F212 Molecules, Biodiversity, Food and Health

C	luest	ion	Expected Answers	Marks	Additional Guidance
1	1 (a)		obese; iron; haemoglobin;		
			nacmoglobin,	3	
1	(b)		24.7;;	2	If answer incorrect or to the wrong number of dp, then ALLOW one mark for working: 69 ÷ 1.67² 24.74 = one mark IGNORE 25 and look for working mark If units are given, they must be kg m ⁻² (or kg/m²) Max 1 for incorrect units
1	(c)	(i)	overweight / borderline overweight ;	1	DO NOT CREDIT if more than one answer given
1	(c)	(ii)	 very close to border / AW; graph does not distinguish between male and female; does not measure actual fat / AW; has, more / less, muscle / bone (than normal) OR (does not take into account) muscle / bone, mass / density /		 1 DO NOT CREDIT mistake reading graph 4 Must refer to idea of amount of muscle / bone being different from normal. DO NOT CREDIT muscle / bone unqualified CREDIT has osteoporosis as ref. to different bone density
			v pregnant,	2 max	

C	Question	Expected Answers		Additional Guidance
1	(d)	1 coronary heart disease / CHD / atherosclerosis / angina / coronary thrombosis / myocardial infarction / heart attack / cardiac arrest / cardiovascular disease / stroke;		1 DO NOT CREDIT heart disease alone / arteriosclerosis
		 2 (osteo)arthritis; 3 (Type 2) diabetes; 4 high blood pressure / <u>hyper</u>tension; 5 gallstones; 		2 DO NOT CREDIT rheumatoid arthritis3 DO NOT CREDIT Type 1 diabetes
		6 cancer;	2 max	6 ACCEPT any type of cancer
		Total	10	

C	Question		Expected Answers		Additional Guidance
2	(a)		 1 hydrogen bond represented as, horizontal / vertical, dashed line between O on one molecule and H on the adjacent molecule; 2 hydrogen / H, bond label (on any drawn bond between 2 molecules); 3 (delta positive) δ⁺ on each drawn H and (delta negative) (2) δ⁻ on each drawn O; 		δ^+ H hydrogen bond δ^+ H \circ δ^-
			and (delta negative) (2) o on each drawn e ,	3	 δ⁺ 1 DO NOT CREDIT if >1 H bond is drawn between the same two molecules 3 if both molecules drawn, δ⁺ and δ⁻ on all atoms. ACCEPT d (lower case) for δ

	Que	stion	Expected Answers	Marks	Additional Guidance
2	(b)				
			ice floats		
		P1	(ice less dense because) molecules spread out;		
		P2	molecules form, crystal structure / lattice / AW;		
		P3	ice forms insulating layer / clearly described;		P3 e.g. acts as a barrier to the cold
		P4	water (below ice), does not freeze / still liquid / remains water / kept at higher temperature;		
		S1	organisms do not freeze ;		S1 DO NOT ACCEPT die (because 'survival' stated in
		S2	animals / organisms, can still, swim / move;		stem)
		S 3	allows, currents / nutrients, to circulate;		
			solubility		
		P5	ions / named ion, polar / charged;		
		P6	ions /named ion, attracted to / bind to / interact with, water;		
		S4	(named) organisms / plants / animals,		
			uptake / AW, minerals / named mineral / nutrients;		S4 ACCEPT obtain / enters / goes in / gets
		S5	correct use of named, mineral / nutrient, in organism;		needs to be more specific than 'for growth / metabolism' suitable examples include but are not limited to: nitrates for amino acids / protein / (named) nucleic acid / phosphate for ATP / phospholipids / plasma membrane / magnesium for chlorophyll etc

			temperature stability		
		P7	many / stable, (hydrogen) bonds between molecules;		P7 Many hydrogen bonds between molecules = 2 marks (gets P7 and H)
		P8	at lot of energy to, force apart molecules / break bonds;		P8 ACCEPT heat as alternative to energy
		P9	high (specific) heat capacity;		P9 DO NOT CREDIT latent heat capacity
		S6	temperature does not change much /		S6 could refer to organisms or surrounding water
			small variation in temperature ;		ACCEPT stays cool in summer / stays warm in winter
					DO NOT CREDIT constant alone
		S7	effect of temperature on , enzymes / metabolic rate ;		S7 ACCEPT any reference to temperature affecting enzyme activity / metabolic rate
		S8	gases remain soluble ;		
			Award once in any section		
		Н	hydrogen bonds;		DO NOT CREDIT if in incorrect context
				7 max	(e.g. they are strong bonds)
			QWC - Award if you see a P mark and an S mark within the same section ;	1	Look for the S mark first, then award QWC if there is a P mark in the same section in the mark scheme
2	(c)				ACCEPT phonetic spelling throughout
			hydrolysis / hydrolytic ;		
			hydrophilic;		IGNORE head
				2	
			Total	13	

