

F212 Molecules, Biodiversity, Food and Health

Question			Expected Answers	Marks	Additional Guidance
1	(a)		double helix ; anti-parallel ; sugar-phosphate ; hydrogen ;	4	
1	(b)	(i)	percentages / amount , C & G similar (in all organisms) ; percentages / amount , A & T similar (in all organisms) ; <u>different / named , organisms</u> have different proportions of , bases / named base / AW ; greatest similarity between human and grasshopper ; least similarity between <i>E coli</i> and the other three ; <i>E. coli</i> has similar proportions of all bases / <i>E.coli</i> has <u>slightly</u> more CG than AT / (named) eukaryote has more AT than CG ; comparative figs with units to support any statement ;	3 max	mp 1 & 2 DO NOT CREDIT ref to a single organism mp 1 & 2 IGNORE ref to complementary DO NOT CREDIT statements in context of organism size e.g. statement that human has more A than <i>E. coli</i> / human has the most AT / <i>E. coli</i> has the most CG This mark is for a general statement e.g. human C = 19.8% <u>and</u> G = 19.9% human A = 30.9% <u>and</u> <i>E. coli</i> A = 24.7% 'human has more A (30.9%) than wheat (27.3%)' = 2 (mp 3 & 7)

Question			Expected Answers	Marks	Additional Guidance
1	(b)	(ii)	<p>(suggests) A , bonds / pairs / links / connects / joins , to T ; (suggests) C , bonds / pairs / links / connects / joins , to G ; (suggests) purine bonds to pyrimidine ; (evidence for) complementary base pairing / which bases pair with each other / base pairing rules ; suggests bases point ‘inwards’ rather than ‘outwards’ ;</p>	2 max	<p>IGNORE A – T or A = T unqualified IGNORE C – G or C = G unqualified</p> <p>ACCEPT ‘bond’ instead of ‘pair’</p>

Question			Expected Answers	Marks	Additional Guidance												
1	(c)		<p>Award 1 mark per correct row</p> <table><tr><th>feature</th><th>DNA</th><th>RNA</th></tr><tr><td>number of strands</td><td>two / double</td><td>one / single</td></tr><tr><td>bases present</td><td>thymine / T (+ adenine + cytosine + guanine)</td><td>uracil / U (+ adenine + cytosine + guanine)</td></tr><tr><td>sugar present</td><td>deoxyribose</td><td>ribose</td></tr></table>	feature	DNA	RNA	number of strands	two / double	one / single	bases present	thymine / T (+ adenine + cytosine + guanine)	uracil / U (+ adenine + cytosine + guanine)	sugar present	deoxyribose	ribose	3	<p>If a choice of answers is given, do not credit unless both answers are valid (e.g. two and double strands for DNA / ribose and pentose sugar)</p> <hr/> <p>ACCEPT letters instead of names of bases Names of bases must be unambiguous, so DO NOT CREDIT adenosine / thiamine / cysteine / etc. If more bases mentioned than T and U, then all bases must be included</p> <hr/> <p>DO NOT CREDIT dioxyribose / oxyribose/ hexose / sugar IGNORE pentose</p>
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number of strands	two / double	one / single															
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sugar present	deoxyribose	ribose															
1	(d)		<p>carries / transfers, the (complementary DNA) , code / <u>genetic</u> information / copy of gene ; out of the nucleus ; (transfers it) to the, ribosome / RER / site of translation ; for, protein / polypeptide, synthesis ;</p>	2 max	<p>IGNORE transcription DO NOT CREDIT ref to the <u>whole</u> DNA code / molecule</p> <p>ACCEPT ‘to make protein’</p>												
			Total	14													

