OCR
Oxford Cambridge and RSA

GCE

Biology

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

Advanced Subsidiary GCE

Mark Scheme for June 2015

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

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

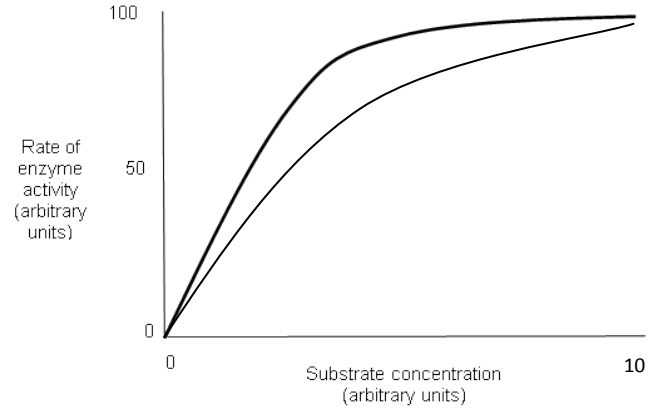
Annotation	Meaning of annotation
	Correct answer
	Incorrect response
	Benefit of Doubt
	Not Benefit of Doubt
	Error Carried Forward
	Given mark
	Underline (for ambiguous/contradictory wording)
	Omission mark
	Ignore
	Partial correct response
	Partial QWC* mark awarded
	Blank page

Here are the subject specific instructions for this question paper

- Use **CON** when a correct response is associated with a piece of clearly incorrect science within the same statement and award no mark.
- For questions in which the command word is 'suggest' ignore incorrect responses and credit a correct response wherever it occurs
- Accept phonetic spellings unless otherwise indicated
- All marks are stand-alone unless otherwise stated in Additional Guidance
- For 'idea of' marking points a wide range of wording is acceptable. The mark is to be awarded for the idea.

Here is the mark scheme for this question paper.

Question			Expected Answers	Mark	Additional Guidance
1	(a)	(i)	peptide (bond / link) **;**	1	**DO NOT CREDIT** dipeptide
1	(a)	(ii)	hydrolysis **;** water / H_2O , is , added / used / needed **;**	 2	**IGNORE** name of bond **CREDIT** OH and H put back on amino acids **ACCEPT** (broken down) with water
1	(b)		**1** substrate / protein , shape is (nearly) complementary to active site **; ora** **2** substrate / protein , enters / fits into , active site (on enzyme) **;** **3** induced fit / description of induced fit **;** **4** (forms) enzyme-substrate complex / ESC **;** **5** destabilising / straining / AW , of bonds (in substrate) **;** then (forms) enzyme-product complex **;** **6** product(s) / amino acids , leave (active site) **;**	5 max	**1 ACCEPT** complimentary **1** "substrate binds to the active site which is complementary to the substrate shape" = 2 marks, mp1 and mp2 **2 ACCEPT** binds to / holds / bonds to **2 IGNORE** collides **5 IGNORE** breaks **6 IGNORE** EPC
1	(c)	(i)	 no units for , 2nd column / egg white **;** amount (rather than volume / in 4th column) **;** incorrect unit / m , in final / time , column **;**	 3	**IGNORE** prompt, and mark the first three answers. **IGNORE** subsequent answers. **CREDIT** marks clearly annotated on table **ACCEPT** volume of egg white needs cm^3 **ACCEPT** 'they should have written volume' **ACCEPT** should have been s **IGNORE** should have been , sec / secs / seconds

Question			Expected Answers	Mark	Additional Guidance
1	(c)	(ii)	equal volume in each tube ; add buffer / control pH ;	 1	**ACCEPT** "make sure the tubes have the same cm^3"
1	(c)	(iii)	control ;	1	**DO NOT CREDIT** control variable
1	(c)	(iv)	improve reliability ; assess, variability / spread of results ; allows calculation of mean ;	 2	**IGNORE** accurate **ACCEPT** identify , anomalous results / outliers **IGNORE** eliminate anomalous results **ACCEPT** reference to statistical test **ACCEPT** standard deviation / t-test / Mann-Whitney **CREDIT** improves accuracy of mean
1	(d)	(i)	line drawn below line on graph ; line from origin that does not peak or plateau ;	 2	If the line goes above the original line at any point = 0 marks **ALLOW** lines touching at right hand end **DO NOT CREDIT** line with increasing gradient **ALLOW** plateau if it joins the original line **ALLOW** plateau below original line if it starts 4 small squares (or fewer) from the end  = 2 marks

