

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.

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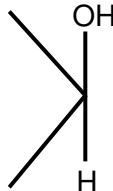
These are the annotations, (including abbreviations), including those used in scoris, which are used when marking

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

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 <div style="border: 1px solid black; display: inline-block; padding: 2px;">active and artificial</div> <div style="border: 1px solid black; display: inline-block; width: 20px; height: 20px; text-align: center; vertical-align: middle;">✓</div> ;	1	DO NOT CREDIT if there is a tick in any other box
2	(b)	(i)		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
		viral RNA , acts as , host cell / m , RNA ; RNA , carries , code / sequence (for viral protein) ; (to) ribosomes ;	2 max	

Question		Expected Answers	Mark	Additional Guidance												
2	(b) (ii)	<p>altered base sequence (of viral RNA) means , altered , primary structure / (sequence of) amino acids ;</p> <p>R-groups / disulphide bonds / hydrogen bonds / ionic bonds , interact differently ;</p> <p>tertiary structure is determined by , bonds / R-groups / secondary structure / primary structure / sequence of amino acids ;</p> <p>3-D shape is tertiary structure ;</p>	3 max	<p>ACCEPT if a nucleotide (in RNA) is different the amino acid (in the protein) is different</p> <p>ACCEPT changed as AW for interact differently</p> <p>ACCEPT implication that 3D is tertiary structure</p>												
2	(b) (iii)	<p>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) ;</p>	1	<p>IGNORE so they don't get the flu without further qualification</p> <p>IGNORE because they are at risk of infection</p>												
2	(c)	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td style="text-align: center;">primary response</td> <td style="text-align: center;">secondary response</td> <td></td> </tr> <tr> <td style="text-align: center;">concentration of antibodies produced</td> <td style="text-align: center;">low(er)</td> <td style="text-align: center;">high(er)</td> <td style="text-align: center;">;</td> </tr> <tr> <td style="text-align: center;">duration of response</td> <td style="text-align: center;">short(er)</td> <td style="text-align: center;">long(er)</td> <td style="text-align: center;">;</td> </tr> </table>		primary response	secondary response		concentration of antibodies produced	low(er)	high(er)	;	duration of response	short(er)	long(er)	;	2	<p>ACCEPT unambiguous AW</p> <p>IGNORE numbers</p> <p>ACCEPT stated time periods where secondary response is longer than primary</p>
	primary response	secondary response														
concentration of antibodies produced	low(er)	high(er)	;													
duration of response	short(er)	long(er)	;													

Question		Expected Answers	Mark	Additional Guidance
2	(d)	<p>helper cells , release , cytokines / interleukins or helper cells , activate / stimulate / AW , B cells ;</p> <p>or helper cells , produce (T) memory cells ;</p> <p>killer / cytotoxic , cells , secrete / release , toxic substances / hydrogen peroxide / H₂O₂ / perforin or killer / cytotoxic , cells , kill / AW , infected cells ;</p> <p>or killer cells , produce (T) memory cells ;</p> <p>memory cells , allow a , secondary / faster , (immune) response ;</p> <p>AVP ;</p>	2 max	<p>CREDIT cause B cells to , differentiate / proliferate IGNORE B memory cells ACCEPT involved in clonal selection</p> <p>AWARD memory cells once only anywhere in the answer</p> <p>ACCEPT lysins IGNORE enzymes</p> <p>IGNORE kill / attack / enter , pathogens ACCEPT killer cells , target / attack , infected cells</p> <p>AWARD memory cells once only anywhere in the answer</p> <p>AWARD memory cells once only anywhere in the answer</p> <p>AWARD 1 mark for suppressor cells / regulator cells , stop immune response</p>
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) <u>globular</u> , 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 ;	5 max	<p>2 ACCEPT prosthetic groups form part of the enzyme</p> <p>5 ACCEPT affects , ionic / hydrogen , bonds in active site</p> <p>6 IGNORE in context of prosthetic group</p> <p>7 ACCEPT help the substrate bind to the active site 7 ACCEPT make ESC formation easier</p> <p>8 ACCEPT substrate as chemical 8 IGNORE substance</p>
		2	bind to , enzyme / active site / allosteric site ;		
		3	(cofactors / coenzymes , bind to enzyme) temporarily ;		
		4	change , shape / tertiary structure , of active site ;		
		5	affect charges on active site ;		
		6	bind to / interact with , substrate ;		
		7	increase (likelihood of) , substrate binding to active site / ESC formation ;		
		8	carry (named) chemical , between / to , (named) enzymes ;		
Total				[14]	