Question			Expected Answers	Marks	Additional Guidance
2	(a)	(i)	<u>Plasmodium</u> ;	1	Look for correct spelling of generic name but do not penalise the use of lower case initial letter. We are not looking for specific name(s), so IGNORE species name. So e.g. <i>Plasmodium falciparum</i> should be credited but NOT <i>P. falciparum</i> / <i>P. vivax</i> / <i>P. ovale</i> / <i>P. malariae</i>
2	(a)	(ii)	<u>female</u> <i>Anopheles</i> ;	1	CREDIT phonetic spelling but genus must be correct
2	(a)	(iii)	hepatocyte / liver (cell) ; erythrocyte / red blood (cell) ;	1 max	If a choice of answers is given do not credit unless both are valid. DO NOT CREDIT 'RBC' as this is not a name

Question			Expected Answers	Marks	Additional Guidance
2	(b)	1	<u>humoral</u> response ;	7 max	<p>ACCEPT 'forms antigen-antibody complex'</p> <p>DO NOT CREDIT ref to disease alone</p>
		2	(B) cell / lymphocyte , has antigen receptor / carries antibody on its surface ;		
		3	specific to / matches / complementary to , only one <u>antigen</u> ;		
		4	<u>clonal selection</u> ;		
		5	selection / activation , of , appropriate / specific , B lymphocyte / B cell ;		
		6	by , macrophages / antigen presenting cells / dendritic cells / T helper cells / cytokines / interleukins ;		
		7	<u>clonal expansion</u> ;		
		8	(selected cell) divides by mitosis / clones ;		
		9	(B) cells , differentiate / specialise ;		
		10	(B cells) form , plasma / effector , cells ;		
		11	(which) secrete / produce , antibodies ;		
		12	antibodies are , specific / complementary , to <u>antigen</u> ;		
		13	(B cells) form memory cells ;		
		14	Either (memory cells) long-lived / remain in circulation / remain in body / provide immunological memory or (provides) secondary response or faster / stronger , response to subsequent exposure (of same antigen / pathogen / parasite) ;		
			QWC ~ correct sequence ;	1	<p>Clonal selection, then clonal expansion, then differentiation (stages named or described)</p> <p>Use the QWC tool to indicate these in the correct sequence and add 1 mark to the 7max for content when all 3 stages have been addressed in the correct sequence.</p>

Question		Expected Answers	Marks	Additional Guidance
2	(c)	<p><i>Assume that candidates are answering in terms of a person <u>leaving</u> the malarial area (unless otherwise stated).</i></p> <p>no repeat infections / no further exposure (to antigen / pathogen / parasite) ; no booster / lose immunological memory ;</p> <p>limited life for memory cells / numbers of memory cells reduce / memory cells lost ;</p> <p>so no , secondary response / secondary response described ;</p>	2 max	<p>DO NOT CREDIT disease / malaria / bacterium / virus</p> <p>CREDIT converse points if they answer the question in the context of a person <u>staying</u> in the malarial area. e.g. repeat infections ; maintain immunological memory ; memory cells present ; secondary response available ;</p>

Question			Expected Answers	Marks	Additional Guidance
2	(d)		<p>different , strains / species / types (of <i>Plasmodium</i>) ; different antigens ; due to , mutation / variation ;</p> <p>more than one stage in the life cycle (within human) ; different stages have different antigens ;</p> <p>so will need , a different vaccine / components of vaccine , for each , strain / stage ;</p> <p>(parasite) concealed / hidden , in cells ; (parasite) only , exposed / in circulation , for short time ;</p> <p>AVP ;</p>	3 max	<p>DO NOT CREDIT 'disease' or 'malaria' unqualified Max 2 if they think it is a virus / bacterium</p> <p>'different strains will require different vaccines' = 2 (mp 1 & 6)</p> <p>CREDIT antigenic concealment</p> <p>e.g. antigenic , shift / drift eukaryotes have greater capacity for variation antigens (on parasite) change over time when in human</p>
			Total	16	

