OCR
Oxford Cambridge and RSA

GCE

Biology

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

Advanced Subsidiary GCE

Mark Scheme for June 2016

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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.

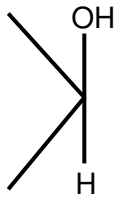
These are the annotations, (including abbreviations), including those used in scoris, which are used when marking

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
	Marking point criteria partially met
	Point contributing to QWC* awarded

Here are the subject specific instructions for this question paper

- **CON** is used when a correct response that would otherwise have been awarded a mark is associated with a piece of clearly incorrect science within the same statement. If this occurs, do not award the mark at this point. However, if, later on in the candidate's answer, the correct response is seen, and is not contradicted in the same statement, the mark can be awarded. This is particularly useful in questions testing biochemistry. Sometimes, incorrect science does not warrant negation of a particular marking point and, where this is likely to occur, there is often advice in the Additional Guidance column.
- 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)	X: C / carbon **;** Y: O / oxygen **;** Z: OH / hydroxyl (group) **;**	3	**Mark the first answer.** If the answer is correct and an additional element or group is given = **0 marks.** For example X = C or CH_2 = 0 marks **Y DO NOT CREDIT** O_2 **Z IGNORE** hydroxy / hydroxide **Z IGNORE** OH^-
1	(a)	(ii)	OH and H groups reversed / AW (on single C atom) **;** on , C_1 / right hand C atom / AW **;**	2	*Max 1 if any other change is described / shown*. **CREDIT** a correct diagram **ACCEPT** right hand part of molecule only **IGNORE** parts of molecule labelled X, Y and Z **IGNORE** C number if it contradicts an otherwise correct answer  = 2 marks
1	(a)	(iii)	(α / alpha / a / A) 1-4 glycosidic **;** maltose **;**	2	**ACCEPT** glycosidic 1,4 **IGNORE** covalent

Question			Expected Answers		Mark	Additional Guidance
1	(b)		**G1**	(contains α-) glucose which is , a respiratory substrate / used in respiration **;**		
			G2	(glycogen) can be , broken down / hydrolysed / digested , by enzymes **;**		**G2 ACCEPT** (glycogen) phosphorylase / transferase / (α1-6) glucosidase / amylase
			S1	polymer / polysaccharide / macromolecule / large molecule / long chains **;**		**S1 IGNORE** many glucose monomers
			S2	insoluble **;**		
			S3	does not affect , water potential / Ψ **;**		**S3 IGNORE** refs to osmosis
			C	(compact so) energy dense / large amount of energy in small volume **;**		**C ACCEPT** dense so can store a lot of energy **C ACCEPT** space / mass , as AW for volume
			B1	(also) 1-6 glycosidic bonds (at branches) **;**		
			B2	branched **;**		
			B3	multiple sites / greater surface area / AW , for , breakdown / (named) enzyme activity **;**		
			B4	quickly , broken down / glucose can be removed quickly **;**		**B4 IGNORE** easily **B4 IGNORE** energy release for this marking point
			A1	animals / feature of animal's lifestyle , require , rapid / AW , energy / ATP , release **;**		**A1 ACCEPT** 'they' as AW for 'animal' **A1** must be a direct statement related to an animal's lifestyle, e.g. exercise / muscle contraction / (animal) movement
			A2	animals have high(er) metabolic rate **;**	**6**	
			QWC – *linking structure to function* 1 A mark and 1 B mark **;**		**1**	**AWARD** if, e.g. **A1** and **B2** are given

Question			Expected Answers	Mark	Additional Guidance
1	(c)		beta- / β- / B / b , pleat(ed sheet) / fold **;** hydrogen / H **;** secondary **;** subunits / chains **;** quaternary **;**	5	 **DO NOT CREDIT** H^+ / H_2 **ACCEPT** 2° **IGNORE** tertiary / fibrous **ACCEPT** globins **IGNORE** strands / units / peptides **ACCEPT** 4° **IGNORE** globular
			Total	**[19]**	

Question			Expected Answers	Mark	Additional Guidance
2	(a)		tick in second box active and artificial ✓ ;	1	**DO NOT CREDIT** if there is a tick in any other box
2	(b)	(i)	viral RNA , acts as , host cell / m , RNA ; RNA , carries , code / sequence (for viral protein) ; (to) ribosomes ;	2 max	**ACCEPT** RNA / DNA , produced from viral RNA **DO NOT CREDIT** tRNA **ACCEPT** RNA is , translated into / used as a template to produce , (viral) protein (or description) **ACCEPT** RNA codes for (viral) protein **DO NOT CREDIT** tRNA **ACCEPT** as a standalone mark