Question			Expected Answers	Mark	Additional Guidance
1	(d)	(ii)	similar shape to , substrate / (part of) albumin / protein ; complementary (shape) to (part of) active site ;	2	**IGNORE** same **ACCEPT** same shape as part of substrate **IGNORE** structure **ACCEPT** tertiary structure
			Total	**[19]**	

Question			Expected Answers	Mark	Additional Guidance
2	(a)	(i)	lives , in / on , host ; gains nutrition / feeds , from (host) ; at the expense of / harms (host) ;	3	The word 'host' must appear at least once in order to gain 3 marks **IGNORE** lives off host **IGNORE** binds to host **ACCEPT** e.g. feeds on blood / get food from it / obtains nutrients from the larger organism **DO NOT CREDIT** sometimes harm **ACCEPT** causes disease
2	(a)	(ii)	mosquito / vector / *Anopheles* , feeds on blood ; breaks skin / skin cannot act as barrier / mosquito pierces skin / mosquito bites skin ;	2	**IGNORE** insect **IGNORE** anticoagulant prevents clot formation (as primary defence has already been breached)

Question			Expected Answers	Mark	Additional Guidance
2	(a)	(iii)	suitable / AW , climate / temperature , for , mosquito / vector / *Anopheles* **;** **ora** more mosquitoes live there / AW ; **ora** *idea of* relatively poor so methods of prevention less effective **;**	1	**ACCEPT** 'warm enough for mosquitoes' **IGNORE** tropical as AW for 'warm' **IGNORE** mosquito is adapted to survive there **ACCEPT** e.g. can't afford , drugs / mosquito nets / habitat management / insecticides **ACCEPT** lack of education
2	(a)	(iv)	**1** climate change / global warming / AW , may result in spread to other parts of the world / AW **;** **2** *idea of* increased movement of (infected) people **;** **3** *idea that* (non-malaria) countries fund anti-malaria measures via international aid **;** **4** resistance of , parasite to drugs / mosquito to insecticides **;**	2 max	**2 ACCEPT** increased tourism / easier to travel **2 ACCEPT** inadvertent transport of mosquitoes **4 IGNORE** 'resistance' without further qualification **4 DO NOT CREDIT** immune
2	(b)	(i)	**A** antigen **;** **B** (extension of) cytoplasm **;** **C** lysosome **;** **D** phagosome / phagocytic vesicle / phago-lysosome **;**	4	**Mark the first answer.** If the answer is correct and another answer is given that is incorrect or contradicts the original answer, then = **0 marks** **B ACCEPT** pseudopod (ia / ium) or close spelling **B IGNORE** neutrophil **C IGNORE** lysome / lysozyme **D ACCEPT** phagocytic vacuole / secondary lysosome

Question			Expected Answers	Mark	Additional Guidance
2	(b)	(ii)	(different) chemicals that attract phagocytes (released from infected erythrocytes) **;**	1	**ACCEPT** in the context of chemicals released by erythrocyte or *Plasmodium* **ACCEPT** cytokines / histamine / interleukin , released **IGNORE** references to antigens on surface
2	(c)		*Globular* **G1** ball (shaped) / spherical / AW **;** **G2** hydrophilic , (R-)groups / regions , on outside (of 3-D structure) / hydrophobic (R-)groups on inside **;** **G3** form H-bonds with water **;** **G4** soluble **;** **G5** example of globular protein (other than haemoglobin) **;** **H1** haemoglobin , carries / transports , oxygen / carbon dioxide **;** **H2** haemoglobin contains , prosthetic group / haem / Fe^{2+} / iron ion (to allow oxygen to be carried) ; **H3** (polypeptide chains within) haemoglobin have tertiary structure (in a ball shape) ;		**G1 IGNORE** round / globular **G5 ACCEPT** (named) enzyme / hormone / antibody / channel / carrier **G5 IGNORE** metabolic / transport **H1 ACCEPT** references to buffering **H2 IGNORE** Fe^{3+} **H3 ACCEPT** haemoglobin has tertiary structure

