OCR
RECOGNISING ACHIEVEMENT

GCE

Biology

Advanced Subsidiary GCE

Unit **F212:** Molecules, Biodiversity, Food and Health

Mark Scheme for June 2012

Oxford Cambridge and RSA Examinations

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All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Annotations

Annotation	Meaning
	Correct answer
	Incorrect response
	Benefit of Doubt
	Not Benefit of Doubt
	Error Carried Forward
	Given mark
	Underline (for ambiguous/contradictory wording)
	Omission mark
	Ignore
	Correct response (for a QWC question)
	QWC* mark awarded
	Contradiction

Subject-specific Marking Instructions

- Use **CON** when a correct response is associated with a piece of clearly incorrect science within the same statement and award no mark. However, a candidate should only miss out on **one** potential mark every time a CON is used.
- For questions in which the command word is 'suggest' ignore incorrect responses and credit a correct response wherever it occurs
- ora = 'or reverse argument'
- Accept phonetic spellings unless otherwise indicated
- All marks are stand-alone unless otherwise stated in Additional Guidance
- For 'idea of' marking points a wide range of wording is acceptable. The mark is to be awarded for the idea.
- Solid underline indicates a required term although correct spelling is not necessary unless indicated.
- Squiggly underline indicates a key idea that is central to the marking point but that does not need to be expressed in the exact word(s) on the mark scheme
- Commas separate key ideas that need to be included in a candidate's answer in order to gain credit
- Where a word or phrase is enclosed by brackets, the word or phrase does not need to be stated in order to gain the mark but the answer should not be inconsistent with that word or phrase.
- While every effort has been made to include suggestions on possible ways in which candidates are likely to phrase responses, candidates will occasionally make correct responses which have not been anticipated by the SSU team. In these circumstances it is expected that examiners will use their professional judgement or contact their team leader for clarification.

Question			Answer	Marks	Guidance
1	(a)	(i)	A substrate ; B active site ;	2	**Mark the first answer on each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then **= 0 marks.**
		(ii)	*idea of* simple representation of the , process / structure **or** *idea of* showing people how it works ;	1	**Examples of acceptable responses** 'to make the process easy to understand' 'it is a visual representation' **IGNORE** 'because you don't know exactly what is happening' **IGNORE** ' because that's the way it works' **IGNORE** 'because it is still unproven'
		(iii)	supported by , more evidence / new research / more work ; *idea of* fitting evidence more closely (than lock & key) ;	1 max	**ACCEPT** example, e.g. X-ray crystallography **ACCEPT** e.g. 'it has now been found that the enzyme shape changes during the reaction' **IGNORE** responses in terms of 'because that is how it happens'. Answers must refer to evidence. **ACCEPT** 'in the lock and key model the lock changes rather than the key'

Question			Answer		Marks	Guidance
	(b)	(i)			3 max	**Mark the first answer on each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then **= 0 marks.**
			1	enzyme / LDH , concentration / volume **;**		**1 IGNORE** 'amount / number'
			2	substrate / lactate, concentration / volume **;**		**2 IGNORE** 'amount / number' **2 IGNORE** 'reactants' **1 or 2 CREDIT** 'volume / concentration , of solution' once if no reference to enzyme **or** substrate
			3	time **;**		
			4	*idea that* fish should be as closely related as possible **;**		**4 ACCEPT** e.g. 'same type of fish' **4 IGNORE** size / age / sex
			5	pH **;**		
		(ii)	**L ;**		**1**	**Do not award mark if more than one letter given.** **ACCEPT** lactate and water at all temperatures