Question			Expected Answers	Marks	Additional Guidance
3	(a)	(i)	A hydrogen ; B <u>glycosidic</u> ;	2	DO NOT CREDIT 'H bond' as this is not a name Correct spelling only. IGNORE α or β or numbers
3	(a)	(ii)	hydrolysis / addition of water ;	1	
3	(a)	(iii)	β / <u>beta</u> , glucose ;	1	Must be qualified as β or beta or B or b
3	(b)		enzymes are <u>specific</u> ; the , carbohydrate molecules / substrates , are different <u>shapes</u> ; <u>active site</u> and substrate are complementary ; so that substrate will fit / formation of ESC ; lock and key / induced fit ;	3 max	

Question			Expected Answers	Marks	Additional Guidance
3	(c)	(i)	<p>pH <u>much</u> , higher / less acidic , than optimum (for enzyme 2) ;</p> <p>change in charge of active site ;</p> <p>hydrogen / ionic , bonds <u>break</u> ;</p> <p>tertiary structure / 3D shape / active site shape , altered ;</p> <p>enzyme / tertiary structure , <u>denatured</u> ;</p> <p>substrate no longer fits active site / ESC does not form ;</p>	3 max	<p>Needs idea of <u>much</u> greater or <u>too</u> high</p> <p>DO NOT CREDIT just 'higher than' or 'above'</p> <p>DO NOT CREDIT too / more , alkaline</p> <p>DO NOT CREDIT peptide / disulphide , bonds break</p> <p>DO NOT CREDIT in context of heat / vibration</p> <p>IGNORE ref to denaturing active site</p> <p>IGNORE ref to denaturing active site</p> <p>DO NOT CREDIT kill / die</p> <p>'substrate doesn't bind to enzyme' is not quite enough</p>
3	(c)	(ii)	<p><i>Mark 1st response on each numbered line unless no answer on one line, then mark 1st 2 answers</i></p> <p>temperature ;</p> <p>substrate <u>concentration</u> ;</p> <p>enzyme <u>concentration</u> ;</p>	2 max	<p>IGNORE ref to time</p>

Question			Expected Answers	Marks	Additional Guidance
3	(d)		<p>Marking points 2 – 6 can be applied to the standard solutions or the sample</p> <p>1 using , standard / known , concentrations (of reducing sugar) ;</p> <p>2 <u>heat</u> with , Benedicts (solution) / $\text{CuSO}_4 + \text{NaOH}$;</p> <p>3 (use of) same volumes of solutions (each time) ;</p> <p>4 (use of) excess Benedicts ;</p> <p>5 changes to , green / yellow / orange / brown / (brick) red ;</p> <p>6 remove precipitate / obtain filtrate ;</p> <p>7 calibrate / zero , colorimeter ;</p> <p>8 using , a blank / water / unreacted Benedicts ;</p> <p>9 use (red) filter ;</p> <p>10 reading of , transmission / absorbance ;</p> <p>11 more transmission / less absorbance , of filtrate = more sugar present ; ora</p> <p>12 (obtain) <u>calibration</u> curve ;</p> <p>13 <u>plotting</u> , transmission / absorbance , against (reducing) sugar concentration ;</p> <p>14 use reading of unknown sugar solution and read off graph to find conc. ;</p>	6 max	<p>e.g. serial dilutions</p> <p>ALLOW boil / $> 80^\circ\text{C}$ DO NOT CREDIT warm DO NOT CREDIT amount / quantity</p> <p>CREDIT description of method e.g. filtering / centrifuging & decanting</p> <p>ACCEPT 'measure how much light , does / does not , pass through'</p> <p>If precipitate is clearly indicated as being present in sample, ALLOW 'less transmission / more absorbance , = more sugar present'</p>
			Total	18	