C	uest	ion	Expected Answers	Marks	Additional Guidance
3	(a)	(i)	X;	1	
3	3 (a) (ii)		1 substrate / PABA, and, inhibitor / sulfonamide, similar shape;2 able to, bind / fit into / block, active site;		1 ACCEPT similar structure DO NOT CREDIT same shape
			3 (shape) complimentary to active site;		DO NOT CREDIT refs to PABA and sulfonamide being complementary to each other or to the enzyme (alone)
			4 both have, hex / benzene / 6-C, (ring);		
			5 both have, NH ₂ / amine ;		
	6 correct ref to a difference between sulfonam		6 correct ref to a difference between sulfonamide and PABA;		6 e.g. only sulfonamide contains S sulfonamide has 1 more NH ₂ group sulfonamide has SONH ₂ but PABA has N ₂ only PABA has COOH group
				3 max	
3	(b)	(i)	<pre>without inhibitor 1 more, PABA / substrate, molecules enter active site;</pre>		ACCEPT more successful collisions between substrate and active site
			2 more, enzyme substrate complexes / ESCs, formed;		
			at low concentration not all active sites occupied / at high concentration all active sites occupied;		3 ACCEPT active sites filled / no free active sites DO NOT CREDIT active sites run out
			4 achieves / reaches, max (turnover) rate / V _{max} ;		4 ACCEPT 'cannot work any quicker' DO NOT CREDIT 'optimum rate' or 'rate levels off'
			5 (at high substrate concentration) enzyme concentration limiting;	3 max	

C	luest	ion	Expected Answers	Marks	Additional Guidance
3	3 (b) (ii)		 with inhibitor 1 inhibitor / sulfonamide, can, fit / block / bind to / compete for, active site; 2 (occupies it) for a short time / temporary / reversibly; 3 fewer active sites available (for substrate) / AW; 4 (idea of) more substrate reduces chance of inhibitor getting in; 		 3 ACCEPT substrate can't access active site 4 ACCEPT more ESC formed in context of overcoming inhibition / substrate can out-compete inhibitor
3	(c)		 1 mutation; 2 sulfonamide is <u>selective</u>, agent / pressure; 3 resistant survive / non resistant die; 4 (resistance) allele / gene / mutation, passed to, offspring / next generation; 5 (happens) over many generations; 6 AVP; 	4 max	 JONOT CREDIT immune for any mark point 3 IGNORE refs to (survivors) breed / reproduce; 5 IGNORE refs to time. Look for generations 6 e.g. mutation is, random / spontaneous allele / gene, passed on by, plasmids / horizontal transmission
3	(d)	(i)	<u>bacteria</u> , killed / destroyed / cannot grow / lyse, in presence of antibiotic;	1	DO NOT CREDIT 'antibiotic works better' or 'there are no bacteria there' or 'bacteria are broken down'
3	(d)	(ii)	streptomycin;	1	IGNORE '4' as it is the number rather than the name

C	Quest	ion	Expected Answers	Marks	Additional Guidance
3	(d)	(iii)			DO NOT CREDIT responses which simply refer to selecting the best antibiotic
			 1 cheap / AW; 2 (test is) quick to carry out / (deals with several antibiotics) at same time / AW; 3 (idea of) allowing early treatment of patient; 4 (idea of) compares antibiotics under same conditions; 5 (correct antibiotic first time) to prevent antibiotic resistance developing; 	3 max	2 DO NOT CREDIT speed of antibiotic action
3	(e)		(new) drugs come from (named) organisms; biodiversity is reducing; habitats / named habitat, destroyed / lost; reason for habitat destruction;	2 max	ACCEPT plants / animals / fungi / species / etc. ACCEPT deforestation / natural environment lost e.g. global warming logging fuel crops construction / industrialisation mining fishing pollution tourism ACCEPT any other valid reason that will destroy natural habitats but not general statements such as 'human development' or 'business'
			Total	20	

C	luest	ion	Expected Answers	Marks	Additional Guidance
4	(a)	(i)	L; M; J;	3	If 2 nd letter given, no mark
4	(a)	(ii)	 1 peptide bond; 2 between, amine / J group (of one amino acid) and carboxyl / L group (of another); 3 H (from amine group) combines with OH (from carboxyl group); 4 condensation reaction OR water, lost / eliminated / produced / created / AW; 5 covalent; 	3 max	CREDIT answers from clearly drawn diagrams with bonds labelled 1 ACCEPT peptide link
4	(b)		 some R groups, attract / repel; disulfide, bridges / bond; between, cysteine / SH / S (atoms); hydrogen / H, bonds; ionic bonds between, oppositely charged / + and -, R groups; hydrophilic R groups, on outside of molecule / in contact with water (molecules); hydrophobic R groups, on inside of molecule / shielded from water (molecules); 	4 max	4 DO NOT CREDIT in context of secondary structure