			F1	*Fibrous* linear / long (chain) **;**		**F1 ACCEPT** straight / rope-like **F1 IGNORE** strand
			F2	(chains can) form (H) bonds with adjacent , chains (within a molecule) **;**		**F2 IGNORE** fibre / fibril **F2 ACCEPT** 'strand' as AW for 'chain' for **F2** only **F2 ACCEPT** crosslink as AW for bond for **F2** only **F2 DO NOT CREDIT** molecule as 'AW' for 'chain' **F2 IGNORE** attractions / (named) covalent bonds
			F3	insoluble / few hydrophilic groups **;**		
			F4	strong / provide strength **;**		**F4 IGNORE** flexible / inelastic / withstands pressure
			F5	have structural role ;		
			C1	collagen has high proportion of glycine , so chains can lie close together / AW **;**		
			C2	collagen forms , crosslinks / covalent bonds , between molecules **;**		**C2 ACCEPT** (micro / macro) fibrils / fibres , as AW for molecules
			C3	crosslinks / ends of molecules, are staggered to avoid , weak points / AW **;**		**C3 ACCEPT** (micro / macro) fibrils / fibres , as AW for molecules
			C4	collagen forms part of , tendon / cartilage / ligament / bone / connective tissue / bronchi / bronchioles / trachea / skin **;**	**7 max**	**C4 IGNORE** blood vessel / artery / vein , wall **C4 IGNORE** lips
			QWC – use of haemoglobin and collagen as examples		**1**	**AWARD** if any H mark **and** any C mark are awarded
				Total	**[21]**	

Question			Expected Answers	Mark	Additional Guidance
3	(a)		spread over wider area / more widespread / bigger range / AW ;	1	**ACCEPT** geographical description, e.g. 'they now live in the South / Wales also' but answer must imply that they still live in previously occupied areas **IGNORE** *idea of* higher numbers **IGNORE** bigger / more without further qualification
3	(b)	(i)	impossible / difficult , to count every individual ; sample provides an estimate ; sample representative (of whole area) ;	2 max	**ACCEPT** *idea that* counting every individual is too time consuming
3	(b)	(ii)	to compare (the two areas) ; (presence or absence of) roe deer is independent variable ; *idea of* controlling variables other than roe deer ;	1 max	**ACCEPT** one area acts as a control **ACCEPT** to see the effect of the roe deer
3	(b)	(iii)	**1** (species) richness is number of species (in a habitat) ; **2** (species) evenness is , abundance / number of individuals of , each / every / all , species (in a habitat) ; **3** *idea that* both (richness and evenness) are needed to reveal dominance ; **4** *idea that* high biodiversity associated with high species richness **and** high species evenness ;	3 max	**IGNORE** amount **ACCEPT** 'how many' as AW for 'number' **ACCEPT** evenness is relative , numbers / abundance , of (each) species **IGNORE** number of individuals of , a / the / one , species

