GCE

Biology

Advanced Subsidiary GCE

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

Mark Scheme for January 2011

Oxford Cambridge and RSA Examinations

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Mark schemes should be read in conjunction with the published question papers and the Report on the Examination.

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Question			Expected Answer	Mark	Additional Guidance
1	(a)	(i)	human immunodeficiency virus / HIV **;**	1	**DO NOT CREDIT** if there is any ref to AIDS
1	(a)	(ii) 1	(infective agent), in blood / body fluids **;**		**1 ACCEPT** any infective agent even if incorrect as question asks for *mode of transmission*
		2	*idea of:* used needles are contaminated **; ora**		**2 ACCEPT** e.g. 'used needles are infected' **2 ACCEPT** e.g. 'new needles are sterile' **2 DO NOT CREDIT** 'dirty' / 'clean' needles
		3	reduces chance of sharing needles **; ora**	2 max	**3 IGNORE** 'prevents' / 'stops'
1	(b)	(i)	amino acid(s) **;** nucleotide(s) **;**	2	*Answers must be on correct line* **ACCEPT** phonetic spelling for both **DO NOT CREDIT** if ref to DNA / 'nucleosides' **ACCEPT** 'ribonucleotides'
1	(b)	(ii) 1	reverse transcriptase in (host) nucleus **;**		
		2	viral DNA, (inserted) in (host), chromosome / DNA **;**		
		3	*idea of:* (viral) RNA / mRNA produced / transcribed **;**		
		4	(to) code for / make / translate, viral proteins **;**	2 max	**4 IGNORE** 'different protein'

Question			Expected Answer	Mark	Additional Guidance
1	(c)	(i)			**Mark the first three answers only regardless of which line they are on**
		1	not vaccinated against TB **;**		**1 IGNORE** general refs to lack of medical care
		2	weakened immune system **;**		
		3	(lifestyle) e.g. poor diet / lack of protein / malnourished / smoking / alcoholism **;**		**3 DO NOT CREDIT** 'alcohol' unqualified **IGNORE** 'poor health'
		4	homelessness **;**		
		5	poor ventilation (of housing) / AW **;**		
		6	overcrowding **;**		
		7	close contact with people from / visiting, area where TB is common **;**		**7 ACCEPT** area where those with TB are not quarantined
		8	close / prolonged, contact with individual(s) with TB **;**		
		9	consumption of milk or beef, from infected cattle / in developing countries **;**		
				3 max	

Question			Expected Answer	Mark	Additional Guidance
	(c)	(ii)			
		1	cytokine / interleukin / receptor has, specific / unique, shape **;**		**1 DO NOT CREDIT** 'cytokine is specific to receptor' as this is implied in question
		2	(cytokine / interleukin), binds / attaches / bonds to / fits into, receptor **;**		
		3	receptor on (cell surface) membrane (of B lymphocyte) **;**		**3 DO NOT CREDIT** 'antibodies' (on cell surface)
		4	(receptor and cytokine have) <u>complementary</u> <u>shapes</u> **;**		
		5	<u>activates</u> / <u>stimulates</u>, clonal expansion / <u>mitosis</u> **;**	**3 max**	**5 ACCEPT** activates / releases 2nd messenger
			Total	**13**	

Question			Expected Answer	Mark	Additional Guidance
2	(a)	(i)	blue-black / black / dark blue **;**	1	**ACCEPT** dark purple / purplish-blue **DO NOT CREDIT** blue or purple unqualified by darkness **ACCEPT** acceptable colour change
2	(a)	(ii)		2	**CREDIT** marking points from clearly labelled diagram max 1 if incorrect charges are on atoms
		1	between oxygen and hydrogen (atoms) **;**		**1 DO NOT CREDIT** molecules / ions
		2	(between) electronegative / δ^-, and electropositive / δ^+ **;**		**2 DO NOT CREDIT** ions / + and – **2 ACCEPT** slight / partial (negative / positive), charge
2	(a)	(iii)		2 max	**IGNORE** refs to denaturation
		1	hydrogen / H, bonds break **;**		
		2	helix, lost / unravels / AW **;**		**2 ACCEPT** spiral / coil
		3	iodine, released / no longer in complex / AW **;**		**3 ACCEPT** no longer contained in helix