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Mark</th><th>Additional Guidance</th></tr>
<tr><td>2</td><td>(b)</td><td>(ii)</td><td>altered base sequence (of viral RNA) means , altered , primary structure / (sequence of) amino acids ;

R-groups / disulphide bonds / hydrogen bonds / ionic bonds , interact differently ;

tertiary structure is determined by , bonds / R-groups / secondary structure / primary structure / sequence of amino acids ;

3-D shape is tertiary structure ;</td><td>3 max</td><td>ACCEPT if a nucleotide (in RNA) is different the amino acid (in the protein) is different

ACCEPT changed as AW for interact differently

ACCEPT implication that 3D is tertiary structure</td></tr>
<tr><td>2</td><td>(b)</td><td>(iii)</td><td>money would be saved / education improved / fewer sick days / reduced spread (of virus) / good example of health practice / few teachers will have immunity (to current strain) ;</td><td>1</td><td>IGNORE so they don’t get the flu without further qualification
IGNORE because they are at risk of infection</td></tr>
<tr><td>2</td><td>(c)</td><td></td><td><table><tr><th></th><th>primary response</th><th>secondary response</th></tr><tr><td>concentration of antibodies produced</td><td>low(er)</td><td>high(er)</td></tr><tr><td>duration of response</td><td>short(er)</td><td>long(er)</td></tr></table> ; ;</td><td>2</td><td>ACCEPT unambiguous AW
IGNORE numbers

ACCEPT stated time periods where secondary response is longer than primary</td></tr>
</table>

Question			Expected Answers	Mark	Additional Guidance
2	(d)		helper cells , release , cytokines / interleukins **or** helper cells , activate / stimulate / AW , B cells **;** **or** helper cells , produce (T) memory cells ; killer / cytotoxic , cells , secrete / release , toxic substances / hydrogen peroxide / H_2O_2 / perforin **or** killer / cytotoxic , cells , kill / AW , infected cells **;** **or** killer cells , produce (T) memory cells ; memory cells , allow a , secondary / faster , (immune) response **;** AVP **;**	**2 max**	**CREDIT** cause B cells to , differentiate / proliferate **IGNORE** B memory cells **ACCEPT** involved in clonal selection **AWARD** memory cells once only anywhere in the answer **ACCEPT** lysins **IGNORE** enzymes **IGNORE** kill / attack / enter , pathogens **ACCEPT** killer cells , target / attack , infected cells **AWARD** memory cells once only anywhere in the answer **AWARD** memory cells once only anywhere in the answer **AWARD** 1 mark for suppressor cells / regulator cells , stop immune response
			Total	**[11]**	

Question			Expected Answers	Mark	Additional Guidance
3	(a)	(i)	add / AW, biuret solution / biuret reagent / biuret mixture / NaOH and $CuSO_4$ **;** observe colour **;**	**2**	**IGNORE** 'biuret' unqualified **DO NOT CREDIT** heat / warm / neutralise / put in water bath **ACCEPT** see if it goes , lilac / purple / mauve / violet **DO NOT CREDIT** if incorrect colour change described **DO NOT CREDIT** precipitate
3	(a)	(ii)	(enzymes are) globular , proteins / polypeptide **;** hydrophilic / water soluble , (R-)groups on outside (of enzyme) **;**	**1 max**	
3	(b)	(i)	concentration 1.4 ± 0.025 **;** 0. 35 **;**	**2**	 **ALLOW ECF** if stated concentration is not 1.4 (i.e. concentration x 250/1000)
3	(b)	(ii)	test more (known) , concentrations / solutions **;** between 1.0 and 2.0 / near 1.4 **;**	**2**	**IGNORE** repeat **IGNORE** bigger range of concentrations
3	(b)	(iii)	carry out Biuret test / test again **;** (using) no enzyme / no protein / (distilled) water **;** set colorimeter to zero **;**	**2 max**	 **DO NOT CREDIT** 'boiled enzyme' Measure absorbance of biuret solution alone = 2 marks

