(c)	(iii)			5 max	Award marks for either a field or laboratory investigation – **must read whole answer before beginning to mark to decide if field or laboratory.** If candidates answer in terms of incidence of malaria award no marks as question states population of mosquitoes but read whole question in case mosquito study described in addition. If the investigation is in the both field and laboratory mark the investigation which gives candidate most marks.
				Field investigation		
			F1	(sampling) before and after insecticide treatment **;**		**F1 IGNORE** refs to treated and untreated areas as stem refers to 'a population'
			F2	*idea of* , unbiased / random, sampling of population **;**		
			F3	example of sampling technique **;**		**F3** e.g. sweep net, pond net, light trap **F3 ACCEPT** insect net **F3 IGNORE** 'net' **or** 'trap' unqualified
			F4	(sampling in) different, times / weather **;**		**F4 IGNORE** intervals unqualified. Answers must refer to time or weather
			F5	large number of samples taken **;**		**F5** Must imply large number or state five or more
			F6	*idea of* standardised sampling procedure **;**		**F6 ACCEPT** idea of counting by the same method
			F7	*idea of* preventing counting same individual more than once **;**		
			F8	*idea of* capture – recapture **;**		
			F9	calculate mean / calculate standard deviation / apply statistical test **;**		**Continued……..**

Question			Answer		Marks	Guidance
				OR		
				Laboratory investigation		Laboratory investigation could be done outside
				idea of:		
			L1	with and without insecticide exposure **;**		**L1** is for changing the independent variable
			L2	measuring mosquito survival / count surviving mosquitoes **;**		**L2** is for measuring the dependent variable **ACCEPT** count the number of dead ones
			L3	controlling one named key variable **;**		**L3 and L4** *award up to 2 marks for* exposure time species of mosquito stage of mosquito life cycle sex of mosquito number of mosquitos insecticide type insecticide concentration volume of insecticide temperature
			L4	controlling second named key variable **;**		
			L5	*idea of* using a range of insecticide concentrations **;**		
			L6	replicates **;**		**L6** Minimum of 3 in total, i.e. original plus two
			L7	calculate mean / calculate standard deviation / apply statistical test **;**		**L7 IGNORE** average
				Total	**12**	

Question			Answer	Marks	Guidance
3	(a)		regulates fluidity of / stabilises / AW, membranes / phospholipid bilayer ; (converted to) steroid / named steroid, hormone(s) ; waterproofing the skin ; making Vitamin D ; making bile (salts) ;	2 max	**Mark the first answer on each prompt line.** **ACCEPT** decreases / maintains, fluidity **ACCEPT** supports structure of membranes **DO NOT CREDIT** makes membrane rigid **DO NOT CREDIT** allows / increases fluidity
3	(b)	(i)	contains C and H and O ; has, OH / hydroxyl, groups ; hex / 6-membered, ring ;	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** C, H and O molecules **DO NOT CREDIT** hexose **ACCEPT** pent ring **IGNORE** 6C ring **IGNORE** branched
3	(b)	(ii)	(saturated) lipids / fats / triglycerides ; protein / polypeptide ;	2	**Mark the first two suggestions** **DO NOT CREDIT** unsaturated (fats) **IGNORE** fatty acids / glycerol **IGNORE** amino acids / peptides

Question			Answer	Marks	Guidance
		(iii)	*LDL* **L1** (carry cholesterol) from liver to, tissues / cells **;** **L2** receptors on (tissue) cells **;** **L3** raise / AW, blood cholesterol **;** **L4** increase / cause, deposition of, fats / lipids / triglycerides / cholesterol, in artery wall / under endothelium **;** **L5** form, plaques / atheromas **;** *HDL* **H1** (carry cholesterol) from, tissues / body / blood, to liver **;** **H2** receptors on, hepatocytes / liver cells **;** **H3** lower / reduce / decrease, (blood) cholesterol **;** **H4** reduce deposition, of fats / lipids / triglycerides / cholesterol **;** **H5** decrease, formation / risk, of, plaques / atheromas **;**	6 max	If it is clear that candidates get LDL and HDL the wrong way round do not award L1 or H1 or QWC and then apply **ECF** **L3 IGNORE** deposits cholesterol **L4 IGNORE** LDL / fatty acids **L4 ACCEPT** under epithelium **H1 ACCEPT** back to liver **H3 ACCEPT** remove from blood **H4 IGNORE** LDL / fatty acids **H5 IGNORE** removing atheromas
			QWC – Award if you award an L mark and an H mark with the same number twice	1	e.g. L1 and H1, **and** L3 and H3