Question			Expected Answer	Mark	Additional Guidance
2	(b)	1	take samples at a range of times / AW **;**		
		B2	same <u>volume</u>s (of solutions) added / removed (each time) **;**		**B2** must be in context of Benedict's test rather than reaction mixture
		B3	heat with, Benedict's (solution) / $CuSO_4$ and NaOH **;**		**B3 DO NOT CREDIT** boil **/** warm **B3 DO NOT CREDIT** if Benedict's added to the mixture at the beginning
		B4	(use of) excess Benedict's **;**		
		B5	changes to, green / yellow / orange / brown / (brick) red **;**		
		C6	remove precipitate / obtain filtrate **;**		**C6 CREDIT** description of method e.g. filtering / centrifuging / decanting
		C7	colorimeter **;**		
		8	calibrate / zero, using, a blank / water / (unreacted) Benedict's **;**		**8 IGNORE** 'control'
		9	use (red / orange) filter **;**		**9 DO NOT CREDIT** if colour of filter is incorrect
		T10	reading of, transmission / absorbance **OR** mass of precipitate **;**		**T10 ACCEPT** 'measure how much light, does / does not, pass through'
		11	more transmission / less absorbance, of filtrate, **OR** greater mass ppt, = more maltose present **; ora**		**11** if unfiltered Benedict's / precipitate is **clearly indicated** as being present **in sample**, **ACCEPT** 'less transmission / more absorbance, = more maltose present' **11 DO NOT CREDIT** if precipitate is added to colorimeter
		12	using, standard / known, concentrations (of maltose) **;**		**12 CREDIT** 'serial dilutions'
		13	(obtain) <u>calibration</u> curve **;**		
		14	<u>plot</u>, transmission / absorbance / mass of ppt, against (reducing sugar) concentration **;**		
		15	<u>use graph</u> to read off concentration of maltose / AW **;**	**6 max**	
			QWC – correct sequence **;**	**1**	1 of mps **B2 to B5**, *then* mp **C6 or C7**, *then* mp **T10**

<table>
<tr><th colspan="3">Question</th><th>Expected Answer</th><th>Mark</th><th>Additional Guidance</th></tr>
<tr><td>2</td><td>(c)</td><td>(i)</td><td>
1 increases / greater / faster ;
2 reaction completed in / plateaus after / concentration is 100% after, 3.5 minutes ;
3 figures with units to support mp 1 ;
</td><td>2 max</td><td>
1 ACCEPT any time between 3.45 and 3.55 min.

3 two maltose concentrations (+ or – chloride) for a given time or two times (+ or – chloride) for given maltose concentration.
3 ACCEPT calculated difference
3 DO NOT CREDIT if ‘%’ and ‘min.’ not given
3 ACCEPT any concentration within ± 1 % and time within ± 0.05 min.
</td></tr>
<tr><td></td><td></td><td></td><td colspan="3">
<table>
<tr><th rowspan="2">Presence or absence of chloride ions</th><th colspan="9">The percentage concentration of maltose (%) present every half a minute</th></tr>
<tr><th>0.0 min</th><th>0.5 min</th><th>1.0 min</th><th>1.5 min</th><th>2.0 min</th><th>2.5 min</th><th>3.0 min</th><th>3.5 min</th><th>4.0 min</th></tr>
<tr><td>Chloride ions present</td><td>0</td><td>24</td><td>54</td><td>70</td><td>80</td><td>88</td><td>95</td><td>100</td><td>100</td></tr>
<tr><td>Chloride ions absent</td><td>0</td><td>12</td><td>20</td><td>29</td><td>36</td><td>40</td><td>45</td><td>48</td><td>50</td></tr>
<tr><td>Difference in maltose concentration When chloride ions are either present or absent</td><td>0</td><td>12</td><td>34</td><td>41</td><td>44</td><td>48</td><td>50</td><td>52</td><td>50</td></tr>
</table>
Allow a + /- 1% for any concentration of maltose and a +/- 2% for the difference in maltose concentrations
</td></tr>
<tr><td>2</td><td>(c)</td><td>(ii)</td><td>
1 (acts as a) cofactor ;
2 (Cl^-) binds to, enzyme / amylase / amylose / substrate ;
3 enzyme substrate complex / ESC, forms more, easily / quickly ;
</td><td>2 max</td><td>
1 IGNORE ‘coenzyme’