Question			Expected Answers		Mark	Additional Guidance
3	(c)		1	cofactors / coenzymes / prosthetic groups **;**		
			2	bind to , enzyme / active site / allosteric site **;**		**2 ACCEPT** prosthetic groups form part of the enzyme
			3	(cofactors / coenzymes , bind to enzyme) temporarily **;**		
			4	change , shape / tertiary structure , of active site **;**		
			5	affect charges on active site **;**		**5 ACCEPT** affects , ionic / hydrogen , bonds in active site
			6	bind to / interact with , substrate **;**		**6 IGNORE** in context of prosthetic group
			7	increase (likelihood of) , substrate binding to active site / ESC formation **;**		**7 ACCEPT** help the substrate bind to the active site **7 ACCEPT** make ESC formation easier
			8	carry (named) chemical , between / to , (named) enzymes **;**	**5 max**	**8 ACCEPT** substrate as chemical **8 IGNORE** substance
				Total	**[14]**	

Question			Expected Answers	Mark	Additional Guidance
4	(a)		global warming **;** *example of consequence of climate change* mud has dried up / mud now too wet / flooding / disease / (new) herbivore / pest**;**	**2**	**ACCEPT** climate change **IGNORE** environmental change **ACCEPT** (new) predator / heavy rainfall / drought **IGNORE** refs to temperature for this marking point **IGNORE** competition
4	(b)	(i)	(at the) level / number / range , of species **;** (at the level of) genetics / genes / gene pool / DNA **;** (at the level of) habitat / ecosystem **;**	**2 max**	**ACCEPT** amount of species / species richness **IGNORE** species evenness **ACCEPT** e.g. range of habitats **IGNORE** area / in a habitat
4	(b)	(ii)	plants are a source of (new) , medicines / drugs / treatments **;**	**1**	**IGNORE** nutritional / health , benefits **IGNORE** antibiotics
4	(b)	(iii)	*Any three from:* **1** genetic variation / source of (named) useful genes **;** **2** (used for) genetic engineering **;** **3** (used for) selective breeding / breeding with , cultivated / crop / AW , varieties **;** **4** variety might be useful in a changing climate **;** **5** (habitat for) pollinators **6** (habitat for) agents of biological control **;** **7** source of a new medicine for livestock **;**	**3 max**	**1 ACCEPT** maintaining gene pool / genetic diversity **2 ACCEPT** description of genetic engineering **3 ACCEPT** cross as AW for breed **4 ACCEPT** species as AW for variety **4 ACCEPT** examples of features useful in a different climate, e.g. drought resistance **7 IGNORE** antibiotics

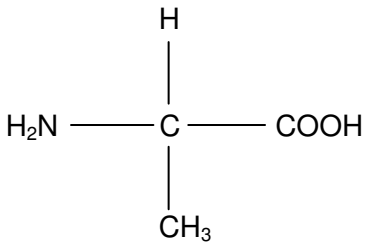
Question			Expected Answers		Mark	Additional Guidance
4	(c)		1	grow / AW , *(N. thermarum*) in a range of (soil) water content **;**		**1 IGNORE** in presence and absence of water **1 ACCEPT** in context of , seed / cutting / plug etc
			2	leave for / over , same / stated , time **;**		**2 IGNORE** rate
			3	measure height / count number of (viable) individuals**;**		**3 ACCEPT** measure , (dry) mass / width / spread / number of leaves **3 IGNORE** measure growth
			4	calculate mean (from the results) **;**		**4 ACCEPT** perform statistical test (on the results) **4 IGNORE** average but **ACCEPT** mean average **4 DO NOT CREDIT** if there are no measurements to process
			5	keep two other named variables constant **;**	**4 max**	**5 ACCEPT** (soil) pH / mineral content / type / mass **5 ACCEPT** temperature / CO_2 concentration / light intensity / light duration / light wavelength / number of seeds etc. (if they are being counted) / age / size (if they are being measured) **5 IGNORE** humidity / health / nutrients / species / light availability / soil fertility
4	(d)	(i)	Convention on International Trade in Endangered Species / CITES **;**		1	**ACCEPT** CITES acronym even if incorrect words are given **ACCEPT** cites / Cites **IGNORE** extra information that is not contradictory
4	(d)	(ii)	Rio Convention / (Rio) Convention on Bio(logical) Diversity **;**		1	**IGNORE** extra information that is not contradictory

Question			Expected Answers	Mark	Additional Guidance
4	(e)		range of , values / intermediates **;** quantitative **;** influenced by environment **;** influenced by more than two genes / polygenic **;**	**3 max**	**ACCEPT** no distinct , categories / groups **ACCEPT** (sketch of) normal distribution / bell-shaped curve **IGNORE** 'can be measured' **ACCEPT** example, e.g. those with more access to nitrate could grow larger
			Total	**[17]**	

