OCR
Oxford Cambridge and RSA

GCE

Biology

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

Advanced Subsidiary GCE

Mark Scheme for June 2017

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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.

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

Question			Expected Answers		Mark	Additional Guidance
	(c)		**1**	first name is genus (name) **and** second name is species (name) **;**		**1 ACCEPT** genus then species
			2	(e.g.) *Homo* is genus **and** *sapiens* is species **;**		
			3	each <u>species</u> has different (binomial) name **;**		
			4	closely related species have same , first / genus / generic , name **;**		
			5	first / genus / generic , name has capital initial letter **and** second / species / specific , name has lower case (initial letter) **;**		
			6	latinised / universal / scientific , name **;**		**6 ACCEPT** Latin
			7	italicised (in print) / underlined (when hand written) **;**	**4 max**	
	(d)		*(degree of similarity between)* DNA **,** base / nucleotide **,** sequence **;**			**ACCEPT** order of DNA bases
			amino acid sequence **;**			
			(in) cytochrome C / haemoglobin **;**		**1 max**	
				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 alveoli ;		
			2	(tar / mucus) increases diffusion distance / slower diffusion ;		
			3	damage to , cilia / ciliated epithelial cells ;		**3 ACCEPT** paralyses / destroys , cilia **3 IGNORE** kills cilia
			4	overproduction of mucus / stimulation of goblet cells ;		
			5	mucus / pathogens , build up / collect / not removed (from lung) ;		**5 IGNORE** smoker's cough
			6	(increased susceptibility to) infection ;		
			7	chronic bronchitis ;		
			8	damage to , epithelium / smooth muscle (of airways) ;		**8 ACCEPT** formation of scar tissue
			9	reduced lumen (of airways) ;		
			10	restricted air flow ;		
			11	phagocytes / neutrophil , release , enzymes / elastase ;		**11 CREDIT** macrophage / monocyte **11 IGNORE** white blood cells
			12	(elastase causes) reduced / loss of , elastin / elastic tissue / elasticity ;		**12 IGNORE** no , elastin / elasticity / elastic tissue
			13	reduced recoil (during expiration) ;		**13 ACCEPT** no recoil
			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 precision ;	1 max	**ACCEPT** idea that chart requires judgement **IGNORE** accurate / reliable / repeatable
		(iv)	0.9 ; ;	2	**AWARD** 2 marks for the correct answer. *Max 1* 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)	**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 ; **6** *idea of* sufficient , time / temperature , for reaction to be complete	2 max	**IGNORE** replicates / more concentrations **IGNORE** removal of precipitate **1 ACCEPT** same volume of Benedict's **4 & 5** If neither mp 4 nor 5 have been awarded **AWARD** 1 mark for 'same volume of solution(s) / liquid(s)' **6 ACCEPT** same , time / temperature
			Total	[17]	

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Mark</th><th>Additional Guidance</th></tr>
<tr><td>4</td><td>(a)</td><td>(i)</td><td>membrane bound / in a nucleus ; ora</td><td>1</td><td>Assume answer refers to animal cell unless stated otherwise.

ACCEPT in plasmids in bacteria</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>
<table>
<tr><th></th><th>DNA</th><th>DNA gyrase</th></tr>
<tr><td>Elements present</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>
</table>
; ; ;
</td><td>3</td><td>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

Award 1 mark for a correct row

IGNORE enzyme

IGNORE dipeptide
ACCEPT phospho-sugar</td></tr>
</table>

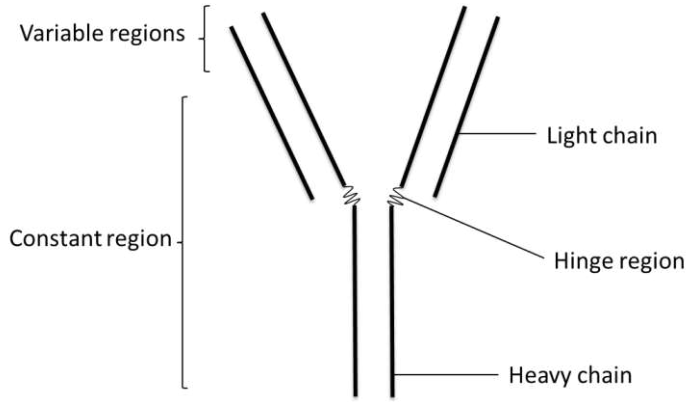
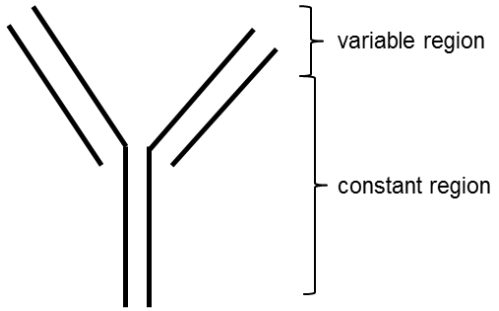
Question			Expected Answers	Mark	Additional Guidance
	(b)		**1** change in base sequence of DNA (of the gene) **;** **2** change in (m)RNA **;** **3** (different) primary structure / amino acid sequence **;** **4** (different) secondary structure **;** **5** (different) tertiary structure **;** **6**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