Question			Expected Answers	Marks	Additional Guidance
4	(a)	(i)	likely to become extinct / on the verge of extinction / numbers are not sustainable / numbers too low for survival of species / numbers drop below 10% of (original) population ;	1	DO NOT CREDIT 'may' / 'might' / 'could' become extinct CREDIT 'die out' or 'wiped out' instead of extinct
4	(a)	(ii)	133 333 ; ;	2	Award 2 marks for a correct answer, even if no working shown. ALLOW 1 mark for seeing 133 333.3333... if answer is incorrectly rounded or not rounded to a whole number. If the answer is incorrect ALLOW 1 mark for $\frac{4000 \times 100}{3}$
4	(b)	(i)	painkiller still being used ; <i>in captivity – allow reverse argument for in the wild</i> fed uncontaminated food / keep away from painkiller ; health of individuals monitored / treated for disease ; eggs (artificially) incubated / young hand reared ; reduced mortality of young ; provision of mate / females breeding can be manipulated ; protection , from hunting / predation ; competition reduced (between , individuals / species) ;	4 max	IGNORE ref to controlling diet or nutrition e.g. hormones / artificial insemination / artificial selection 'safer environment' is not quite enough

Question			Expected Answers	Marks	Additional Guidance
4	(b)	(ii)	<p>maintain / increase , <u>genetic</u> variation / gene pool ;</p> <p>reduce risk of , inbreeding / breeding between related birds ;</p> <p>different ‘races’ of vulture in different areas / geographical variation / different subspecies ;</p> <p>less likely all contaminated with painkiller ;</p> <p>less risk of losing all individuals due to , disease / natural disaster / human action ;</p>	3 max	<p>In the context of the vultures, rather than ‘biodiversity’</p> <p>CREDIT different alleles</p> <p>DO NOT CREDIT different genes</p> <p>CREDIT ora for idea of promoting outbreeding</p> <p>ALLOW ref to types of (white-backed) vulture</p>
4	(c)		<p>reason or explanation ; ; ;</p> <p><i>Suitable examples include but are not limited to:</i></p> <ul style="list-style-type: none"> • maintains biodiversity • part of food chain / part of ecosystem / part of food web / scavengers • have a right to existence / moral reason • specific religious reason • give pleasure / beautiful creatures • ecotourism • useful product / source of medicine / medical research • genetic resource • saves clearing up / remove carcasses • prevents disease • keeps , rat / dog , population down 	3	<p>CREDIT any three valid suggestions.</p> <p><i>Ignore the numbers on the answer lines.</i></p> <p><i>Mark as prose and award points as they arise.</i></p> <p>The idea of research must be qualified</p>

Question			Expected Answers	Marks	Additional Guidance
4	(d)		ban / make illegal , use of this painkiller ; provide alternative painkillers (that do not have the same ecological impact) ; no hunting / no killing / legal protection , of white-backed vultures ; protected areas / sanctuary / reserves ; provide breeding sites ; prevent habitat destruction ; monitoring (of vultures) / tagging ; feeding programme (for released birds) / provide uncontaminated carcasses ; qualified ref. to education ; promotion of ecotourism ; in case the population falls again , sperm and egg banks / frozen embryos ;	3 max	e.g. to farmers / local people (on importance of vultures)
			Total	16	

Question			Expected Answers	Marks	Additional Guidance
5	(a)	(i)	nucleus / nuclei ;	1	If more than 1 answer given = 0
5	(a)	(ii)	<p><i>mildew ...</i></p> <p>(usually) chitin / not cellulose (cell) , wall ;</p> <p><u>external</u> digestion / secretes enzymes <u>externally</u> ;</p> <p>heterotrophic / saprophytic / saprotrophic / saprobiont ;</p> <p>no , plastids / chloroplasts / amyloplasts ;</p> <p>spores ;</p> <p>hyphae / mycelium ;</p> <p>multi-nucleate / coenocytic / aseptate ;</p>	2 max	<p>If 1st statement INCORRECT, max 1</p> <p>Must be external or outside or equivalent</p> <p>CREDIT syncytium / syncytial</p>
5	(a)	(iii)	<p><i>pear tree ...</i></p> <p><u>cellulose</u> cell walls ;</p> <p>multicellular ;</p> <p>has , chloroplasts / plastids / chlorophyll /</p> <p style="padding-left: 150px;">photosynthetic pigment ;</p> <p>(photo)autotrophic / <u>performs</u> photosynthesis ;</p>	2 max	<p>If 1st statement INCORRECT, max 1</p> <p>IGNORE any references to vacuoles or other organelles</p> <p>'makes its own food' is not enough</p>
5	(a)	(iv)	<p>Proto<u>o</u>ctista / Proto<u>o</u>ctist(s) ;</p> <p>Animalia / animal(s) ;</p>	2	<p>CREDIT in either order</p> <p>DO NOT CREDIT Protista / Protist <i>look for the 'c'</i></p>