Question			Answer		Marks	Guidance
		(iii)	**1**	(1°C is) below the optimum temperature / optimum temperature is higher , for this enzyme **;**	**2 max**	**1 ACCEPT ‘**optimum is 10°C’ **1 IGNORE** ‘1°C is not the optimum temperature’ **1 ACCEPT** ‘1°C is further away from the optimum (than 10°C)’
			2	(at 1°C) low kinetic energy / KE , of , enzyme / substrate **;**		**2 ACCEPT** ‘molecules’ / ‘particles’
			3	less chance of substrate entering active site / less chance of ESC formation / fewer collisions between substrate and active site **;**		**3 ACCEPT ‘**fewer ESC formed’ **3 ACCEPT** ‘slower ESC formation’ **3 IGNORE** denatured
			4	*idea of* activation energy harder to reach **;**		**4 ACCEPT** ‘activation energy is greater’
		(iv)	easier for / increased chance of , substrate, entering active site **;** more bonds can form / greater surface area for contact (between active site and substrate) **;** easier for active site to change shape (as part of induced fit) **;** the induced fit , will be easier / AW **;**		**1**	Answers must imply ‘easier’ or ‘quicker’ **ACCEPT** ‘fitting into’ ‘joining’ ‘binding’ **IGNORE** refs to ‘binding to a larger range of substrates’ **IGNORE** refs to ESC **ACCEPT** ‘different bonds can form’ **ACCEPT** ‘(named) bonds form more easily’ **DO NOT CREDIT** if a candidate thinks that flexibility increases kinetic energy

Question			Answer	Marks	Guidance
	(c)	(i)	different, amino acids / amino acid sequence / primary structure **;** different, (named feature of) secondary / (named feature of) tertiary / quaternary, structure **;**	**2**	**ACCEPT** 'different R groups present' **ACCEPT** e.g. more α-helices / different or fewer (named) bonds / (different) prosthetic group / co-factor / ion / co-enzyme / R-groups in different orientation / polypeptide OR chain will fold differently **IGNORE** 3D **IGNORE** protein / enzyme , will fold differently
		(ii)	different , base / nucleotide , sequence **;** different , proportion / ratio , of bases / nucleotides **;** different , allele / gene (would code for the polypeptide) **;**	**2**	**IGNORE** 'different gene sequence' **IGNORE** mutation **ACCEPT** different triplet / codon **ACCEPT** 'number of bases / nucleotides' **ACCEPT** 'different numbers of A or T / C or G' **ACCEPT** 'more adenines' etc **ACCEPT** 'mRNA will be different' **IGNORE** chromosome
	(d)	(i)	enzyme could have potential / future , application **;** any example of potential application **;**	**1 max**	**IGNORE** refs to enzyme being useful to the Antarctic fish **IGNORE** genetic resource or any ref to biodiversity **ACCEPT** 'could be of use to humans' eg medical use, low temperature washing powder, scientific research

Question				Answer	Marks	Guidance
		(ii)	1	ban fishing (in this area / Antarctic) ;	2 max	1 Answers must refer to banning or legislating (and fishing) 1 **IGNORE** 'legislation' unqualified, 1 **IGNORE** less fishing unqualified 1 **IGNORE** 'ban hunting' unqualified
			2	*idea of* quotas / limits on numbers caught ;		2 **ACCEPT** refs to net / mesh size 2 **ACCEPT** idea of patrolling / enforcing
			3	*idea of* protecting (this) habitat (from drilling etc) ;		3 **CREDIT** in terms of maintaining fish's food source 3 **IGNORE** 'feeding fish' 3 **IGNORE** refs to 'in National Parks' unqualified 3 **e.g.** 'protect habitat by banning fishing' = 2 marks (mp1 and mp 3)
			4	*ex situ* (conservation) / captive breeding ;		4 **ACCEPT** 'in captivity' / AW 4 **ACCEPT** 'fish farming' 4 **ACCEPT** ref to sperm / egg, banks
			5	*idea of* promoting other species (for eating) ;		
			6	educating people in the fishing industry ;		6 **IGNORE** education unqualified
				Total	18	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>2</td><td>(a)</td><td></td><td>
<table>
<tr><th>kingdom</th><th>membrane -bound organelles</th><th>cell wall</th><th>type(s) of nutrition</th></tr>
<tr><td></td><td></td><td></td><td>heterotrophic and autotrophic ;</td></tr>
<tr><td>protoctist(s)/ Protoctista ;</td><td></td><td></td><td></td></tr>
<tr><td></td><td>present ;</td><td></td><td></td></tr>
<tr><td>plant(s) / Plantae ;</td><td></td><td>(present and made of) cellulose ;</td><td></td></tr>
<tr><td></td><td>present ;</td><td></td><td></td></tr>
</table>
</td><td>6</td><td>Mark the first answer in each box. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks

