

GCE

Biology

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

Advanced Subsidiary GCE

Mark Scheme for June 2017

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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 used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

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

*Quality of Written Communication

Question		Expected Answers	Mark	Additional Guidance
1	(a)	(i)		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
			1	ACCEPT (both) have contractile vacuole IGNORE membrane bound organelles
		(ii)	1 max	ACCEPT only <i>Euglena</i> has food vacuole IGNORE flagellum
		(iii)	2	IGNORE Protista IGNORE Protista
	(b)	(i)	1	
		<p>domain ;</p> <p><i>kingdoms</i></p> <p>1 4 (of 5) / all but 1 , kingdoms are eukaryotic ; ora</p> <p>2 <i>idea that</i> prokaryotes fundamentally different from eukaryotes ;</p> <p><i>domains</i></p> <p>3 (Eu / true) bacteria different from Archaea ;</p> <p>4 <i>idea that</i> Archaea share some features with eukaryotes ref to , differences / similarities in , RNA / cell wall / fatty</p> <p>5 acids / RNA polymerase / histones / plasmids / spore formation ;</p> <p>6 more / new , evidence / information , than before</p> <p>7 (3 domains more accurately) reflects , phylogeny / evolutionary relationship ;</p>	3 max	<p>1 ACCEPT 4 eukaryotic kingdoms listed</p> <p>2 ACCEPT example of key difference, e.g. only kingdom to lack nucleus</p> <p>4 CREDIT Archaea more closely related to eukaryotes</p> <p>5 ACCEPT other detail of similarity / difference</p> <p>6 Must be a clear statement about changing scientific ideas over time</p>

Question		Expected Answers	Mark	Additional Guidance
	(c)	<p>1 first name is genus (name) and second name is species (name) ;</p> <p>2 (e.g.) <i>Homo</i> is genus and <i>sapiens</i> is species ;</p> <p>3 each <u>species</u> has different (binomial) name ;</p> <p>4 closely related species have same , first / genus / generic , name ;</p> <p>5 first / genus / generic , name has capital initial letter and second / species / specific , name has lower case (initial letter) ;</p> <p>6 latinised / universal / scientific , name ;</p> <p>7 italicised (in print) / underlined (when hand written) ;</p>	4 max	<p>1 ACCEPT genus then species</p> <p>6 ACCEPT Latin</p>
	(d)	<p>(degree of similarity between) DNA , base / nucleotide , sequence ;</p> <p>amino acid sequence ;</p> <p>(in) cytochrome C / haemoglobin ;</p>	1 max	ACCEPT order of DNA bases
Total			[13]	

Question		Expected Answers		Mark	Additional Guidance
2	(a)	tar / benz(o)pyrene / benzene / formaldehyde ;		1	ACCEPT other named carcinogen in cigarette smoke
	(b)	1	tar builds up in <u>alveoli</u> ;	7 max	3 ACCEPT paralyses / destroys , cilia 3 IGNORE kills cilia 5 IGNORE smoker's cough 8 ACCEPT formation of scar tissue 11 CREDIT macrophage / monocyte 11 IGNORE white blood cells 12 IGNORE no , elastin / elasticity / elastic tissue 13 ACCEPT no recoil
		2	(tar / mucus) increases diffusion distance / slower diffusion ;		
		3	damage to , cilia / ciliated epithelial cells ;		
		4	overproduction of mucus / stimulation of goblet cells ;		
		5	mucus / pathogens , build up / collect / not removed (from lung) ;		
		6	(increased susceptibility to) infection ;		
		7	chronic bronchitis ;		
		8	damage to , epithelium / smooth muscle (of airways) ;		
		9	reduced <u>lumen</u> (of airways) ;		
		10	restricted air <u>flow</u> ;		
		11	phagocytes / neutrophil , release , enzymes / elastase ;		
		12	(elastase causes) reduced / loss of , elastin / elastic tissue / elasticity ;		
		13	reduced recoil (during expiration) ;		
		14	emphysema / COPD ;		
		7 max			
		QWC ;		1	Award if: Mp 7 and 14 have been awarded and 2 other marks from 2 different sections
				8 max	
Total				[9]	

