OCR
RECOGNISING ACHIEVEMENT

GCE

Biology

Advanced GCE **A2 H421**

Advanced Subsidiary GCE **AS H021**

Mark Scheme for the Units

January 2010

HX21/MS/R/10J

Oxford Cambridge and RSA Examinations

F212 Molecules, Biodiversity, Food and Health

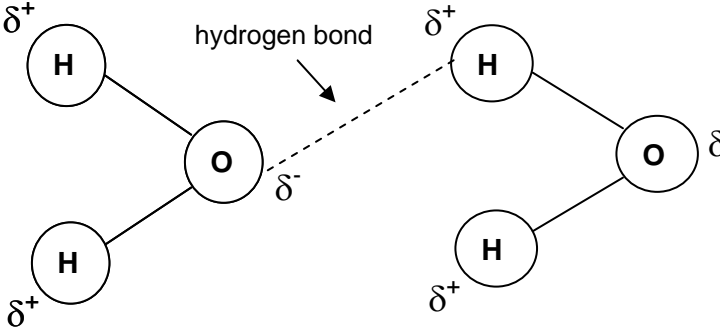| Question			Expected Answers	Marks	Additional Guidance
1	(a)		obese ; iron ; haemoglobin ;	3	
1	(b)		24.7 ; ;	2	If answer incorrect or to the wrong number of dp, then **ALLOW** one mark for working: $69 \div 1.67^2$ 24.74 = one mark **IGNORE** 25 and look for working mark If units are given, they **must** 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

F212   **Mark Scheme**   **January 2010**

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 ;		**1 DO NOT CREDIT** heart disease alone / arteriosclerosis
			2 (osteo)arthritis ;		**2 DO NOT CREDIT** rheumatoid arthritis
			3 (Type 2) diabetes ;		**3 DO NOT CREDIT** Type 1 diabetes
			4 high blood pressure / <u>hyper</u>tension ;		
			5 gallstones ;		
			6 cancer ;	**2 max**	**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

		P7	*temperature stability* many / stable, (hydrogen) bonds between molecules **;**		**P7** Many hydrogen bonds between molecules = 2 marks (gets P7 and H)
		P8 P9	at lot of energy to, force apart molecules / break bonds **;** high (specific) <u>heat</u> <u>capacity</u> **;**		**P8 ACCEPT** heat as alternative to energy **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, <u>active site</u> ; **3** (shape) <u>complimentary</u> to <u>active site</u> ; **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 <u>active site</u> ;
			
			 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 <u>concentration</u>
			                                                 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 **;**
			 <u>reason</u> for habitat destruction **;**
				2 max	**ACCEPT** plants / animals / fungi / species / etc.
					
					 ACCEPT deforestation / natural environment <u>lost</u>
					 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	

F212   **Mark Scheme**   **January 2010**

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

F212   **Mark Scheme**   **January 2010**

Question			Expected Answers	Marks	Additional Guidance
4	(c)	(i)	(see table below)	3 max	**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)
4	(c)	(ii)	(high tensile) strength / strong **;** does not stretch / is not elastic **;** insoluble **;** flexible **;**	2 max	Mark the 1st answer on each numbered line **IGNORE** fibrous / tough
			Total	**15**	

	glycogen	collagen	
1	carbohydrate / polysaccharide	protein / polypeptide	;
2	(alpha) glucose (units)	amino acid (units)	;
3	identical units	different amino acid units	;
4	glycosidic, bonds / links	peptide, bonds / links	;
5	branched	unbranched / linear	;
6	non-helical	helical	;
7	one chain (per molecule)	three chains (per molecule)	;
8	no cross links	cross links (between chains)	;
9	contains C H O	contains C H O N	;

F212   **Mark Scheme**   **January 2010**

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

F212   **Mark Scheme**   **January 2010**

Question			Expected Answers	Marks	Additional Guidance
5	(a)	(iii)		4	**DO NOT CREDIT** hybrid ticks **IGNORE** crosses in the 'blank' boxes

effect	nicotine	carbon monoxide	
increases heart rate	✓		
constricts arterioles	✓		;
damages the lining of arteries		✓	;
reduces the ability of haemoglobin to carry oxygen		✓	;
makes platelets sticky	✓		;

F212   **Mark Scheme**   **January 2010**

Question			Expected Answers	Marks	Additional Guidance

5	**(b)**		**1** damage to <u>endothelium</u> ;
			
			 2 LDLs <u>contain</u>, saturated fat / cholesterol ;
			
			 3 LDLs collect at site of damage ;
			 4 fatty substances / cholesterol / LDLs,
			         deposited, <u>in</u> artery wall / <u>under</u> endothelium ;
				2 max	**2 DO NOT CREDIT** moves / transports
					    CREDIT LDLs are <u>protein</u> **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 <u>lumen</u> ;
			 2 increases / eases / decreases resistance to, blood flow ;
			
			 3 (therefore) more, O_2 / glucose ;
			
			 4 for <u>aerobic</u> respiration ;
			 5 in, heart <u>muscle</u> / cardiac <u>muscle</u> / 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
		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**	<u>complementary</u>, 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	<u>semi-conservative</u> 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
					6 max	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

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	

F212   **Mark Scheme**   **January 2010**

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 <u>number</u> of different <u>species</u> **;**
			 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 <u>species</u> richness / <u>species</u> diversity
					
					 4 must have ref to number / how many / etc.

7	**(b)**		not <u>random</u> / should have been <u>random</u> **;** 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'

Mark Scheme

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)

F212 | **Mark Scheme** | **January 2010**

Question			Expected Answers	Marks	Additional Guidance
7	(d)	(i)	record / identify / list / AW, all species / (all) other plants **;** (count / estimate) numbers of <u>individuals</u> 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**	

Grade Thresholds

Advanced GCE (Biology) (H021 H421)
January 2010 Examination Series

Unit Threshold Marks

Unit		Maximum Mark	A	B	C	D	E	U
F211	Raw	60	40	35	31	27	23	0
	UMS	90	72	63	54	45	36	0
F212	Raw	100	69	62	56	50	44	0
	UMS	150	120	105	90	75	60	0
F214	Raw	60	40	36	32	28	25	0
	UMS	90	72	63	54	45	36	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	8.8	28.6	54.1	78.4	95.1	100.0	1505

1505 candidates aggregated this series

For a description of how UMS marks are calculated see:

http://www.ocr.org.uk/learners/ums/index.html

Statistics are correct at the time of publication.