IGNORE case of initial ‘P’

ACCEPT ‘✓’ or ‘yes’

IGNORE case of initial ‘P’

ACCEPT ‘✓’ or ‘yes’</td></tr>
<tr><td></td><td>(b)</td><td></td><td>fungi ;</td><td>1</td><td>Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks

ALLOW fungus / fungal / fungae
IGNORE case of initial ‘f’</td></tr>
</table>

Question			Answer		Marks	Guidance
	(c)			*Assume answers refer to 3 domain classification unless otherwise stated*	3 max	**CREDIT** Latin forms of domain names throughout **IGNORE** case of initial letter
			1	based on (differences in) , DNA / RNA / nucleic acids / polynucleotides **;**		**1 CREDIT** in the context of an example
			2	*idea that* more accurately reflects origins (of, prokaryotes / eukaryotes) **;**		
			3	(domain) divides / AW , prokaryotes **; ora**		**3** 'prokaryotes are split into groups because bacteria and archaea are different' = 2 marks (mp 3 and 4)
			4	*idea that* domain reflects differences / AW , between (eu)bacteria and archaea **;**		**4 ACCEPT** phonetic spellings of 'archaea' **4 ACCEPT** 'archaebacteria' **4 IGNORE** multiple examples for this mp, must be a general statement
			5	example of two differences to support point 3 or 4 **;**		**5 IGNORE** if mp 3 or 4 not awarded **5** e.g. (differences between) cell wall / cell membrane / flagella / (named) RNA enzymes / ATPase / proteins bound to genetic material / DNA replication / transcription etc
			6	(domain) groups / AW , eukaryotes together **; ora**		**6 IGNORE** as part of a list of domains. Answer must state that eukaryotes have been placed in the same group. **6** 'eukaryotes are placed in the same group because they have similarities' = 2 marks (mp 6 and 7) **6 IGNORE** 'are similar'
			7	*idea that* domain reflects the fact that there are similarities between eukaryotic kingdoms **;**		**7 IGNORE** multiple examples for this mp, must be a general statement
			8	example of two or more similarities to support point 6 or 7 **;**		**8 IGNORE** if mp 6 or 7 not awarded **8** e.g. all eukaryotes have, nuclei / membrane bound organelles / 80S ribosomes / large cell size / linear DNA / chromosomes / histones etc.
				Total	10	

Question			Answer		Marks	Guidance
3	(a)		1	natural / directional , selection ;	4 max	
			2	mutation ;		2 **DO NOT CREDIT** if implied as a consequence of selection pressure
			3	(mutation / genetic variation, is) random / due to chance / spontaneous / pre-existing ;		
			4	selection pressure is lack of / competition for , food / prey ;		4 **ACCEPT** 'selection pressure is ability to hunt' 4 **ACCEPT** 'selective pressure'
			5	individuals with mutation(s) / allele(s) / gene(s) (for echolocation) , survive ; **ora**		5 **IGNORE** refs to breeding / reproduction 5 **ACCEPT** 'individuals that can echolocate survive' **ora** 5 **DO NOT CREDIT** if answer implies that echolocation is a learned behaviour
			6	(echolocation) allele(s) / gene(s) / mutation(s) , passed on (to next generation) ;		6 **IGNORE** 'genetic trait(s)'
			7	over many generations frequency of , echolocation / allele / characteristic , increases ;		7 Answers must imply multiple generations 7 **ACCEPT** 'over time' as an alternative to 'over many generations' but must be further qualified
	(b)	(i)		*Pipistrellus* ;	1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **IGNORE** case of initial letter 'P' **DO NOT CREDIT** if species name given as well