Question			Expected Answers	Mark	Additional Guidance
3	(a)	(i)	disaccharide ;	1	ACCEPT reducing sugar
		(ii)	glycosidic ; (α) 1-4 ; between OH groups (on different glucose molecules) ; condensation ; water molecule produced ;	5	CREDIT unambiguous answers on a diagram DO NOT CREDIT if diagram contradicts text CREDIT anywhere seen ACCEPT bond correctly drawn between 2 glucose molecules that show OH groups on C ₁ and C ₄
		(iii)	starch / glycogen / sucrose ;	1	ACCEPT any correct carbohydrate DO NOT CREDIT cellulose
	(b)	(i)	(from) blue to , red / orange ;	1	
		(ii)	glucose / it , is a reducing sugar ;	1	ACCEPT a reducing sugar is present IGNORE contains a reducing sugar CREDIT glucose has a carbonyl group CREDIT glucose reduces , Benedict's / copper (ions)
		(iii)	more objective / less subjective / quantifiable / numeric / quantitative ; (instrument has) greater <u>precision</u> ;	1 max	ACCEPT idea that chart requires judgement IGNORE accurate / reliable / repeatable
		(iv)	0.9 ; ;	2	AWARD 2 marks for the correct answer. <i>Max 1</i> if given as more than 2 decimal places AWARD 1 mark if evidence of 3.6 read from graph or there is a vertical line drawn from the curve to the x-axis at 3.6 g dm ⁻³ AWARD 1 mark ecf for correct calculation from incorrect reading

Question		Expected Answers	Mark	Additional Guidance
	(v)	there might have been other , reducing sugars / sugars giving positive result , present ;	1	
(c)	(i)	(set to) zero / use a blank / calibrate to 0 ; (zero with) solution (resulting from Benedict's test) containing zero glucose ;	2 max	
	(ii)	<p>1 use excess Benedict's ; 2 same concentration of Benedict's ; 3 use , red / same , filter ; 4 same volume of fruit drink ; 5 same volume(s) of , filtrate ;</p> <p>6 <i>idea of sufficient</i> , time / temperature , for reaction to be complete</p>	2 max	<p>IGNORE replicates / more concentrations IGNORE removal of precipitate</p> <p>1 ACCEPT same volume of Benedict's</p> <p>4 & 5 If neither mp 4 nor 5 have been awarded AWARD 1 mark for 'same volume of solution(s) / liquid(s)'</p> <p>6 ACCEPT same , time / temperature</p>
Total			[17]	

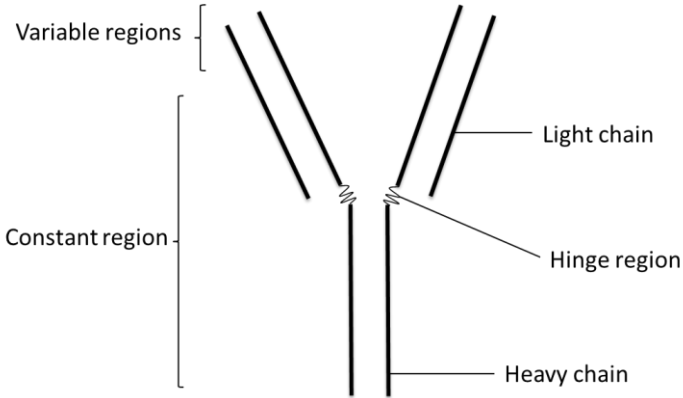
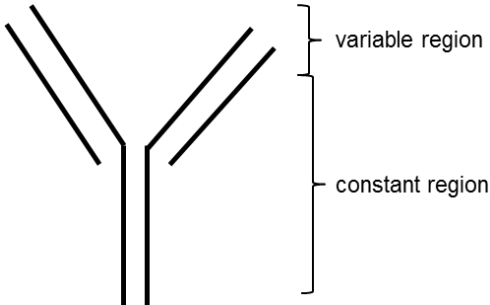
Question			Expected Answers	Mark	Additional Guidance															
4	(a)	(i)	membrane bound / in a nucleus ; ora	1	Assume answer refers to animal cell unless stated otherwise. ACCEPT in plasmids in bacteria															
		(ii)	<table border="1"> <thead> <tr> <th></th> <th>DNA</th> <th>DNA gyrase</th> </tr> </thead> <tbody> <tr> <td><i>Elements present</i></td> <td>C, H, O, N, P</td> <td>C, H, O, N, S</td> </tr> <tr> <td>Type of molecule</td> <td>nucleic acid / polynucleotide</td> <td>protein / polypeptide</td> </tr> <tr> <td>Name of monomer</td> <td>nucleotide</td> <td>amino acid</td> </tr> <tr> <td>Bond linking monomers</td> <td>phosphodiester / sugar-phosphate</td> <td>peptide</td> </tr> </tbody> </table>		DNA	DNA gyrase	<i>Elements present</i>	C, H, O, N, P	C, H, O, N, S	Type of molecule	nucleic acid / polynucleotide	protein / polypeptide	Name of monomer	nucleotide	amino acid	Bond linking monomers	phosphodiester / sugar-phosphate	peptide	3	<p>Mark the first answer in each cell. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer, then = 0 marks</p> <p>Award 1 mark for a correct row</p> <p>IGNORE enzyme</p> <p>IGNORE dipeptide ACCEPT phospho-sugar</p>
	DNA	DNA gyrase																		
<i>Elements present</i>	C, H, O, N, P	C, H, O, N, S																		
Type of molecule	nucleic acid / polynucleotide	protein / polypeptide																		
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Bond linking monomers	phosphodiester / sugar-phosphate	peptide																		