Question			Answer	Marks	Guidance
	(c)	(i)	(red) meat contains (large amounts of) saturated, fat / fatty acids **;** (meat / saturated fat) associated with / leads to, increased / large amounts of, LDLs **;**	2	**ACCEPT** ora throughout for consequences of non-red meat diet No **ECF** from 3 (b) (iii) **ACCEPT** animal fat is saturated fat **CREDIT** high LDL/HDL ratio **IGNORE** makes LDLs unqualified answer must imply increased amount
		(ii)	(type 2) diabetes **;** angina / coronary heart disease / CHD / stroke / hypertension / high blood pressure / obesity **;**	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** **DO NOT CREDIT** type 1 diabetes **IGNORE** conary **DO NOT CREDIT** chronic
			Total	**15**	

Question			Answer	Marks	Guidance
4	(a)		taxonomy / taxonomic ; hierarchy ; phylogeny / phylogenetic ;	3	**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** phonetic spelling throughout **ACCEPT** hierarchical system
	(b)	(i)	**1** (cells have) no cell wall ; **2** heterotrophic ; **3** eukaryotic ; **4** multicellular ; **5** (fertilized eggs develop into), blastula / ball of cells ; **6** high degree of mobility / AW ;	2 max	**Mark the first answer on each prompt line.** **1 DO NOT CREDIT** absence of a qualified cell wall, e.g. 'no cellulose cell wall' **2 ACCEPT** phonetic spelling **3 ACCEPT** named eukaryotic cell feature **4 IGNORE** references to tissues **6 DO NOT CREDIT** unqualified references to movement **ACCEPT** refs to mobility during part of life cycle **IGNORE** cilia / flagella
		(ii)	Eukaryota(e) / Eukarya / eukaryote(s) ;	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** case of initial letter

Question			Answer	Marks	Guidance
		(iii)		4 max	*Candidates may refer to individual species using common or scientific names.* ***ACCEPT*** *use of either or both.* ***IGNORE*** *case of initial letter*
			1 all are in same family as all, are closely related **;**		**1** idea of link between family and close relationship must be made
			2 kea and kaka are both, same genus / *Nestor* **;** **ora** for kakapo		
			3 kea and kaka, are more closely related / share more recent common ancestor, (than with kakapo) **;**		**3 ACCEPT** ora for less close relationship between kakapo and others
			4 kea and kaka have more genes in common / AW (than with kakapo) **;**		**4 ACCEPT ora** **4** Answers must refer to genes / genetics / DNA **4 IGNORE** cytochrome c
			5 example of genetic similarity (between kaka and kea) evident from Fig 4.1 **;**		**5** E.g. kaka and kea both brown / kaka and kea both have similar shaped beaks **5 IGNORE** unqualified references to appearance
			6 differences between, kea and kaka / all three, are great enough for each to be described as a different species **;**		
	(c)	(i)	differences **;** in / within / between, species **;**	2	**ACCEPT** within a population

Question			Answer	Marks	Guidance
	(c)	(ii)	genetic differences / different alleles / inherited differences ; environment / diet / disease ;	2	**Mark the first suggestion on each prompt line.** **ACCEPT** different genes **ACCEPT** mutation **ACCEPT** sex **IGNORE '**different habitat'
	(c)	(iii)	only small number have been sampled / AW ; *idea that* individuals sampled may not be representative of population ; data collected when population was larger / smaller population may mean range has changed ;	2	**Mark the first two reasons – ignore prompt lines.** **ACCEPT** 'whole population has not been sampled' **IGNORE** rare unqualified **ACCEPT** larger ones more likely to be caught / measured **ACCEPT** individuals sampled from one area might be different from average of whole population