Question			Answer	Marks	Guidance
3	(b)	(ii)	similar / same, (body) mass ; similar wingspan ; `similar / same, colour ; all characteristics , similar / same, except echolocation / wingspan ; previously unable to measure echolocation (frequency) ;	1 max	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **IGNORE** 'similar appearance' **ACCEPT** 'both 5.5 g' **IGNORE** 'same' **ACCEPT** 'almost the same' or 'small difference' or ref to figures **ACCEPT** 'both (medium to dark) brown'
	(b)	(iii)	**1** genetics / genes / DNA ; **2** RNA ; **3** amino acid sequences ; **4** cytochrome C / fibrinopeptide ;	2 max	**Mark the first two answers only.** **1 IGNORE** chromosomes **1 ACCEPT** (named) bases **1 or 2 CREDIT** 'nucleotide sequence / polynucleotide base sequence' for 1 mark if neither of mp 1 nor mp 2 have been awarded **3 ACCEPT** primary structure of polypeptide **4 ACCEPT** haemoglobin

Question			Answer	Marks	Guidance
3	(b)	(iv)	(inter)breed / AW **;** determine if offspring are fertile **;** if offspring are infertile / no offspring produced, then different species **; ora**	2 max	**ACCEPT** 'mate' / 'reproduce' **CREDIT** 'observe to see if populations are reproductively isolated' as resitting A2 candidate might consider phylogenetic species definition This mark is for assessing the fertility of the offspring 'if they belong to the same species they will be able to breed with each other and produce fertile offspring' = 2 marks (1st and 3rd)

Question			Answer		Marks	Guidance
3	(c)			***Most marks*** *(apart from **C2**, **C5** and **D5**) are stand alone and do not need to be linked to context. However, **max 5** if any statements are mismatched.*	**6 max**	*For example* ' some variation is controlled by only one gene this variation will have intermediates' **AWARD D2** and **C4** but **max 5** for the whole question and **DO NOT AWARD QWC** and put **CON** in the margin
			C1	continuous ;		
			C2	(continuous / AW , is) effect of , many genes / polygenic / genes and environment / genetic and environmental / environment **;**		**C2 IGNORE** alleles **C2 IGNORE** example of environmental factor, e.g.diet **C2** Must be linked to context of continuous variation
			C3	quantitative **;**		**C3** No ora for discontinuous
			C4	there is a range / any value is possible / intermediate values / no distinct groups / AW **;**		
			C5	*example* to illustrate any C marking point **;**		**C5 must be linked to another C mark** **CREDIT** only , body mass / wingspan / colour / range of pitch within species
			D1	discontinuous ;		
			D2	(effect of) one / few, genes **;**		**D2 ACCEPT** 'there is a gene for pitch' or 'there are high-pitched and low-pitched alleles' **D2 ACCEPT** any suggestion of a low number of genes **D2 IGNORE '**variation is genetic'
			D3	little / no, environmental effect **;**		**D3 ACCEPT** 'only influences by genes' / AW **D3 IGNORE** unqualified refs to genes
			D4	discrete categories / no intermediates / AW **;**		**D4 ACCEPT** 'set groups'
			D5	*example* to illustrate any D marking point **;**		**D5 Must be linked to another D mark** **D5 CREDIT** only these examples: low-pitched or high-pitched / pitch variation between species / sex / no bat call between 47 and 52 Hz **D5 IGNORE** 'colour' as an example to support a D mark

Question			Answer	Marks	Guidance
3	(c)		**QWC** – Award for successfully relating continuous or discontinuous variation to the effect of genes or environment **;**	1	Award if candidates have been awarded **either** **C2 and any other C mark** **or** **D2 / D3 and one of D1, D4 or D5** **DO NOT AWARD QWC** if any mark has been given in the wrong context
			Total	17	