Q	uest	ion	Expected Answers					Additional Guidance
4	(c)	(i)	glycogen collagen				AWARD 1 mark per correct row Comparative statements must be made in a row	
			1	carbohydrate / polysaccharide	protein / polypeptide	;		
			2	(alpha) glucose (units)	amino acid (units)	;		2 DO NOT CREDIT beta
			3	identical units	different amino acid units];		
			4	glycosidic, bonds / links	peptide, bonds / links	;		
			5	branched	unbranched / linear] ;		5 ALLOW straight
			6	non-helical	helical	;		
			7	one chain (per molecule)	three chains (per molecule)			7 DO NOT CREDIT strands
			8	no cross links	cross links (between chains)			
			9	contains C H O	contains C H O N	;		9 IGNORE S (for collagen)
							3 max	
4	(c)	(ii)						Mark the 1 st answer on each numbered line
				igh tensile) strength / strong;				IGNORE fibrous / tough
				es not stretch / is not elastic;				
				soluble; xible;			2 max	
				<u>, </u>	То	tal	15	

C	uest	ion	Expected Answers	Marks	Additional Guidance
5	(a)	(i)	(diagram shows that some) individuals have more than one risk factor;	1	DO NOT CREDIT CHD is multifactorial
5	(a)	(ii)			Mark the 1 st answer on each numbered line.
			1 high, saturated / animal, fat diet;		1 ACCEPT absence of polyunsaturated fats
			2 high salt intake;		
			3 (diet) low in (named) antioxidants / vitamin A / vitamin C / vitamin E ;		
			4 obesity;		
			5 genetic / heredity / inherited / ethnicity / race;		
			6 gender / sex;		
			7 excess alcohol consumption;		7 must indicate, excess / high levels
			8 (increasing) age;		
			9 diabetes ;		
			10 stress;		
				2 max	

C	Question		Ex	pected Answers		Mark	s Additional Guidance
5	(a)	(iii)					DO NOT CREDIT hybrid ticks
			effect	nicotine	carbon monoxide		IGNORE crosses in the 'blank' boxes
			increases heart rate	✓			
			constricts arterioles	✓		;	
			damages the lining of arteries		✓	;	
			reduces the ability of haemoglobin to carry oxygen		✓	;	
			makes platelets sticky	✓		;	
						4	

(Quest	ion	Expected Answers	Marks	Additional Guidance
5	(b)		1 damage to endothelium;		
			2 LDLs contain, saturated fat / cholesterol;		DO NOT CREDIT moves / transports CREDIT LDLs are protein and saturated fat / cholesterol
			3 LDLs collect at site of damage;		3 must be stated
			4 fatty substances / cholesterol / LDLs, deposited, <u>in</u> artery wall / <u>under</u> endothelium;		4 ACCEPT fats / lipids ACCEPT under lining of artery wall DO NOT CREDIT veins / vessels / capillaries
				2 max	
5	(c)		1 increases size / AW, of lumen;		1 ACCEPT reduces blockage in lumen
			2 increases / eases / decreases resistance to, blood flow;		2 ACCEPT 'more blood' / 'blood flows more freely' / 'blood flows as normal' / 'quicker blood flow'
			3 (therefore) more, O ₂ / glucose ;		needs idea of more oxygen (than before operation) CREDIT idea of preventing oxygen starvation
			4 for <u>aerobic</u> respiration;		
			5 in, heart muscle / cardiac muscle / myocardium;		
			6 more CO ₂ removed;		
				4 max	'more oxygenated blood' gets mark points 2 and 3
			Total	13	

Question		ion	Expected Answers	Marks	Additional Guidance
6	(a)	(i)	<u>de</u> oxyrib <u>ose</u> (sugar) ;		DO NOT CREDIT dioxyribose
			phosphate (group);		DO NOT CREDIT phosphate head or phosphate backbone
			(nitrogenous / purine or pyrimidine) base / one correctly named base ;	3	DO NOT CREDIT letter instead of named base DO NOT CREDIT uracil DO NOT CREDIT incorrect spelling of thymine with 'a'
6	(a)	(ii)			assume answer refers to RNA unless otherwise stated
			has ribose; uracil / U, instead of, thymine / T; single stranded; 3 forms / AW;		DO NOT CREDIT incorrect spelling of thymine with 'a'
				2 max	