Question			Answer	Marks	Guidance
4	(d)		*Name* **1** speciation **;** *Mechanism – max 2 marks* **2** isolation / separation, (of populations) **;** **3** further detail of isolating mechanism **;** **4** mutation / genetic variation **;** **5** natural selection / description of natural selection **;** **6** different selection pressure(s) (in different environment) **;** **7** (enough) time to allow changes in population to prevent interbreeding / AW **;**	3 max	**1 IGNORE** 'natural selection' on name line **2 IGNORE** barrier **3** e.g. river, mountain, reproductive, geographical, temporal, polyploidy, qualified barrier **3 IGNORE** allopatric / sympatric unqualified **5** description must mention differential survival **and** genes being passed on **6 IGNORE** selection pressure unqualified **6** 'different' can be described using an example
			Total	**19**	

Question			Answer		Marks	Guidance
5	(a)		41 667 ; ;		2	Award 2 marks for a correct answer, even if no working shown. **ALLOW** 1 mark for 41 666.666˙,41 666.7, 41 666.67, 41 666.667, 41 670, 41 700, 41 666, 41668 or 42 000. If the answer is incorrect **ALLOW** 1 mark for $\frac{2500 \times 100}{6}$
	(b)				3	**Mark the first three reasons regardless of lines**
			1	part of ecosystem / habitat for other organisms ;		**1 IGNORE** maintains biodiversity
			2	part of food, chain / web ;		**2 ACCEPT** food source **2 IGNORE** home
			3	wood useful for specific purpose ;		**3** e.g. making , fences / furniture / boundary marker
			4	(potential) source of medicine ;		
			5	genetic resource ;		**5 ACCEPT** description or example but must refer to genes
			6	aesthetic value / give pleasure / beautiful trees ;		**6 ACCEPT** tourism
			7	ethical reason / moral responsibility ;		**7 ACCEPT** *idea that* they have a right to existence **7 DO NOT CREDIT** 'playing God'
			8	resource for (non-medical) scientific research ;		

Question			Answer		Marks	Guidance
	(c)	(i)	not in, natural / normal, habitat / environment **;**		1	
		(ii)	**1**	most plants produce an excess **;**	4 max	
			2	(so) can be collected (from wild) without damaging (wild) , plants / organisms / population / habitat **;**		
			3	take up little space **; ora**		
			4	able to store, large numbers / more species **; ora**		
			5	easy / cheaper, to transport / AW **; ora**		**5 ACCEPT** can easily be sent where wanted
			6	*idea of* remaining viable for long periods **; ora**		**6** Answers must have some reference to survival, not just 'can be stored for a long time'
			7	less susceptible to, disease / pests / environmental change **; ora**		**7 IGNORE** recovery / survival , from disease **7 CREDIT** answers that describe (greater) disease resistance as a property of the seeds themselves **or** that the seed bank is a (more) protected environment for the seeds **IGNORE** cheaper unqualified

Question			Answer		Marks	Guidance
5	(c)	(iii)	1	(maintain / increase) genetic variation / gene pool ;	3 max	**1 ACCEPT** different alleles **1 DO NOT CREDIT** different genes
			2	reduced chance of (future), disease / environmental change, affecting (whole) population ;		**2 ACCEPT** 'so if one dies from a disease some might survive' **2 ACCEPT** 'to get some plants that are resistant to different diseases'
			3	reduces chance of inbreeding ;		
			4	maintain, geographical variation / varieties / races / strains / subspecies ;		**4 IGNORE** variation unqualified
				Total	**13**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>6</td><td>(a)</td><td></td><td>
<table>
<tr><td>Characteristics are passed on to the next generation</td><td>W</td><td>;</td></tr>
<tr><td>There is a struggle for existence</td><td>Y and Z</td><td>;</td></tr>
<tr><td>Individuals with beneficial characteristics are among the few who survive</td><td>X and Y and Z</td><td>;</td></tr>
</table>
</td><td>3</td><td>DO NOT CREDIT if letter is unclear