Question			Answer	Marks	Guidance
4	(a)	(i)	polysaccharide **;**	1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **ACCEPT** phonetic spelling **IGNORE** polymer **IGNORE** oligosaccharide
		(ii)	*similarity* chain / unbranched / glycosidic bonds / (contain) hexose / hex ring / O in each ring / CHO **;** *difference* *agarose has:* two types of (glycosidic) bond **or** two different, sugars / sugar residues / monosaccharides **or** disaccharide, monomer / subunit / AW **or** (residues) are alternately rotated / AW **or** straight chain **;**	**2**	**IGNORE** polysaccharides **IGNORE** 6-carbon ring **ACCEPT** 5-carbon ring Assume answer refers to agarose unless otherwise stated **ACCEPT** ora for any point **DO NOT CREDIT** references to any incorrect bond **ACCEPT** any suggestion of bonding to different numbered carbon atoms (as numbers are not given in diagram) **ACCEPT** 'alternating bonds' **IGNORE** refs to glucose **ACCEPT** 'flipped' / 'reflected' **ACCEPT** 'amylose is coiled'

Question			Answer	Marks	Guidance
4	(b)		(bacteria) do not, make / have, correct <u>enzyme</u> (to digest agarose) **;** agarose, does not fit / not complementary to, <u>active site</u> (of bacterial enzymes) **;** bacteria unable to transport **,** substrate / enzyme , across membrane **;**	**1 max**	**DO NOT CREDIT** in incorrect context e.g. 'bacteria do not have amylase' or 'bacterial enzyme cannot break down amylose'
	(c)	(i)	<u>control</u> **;** compare with tube A / see what happened when there was no bacteria / show it was bacteria doing it / to show it does not break down on its own / to show that the nutrient solution does not break it down **;**	**2**	**ACCEPT** 'compare it with the other tube' **IGNORE** 'compare the tubes'

Question			Answer	Marks	Guidance
4	(c)	(ii)	*idea that* some, starch / other polysaccharide / (reducing) sugar present in , nutrient solution / culture solution / bacteria (at start) **;** presence of some mutated , *E. coli* / bacteria , (that can break it down) **;** presence of (other) microorganism that can break it down **;**	**1 max**	**IGNORE** experimental error unqualified **IGNORE** any reference to temperature **IGNORE** other carbohydrate
		(iii)	replicate(s) / repeat(s) **;** more than one sample tested from each tube / sample each tube twice **;**	**2**	**Mark the first answer on each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **IGNORE** 'do more tests' **IGNORE** 'disregard anomalous results' **IGNORE** 'compare with other results' **IGNORE** 'calculate mean'

Question				Answer	Marks	Guidance
4	(d)	(i)	1	add, Benedict's (reagent) / $CuSO_4$ + NaOH / alkaline copper sulphate ;	5 max	**1 ACCEPT** 'do Benedict's test' **1 DO NOT CREDIT** if adding acid / hydrolysing
			2	heat ;		**2 ALLOW** boil **2 IGNORE** warm **2 ACCEPT** any temperature between 80°C and 100°C **2 ACCEPT** gently heat
			3	(forms) <u>precipitate</u> ;		
			4	(colour changes from blue to), green / yellow / orange / brown / (brick) red ;		
				concentration estimated from		Read as prose and mark the best suggestions
				EITHER		**5/6 DO NOT AWARD** if candidate is using a colorimeter
			5a	degree of colour change / use different colours ;		**5a ACCEPT** 'the darker / redder , the more reducing sugar' **5a ACCEPT** in context of precipitate or supernatant
			6a	comparison (of final colour) with , standard / known, solution ;		**6a** Answers must include the idea of comparison **6a ACCEPT** ref to calibration curve as long as not in context of colorimeter
				OR		
			5b	filter / centrifuge , **and** weigh precipitate ;		
			6b	greater mass = more sugar present / use of a standard curve ;		**6b ACCEPT** weight **6b ACCEPT** amount
				OR		
			5c	centrifuge ;		
			6c	size , of pellet / colour of supernatant (liquid), indicates concentration ;		**6c ACCEPT** mass