Question			Expected Answers		Mark	Additional Guidance
5			**C1**	damage to / paralyses , cilia / ciliated epithelium **;**		**C1 IGNORE** cilia die / stick together **C1 ACCEPT** destroys cilia
			C2	over-production of mucus by goblet cells **;**		**C2** Must contain the idea of more mucus than normal
			C3	persistent / AW / smoker's , cough to , remove mucus / remove (trapped) pathogens / improve air-flow **;**		**C3** Benefits of coughing must be clearly stated
			C4	an example of damage to airways ;		**C4** forms scar tissue / increases wall thickness / reduces lumen diameter / inflammation / smooth muscle formation **C4 IGNORE** reference to alveoli for this marking point
			B1 **B2**	mucus , accumulates / not wafted by cilia **;** chronic bronchitis **;**		**B1 & C3** Repeated coughing to remove accumulated mucus = 2 marks
			E1	phagocytes , release elastase / break down elastin **;**		**E1 IGNORE** white blood cells **E1 ACCEPT** macrophages / monocytes / neutrophils
			E2 **E3** **E4**	loss of alveolar , recoil / elasticity **;** emphysema / COPD **;** damage to alveoli reduces surface area (to volume ratio) for , gas exchange / O_2 uptake **;**		**E4 IGNORE** increased diffusion distance
			L1	causes mutations (in cells lining airways) **;**		**L1 ACCEPT** contains mutagens **L1 IGNORE** carcinogens
			L2	uncontrolled cell , division / multiplication **;**		**L2 IGNORE** growth **L2 IGNORE** ref to speed of cell division
			L3	(lung) cancer / formation of tumour(s) **;**	**8**	**L3 ACCEPT** formation of , mass / lump , of cells
			QWC – range of effects Marks with 3 different letters have been awarded.		**1**	**AWARD** e.g, if C1, B1 and L3 are awarded
				Total	**[9]**	

Question			Expected Answers	Mark	Additional Guidance
6	(a)	(i)	fungi **;**	**1**	
6	(a)	(ii)	(Do the cells have) <u>cellulose</u> cell walls / chloroplasts (?) **;**	**1**	**DO NOT CREDIT** chlorophyll / autotrophic **IGNORE** vacuole
6	(a)	(iii)	(Do the cells have) a nucleus / (named) membrane bound organelles / 80S ribosomes(?) **;** (Is the organism) multicellular (?) **;**	**1 max**	**ACCEPT** Are the cells eukaryotic / is a cell wall absent / does it form a blastula / can it produce fertilised eggs(?) **IGNORE** all other responses
6	(b)	(i)	Q phylum / phyla R class S order T family **;;**	**2**	If any answer is wrong **AWARD** max 1 if the other 3 taxa are correct If Q is wrong **AWARD** max 1 if all stated taxa are in the correct **consecutive** sequence **Q IGNORE** phylus
6	(b)	(ii)	**1** eukaryotes / in eukaryote domain **;** **2** (classified on the basis of) genetics / amino acid sequences **;** **3** genetics / observable features / amino acid sequences , distinct from other , (eukaryotic) kingdoms **;** **4** genetics / amino acid sequence , less similar to , protoctists **or** genetics / amino acid sequence , more similar to , plants / fungi **;**	**3 max**	**ACCEPT** 'genes / DNA / RNA / base sequences / proportion of bases' as AW for genetics **4 IGNORE** observable features for this marking point **4 IGNORE** animals

Question			Expected Answers		Mark	Additional Guidance
6	(b)	(iii)	1	*idea that* 3 domains fits phylogeny better **;**		**1 ACCEPT** e.g. classifies species that are more closely related together / it is a better representation of the true relationship / reflects evolutionary history better **1 IGNORE** clearer **1 IGNORE** reference to common ancestors
			2	(there are) key / many / fundamental / important , differences between , bacteria / prokaryotes , **and** , eukaryotes / other (4) kingdoms **;**		**2 ACCEPT** there are fundamental similarities between the 4 eukaryotic kingdoms that are not shared with prokaryotes
			3	eukaryotes all have , nucleus / membrane-bound organelles / 80S ribosomes **;**		
			4	(there are) key / many / fundamental / important , differences between bacteria and archaea **;**		**4 ACCEPT** 'there are good reasons why prokaryotes should be split' **4 ACCEPT** 'bacteria and archaea are more different that we thought'
			5	bacteria and archaea have different , cell membrane / flagella / (named) enzymes / transcription / DNA replication / RNA **;**	**3 max**	
				Total	**[11]**	