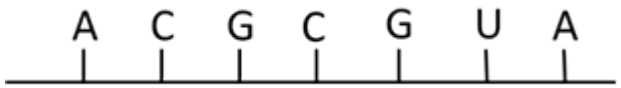
Question			Expected Answers	Mark	Additional Guidance
3	(b)	(iv)	plants are , the basis / AW , of (all) food chains **;** shrubs / plants , are food for , insects / animals , that birds eat **;** *idea that* shrubs might provide , nesting sites / cover / protection / habitat **;**	**1 max**	**IGNORE** birds eat , shrubs / seeds / fruit **IGNORE** 'fewer insects' without reason for fewer insects **AWARD** in the context of birds, or animals that birds eat **IGNORE** home
	(b)	(v)	(habitat) dominated by, one / few / AW, species **;** ecosystem / habitat , is , unstable / less likely to cope with change **;**	**2**	**ACCEPT** high number of one species **IGNORE** area / environment **ACCEPT** in the context of an example of environmental change **ACCEPT** a change in one species with have a large effect on the , ecosystem / habitat / food chain
3	(c)	(i)	*idea of* danger to , humans / local wildlife / domestic animals / deer **;** environment may no longer be suitable for lynx / AW **;**	**1**	**ACCEPT** *idea of* danger to existing food chains **IGNORE** could become a pest **IGNORE** dangerous without further qualification **IGNORE** competition

Question			Expected Answers	Mark	Additional Guidance
3	(c)	(ii)	**1** (phylogeny is) the evolutionary , relationship between / history of , organisms / species **;** **2** phylogeny is the basis of classification ; **3** example of molecular evidence used to classify **;** **4** species / organisms , within the same group have shared , phylogeny / evolutionary history / common ancestor **; ora** **5** *idea that* phylogeny of *L. lynx* and *L. pardinus* are sufficiently , different to have been placed in separate species / similar to have been placed in same genus **;**	**4 max**	**1 ACCEPT** reasonable description of evolutionary , history / relationship, e.g. changes in ancestral organisms **2** Must be a clear statement **3 ACCEPT** base sequence / amino acid sequence / DNA / cytochrome C / haemoglobin / ATPase (used to classify)
3	(c)	(iii)	modern / new / better , technology (to distinguish between closely related species) **;** more , molecular / biochemical / DNA / genetic , evidence **;**	**1**	**ACCEPT** named example, e.g. DNA sequencing

Question			Expected Answers	Mark	Additional Guidance
3	(c)	(iv)	**1** *idea of* impact on food chain(s) **;** **2** *idea of* right to exist / duty of humans to care for other species / ethical reason / preserving species for future generations **;** **3** *idea of* aesthetic reason **;** **4** economic reason / tourism / might provide useful resource **;**	**3max**	**1 ACCEPT** controlling deer population **1 ACCEPT** top carnivore / top predator / keystone species / it might compete with existing species **1 IGNORE** other species might die **2 IGNORE** 'playing God' **2 IGNORE** refs to poaching / hunting **3 ACCEPT** beautiful creatures / nice to look at / AW
			Total	**[19]**	

Question			Expected Answers	Mark	Additional Guidance
4	(a)		0.096 **; ;** tonnes ha^{-1} y^{-1} **;**	**3**	If answer is incorrect **CREDIT** one mark for correctly identifying a difference of 4.3 (tonnes ha^{-1}) **ACCEPT** tonnes per hectare per , year **ACCEPT** tonnes ha^{-1}/yr **ACCEPT** tonnes ha^{-1} per year **IGNORE** annum

Question			Expected Answers	Mark	Additional Guidance
4	(b)		**1** crossbreed / breed / interbreed , high-yielding , wheat plants / individuals **;** **2** assess / test / measure , yield / AW **;** **3** crossbreed / AW , selected / best / high-yielding , offspring **;** **4** over generations **;** **5** marker assisted selection / prevent self-pollination / genetic screening / prevent unwanted (cross) pollination **;**	**4 max**	**1 ACCEPT** breed high-yielding individuals **1 ACCEPT** 'mate / reproduce' as AW for 'breed' **1 IGNORE** inbreed **1 ACCEPT** description of high-yielding plant, e.g. more , ears / grain / seed / wheat **1 ACCEPT** if only one of the plants is high-yielding **2 IGNORE** select the best offspring **4 ACCEPT** several / a few generations **4 IGNORE** time **5 ACCEPT** descriptions **5 IGNORE** the ones with the correct gene **5 ACCEPT** prevent self-fertilization
4	(c)		(use of) fertiliser **;** (use of) pesticide / fungicide / insecticide **;** improved technology **;**	**2 max**	**IGNORE** prompt lines and mark as prose **IGNORE** refs to climate change **IGNORE** crop rotation **IGNORE** increase in soil minerals **IGNORE** irrigation **ACCEPT** selective herbicide **IGNORE** decrease in pests **ACCEPT** e.g. better harvesting technology **IGNORE** genetic modification / irrigation
			Total	**[9]**	