2 ACCEPT binds to, active site

3 ACCEPT description
</td></tr>
</table>

Question			Expected Answer	Mark	Additional Guidance
2	(c)	(iii)			**Mark the first three answers only regardless of which line they are on** **DO NOT CREDIT** refs to, time
		1	temperature **;**		
		2	pH **;**		
		3	enzyme / amylase / chloride, <u>concentration</u> **;**		**3 IGNORE** 'amount' or 'volume' **3 DO NOT CREDIT** 'concentration' unqualified
		4	substrate / starch / amylose, <u>concentration</u> **;**		**4 IGNORE** 'amount' or 'volume' **4 DO NOT CREDIT** 'concentration' unqualified
		5	constant / regular, stirring **;**		
		6	(fixed) <u>volume</u> of solution (removed each time for sampling) **;**	**3 max**	
			Total	**19**	

Question			Expected Answer	Mark	Additional Guidance
3	(a)	(i)			**ACCEPT** reference to numbers rather than breeding success throughout
		1	(all), sub-arctic / all 4 named sub-arctic, species / birds, show decrease **;**		**1** sub-arctic species = snow bunting + Lapland bunting + ptarmigan + dotterel
		2	(all / most), other / non sub-arctic / all 4 named non sub-arctic, species / birds, show, increase / no change **;**		**2** non sub-arctic species = red grouse + wheatear + meadow pipit + ring ouzel
		3	greater change / AW (in breeding success), in sub-arctic than in non sub-arctic species **;**		
		4	comparative figs (in 1970 **AND** 2000) **;**		**4** number of young for one sub-arctic and one non sub-arctic species in 1970 and 2000 (or calculated subtraction between the two years) **4 DO NOT CREDIT** if figures are not from 1970 and 2000
				3	

species	number of young raised per year		
	1970	**2000**	**difference in number of young raised between 1970 and 2000**
Snow bunting*	78	2	Down 76
Lapland bunting*	7	0	Down 7
Ptarmigan*	1280	876	Down 404
Red grouse	890	962	Up 72
Wheatear	209	231	Up 22
Meadow pipit	23	82	Up 59
Ring ouzel	23	26	Up 3
Dotterel*	45	35	Down 10

Question			Expected Answer	Mark	Additional Guidance
3	(a)	(ii)			
		1	climate change / global warming **;**		**1 IGNORE** greenhouse effect **1 DO NOT CREDIT** 'it is too warm' or 'it is not cold enough' without reference since 1970
		2	(environmental) change too rapid for adaptation **;**		
		3	change in, flora / plants / food supply / insects / prey / predators / human activity **;**		**3 ACCEPT** camouflage no longer appropriate / reduction in size of habitats
		4	disease (that affects sub-arctic species more than others) **;**		
		5	sub-arctic species, less well-adapted than / have been outcompeted by, non sub-arctic species / AW **;**		**5 ACCEPT** ora
				2 max	
3	(b)	(i)	the number of species present (in a habitat) **;**	**1**	**DO NOT CREDIT** range / amount

Question			Expected Answer	Mark	Additional Guidance
3	(b)	(ii)			**Mark the first <u>three</u> suggestions**
		1	*idea of:* unbiased method to selecting sampling <u>area</u> **;**		**1 ACCEPT** e.g. random selection of, areas / coordinates OR use of transect **1 IGNORE** 'random sampling' unqualified
		2	sample many times / AW, and calculate mean / average **;**		
		3	standardised sweeping procedure **;**		**3** e.g. same type of movement / same length of time same number of sweeps **3 ACCEPT** sample at same time of day **3 IGNORE** same collector **3 IGNORE** refs to using alternative collecting techniques in order to collect more insect species
		4	ensure insects do not escape (before being identified) **;**		**4 ACCEPT** use of pooter
		5	method to prevent recounting **;**		**5** if ref to mark-release-recapture, **IGNORE** 'release and recapture' and look for idea for preventing recounting
		6	sample at different times of, day / month / year / weather conditions **;**	**3 max**	