Question			Expected Answers		Mark	Additional Guidance
7	(a)					**CREDIT** displayed formulae for groups throughout
			1	central , C / carbon (atom) **;**		**1 DO NOT CREDIT** if joined to another group by an incorrect bond
			2	NH_2 / amine (group) **;**		**2 ACCEPT** amino group / HNH
			3	COOH / carboxyl (group) opposite amine group **;**		**3 ACCEPT** carboxylic (acid) group **3 DO NOT CREDIT** if single bond drawn between C and O
			4	CH_3 / methyl (group) , opposite , hydrogen / H **;**		 **= 4 marks**
					4	If diagram is correct, **IGNORE** contradictory prose. If diagram is incorrect, **DO NOT AWARD** mark for correct prose
7	(b)	(i)	increases level of / produces (more), low density lipoproteins / LDL **;**			**ACCEPT** converted to LDLs **IGNORE** saturated fats contain LDLs
			LDLs carry cholesterol from <u>liver</u> to , (named) tissues / cells / blood **;**			
			decreases the activity of (LDL) receptors (on cells) / less binding (of LDL) to cells **;**		**2 max**	

Question			Expected Answers		Mark	Additional Guidance
7	(b)	(ii)	1	(increased) deposition of , fat / lipid / cholesterol / LDL (in artery wall) **;**		**1 ACCEPT** 'build up' as AW for deposit
			2	in artery wall / under endothelium **;**		**2 ACCEPT** under , epithelium / lining of artery wall
			3	atherosclerosis / formation of atheroma **;**		**3 ACCEPT** plaque formation **3 IGNORE** arterio- / arth-
			4	narrowing / AW , of lumen of coronary artery **;**		**4 IGNORE** conary
			5	reduced / restricted , blood flow **;**		
			6	less oxygen delivered to , cardiac / heart , muscle **;**	**4 max**	**6 ACCEPT** myocardium gets less O_2
7	(c)		enzyme / lipase , inhibitor ;		**1**	**ACCEPT** any description of competitive or non-competitive inhibition of enzyme
				Total	**[11]**	

Question			Expected Answers		Mark	Additional Guidance
8	(a)		concentration **;**		1	**IGNORE** volume / mass
8	(b)		**1**	breeding does not cause mutation **;**		**1 DO NOT AWARD** if any incorrect science is associated with this statement, e.g. 'breeding doesn't cause mutations it just makes them more likely to happen.
				*Any **one** from:*		
			2	mutation is , random / spontaneous / chance **;**		
			3	mutation is , change / damage , to , DNA / base / nucleotide sequence **;**		
			4	inbreeding reduces , gene pool / range of alleles / genetic variation / genetic diversity **;**		
			5	inbreeding increases likelihood of individual possessing two (harmful) recessive alleles (of the same gene) **;**	2 max	
8	(c)		**1**	high , Simpson's Index / biodiversity , means not likely to be , approved / built **;**		**1 ACCEPT** 'will not be' as AW for 'not likely to be'
				*Any **one** from:*		
			2	damage to biodiversity would be great(er) **;**		**2 IGNORE** habitat **2 ACCEPT** rare species might be affected
			3	*idea that* planning decisions are often based on factors other than biodiversity **;**	2 max	**3 ACCEPT** EIAs also assess (measures to minimise) impact **3 ACCEPT** the area might be an SSSI already

Question			Expected Answers		Mark	Additional Guidance
8	(d)		1	enzymes not denatured **;**		**DO NOT CREDIT** if the answer states that the bacterium has been denatured
				*Any **two** from*		
			2	decay / food spoilage , is slow(er) **;**		
			3	molecules / enzymes / substrates , have little / AW , kinetic energy / KE / E_k **;**		**3 DO NOT CREDIT** no kinetic energy
			4	fewer collisions , between substrate and <u>active site</u> / forming ESC **;**		**4 DO NOT CREDIT** no collisions
			5	(liquid) water availability reduced / AW **;**	**3 max**	
				Total	**[8]**	

APPENDIX 1 – this contains a generic mark scheme grid

Mark Scheme Conventions

The following conventions appear in the Mark Scheme

1. 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.

2. Solidus /. A solidus indicates alternative ways that a mark might be gained for a given Mark Point.

3. 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 to see if something creditworthy appears later in the response.

4. 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.

5. *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 such as those related to environmental or health issues.

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