Question			Expected Answers	Marks	Additional Guidance
5	(b)	(i)	<p><u>discontinuous</u> ;</p> <p>single / few , genes ;</p> <p><u>qualitative</u> ;</p> <p>discrete categories / either low or high resistance / no intermediates ;</p> <p>no / small / little , environmental effects ;</p>	<p>1</p> <p>2 max</p>	<p>CREDIT at any point in the answer</p> <p>IGNORE genetic</p> <p>CREDIT a description of discontinuous variation (to max 2) even if the type of variation given is incorrect.</p> <p>CREDIT 'large / only , genetic effect'</p>
5	(b)	(ii)	<p>artificial <u>selection</u> / <u>selective</u> breeding ;</p> <p>cross / breed , Iranian / resistant , wheat with , high yield / UK , wheat ;</p> <p>method to prevent self , pollination / fertilisation ;</p> <p>select , best offspring / offspring with good yield <u>and</u> resistant ;</p> <p>(back) cross to high yield (UK) wheat / interbreed best offspring / interbreed offspring with both characteristics ;</p> <p>idea of breeding (and selecting) for many generations ;</p>	<p>3 max</p>	<p>IGNORE country incorrectly linked to characteristic as long as the correct cross has been described</p> <p>e.g. removing anthers / bag stigma</p>

Question		Expected Answers	Marks	Additional Guidance
5	(c)	<p><u>genetic</u> variation ;</p> <p>(due to) mutation ; (mutation is) spontaneous / random / pre-existing ;</p> <p>(due to) <u>sexual</u> reproduction ; mildew fungus produces large numbers of , spores / gametes / offspring ;</p> <p>wheat resistance acts as a <u>selection pressure</u> ; (individuals that overcome resistance) have selective advantage / are more likely to survive ; pass on , mutation / (mutated) allele (to offspring) ;</p> <p>increase in allele frequency (of allele to overcome resistance) ;</p>	4 max	<p>IGNORE 'survival of the fittest' as this is not an explanation</p> <p>CREDIT ora for those with selective disadvantage</p> <p>ALLOW gene DO NOT CREDIT characteristic / ability</p>
		Total	17	

Question			Expected Answers	Marks	Additional Guidance
6	(a)	(i)	<p>named component of cigarette smoke (correctly linked to a stated problem) ;</p> <p><i>tar, hydrogen cyanide, carbon monoxide (but NOT in context of Hb), ammonia, sulphur dioxide</i></p> <p>destroy / paralyse , cilia ; mucus not removed ;</p> <p><i>tar</i></p> <p>over-active goblet cells / extra mucus produced ;</p> <p>(accumulation of mucus) leads to , infections / bronchitis ;</p> <hr/> <p>neutrophils / phagocytes / macrophages / monocytes (invade) ;</p> <p>secrete , enzyme / elastase ; elastin / elastic fibres , digested / destroyed ; low(er) level of , elastase inhibitor / α antitrypsinase ; alveoli fail to <u>recoil</u> ;</p> <p>constriction of (terminal) bronchioles ; (so) coughing / forced expiration , causes alveoli to burst ; reduced surface area ;</p>	5 max	<p>e.g. 'tar destroys cilia' = 2 (1 for this mark, linking the component with a stated problem, and also the mark for destroying cilia)</p> <p>DO NOT CREDIT tar more than once IGNORE nicotine</p> <hr/> <p>ALLOW white blood cells DO NOT CREDIT lymphocytes</p> <p>CREDIT formation of scar tissue / fibrosis</p>
			<p>QWC ;</p>	1	<p>Award if at least 1 mark has been given from each of the mark scheme sections for this question. Use the QWC symbol and add to the content mark(s).</p>