<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>
<table>
<tr><th>Statement or term</th><th></th><th></th></tr>
<tr><td>Continuous</td><td>✓</td><td></td></tr>
<tr><td>Controlled only by few genes</td><td></td><td></td></tr>
<tr><td>Discrete categories</td><td></td><td></td></tr>
<tr><td>Discontinuous</td><td></td><td></td></tr>
<tr><td>Intermediates present</td><td>✓</td><td>;</td></tr>
<tr><td>Polygenic</td><td>✓</td><td>;</td></tr>
<tr><td>Qualitative</td><td></td><td></td></tr>
<tr><td>Quantitative</td><td>✓</td><td>;</td></tr>
</table>
</td><td>3</td><td>One mark for each correct tick.
If more than 3 ticks given, -1 mark for each incorrect tick

IGNORE hybrid ticks</td></tr>
</table>

Question			Expected Answers		Mark	Additional Guidance	
	(b)		**1**	natural selection **;**		**1**	**ACCEPT** directional / artificial , selection
						2	**IGNORE** 'survival of the fittest' as this is not an explanation
			2	genetic variation **;**			
			3	(due to) mutation **;**		**3**	**CREDIT** refs to meiosis
			4	(mutation is) spontaneous / random **;**			
			5	*idea of* overproduction of elephant offspring **;**			
			6	hunting acts as a selection pressure **;**			
			7	short-tusked elephants , less likely to be killed / more likely to survive **;**		**7**	**IGNORE** refs to reproduction
						7	**CREDIT** ora for long tusked animals
			8	pass on **,** mutation / (mutated) allele (to offspring) **;**		**8**	Answer must imply allele for tusk length, not simply "alleles".
						8	**ACCEPT** 'gene' if 'gene for short tusk' is implied.
						8	**DO NOT CREDIT** characteristic
			9	increase frequency of allele (for short tusks) **;** ora			
			10	over (many) generations **;**	**6 max**		
	(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)		protected areas / sanctuary / reserves / parks **;** protect / prevent destruction of , <u>habitat</u> **;** monitoring (of elephants) / tagging **;** ensure adequate food is available **;** qualified ref. to education **;** AVP **; ;**	**3 max**	**ACCEPT** ban hunting / employ rangers **IGNORE** remove predators / don't kill elephants e.g. to tourists about buying ivory products e.g. promotion of (eco)tourism / financial compensation to farmers / game corridors / method for keeping elephants off farmland
			Total	**[13]**	

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

Question			Expected Answers		Mark	Additional Guidance
				primary response		
			1	involves antigen presentation **;**		**1 CREDIT** description **1 IGNORE** antigen presenting cells without reference to a process **1 ACCEPT** in context of T-helper cells or B cells
			2	produces fewer antibodies **;** ora		
			3	has shorter duration **;** ora		
			4	clonal selection **;**		**4 ACCEPT** in context of T-(helper) cells
			5	clonal expansion / mitosis **;**		**5 ACCEPT** in context of T-(helper) cells
			6	differentiation **;**		**6 ACCEPT** in context of T-(helper) cells
			7	plasma cells produce antibodies **;**		**7 IGNORE** effector cells
				secondary response		
			8	memory cells (present at beginning) **;**		
			9	presence of more (memory) cells allows clonal , selection / expansion , to happen more quickly ;	**5 max**	
			QWC ;		**1**	**AWARD** if mp 7 **and** mp 9 both given
		(iii)	*idea that* pathogen is killed before **,** it makes you ill / symptoms appear **;** *idea that* less **,** medication / treatment **,** required **;**		**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)		*Trend* **1** the higher the (blood) cholesterol, the higher the risk of heart disease **;** *Comparison* (*any 2 of the following mark points*) **2** (always) lower (risk of CHD) than men (at equivalent blood cholesterol) **; ora** **3** difference (between men and women) , larger / AW , at , high / >239 mg 100cm^{-3} , blood cholesterol **; ora** **4** two figures with units **to support ;** **2 max**	**3 max**	Max 2 if mp 1 not awarded **1** Answers must refer to cholesterol and heart disease **;** **2 IGNORE** tends to be lower **3 ACCEPT** rate of increase in men is higher **4** Figures must support (an attempt at) mp 2 or 3
	(b)		**1** cholesterol / fat , deposited , in arterial walls / under lining (of artery wall) **;** **2** reduced / narrowed , lumen of (coronary) arteries **;** **3** restricted / reduced , blood flow in coronary arteries **;** **4** increased likelihood of coronary thrombosis **;**	**3 max**	**1 ACCEPT** LDL deposited in artery wall 1 **ACCEPT** atheroma / plaque , builds up in artery wall **3 IGNORE** no blood flow **4 ACCEPT** description of thrombus , detachment / lodging in coronary arteries

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

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

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

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