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Mark</th><th>Additional Guidance</th></tr>
<tr><td>5</td><td>(a)</td><td>(i)</td><td>thymine ;</td><td>1</td><td></td></tr>
<tr><td>5</td><td>(a)</td><td>(ii)</td><td>correct complementary sequence ;
bases joined by a backbone drawn below the letters ;</td><td>2</td><td>IGNORE bonds between bases


= 2 marks</td></tr>
<tr><td>5</td><td>(b)</td><td></td><td>
<table>
<tr><th>Statement</th><th>Incorrect statements</th><th></th></tr>
<tr><td>The DNA molecule unwinds</td><td></td><td></td></tr>
<tr><td>Hydrogen bonds between the base pairs break</td><td></td><td></td></tr>
<tr><td>Free RNA nucleotides join to bases on the exposed DNA strands</td><td>X</td><td>;</td></tr>
<tr><td>Both polypeptide strands act as a template</td><td>X</td><td>;</td></tr>
<tr><td>Hydrogen bonds form between complementary bases</td><td></td><td></td></tr>
<tr><td>3 hydrogen bonds form between bases A and T</td><td>X</td><td>;</td></tr>
<tr><td>DNA polymerase links the new nucleotides</td><td></td><td></td></tr>
<tr><td>Covalent bonds form between the phosphate of one nucleotide and the pentose sugar of the next nucleotide</td><td></td><td></td></tr>
</table>
</td><td>3</td><td>Four ‘X’s – max 2
Five ‘X’s – max 1
Six or more ‘X’s – DO NOT CREDIT any marks
If candidate does not use ‘X’, ACCEPT unambiguous system of indicating correct answers.</td></tr>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Mark</th><th>Additional Guidance</th></tr>
</table>

Question			Expected Answers	Mark	Additional Guidance
5	(c)				**Mark the first answer.** If the answer is correct and another answer is given that is incorrect or contradicts the original answer, then = **0 marks**
			1 individuals / organisms / species / phenotypes ;		**IGNORE** offspring
			2 genetic ;		**ACCEPT** inherited / genetical
			3 environment ;		**IGNORE** named example of environment, e.g. diet
			4 intraspecific ;		**ACCEPT** intraspecies
			5 selection / survival ;		**ACCEPT** breeding / reproduction **ACCEPT** natural selection / survival of the fittest
				5	
			Total	**[11]**	

Question			Expected Answers		Mark	Additional Guidance
6	(a)				6 max	**CREDIT** marking points from a suitably annotated correctly labelled diagrams but read text first
			1	2 light chains and 2 heavy chains / 4 polypeptide chains **;**		**1 IGNORE** long / short **1 CREDIT** implication from labelled diagram
			2	variable region allows , binding / attachment , to antigen **;**		**2 IGNORE** complementary **2 ALLOW** AW for region
			3	two variable regions allow binding of more than one (of the same) antigen **;**		**3 ALLOW** AW for region
			4	variable region on different antibodies allows specificity to different antigens **;**		**4 ALLOW** AW for region
			5	constant region allows , recognition by / attachment to / binding to , (named) phagocytes **;**		**5 ALLOW** AW for region **5 IGNORE** complementary
			6	hinge (region) allows flexibility **;**		**6 ACCEPT** allows arms to , move / bend
			7	disulfide , bonds / bridges **,** hold , polypeptides / light and heavy chains , together **;**		
			QWC – statements linking structure and function for variable region and one other region		**1**	**AWARD** if one mark from 2 to 4 and one mark from 5 to 7 are given