Question			Expected Answer	Mark	Additional Guidance
3	(b)	(iii)			
		1	(measures), abundance / numbers, of individuals in each species **;**		
		2	species evenness is more quantitative than species richness **; ora**		
		3	high(er) species evenness indicates high(er) biodiversity **; ora**		
		4	low species evenness indicates, dominance by / high abundance of, one / few, species **; ora**		
		5	used to calculate (Simpson's) Index of Diversity **;**		
		6	example used to illustrate explanation of mp 3 or 4 **;**	**3 max**	**6** e.g. "Two areas have the same number of species. One with 90% of 1 species has less biodiversity than one where all species have an abundance of 5-20%"
			Total	**12**	

Question			Expected Answer	Mark	Additional Guidance
4	(a)	1	free from, disease / illness **;**		**1 ALLOW** infection **CREDIT** 'not just the absence of disease'
		2	physical **and** mental **and** social wellbeing / AW **;**		**2 DO NOT CREDIT** 'state' / 'condition'
		3	good nutrition **;**		**3 ACCEPT** balanced diet
		4	suitably housed **;**	**2 max**	**4 ACCEPT** ref to economic wellbeing

Question			Expected Answer	Mark	Additional Guidance
4	(b)				**Mark first F mark on line and assume explanation relates to that** **ACCEPT** named example(s) of pathogen or parasite **CREDIT E** marks if a reasonable, but non-creditworthy, attempt at an **F** mark has been made, e.g. 'lining of nasal passages' for **F2**
		F1	skin **;**		
		E1	*idea of:* physical barrier to prevent entry of microorganisms **;**		**E1 ACCEPT** 'pathogens cannot pass through cells' **E1 ACCEPT** antibacterial effects of sebum or sweat **E1 DO NOT CREDIT** physical barrier unqualified
		F2	mucous membrane(s) / goblet cells **;**		
		E2	(produce) mucus to trap, pathogens / parasite **;**		
			OR		
		F2	mucus **;**		
		E2	traps pathogens **;**		
		F3	cilia / ciliated epithelium **;**		
		E3	remove, pathogen / parasite, laden / AW, mucus **;**		
		F4	blood clotting **;**		
		E4	prevents, pathogens / parasite, entering bloodstream **;**		
		F5	ear wax / nasal hairs **;**		
		E5	traps, pathogens / parasite **;**		
		F6	lysozyme / tears / nasal secretions / saliva **;**		**F6 IGNORE** lysosome(s)
		E6	kills bacteria / contains antibacterial agent **;**		**E6 ACCEPT** contains antibodies
		F7	gastric juice / stomach acid **;**		**F7 ACCEPT** 'enzymes in the stomach' or 'acid in vagina'
		E7	kills, pathogens / parasite **;**		
				4 max	

Question			Expected Answer	Mark	Additional Guidance
4	(c)	(i)			
		1	lives, on / in / in contact with, **and** harms <u>host</u> **;**		**1** living on / in must be stated, cannot be implied from feeding **1 IGNORE** 'live off'
		2	takes nutrition from / feeds on (host) **;**		
		3	warmth **;**		**3 ACCEPT** 'incubate'
		4	protection / safe place / AW **;**		
		5	allows transmission / spread, to a new host / AW **;**		**5 ACCEPT** 'distributed' / 'passed on' as implies new host
				4 max	
4	(c)	(ii)			
		1	wash / clean / disinfect / sterilize, hands **;**		
		2	not, scratching / touching, of anus **;**		**2 ACCEPT** method to prevent scratching e.g. cutting nails **2 IGNORE** 'wash anus'
		3	drugs to, kill / remove, parasite / eggs **;**		**3 DO NOT CREDIT** 'antibiotics' **3 IGNORE** 'anti-bacterial'
				2 max	
			Total	**12**	

Question			Expected Answer	Mark	Additional Guidance
5	(a)		<table><tr><th>statement</th><th>DNA only (**D**) or RNA only (**R**) or both DNA and RNA (**B**)</th></tr><tr><td>contains thymine</td><td>**D**</td></tr><tr><td>contains ribose</td><td>**R** ;</td></tr><tr><td>consists of 2 chains connected to each other with hydrogen bonds</td><td>**D** ;</td></tr><tr><td>has a sugar-phosphate backbone</td><td>**B** ;</td></tr><tr><td>has 4 different nitrogenous bases</td><td>**B** ;</td></tr><tr><td>contains a pentose sugar</td><td>**B** ;</td></tr><tr><td>is found in the nucleus and cytoplasm</td><td>**R** ;</td></tr></table>	6	**Award** 1 mark for each correct row **DO NOT CREDIT** if more than one letter in a box