Question		Expected Answers	Mark	Additional Guidance
	(b)	<p>1 change in base sequence of DNA (of the gene) ;</p> <p>2 change in (m)RNA ;</p> <p>3 (different) primary structure / amino acid sequence ;</p> <p>4 (different) secondary structure ;</p> <p>5 (different) tertiary structure ;</p> <p>6 (different) 3D-shape ;</p> <p>7 shape of enzyme's binding site (for fluoroquinolone) changes ;</p> <p>8 (DNA gyrase) no longer complementary to fluoroquinolone ;</p>	5 max	<p>7 DO NOT CREDIT active site</p> <p>8 DO NOT CREDIT if answer implies fluoroquinolone binds to active site</p>
	(c) (i)	<p>1 reduced number of / kills / slows , pathogens ;</p> <p>2 prevents / reduced / no , infection / (infectious) disease ;</p> <p>3 less <u>energy</u> spent fighting , disease / pathogen ;</p> <p>4 greater proportion of <u>food</u> / more <u>energy</u> , used for growth ;</p> <p>5 <i>idea that</i> fewer periods of low food consumption ;</p> <p>6 <u>more</u> growth / AW ;</p>	3 max	<p>1 Must be in context of individual animals</p> <p>2 IGNORE sick / poorly / illness</p> <p>2 ACCEPT in context of spread of infection</p> <p>2 IGNORE treat</p> <p>5 e.g. animals won't go 'off their food'</p> <p>6 e.g. <u>greater</u> increase in , mass / size</p> <p>6 IGNORE more , food / milk / bacon etc</p> <p>6 IGNORE yield</p>
	(ii)	(bacteria develop) <u>resistance</u> ;	1 max	
Total			[13]	

Question			Expected Answers	Mark	Additional Guidance																		
5	(a)	(i)	<table border="1"> <thead> <tr> <th>Statement or term</th> <th></th> </tr> </thead> <tbody> <tr> <td>Continuous</td> <td>✓</td> </tr> <tr> <td>Controlled only by few genes</td> <td></td> </tr> <tr> <td>Discrete categories</td> <td></td> </tr> <tr> <td>Discontinuous</td> <td></td> </tr> <tr> <td>Intermediates present</td> <td>✓ ;</td> </tr> <tr> <td>Polygenic</td> <td>✓ ;</td> </tr> <tr> <td>Qualitative</td> <td></td> </tr> <tr> <td>Quantitative</td> <td>✓ ;</td> </tr> </tbody> </table>	Statement or term		Continuous	✓	Controlled only by few genes		Discrete categories		Discontinuous		Intermediates present	✓ ;	Polygenic	✓ ;	Qualitative		Quantitative	✓ ;	3	<p>One mark for each correct tick. If more than 3 ticks given, -1 mark for each incorrect tick</p> <p>IGNORE hybrid ticks</p>
Statement or term																							
Continuous	✓																						
Controlled only by few genes																							
Discrete categories																							
Discontinuous																							
Intermediates present	✓ ;																						
Polygenic	✓ ;																						
Qualitative																							
Quantitative	✓ ;																						

