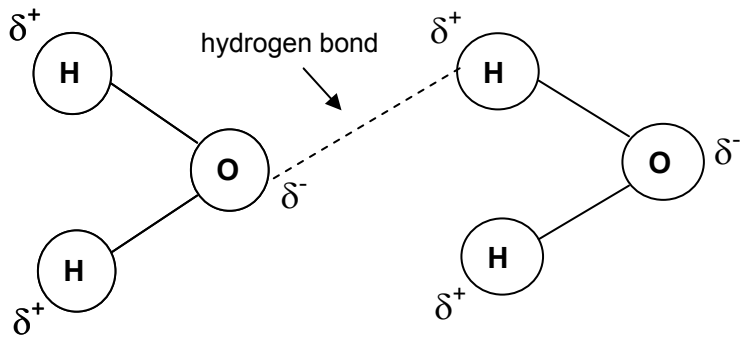
F212 Molecules, Biodiversity, Food and Health

Question			Expected Answers	Marks	Additional Guidance
1	(a)		obese ; iron ; haemoglobin ;	3	
1	(b)		24.7 ; ;	2	If answer incorrect or to the wrong number of dp, then **ALLOW** one mark for working: $69 \div 1.67^2$ 24.74 = one mark **IGNORE** 25 and look for working mark If units are given, they **must** be $kg\,m^{-2}$ (or kg/m^2) Max 1 for incorrect units
1	(c)	(i)	overweight / borderline overweight ;	1	**DO NOT CREDIT** if more than one answer given
1	(c)	(ii)	**1** very close to border / AW ; **2** graph does not distinguish between male and female ; **3** does not measure actual fat / AW ; **4** has, more / less, muscle / bone (than normal) **OR** (does not take into account) muscle / bone, mass / density / weight ; **5** muscle / bone, heavier / denser, than fat / AW ; **6** pregnant ;	2 max	**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

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

Question			Expected Answers	Marks	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** **<u>and</u>** (delta negative) (2) δ^- on **each** drawn **O ;**	**3**	 **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

Question			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 stem)
		S2	animals / organisms, can still, swim / move **;**		
		S3	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 **;**		**S5** 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 / small variation in temperature **;**		**S6** could refer to organisms **or** surrounding water **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 **;**		
		H	*Award once in any section* hydrogen bonds **;**	**7 max**	**DO NOT CREDIT** if in incorrect context (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)**		hydrolysis / hydrolytic **;** hydrophilic **;**	**2**	**ACCEPT** phonetic spelling throughout **IGNORE** head
			Total	**13**	

Question			Expected Answers	Marks	Additional Guidance
3	(a)	(i)	X ;	1	
3	(a)	(ii)	**1** substrate / PABA, **and**, inhibitor / sulfonamide, similar shape**;** **2** able to, bind / fit into / block, active site **;** **3** (shape) complimentary to active site **;** **4** both have, hex / benzene / 6-C, (ring) **;** **5** both have, NH_2 / amine **;** **6** correct ref to a difference between sulfonamide and PABA **;**	**3 max**	**1 ACCEPT** similar structure **DO NOT CREDIT** same shape **3 DO NOT CREDIT** refs to PABA and sulfonamide being complementary to each other or to the enzyme (alone) **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	(b)	(i)	*without inhibitor* **1** more, PABA / substrate, molecules enter active site **;** **2** more, enzyme substrate complexes / ESCs, formed **;** **3** at low concentration not all active sites occupied / at high concentration all active sites occupied **;** **4** achieves / reaches, max (turnover) rate / V_{max} **;** **5** (at high substrate concentration) enzyme concentration limiting **;**	**3 max**	**1 ACCEPT** more successful collisions between substrate and active site **3 ACCEPT** active sites filled / no free active sites **DO NOT CREDIT** active sites run out **4 ACCEPT** 'cannot work any quicker' **DO NOT CREDIT** 'optimum rate' or 'rate levels off'

Question			Expected Answers	Marks	Additional Guidance
3	(b)	(ii)	*with inhibitor* **1** inhibitor / sulfonamide, can, fit / block / bind to / compete for, <u>active site</u> **;** **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**;**	**2 max**	**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**	**DO NOT 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

Question			Expected Answers	Marks	Additional Guidance
3	(d)	(iii)	**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**	**DO NOT CREDIT** responses which simply refer to selecting the best antibiotic **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**	

Question			Expected Answers	Marks	Additional Guidance
4	(a)	(i)	L ; M ; J ;	3	If 2nd 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)		**1** some R groups, attract / repel ; **2** disulfide, bridges / bond ; **3** between, cysteine / SH / S (atoms) ; **4** hydrogen / H, bonds ; **5** ionic bonds between, oppositely charged / + and -, R groups ; **6** hydrophilic R groups, on outside of molecule / in contact with water (molecules) ; **7** hydrophobic R groups, on inside of molecule / shielded from water (molecules) ;	4 max	**4 DO NOT CREDIT** in context of **secondary** structure