Question		Expected Answers	Mark	Additional Guidance	
4	(a)	global warming ; <i>example of consequence of climate change</i> mud has dried up / mud now <u>too</u> wet / flooding / disease / (new) herbivore / pest;	2	ACCEPT climate change IGNORE environmental change ACCEPT (new) predator / <u>heavy</u> 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)	<i>Any three from:</i> 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 <u>livestock</u> ;	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)	<p>1 grow / AW , (<i>N. thermarum</i>) in a range of (soil) water content ;</p> <p>2 leave for / over , same / stated , time ;</p> <p>3 measure height / count number of (viable) individuals;</p> <p>4 calculate mean (from the results) ;</p> <p>5 keep two other named variables constant ;</p>	4 max	<p>1 IGNORE in presence and absence of water 1 ACCEPT in context of , seed / cutting / plug etc</p> <p>2 IGNORE rate</p> <p>3 ACCEPT measure , (dry) mass / width / spread / number of leaves 3 IGNORE measure growth</p> <p>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</p> <p>5 ACCEPT (soil) pH / mineral content / type / mass 5 ACCEPT temperature / CO₂ 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</p>
4	(d)	(i)	Convention on International Trade in Endangered Species / CITES ;	<p>ACCEPT CITES acronym even if incorrect words are given ACCEPT cites / Cites IGNORE extra information that is not contradictory</p>
4	(d)	(ii)	Rio <u>Convention</u> / (Rio) <u>Convention</u> on <u>Bio</u> (logical) <u>Diversity</u> ;	<p>IGNORE extra information that is not contradictory</p>

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

Question	Expected Answers	Mark	Additional Guidance
5	<p>C1 damage to / paralyses , cilia / ciliated epithelium ;</p> <p>C2 over-production of mucus by <u>goblet</u> cells ;</p> <p>C3 persistent / AW / smoker's , cough to , remove mucus / remove (trapped) pathogens / improve air-flow ;</p> <p>C4 an example of damage to airways ;</p> <p>B1 mucus , accumulates / not wafted by cilia ; B2 <u>chronic</u> bronchitis ;</p> <p>E1 phagocytes , release <u>elastase</u> / break down <u>elastin</u> ;</p> <p>E2 loss of alveolar , recoil / <u>elasticity</u> ; E3 emphysema / COPD ; E4 damage to alveoli reduces surface area (to volume ratio) for , gas exchange / O₂ uptake ;</p> <p>L1 causes <u>mutations</u> (in cells lining airways) ;</p> <p>L2 <u>uncontrolled</u> cell , division / multiplication ;</p> <p>L3 (lung) cancer / formation of tumour(s) ;</p>	8	<p>C1 IGNORE cilia die / stick together C1 ACCEPT destroys cilia</p> <p>C2 Must contain the idea of more mucus than normal</p> <p>C3 Benefits of coughing must be clearly stated</p> <p>C4 forms scar tissue / increases wall thickness / reduces lumen diameter / inflammation / smooth muscle formation C4 IGNORE reference to alveoli for this marking point</p> <p>B1 & C3 Repeated coughing to remove accumulated mucus = 2 marks</p> <p>E1 IGNORE white blood cells E1 ACCEPT macrophages / monocytes / neutrophils</p> <p>E4 IGNORE increased diffusion distance</p> <p>L1 ACCEPT contains mutagens L1 IGNORE carcinogens</p> <p>L2 IGNORE growth L2 IGNORE ref to speed of cell division</p> <p>L3 ACCEPT formation of , mass / lump , of cells</p>
	<p><i>QWC – range of effects</i> Marks with 3 different letters have been awarded.</p>	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 , protists 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)	<p>1 <i>idea that 3 domains fits phylogeny better ;</i></p> <p>2 (there are) key / many / fundamental / important , differences between , bacteria / prokaryotes , and , eukaryotes / other (4) kingdoms ;</p> <p>3 eukaryotes all have , nucleus / membrane-bound organelles / 80S ribosomes ;</p> <p>4 (there are) key / many / fundamental / important , differences between bacteria and archaea ;</p> <p>5 bacteria and archaea have different , cell membrane / flagella / (named) enzymes / transcription / DNA replication / RNA ;</p>	3 max	<p>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</p> <p>1 IGNORE clearer</p> <p>1 IGNORE reference to common ancestors</p> <p>2 ACCEPT there are fundamental similarities between the 4 eukaryotic kingdoms that are not shared with prokaryotes</p> <p>4 ACCEPT 'there are good reasons why prokaryotes should be split'</p> <p>4 ACCEPT 'bacteria and archaea are more different than we thought'</p>
Total				[11]	