Question		Expected Answers		Mark	Additional Guidance
	(b)	1	<u>natural selection</u> ;	6 max	1 ACCEPT directional / artificial , selection
		2	<u>genetic variation</u> ;		2 IGNORE 'survival of the fittest' as this is not an explanation
		3	(due to) mutation ;		3 CREDIT refs to meiosis
		4	(mutation is) spontaneous / random ;		
		5	<i>idea of overproduction of elephant offspring</i> ;		7 IGNORE refs to reproduction 7 CREDIT ora for long tusked animals
		6	hunting acts as a <u>selection pressure</u> ;		
		7	short-tusked elephants , less likely to be killed / more likely to survive ;		
		8	pass on , mutation / (mutated) allele (to offspring) ;		8 Answer must imply allele for tusk length, not simply "alleles".
		8			8 ACCEPT 'gene' if 'gene for short tusk' is implied.
		8			8 DO NOT CREDIT characteristic
		9	increase frequency of allele (for short tusks) ; ora		
		10	over (many) generations ;		
	(c)	CITES ;		1	If written as words ACCEPT any words beginning with the correct letters as long as T is Trade IGNORE CITIES

Question		Expected Answers	Mark	Additional Guidance
	(d)	<p>protected areas / sanctuary / reserves / parks ;</p> <p>protect / prevent destruction of , <u>habitat</u> ;</p> <p>monitoring (of elephants) / tagging ;</p> <p>ensure adequate food is available ;</p> <p>qualified ref. to education ;</p> <p>AVP ; ;</p>	3 max	<p>ACCEPT ban hunting / employ rangers</p> <p>IGNORE remove predators / don't kill elephants</p> <p>e.g. to tourists about buying ivory products</p> <p>e.g. promotion of (eco)tourism / financial compensation to farmers / game corridors / method for keeping elephants off farmland</p>
			Total	[13]

Question			Expected Answers	Mark	Additional Guidance
6	(a)	(i)	<p>1 one constant region labelled ;</p> <p>2 two variable regions labelled at 2 ends (of forks) ;</p> <p>3 hinge region labelled at correct position ;</p> <p>4 light and heavy chains labelled in correct position ;</p> 		<p><i>Max 2 if molecule not Y-shaped</i></p> <p>1 ACCEPT any size but must not include variable region</p> <p>2 Must not include whole of 'arms'</p> <p>e.g.</p>  <p>= 2 marks (mp 2, 4)</p>
				3 max	

Question			Expected Answers	Mark	Additional Guidance
			<p>1 <i>primary response</i> involves antigen presentation ;</p> <p>2 produces fewer antibodies ; ora 3 has shorter duration ; ora</p> <p>4 clonal selection ; 5 clonal expansion / mitosis ; 6 differentiation ;</p> <p>7 plasma cells produce antibodies ;</p> <p><i>secondary response</i> 8 memory cells (present at beginning) ;</p> <p>9 presence of more (memory) cells allows clonal , selection / expansion , to happen more quickly ;</p>	5 max	<p>1 CREDIT description 1 IGNORE antigen presenting cells without reference to a process 1 ACCEPT in context of T-helper cells or B cells</p> <p>4 ACCEPT in context of T-(helper) cells 5 ACCEPT in context of T-(helper) cells 6 ACCEPT in context of T-(helper) cells</p> <p>7 IGNORE effector cells</p>
			QWC ;	1	AWARD if mp 7 and mp 9 both given
		(iii)	<p><i>idea that</i> pathogen is killed before , it makes you ill / symptoms appear ;</p> <p><i>idea that</i> less , medication / treatment , required ;</p>	1 max	Answer must mention (named) pathogen ACCEPT e.g. bacterium doesn't get a chance to make you ill

Question		Expected Answers	Mark	Additional Guidance
	(b)	globular ; polar ; hydrophilic ;	3	IGNORE hydrophilic ACCEPT charged
	(c) (i)	(foetus) does not produce own <u>antibodies</u> / (foetus's) immune system not activated ;	1	ACCEPT foetus does not have to produce antibodies
	(ii)	natural / short term ;	1	
		Total	[15]	