DO NOT CREDIT if more than one letter is given

DO NOT CREDIT if an incorrect letter is given

DO NOT CREDIT if an incorrect letter is given</td></tr>
<tr><td></td><td>(b)</td><td></td><td>MRSA / it, is harder to treat / may become untreatable ;

potential for, disease outbreak / epidemic / pandemic / killing many people ;

developing new / more powerful, <u>antibiotics</u>, is expensive / takes time ;</td><td>2 max</td><td>ACCEPT MRSA / it, can’t be killed (by antibiotics)
ACCEPT antibiotics will no longer work on, MRSA / it

IGNORE new antibiotics are hard to discover</td></tr>
</table>

Question			Answer		Marks	Guidance
6	(c)		1	fossils show that organisms have changed over time ;	3	**1 CREDIT** many fossil organisms dissimilar from modern organisms
			2	*idea that* fossils or rocks can be dated ;		**2 ACCEPT** idea of fossils in chronological order
			3	*idea of* fossils showing intermediate forms / sequences ;		**3** e.g. *Archaeopteryx* / *Tiktaalik* / horse **3** general trend from, small / simple, to, large / complex
				Total	**8**	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>7</td><td>(a)</td><td></td><td>
<table>
<tr><td>form part of cellular response</td><td>both</td></tr>
<tr><td>mature in thymus</td><td>(only) T (lymphocytes) ;</td></tr>
<tr><td>secrete substances which kill infected cells</td><td>(only) T (lymphocytes) ;</td></tr>
<tr><td>manufacture antibodies</td><td>(only) B (lymphocytes) ;</td></tr>
<tr><td>undergo clonal expansion</td><td>both / B and T ;</td></tr>
<tr><td>activate other lymphocytes</td><td>(only) T (lymphocytes) ;</td></tr>
</table>
</td><td>5</td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>no antibodies detected before 4 days / antibodies appear at 4 days ;

increase then decrease / peak ;

figures for peak with time and antibody concentration ;

decrease less steep than increase / AW ; ora
antibody concentration returns to zero at 27 days ;</td><td>3 max</td><td>ACCEPT ‘around 4 days’
ACCEPT upper limit of 4.5 days for first appearance of antibodies
IGNORE ‘before 5 days’
IGNORE references to increase at 4 days, answers must imply none to begin with

ACCEPT 13 days ± 0.5 day, 25 units ± 0.5 units
ACCEPT 25 au ± 0.5 au 9 days ± 0.5 day after initial appearance</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>7</td><td>(b)</td><td>(ii)</td><td>the drawn line should show
higher peak and steeper initial increase ;

antibodies appear between days 30 and 34 and concentration at 60 days above peak for primary response ;</td><td>2</td><td>Peak must be at least 30 au
Compare gradient with initial increase up to day 10
NBOD if gradients are similar
ACCEPT ruled line close to vertical

DO NOT CREDIT vertical
ACCEPT a line that starts to rise at 30 or 34 days</td></tr>
<tr><td>7</td><td>(c)</td><td></td><td><table><tr><th>region</th><th>name</th><th>function</th></tr><tr><td>A</td><td>hinge (region) ;</td><td>flexibility / binding of more than one antigen ;</td></tr><tr><td>B</td><td>constant / Fc (region) ;</td><td>attachment / binding , to phagocytes ;</td></tr><tr><td>C</td><td>variable / hypervariable / Fab (region) ;</td><td>binding / attachment , to antigens ;</td></tr></table></td><td>6</td><td>Marks for name and function should be awarded independently.
DO NOT CREDIT if incorrect answer appears in same box
ACCEPT hinges / hinged

ACCEPT neutrophils / macrophages / granulocytes
ACCEPT monocytes

IGNORE recognise antigens</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>16</td><td></td></tr>
</table>

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