Question			Answer		Marks	Guidance
		(ii)			3 max	*Max 2 if any point out of sequence*
			1	add (hydrochloric) acid and boil ;		**1 CREDIT** add hydrolytic enzyme **1 ACCEPT** heat
			2	add, (named) alkali / (sodium) carbonate / (sodium) hydrogencarbonate ;		**2 CREDIT** 'neutralise' if not contradicted by named chemical
			3	then carry out reducing sugar test (again) / described ;		
				Total	**17**	

Question			Answer	Marks	Guidance
5	(a)	(i)	11.3 **; ;**	2	**Correct answer = 2 marks** even if no working shown. **IGNORE** '-' before the number If the answer is incorrect, **ALLOW** 1 mark for seeing $\frac{(2.75 - 2.44)}{2.75} \times 100$ **or** $\frac{0.31}{2.75} \times 100$ If the answer is not given to 1 decimal place, **ALLOW** 1 mark for A correct but unrounded answer (11.2727…, 11.27˙ etc) **or** A correct answer that has been rounded to the wrong number or decimal places **or** A correct answer seen but has been rounded incorrectly (eg 11.2)

Question			Answer		Marks	Guidance
5	(a)	(ii)			4 max	**ACCEPT** curve / lung function / amount of exhaled air , as AW for FEV
			1	non-smokers' FEV higher than smokers' **; ora**		**1 DO NOT CREDIT** FEV is higher **at the start** (alone) as this implies it is lower later on
			2	smokers' FEV , declines / falls / drops / decreases (over time) **;**		**2 IGNORE** 'both decline'
			3	widening gap (between smokers and non-smokers) / rate of decline is lower in non-smokers / smaller reduction in non-smokers **;**		**3 ACCEPT** ora for decline and extent of reduction
			4	non smokers' (FEV) increases then decreases / peaks **;**		
			5	non-smokers' (curve / FEV / lung function) has peak at 1.5 years **and** 2.88 dm^3 **;**		
			6	appropriate figures to support mp 1 - 3 **;**		**6** Figures must include 2 FEVs with units linked to time in years and must support the point being made. **6 ALLOW** valid calculated comparison **6 ALLOW** comparative dates such as '2 years later'

Time (years)	FEV_1 (dm^3) had stopped smoking	FEV_1 (dm^3) continue to smoke	Acceptable range for difference	Other useful figures:
0.0	2.82	2.75	0.07	Increase over 1 ½ years for stopped smoking = 0.06 dm^3 Decrease over 1 ½ years for continue to smoke = 0.06 – 0.07 dm^3 Decrease over from 1 ½ years to 5 years for stopped smoking = 0.10 – 0.11 dm^3 Decrease over from 1 ½ years to 5 years for continue to smoke = 0.24 – 0.25 dm^3 Decrease over 5 years for stopped smoking = 0.04 – 0.05 dm^3 Decrease over 5 years for continuing smokers = 0.31 dm^3
0.5	2.85	2.73	0.12	
1.0	2.87	2.71	0.16	
1.5	2.88	2.68 – 2.69	0.19 – 0.20	
2.0	2.87	2.67 – 2.68	0.19 – 0.20	
2.5	2.86	2.64	0.22	
3.0	2.84	2.60	0.24	
3.5	2.82 – 2.83	2.56 – 2.57	0.25 – 0.27	
4.0	2.80	2.53	0.27	
4.5	2.78 – 2.79	2.49	0.29 – 0.30	
5.0	2.77 – 2.78	2.44	0.33 – 0.34	