Question		Expected Answers	Mark	Additional Guidance
7	(a)	<p><i>Trend</i></p> <p>1 the higher the (blood) cholesterol, the higher the risk of heart disease ;</p> <p><i>Comparison</i> (any 2 of the following mark points)</p> <p>2 (always) lower (risk of CHD) than men (at equivalent blood cholesterol) ; ora</p> <p>3 difference (between men and women) , larger / AW , at , high / >239 mg 100cm⁻³ , blood cholesterol ; ora</p> <p>4 two figures with units to support ;</p> <p style="text-align: right;">2 max</p>	3 max	<p>Max 2 if mp 1 not awarded</p> <p>1 Answers must refer to cholesterol and heart disease ;</p> <p>2 IGNORE tends to be lower</p> <p>3 ACCEPT rate of increase in men is higher</p> <p>4 Figures must support (an attempt at) mp 2 or 3</p>
	(b)	<p>1 cholesterol / fat , deposited , <u>in</u> arterial walls / under lining (of artery wall) ;</p> <p>2 reduced / narrowed , <u>lumen</u> of (coronary) arteries ;</p> <p>3 restricted / reduced , blood flow in <u>coronary</u> arteries ;</p> <p>4 increased likelihood of coronary thrombosis ;</p>	3 max	<p>1 ACCEPT LDL deposited in artery wall</p> <p>1 ACCEPT atheroma / plaque , builds up in artery wall</p> <p>3 IGNORE no blood flow</p> <p>4 ACCEPT description of thrombus , detachment / lodging in coronary arteries</p>

Question		Expected Answers	Mark	Additional Guidance
	(c)	<p>1 (correlation / the data) does not imply causal link / AW ;</p> <p>2 CHD could <i>cause</i> high cholesterol ;</p> <p>3 another factor could be causing the increase in , <u>both</u> / CHD <u>and</u> cholesterol ;</p> <p>4 the correlation could be coincidental ;</p> <p>5 only 3 broad categories of concentration could disguise variation within range ;</p> <p>6 unknown sample size ;</p> <p>7 only one study ;</p> <p>8 men and women could have <u>different</u> , underlying health conditions / age ranges ;</p>	3 max	<p>1 IGNORE there is no causal link</p> <p>3 IGNORE CHD is multifactorial</p> <p>Answer must reference a potential difference between the groups of men and women</p>
		Total	[9]	

Question			Expected Answers	Mark	Additional Guidance
8	(a)	(i)	<p>can interbreed to produce fertile offspring ;</p> <p><i>award 1 mark for any two of the following</i></p> <p>(group of) organisms with similar , shape / appearance / anatomy</p> <p>(group of) organisms with similar , physiology / biochemistry</p> <p>(group of) organisms with similar behaviour ;</p>	2	<p>ACCEPT breed / mate / reproduce as AW for interbreed</p> <p>ACCEPT genetics</p>
		(ii)	<p>genetic ;</p> <p>habitat ;</p>	2	ACCEPT gene
	(b)		<p>new , drugs / medicines , needed ;</p> <p>(many / new) drugs / medicines , discovered in , plants / organisms ;</p> <p><i>idea that</i> higher biodiversity means larger range of , plants / organisms , from which to choose ;</p> <p><i>idea that</i> synthetic compounds can be produced using the natural compound as a pattern ;</p>	2 max	<p>IGNORE antibiotics throughout</p> <p>ACCEPT species</p>

Question		Expected Answers	Mark	Additional Guidance
	(c)	<p>1 genetic variation / AW ;</p> <p>2 (used for) selective breeding / genetic engineering ;</p> <p>3 (variety) might be useful in a changing climate ;</p> <p>4 <i>idea that</i> lost domestic variety could be recreated using wild ancestor ;</p> <p>5 (maintain population of) pollinators ;</p> <p>6 (maintain population of) agents of biological control ;</p> <p>7 source of a new medicine for livestock ;</p>	3 max	<p>2 ACCEPT description of genetic engineering or selective breeding</p> <p>3 ACCEPT examples of features useful in a different climate, e.g. drought resistance</p> <p>7 IGNORE antibiotics</p>
	(d)	<p>crops (growing in new areas) encounter , new / different , diseases / pests ;</p> <p>(crops) have , little / no , <u>resistance</u> ;</p> <p><i>idea that</i> changed temperatures result in higher , pathogen / pest , numbers ;</p>	2 max	
		Total	[11]	

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning

Telephone: 01223 553998

Facsimile: 01223 552627

Email: general.qualifications@ocr.org.uk

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