Question		Expected Answers	Mark	Additional Guidance
7	(a)	<p>1 central , C / carbon (atom) ;</p> <p>2 NH₂ / amine (group) ;</p> <p>3 COOH / carboxyl (group) opposite amine group ;</p> <p>4 CH₃ / methyl (group) , opposite , hydrogen / H ;</p>	4	<p>CREDIT displayed formulae for groups throughout</p> <p>1 DO NOT CREDIT if joined to another group by an incorrect bond</p> <p>2 ACCEPT amino group / HNH</p> <p>3 ACCEPT carboxylic (acid) group</p> <p>3 DO NOT CREDIT if single bond drawn between C and O</p> <div style="text-align: center;"> <p style="text-align: right;">= 4 marks</p> </div> <p>If diagram is correct, IGNORE contradictory prose. If diagram is incorrect, DO NOT AWARD mark for correct prose</p>
7	(b)	(i)	<p>increases level of / produces (more), low density lipoproteins / LDL ;</p> <p>LDLs carry cholesterol from <u>liver</u> to , (named) tissues / cells / blood ;</p> <p>decreases the activity of (LDL) receptors (on cells) / less binding (of LDL) to cells ;</p>	<p>ACCEPT converted to LDLs</p> <p>IGNORE saturated fats contain LDLs</p> <p>2 max</p>

Question		Expected Answers	Mark	Additional Guidance
7	(b) (ii)	<p>1 (increased) deposition of , fat / lipid / cholesterol / LDL (in artery wall) ;</p> <p>2 in artery wall / under endothelium ;</p> <p>3 atherosclerosis / formation of atheroma ;</p> <p>4 narrowing / AW , of <u>lumen</u> of <u>coronary</u> artery ;</p> <p>5 reduced / restricted , blood flow ;</p> <p>6 less oxygen delivered to , cardiac / heart , <u>muscle</u> ;</p>	4 max	<p>1 ACCEPT 'build up' as AW for deposit</p> <p>2 ACCEPT under , epithelium / lining of artery wall</p> <p>3 ACCEPT plaque formation 3 IGNORE arterio- / arth-</p> <p>4 IGNORE conary</p> <p>6 ACCEPT myocardium gets less O₂</p>
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 ;	2 max	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.
		2	<i>Any one from:</i> mutation is , random / spontaneous / chance ;		
		3	mutation is , change / damage , to , DNA / base / nucleotide sequence ;		
		4	<u>inbreeding</u> reduces , gene pool / range of alleles / genetic variation / genetic diversity ;		
		5	<u>inbreeding</u> increases likelihood of individual possessing two (harmful) recessive alleles (of the same gene) ;		
8	(c)	1	high , Simpson's Index / biodiversity , means not likely to be , approved / built ;	2 max	1 ACCEPT 'will not be' as AW for 'not likely to be' 2 IGNORE habitat 2 ACCEPT rare species might be affected 3 ACCEPT EIAs also assess (measures to minimise) impact 3 ACCEPT the area might be an SSSI already
		2	<i>Any one from:</i> damage to <u>biodiversity</u> would be <u>great(er)</u> ;		
		3	<i>idea that</i> planning decisions are often based on factors other than biodiversity ;		

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