Question			Answer		Marks	Guidance
5	(b)	(i)		*causes*	6 max	
			1	tar ;		
			2	(cigarette smoke) destroys / damages / paralyses, cilia / ciliated epithelium ;		2 **ALLOW** in response to any component of cigarette smoke 2 **DO NOT CREDIT** 'kills cilia' / 'cilia die' 2 **IGNORE** 'cilia stick together'
			3	(cigarette smoke stimulates) goblet cells to release more mucus ;		3 **ALLOW** in response to any component of cigarette smoke 3 Must contain the idea of more mucus than normal
			4	mucus (in airways) , builds up / cannot be removed / AW ;		
			5	more, pathogens / bacteria / viruses / microbes, collect / trapped / accumulate (in mucus) ;		5 **IGNORE** 'pathogens' alone must have idea of increasing number of pathogens e.g. **ACCEPT** 'breeding' 'multiplying' /AW 5 **ACCEPT** 'higher number of pathogens present' 5 **ACCEPT** 'infections more likely'
			6	*idea that* cough is an attempt to , increase air flow / remove microbes , by removing mucus ;		6 There must be a reason for removing the mucus 6 **ACCEPT** 'to clear the throat by removing mucus' 6 **ACCEPT** 'to reduce infections by removing mucus'
				effects		
			7	(frequent coughing) damages / inflames, (named) airway / alveoli / elastic fibres ;		7 **IGNORE** damage to lungs 7 **IGNORE** damage as a result of elastase / emphysema
			8	formation of scar tissue ;		8 **CREDIT** in any part of lung
			9	airway / bronchi / bronchiole, walls thicken ;		9 **IGNORE** 'trachea' 9 **CREDIT** 'smooth muscle (in wall) thickens'
			10	lumen of , airway / bronchi / bronchiole , narrows ;		10 **IGNORE** 'trachea'
			11	flow of air restricted ;		11 'airflow restricted due to extra smooth muscle' = 2 marks, mp 9 and 11
			12	(damage to alveoli causes) reduced surface area for , gas exchange / oxygen diffusion ;		
			QWC – One cause of cough and one effect of cough		1	**Award** if at least 1 mark has been given from each of the mark scheme sections (1-6 and 7-**11**) for this question.

Question			Answer		Marks	Guidance
5	(b)	(ii)	emphysema ; chronic bronchitis ; asthma ;		2 max	**Mark the first answer on each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **ACCEPT** phonetic spellings **IGNORE** emphysemia
		(iii)	**1**	elastin is substrate ;	5 max	**1** Must be a clear statement
			2	(elastin / substrate) binds to / fits into , active site ;		**2 IGNORE** complementary **2 ACCEPT** goes in to
			3	active site / enzyme / elastase / substrate / elastin, shape changes ;		**3/4 CREDIT** 'mould around' once for either mp 3 or mp 4 but award the alternate marking point if seen
			4	*idea of* closer fit (between active site and substrate) ;		**4 ACCEPT** eg tighter / more precisely / in a better position
			5	more bonds form (between substrate and active site) ;		**5 ACCEPT** 'interactions'
			6	forms enzyme-substrate-complex / ESC ;		
			7	*idea that* (change in shape of active site) destabilises / weakens , bonds (in substrate) / substrate ;		**7 ACCEPT** e.g. puts, pressure / strains, on
			8	activation energy reduced ;		
			9	*idea of* further shape change of, active site / enzyme, after products form ;		**9 IGNORE** 'the enzyme is unchanged'
				Total	20	

Question			Answer		Marks	Guidance
6	(a)	(i)	1	artificial selection / selective breeding ;	3 max	
			2	select (male and female) sheep that are, larger / woollier / meatier/ have desired characteristics ;		2 **ACCEPT** 'large / woolly / meaty, male and female that can produce healthy offspring' ; **2** 'sheep' can be inferred from 'individuals' as it is in the stem of the question
			3	crossbreed / breed (together) / mate (together) / interbreed ;		3 **ACCEPT** 'reproduce'
			4	select , best / AW, offspring ;		
			5	*idea of* breeding (and selecting) for , many / several , generations ;		5 **IGNORE** traits passed on through generations, answers must imply breeding and selection
		(ii)		(use of) (named) antibiotics ; (use of) (named) pesticides / insecticides / fungicides ; cloning / genetic modification / AW ; artificial insemination / AI / IVF / marker-assisted selection ; hormones ; vaccinations ;	1 max	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **IGNORE** refs to 'fertiliser' etc., as 'sheep' is in question stem **IGNORE** refs to diet **ACCEPT** 'steroids' / 'growth supplements' **IGNORE** 'better veterinary care'

