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) ; different / named , organisms have different proportions of , bases / named base / AW ; greatest similarity between human and grasshopper ; least similarity between *E coli* and the other three ; *E. coli* has similar proportions of all bases / *E.coli* has slightly 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 *E. coli* / human has the most AT / *E. coli* has the most CG This mark is for a general statement e.g. human C = 19.8 % and G = 19.9 % human A = 30.9 % and *E. coli* 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)	(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' ;	2 max	**IGNORE** A – T or A = T unqualified **IGNORE** C – G or C = G unqualified **ACCEPT** 'bond' instead of 'pair'

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Marks</th><th>Additional Guidance</th></tr>
<tr><td>1</td><td>(c)</td><td></td><td>Award 1 mark per correct row
<table>
<tr><th>feature</th><th>DNA</th><th>RNA</th><th></th></tr>
<tr><td>number of strands</td><td>two / double</td><td>one / single</td><td>;</td></tr>
<tr><td>bases present</td><td>thymine / T
(+ adenine
+ cytosine
+ guanine)</td><td>uracil / U
(+ adenine
+ cytosine
+ guanine)</td><td>;</td></tr>
<tr><td>sugar present</td><td>deoxyribose</td><td>ribose</td><td>;</td></tr>
</table></td><td>3</td><td>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)

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

DO NOT CREDIT dioxyribose / oxyribose/ hexose / sugar
IGNORE pentose</td></tr>
<tr><td>1</td><td>(d)</td><td></td><td>carries / transfers, the (complementary DNA) ,
code / genetic information / copy of gene ;
out of the nucleus ;
(transfers it) to the, ribosome / RER / site of translation ;
for, protein / polypeptide, synthesis ;</td><td>2 max</td><td>IGNORE transcription
DO NOT CREDIT ref to the whole DNA code / molecule

ACCEPT ‘to make protein’</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>14</td><td></td></tr>
</table>

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. *Plasmodium falciparum* should be credited but **NOT** *P. falciparum* / *P. vivax* / *P. ovale* / *P. malariae*
2	(a)	(ii)	<u>female</u> *Anopheles* ;	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	humoral response ;		
		2	(B) cell / lymphocyte , has antigen receptor / carries antibody on its surface ;		
		3	specific to / matches / complementary to , only one antigen ;		
		4	clonal selection ;		
		5	selection / activation , of , appropriate / specific , B lymphocyte / B cell ;		
		6	by , macrophages / antigen presenting cells / dendritic cells / T helper cells / cytokines / interleukins ;		
		7	clonal expansion ;		
		8	(selected cell) divides by mitosis / clones ;		
		9	(B) cells , differentiate / specialise ;		
		10	(B cells) form , plasma / effector , cells ;		
		11	(which) secrete / produce , antibodies ;		**ACCEPT** 'forms antigen-antibody complex'
		12	antibodies are , specific / complementary , to antigen ;		
		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) ;	7 max	**DO NOT CREDIT** ref to disease alone
			QWC ~ correct sequence ;	1	Clonal selection, then clonal expansion, then differentiation (stages named or described) 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.

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

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

Question			Expected Answers	Marks	Additional Guidance
3	(a)	(i)	**A** hydrogen ; **B** glycosidic ;	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 / beta , glucose ;	1	Must be qualified as β or beta or B or b
3	(b)		enzymes are specific ; the , carbohydrate molecules / substrates , are different shapes ; active site 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)	pH much , higher / less acidic , than optimum (for enzyme 2) ; change in charge of active site ; hydrogen / ionic , bonds break ; tertiary structure / 3D shape / active site shape , altered ; enzyme / tertiary structure , denatured ; substrate no longer fits active site / ESC does not form ;	3 max	Needs idea of much greater or too high **DO NOT CREDIT** just 'higher than' or 'above' **DO NOT CREDIT** too / more , alkaline **DO NOT CREDIT** peptide / disulphide , bonds break **DO NOT CREDIT** in context of heat / vibration **IGNORE** ref to denaturing active site **IGNORE** ref to denaturing active site **DO NOT CREDIT** kill / die 'substrate doesn't bind to enzyme' is not quite enough
3	(c)	(ii)	*Mark 1st response on each numbered line unless no answer on one line, then mark 1st 2 answers* temperature ; substrate concentration ; enzyme concentration ;	2 max	**IGNORE** ref to time