Question			Expected Answers	Mark	Additional Guidance
6	(b)		*neutralisation* **N1** cover / block , binding site / antigen / receptor site (on pathogen) **;** **N2** bind to toxins **;** **N3** prevent **,** binding / entry **,** to (host) cell **;** *agglutination* **A1** clump / bind together , (many) pathogens **;** **A2** (clump) too large to , enter (host) cell / cross membranes **;** **A3** increase likelihood of being consumed by (named) phagocyte / more can be consumed by phagocyte at once **;**	4	If neutralisation is correctly described but labelled agglutination, **DO NOT CREDIT** the first mark but apply **ECF** thereafter **IGNORE** references to parts of antibody, e.g. variable / constant **N1 IGNORE** binds **N3 IGNORE** prevent pathogen reproduction **N3 GNORE** 'harm / infect , host cell' If neutralisation is correctly described but labelled agglutination, **DO NOT CREDIT** the first mark but apply **ECF** thereafter **A2 IGNORE** move **A3 IGNORE** 'white blood cell' **A3 DO NOT CREDIT** lymphocyte **A3 ACCEPT** eaten by phagocytes more easily
			Total	**[11]**	

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Mark</th><th>Additional Guidance</th></tr>
<tr><td>7</td><td>(a)</td><td>(i)</td><td>
<table>
<tr><th>Statement</th><th>tri-glyceride</th><th>phospho-lipid</th><th>cholesterol</th></tr>
<tr><td>contains only the elements carbon, hydrogen and oxygen</td><td>✓</td><td></td><td>✓</td></tr>
<tr><td>insoluble in water</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td>contains glycerol</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>contains ester bonds</td><td>✓</td><td>✓</td><td></td></tr>
<tr><td>important in membrane structure</td><td></td><td>✓</td><td>✓</td></tr>
<tr><td>contains fatty acids</td><td>✓</td><td>✓</td><td></td></tr>
</table>
;
;
;
;
;
;
</td><td>6</td><td>AWARD one mark per correct row
ACCEPT use of an unambiguous symbol other than a tick (e.g. Y)
DO NOT CREDIT if there is any ambiguity in the symbol used</td></tr>
<tr><td>7</td><td>(b)</td><td></td><td>mix with / add , ethanol / alcohol , and water ;

(goes) cloudy ;</td><td>2</td><td>DO NOT CREDIT reference to any incorrect biochemical test

ACCEPT milky / white (emulsion)
DO NOT CREDIT precipitate</td></tr>
<tr><td>7</td><td>(c)</td><td></td><td>less (overall , lipid / fat) ;

less / no , saturated (fat / lipid / fatty acids) ;

more unsaturated (fat / lipid / fatty acids) ;</td><td>2 max</td><td>Cannot be inferred from marking points 2 and 3
ACCEPT no / less , cholesterol
ACCEPT meat has more

ACCEPT meat has more

ACCEPT meat has less

“Higher ratio of unsaturated to saturated” = 2 marks (mp 2 and 3)</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>[10]</td><td></td></tr>
</table>

APPENDIX 1 – this contains a generic mark scheme grid

Mark Scheme Conventions
The following conventions appear in the Mark Scheme

- Bracketed words. The words in brackets are there to 'set the scene' and indicate the context in which the answer is expected. They do not need to appear. Award the mark as long as the statement in the brackets is not contradicted.
- Solidus /. A solidus indicates alternative ways that a mark might be gained for a given Mark Point.
- Use of the comma in a mark point. This indicates that some information from either side of the comma or commas is needed. It is used in conjunction with the solidus.
- In some cases the Guidance column may indicate examples of wording or terms that are acceptable (ACCEPT) or that should be ignored (IGNORE). In the case of IGNORE read on (or previously) to see if something creditworthy appears later in the response.
- Underlining
    - solid underline. The word or part of word underlined is required but minor mis-spellings are acceptable as long as the word is phonetically the same
    - wavy underline. This indicates that whilst the word underlined is not precisely needed, alternative responses need to be closely related in meaning or be a clear description.
- *idea of.* This is used as a prefix to marking points where there may be a fairly wide range of responses which cover the essence of the required response. This often requires examiner judgement. These often, but not exclusively, appear in questions related to environmental or health issues.

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