Question			Answer		Marks	Guidance
6	(b)	(i)	1	broken down by, decomposers / bacteria / fungi ;	3 max	
			2	add (named) mineral(s) to soil ;		2 **IGNORE** nutrients **ACCEPT** ions
			3	nitrate and phosphate and potassium / NPK ;		3 **ACCEPT** nitrogen , $NO_3^{(-)}$, $PO_4^{(3-)}$, $K^{(+)}$ NH_3, $NH_4^{(+)}$, ammonium, ammonia 3 **IGNORE** phosphorous, P , N_2
			4	specific use of (any) named mineral ;		4 eg nitrate or nitrogen for protein, magnesium for chlorophyll, etc. 4 **DO NOT CREDIT** vague uses like 'nitrate for growth'
			5	lack of (named) , mineral(s) / nutrient(s) / ion(s), is limiting factor (for growth) ;		
			6	*example of* way in which soil quality is improved ;		6 **ACCEPT** for example change in pH / crumb size / air content / moisture content / less leaching of minerals / increased humus / presence of (named) detritivores / less risk of soil erosion

Question				Answer	Marks	Guidance
6	(b)	(ii)	1	(fertiliser) promotes growth of, one / few, (plant) species ;	2 max	1 **ACCEPT** 'once species might grow more than another' 1 **IGNORE** 'yield'
			2	other (plant) species , out-competed / AW (as a result of competition from crop species) ;		2 **IGNORE** fertilisers / eutrophication , killing other plants 2 **ACCEPT** 'other plants die' in the context of their being out-competed by the crop plant
			3	*idea of* disruption of food chains ;		3 **DO NOT CREDIT** in the context of biomagnification / eutrophication
			4	*idea of* reduction in , soil quality / humus , over time so plants cannot grow ;		4 **ACCEPT** 'might change soil pH so some plants can't grow'
		(iii)			3 max	**IGNORE** answers in the context of genetic variation **within the domestic population**. For example,' if one plant is susceptible to a disease then they might not all die'.
			1	loss of genetic , diversity / variation (in wild population) ;		1 **ACCEPT** small / reduced , gene pool
			2	environment / agricultural requirements, may change (in future) ;		
			3	(lost) genes / alleles , may have been useful ;		3 **ACCEPT** 'potential genetic resource may have been lost'
			4	e.g. of gene useful to agriculture ;		4 *e.g., gene for* pest resistance / disease resistance / heat tolerance / drought tolerance ; 4 **DO NOT CREDIT** immunity to diseases
			5	fewer pollinators ;		
			6	loss of (pest) predators ;		
				Total	12	

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>7</td><td></td><td></td><td>
<table>
<tr><th>definition</th><th>term</th></tr>
<tr><td>sampling in which the observer does not decide when and where to take measurements</td><td>random ;</td></tr>
<tr><td>a representative group of organisms that are selected from a population</td><td>sample ;</td></tr>
<tr><td>the area in which an organism lives</td><td>habitat ;</td></tr>
<tr><td>a measure of the relative numbers of individuals in each species</td><td>species evenness ;</td></tr>
<tr><td>the frequency of occurrence of plants in a particular area</td><td>abundance ;</td></tr>
<tr><td>the number of species present in a particular area</td><td>species richness ;</td></tr>
</table>
</td><td>6</td><td>DO NOT AWARD mark if two or more answers are given in any box except IGNOREs listed below

IGNORE systematic

IGNORE percentage cover

IGNORE biodiversity</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>6</td><td></td></tr>
</table>

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