Q	Question		Expected Answers		Marks	Additional Guidance
6	(b)		1	untwist / unwind ;		1 DO NOT CREDIT unravel
		s	2	unzip / described ;		2 DO NOT CREDIT strands separating without
		S	3	H bond breaks;		qualification
			4	both strands act as template ;		
		N	5	(aligning of) free (DNA) <u>nucleotides</u> ;		5 DO NOT CREDIT bases
		N	6	complementary, base / nucleotide, pairing;		6 & 7 Do not consider for QWC if mark awarded in the
		N	7	C to G and T to A / purine to pyrimidine;		context of breaking apart or DNA structure only, rather than forming new double helix
		R	8	hydrogen bonds reform ;		
		R	9	sugar-phosphate back bone forms;		
		R	10	(using) covalent / phosphodiester, bond;		
			11	semi-conservative replication;		
			12	DNA polymerase ;		12 CREDIT at any stage in the process
			13	AVP;	6 max	13 e.g. ligase / helicase / gyrase used in correct context C – G 3 H bonds / T – A 2 H bonds activation of free nucleotides (with 2 phosphates) synthesis in the 5' to 3' direction Okazaki fragments on lagging strand
				QWC - correct sequence – 1 S mark, then 1 N mark, then 1 R mark;	1	It should be clear that candidate realises that the sequence is S, then N then R – even if not written in that order DO NOT CREDIT if any ref to transcription / translation

(c)			I	
	(i)	polypeptide / protein / primary structure / a sequence of amino acids ;	1	DO NOT CREDIT 'codes for an amino acid' IGNORE enzyme / named protein
(c)	(ii)	different, sequence of amino acids / primary structure / AW; different protein / protein folds up differently / different tertiary structure; (product) no longer functions / different function;		DO NOT CREDIT 'product' or incorrect biochemical (e.g. carbohydrate) ACCEPT suitable example, e.g. active site of enzyme
		(product) no longer functions / unicronic function ;	2 max	no longer complimentary to substrate
				different tertiary structure; (product) no longer functions / different function;

(Question		Expected Answers	Marks	Additional Guidance
7	(a)		habitat 1 the place where, an organism / organisms / a population / a community, lives; 1 max		ACCEPT animal or plant ACCEPT location / environment / area DO NOT CREDIT ecosystem
			 biodiversity variety of life / the range of living organisms found / AW; variety / range, of, habitats / ecosystems; number of different species; variety / genetic diversity, within species; 2 max 	3 max	 max 2 for biodiversity DO NOT CREDIT ref to variation ACCEPT species richness / species diversity must have ref to number / how many / etc.
7	(b)		not random / should have been random; unrepresentative / skewed / biased, results; creates an over-estimate of diversity; may miss some (dominant) species / does not cover full range of species;	2 max	DO NOT CREDIT ref to 'fair test' unless qualified 'misleading' is not quite good enough CREDIT plant / animal instead of species
7	(c)	(i)	remove units from the body of the table <u>and</u> put units in column heading / AW;	1	ALLOW 'measurement' or 'type of measurement' instead of 'unit' DO NOT CREDIT 'units are not necessary in table'

(Question		Expected Answers	Marks	Additional Guidance	
7	(c)	(ii)	bell shaped;		must start at 0% cover and after 0m and finish at 0% cover and before 100m line must cross the line for bracken	
					allow sharp angle for peak of bell	
					allow charp angle for peak of bein	
			peak / highest point, for ling between peaks for bracken and cotton grass (on horizontal axis);			
			peak / highest point, for ling lower than both			
			bracken and cotton grass (on vertical axis);	3		
-		/		3		
7	(c)	(iii)	1 absent at bottom of slope / present at top of slope;		1 DO NOT CREDIT that bracken is present at top if answer also implies that some bracken is present at the bottom ALLOW 'before 40 - 50m' as AW for 'bottom' ALLOW 'after 40 - 50m' as AW for 'top' ALLOW 'start' instead of 'bottom' and 'finish' or 'end' or 'higher up' instead of 'top' Needs to be stated – cannot be implied from mp 2	
			2 amount of bracken / percentage cover, increases with increasing distance;			
			3 comparative figs. with units;		3 two percentages at two stated distances (must be from table) e.g. 0% at 0m and 74% at 100m	
					or percentage difference between two stated distances	
					ALLOW 'percentage cover' instead of % for units	
				2 max	DO NOT CREDIT 0% at the bottom and 74% at the top (as no distance has been quoted)	

C	Question		Expected Answers	Marks	Additional Guidance
7	(d)	(i)	record / identify / list / AW, all species / (all) other plants; (count / estimate) numbers of individuals within each species / AW;	2 max	IGNORE observe IGNORE animals for this habitat IGNORE 'species richness' and any other calculation ACCEPT the number of plants / species If the formula is given, only credit this mark if 'n' is explained in terms of the number of individuals within the species
7	(d)	(ii)	not stable / at risk / low ability to withstand change / AW; more likely to lose species;	1 max	IGNORE 'biodiversity is low' as this is given in the question IGNORE 'only a few species' or 'dominated by a few species' as these are descriptions of low biodiversity
			Total	14	