Question			Expected Answers	Marks	Additional Guidance
3	(d)		***Marking points 2 – 6 can be applied to the standard solutions or the sample***		
		1	using **,** standard / known , concentrations (of reducing sugar) **;**		e.g. serial dilutions
		2	heat with **,** Benedicts (solution) / $CuSO_4$ + NaOH **;**		**ALLOW** boil / > 80^oC **DO NOT CREDIT** warm
		3	(use of) same volumes of solutions (each time) **;**		**DO NOT CREDIT** amount / quantity
		4	(use of) excess Benedicts **;**		
		5	changes to **,** green / yellow / orange / brown / (brick) red **;**		
		6	remove precipitate / obtain filtrate **;**		**CREDIT** description of method e.g. filtering / centrifuging & decanting
		7	calibrate / zero **,** colorimeter **;**		
		8	using **,** a blank / water / unreacted Benedicts **;**		
		9	use (red) filter **;**		
		10	reading of **,** transmission / absorbance **;**		**ACCEPT** 'measure how much light **,** does / does not **,** pass through'
		11	more transmission / less absorbance **,** of filtrate = more sugar present **;** **ora**		If precipitate is **clearly indicated** as being present in sample, **ALLOW** **'**less transmission / more absorbance **,** = more sugar present'
		12	(obtain) calibration curve **;**		
		13	plotting **,** transmission / absorbance **,** against (reducing) sugar concentration **;**		
		14	use reading of unknown sugar solution and read off graph to find conc. **;**	**6 max**	
			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 ; *in captivity – allow reverse argument for in the wild* 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)	maintain / increase **,** genetic variation / gene pool **;** reduce risk of **,** inbreeding / breeding between related birds **;** different 'races' of vulture in different areas / geographical variation / different subspecies **;** less likely **all** contaminated with painkiller **;** less risk of losing all individuals due to **,** disease / natural disaster / human action **;**	**3 max**	In the context of the vultures**,** rather than 'biodiversity' **CREDIT** different alleles **DO NOT CREDIT** different genes **CREDIT ora** for idea of promoting outbreeding **ALLOW** ref to types of (white-backed) vulture
4	(c)		reason **or** explanation **; ; ;** *Suitable examples include but are **not** limited to:* • 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**	**CREDIT any three valid suggestions**. *Ignore the numbers on the answer lines.* *Mark as prose and award points as they arise.* The idea of research must be qualified

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)	*mildew ...* (usually) chitin / not cellulose (cell) , wall ; external digestion / secretes enzymes externally ; heterotrophic / saprophytic / saprotrophic / saprobiont ; no , plastids / chloroplasts / amyloplasts ; spores ; hyphae / mycelium ; multi-nucleate / coenocytic / aseptate ;	2 max	*If 1st statement INCORRECT, max 1* Must be external or outside or equivalent **CREDIT** syncytium / syncytial
5	(a)	(iii)	*pear tree ...* cellulose cell walls ; multicellular ; has , chloroplasts / plastids / chlorophyll / photosynthetic pigment ; (photo)autotrophic / performs photosynthesis ;	2 max	*If 1st statement INCORRECT, max 1* **IGNORE** any references to vacuoles or other organelles 'makes its own food' is not enough
5	(a)	(iv)	Prot**oct**ista / Prot**oct**ist(s) ; Animalia / animal(s) ;	2	**CREDIT** in either order **DO NOT CREDIT** Protista / Protist *look for the **'c'***

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

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