Question			Expected Answers	Marks	Additional Guidance
6	(a)	(ii)	shortness of breath / shallow breathing / strained breathing / hard to breathe out / wheezing ; barrel chest ; fatigue / extreme tiredness / cannot exert themselves ; pulmonary hypertension / high blood pressure to lungs ; enlargement of right side of heart ; heart failure / congestive cardiac failure / fluid buildup in lungs ; cyanosis / skin with blue tinge ;	2 max	DO NOT CREDIT difficulty in breathing / heavy breathing / hard to breathe in e.g. cannot walk far DO NOT CREDIT heart attack / MI / CHD / COPD ALLOW grey / ashen DO NOT CREDIT pale unqualified
6	(a)	(iii)	long term / lifelong / persistent ; slow onset / takes time for the symptoms to show ; (usually) degenerative / gets (progressively) worse ;	2 max	ALLOW no cure / irreversible IGNORE ref to death
6	(b)	(i)	rises in both , initially / until age 15 ; (always) lower in smoker / higher in non smoker ; gap / difference , increases with age ; in non smoker , plateaus / flattens / increase slows , after 17 / at 18 or 19 ; in smoker falls after , 15 / 16 ; in smoker , trough / fall then rise / minimum / anomaly , at 17 ; figs to compare ;	4 max	Two sets of x and y figures with units for peak flow rate at least once – must compare either peak flow of smoker and non-smoker at same stated age or peak flow at two different stated ages for same person Could be in the same place or in different parts of the answer

Question			Expected Answers	Marks	Additional Guidance
6	(b)	(ii)	<p>(initial increase as) lungs grow with age ;</p> <p>loss of , elastin / elastic fibres , in alveoli ; reduced / no , recoil ;</p> <p>decreased diameter of / thicker smooth muscle in / scar tissue in / inflammation of / blockage due to mucus of , (named) airways ;</p> <p>increase in resistance to air flow ;</p> <p>suitable explanation for , low / anomalous , reading at 17 ;</p>	2 max	<p>e.g. infection / unreliable (procedure) / asthma IGNORE ref to increased smoking</p>
6	(b)	(iii)	<p>more individuals (male) should be used ;</p> <p>replicates / repeat measurements (at one time) ;</p> <p>calculate , mean / average ;</p> <p>identify / deal with , anomalous results ;</p> <p>take measurements at more frequent intervals;</p> <p>controlled variable ;</p>	3 max	<p>e.g. every 6 months</p> <p>Suitable examples include but are not limited to <i>make sure that ...</i></p> <ul style="list-style-type: none"> • same number of cigarettes smoked • same type of cigarette • similar level of fitness • similar , build / body size • exclude individuals with other respiratory problems (e.g. asthma / bronchitis) • same exposure to , passive smoking / environmental pollution <p>DO NOT CREDIT ref to females / (general) health / occupation unqualified / lifestyle</p>
			Total	19	

Grade Thresholds

Advanced GCE (Biology) (H021 H421)
June 2009 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A	B	C	D	E	U
F211	Raw	60	42	37	33	29	25	0
	UMS	90	72	63	54	45	36	0
F212	Raw	100	66	59	52	45	38	0
	UMS	150	120	105	90	75	60	0
F213	Raw	40	33	30	27	25	23	0
	UMS	60	48	42	36	30	24	0

Specification Aggregation Results

Overall threshold marks in UMS (ie after conversion of raw marks to uniform marks)

	Maximum Mark	A	B	C	D	E	U
H021	300	240	210	180	150	120	0

The cumulative percentage of candidates awarded each grade was as follows:

	A	B	C	D	E	U	Total Number of Candidates
H021	16.0	30.8	47.4	64.9	80.0	100.0	20698

20698 candidates aggregated this series

For a description of how UMS marks are calculated see:
http://www.ocr.org.uk/learners/ums_results.html

Statistics are correct at the time of publication.

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