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Marks</th><th>Additional Guidance</th></tr>
<tr><td>4</td><td>(c)</td><td>(i)</td><td>
<table>
<tr><th></th><th>glycogen</th><th>collagen</th><th></th></tr>
<tr><td>1</td><td>carbohydrate / polysaccharide</td><td>protein / polypeptide</td><td>;</td></tr>
<tr><td>2</td><td>(alpha) glucose (units)</td><td>amino acid (units)</td><td>;</td></tr>
<tr><td>3</td><td>identical units</td><td>different amino acid units</td><td>;</td></tr>
<tr><td>4</td><td>glycosidic, bonds / links</td><td>peptide, bonds / links</td><td>;</td></tr>
<tr><td>5</td><td>branched</td><td>unbranched / linear</td><td>;</td></tr>
<tr><td>6</td><td>non-helical</td><td>helical</td><td>;</td></tr>
<tr><td>7</td><td>one chain (per molecule)</td><td>three chains (per molecule)</td><td>;</td></tr>
<tr><td>8</td><td>no cross links</td><td>cross links (between chains)</td><td>;</td></tr>
<tr><td>9</td><td>contains C H O</td><td>contains C H O N</td><td>;</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>
</td><td>3 max</td><td>AWARD 1 mark per correct row
Comparative statements must be made in a row

2 DO NOT CREDIT beta

5 ALLOW straight

7 DO NOT CREDIT strands

9 IGNORE S (for collagen)</td></tr>
<tr><td>4</td><td>(c)</td><td>(ii)</td><td>(high tensile) strength / strong ;
does not stretch / is not elastic ;
insoluble ;
flexible ;</td><td>2 max</td><td>Mark the 1st answer on each numbered line
IGNORE fibrous / tough</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>15</td><td></td></tr>
</table>

Question			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)	**1** high, saturated / animal, fat diet ; **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 ; **8** (increasing) age ; **9** diabetes ; **10** stress ;	2 max	Mark the 1st answer on each numbered line. **1 ACCEPT** absence of polyunsaturated fats **7** must indicate, excess / high levels

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Marks</th><th>Additional Guidance</th></tr>
<tr><td>5</td><td>(a)</td><td>(iii)</td><td>
<table>
<tr><th>effect</th><th>nicotine</th><th>carbon monoxide</th></tr>
<tr><td>increases heart rate</td><td>✓</td><td></td></tr>
<tr><td>constricts arterioles</td><td>✓</td><td></td></tr>
<tr><td>damages the lining of arteries</td><td></td><td>✓</td></tr>
<tr><td>reduces the ability of haemoglobin to carry oxygen</td><td></td><td>✓</td></tr>
<tr><td>makes platelets sticky</td><td>✓</td><td></td></tr>
</table>
;
;
;
;
;
</td><td>4</td><td>DO NOT CREDIT hybrid ticks
IGNORE crosses in the ‘blank’ boxes</td></tr>
</table>

Question			Expected Answers	Marks	Additional Guidance
5	(b)		**1** damage to endothelium **;** **2** LDLs contain, saturated fat / cholesterol **;** **3** LDLs collect at site of damage **;** **4** fatty substances / cholesterol / LDLs, deposited, in artery wall / under endothelium **;**	**2 max**	**2 DO NOT CREDIT** moves / transports **CREDIT** LDLs are protein **and** saturated fat / cholesterol **3** must be stated **4 ACCEPT** fats / lipids **ACCEPT** under lining of artery wall **DO NOT CREDIT** veins / vessels / capillaries
5	(c)		**1** increases size / AW, of lumen **;** **2** increases / eases / decreases resistance to, blood flow **;** **3** (therefore) more, O_2 / glucose **;** **4** for aerobic respiration **;** **5** in, heart muscle / cardiac muscle / myocardium **;** **6** more CO_2 removed **;**	**4 max**	**1 ACCEPT** reduces blockage in lumen **2 ACCEPT** 'more blood' / 'blood flows more freely' / 'blood flows as normal' / 'quicker blood flow' **3** needs idea of more oxygen (than before operation) **CREDIT** idea of preventing oxygen starvation 'more oxygenated blood' gets mark points 2 and 3
			Total	**13**	

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

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 qualification
		S	3	H bond breaks ;		
			4	both strands act as template ;		
		N	5	(aligning of) free (DNA) nucleotides ;		5 **DO NOT CREDIT** bases
		N	6	complementary, base / nucleotide, pairing ;		6 & 7 Do not consider for **QWC** if mark awarded in the context of breaking apart or DNA structure only, rather than forming new double helix
		N	7	C to G **and** T to A / purine to pyrimidine ;		
		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 ;		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
					6 max	
				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

Question			Expected Answers	Marks	Additional Guidance
6	(c)	(i)	polypeptide / protein / primary structure / a sequence of amino acids ;	1	**DO NOT CREDIT** 'codes for an amino acid' **IGNORE** enzyme / named protein
6	(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 ;	2 max	**DO NOT CREDIT** 'product' or incorrect biochemical (e.g. carbohydrate) **ACCEPT** suitable example, e.g. active site of enzyme no longer complimentary to substrate
			Total	15	

Question			Expected Answers	Marks	Additional Guidance
7	(a)		*habitat* **1** the place where, an organism / organisms / a population / a community, lives **;** **1 max** *biodiversity* **2** variety of life / the range of living organisms found / AW **;** **3** variety / range, of, habitats / ecosystems **;** **4** number of different species **;** **5** variety / genetic diversity, within species **;** **2 max**	**3 max**	**1 ACCEPT** animal or plant **ACCEPT** location / environment / area **DO NOT CREDIT** ecosystem ***max 2** for biodiversity* **2 DO NOT CREDIT** ref to variation **ACCEPT** species richness / species diversity **4** 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 **and** 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 ; 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	• 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
7	(c)	(iii)	**1** absent at bottom of slope / present at top of slope ; **2** amount of bracken / percentage cover, increases with increasing distance ; **3** comparative figs. with units ;	2 max	**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 **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 **DO NOT CREDIT** 0% at the bottom and 74% at the top (as no distance has been quoted)

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**	