Question			Expected Answer	Mark	Additional Guidance
5	(b)	(i)			
		1	(information used to) decide which, group / taxon, organism / species / named example, fits in **;**		**1** answers must refer to the information provided by the study of DNA, rather than simply the job of taxonomists**,** e.g. **ACCEPT** 'it can be used to put organisms into groups' **1 IGNORE** 'for classification' unqualified – look for idea of: groups **1 CREDIT** ref to belonging to same taxonomic group, e.g. 'to see if it belongs in the genus *Homo*'
		2	compare the proportion of (different) bases **;**		**2 IGNORE** 'examine proportion of bases' **2 CREDIT** idea for looking at similarities / differences
		3	compare the DNA / genes / sequence of bases **;**		**3 IGNORE** 'examine sequence of bases' **3 CREDIT** idea for looking at similarities / differences
		4	*idea of:* the more similar the, DNA / genes, the closer the relationship / AW **;**	**2 max**	**4** Must contain reference to similarity of DNA
5	(b)	(ii)			**Mark the first <u>two</u> suggestions** **IGNORE** ref to genetics as DNA is 'biochemical'
		1	fossil record **;**		
		2	anatomy / physiology / behaviour **;**		**2 ACCEPT** AW for anatomy, e.g. observable / physical features / cell structure **2 ACCEPT** AW for physiology, e.g. method of reproduction
		3	embryology / AW **;**	**2 max**	
5	(c)		**J ;** **T ;**	**2**	**DO NOT CREDIT** names

Question			Expected Answer	Mark	Additional Guidance
5	(d)	(i)			
		1	no DNA from living specimens in Wales analysed **;**		
		2	population (may have) evolved / mutations have occurred / genetic variation, (since 1948) **;**	1 max	**2 ACCEPT** description of evolved **2 DO NOT CREDIT** 'evolution' unqualified by context of pine marten population
5	(d)	(ii)			**ACCEPT** animals as AW for pine martens throughout answer
		1	(introduced) pine martens might not be adapted to local conditions / AW **;**		**1 ACCEPT** not adapted to the habitat **1 DO NOT CREDIT** 'used to'
		2	(local) habitat, might have changed / is no longer suitable (for any pine martens) / AW **;**		
		3	introduced, pine martens, might outcompete native, population / pine martens **;**		**3 ACCEPT** introduced pine martens might kill native / Welsh pine martens **3 IGNORE** 'compete' unqualified
		4	introduced pine martens might bring disease **;**		
		5	Welsh pine marten would lose its, distinctiveness / identity, because of interbreeding **;**	1 max	
			Total	**14**	

Question			Expected Answer	Mark	Additional Guidance
6	(a)	(i)	genes / genetic / mutation **;** environment(al) **;**	**2**	**Mark the first answer on each line** **IGNORE** inherited / DNA
6	(a)	(ii) **1** **2** **3** **4**	no defined categories **;** range of values / intermediate values **;** influenced by, environment / many genes / genes and environment **;** quantitative / has to be measured / cannot be counted **;**	**3 max**	 **2 ACCEPT** ref to bell-shaped curve / binomial distribution **3 ACCEPT** any ref to 3 or more genes **4 ACCEPT** metric
6	(a)	(iii)	B **;**	**1**	**DO NOT CREDIT** if more than one letter is given
6	(a)	(iv) **1** **2** **3** **4**	growth too rapid **;** increased susceptibility to, disease / named abnormality **;** <u>inbreeding</u> **;** reduces <u>gene pool</u> / <u>genetic</u> variation / <u>genetic</u> diversity **;**	**2 max**	 **2** e.g. bone / skeletal abnormalities or low immunity **3 DO NOT CREDIT** if implies inbreeding causes mutations **4 IGNORE** refs to biodiversity

Question			Expected Answer	Mark	Additional Guidance
6	(a)	(v)			
		1	maintain biodiversity ;		
		2	aesthetic (reasons) / tourism ;		
		3	ethical (reasons) ;		**3 ACCEPT** religious
		4	part of a food chain / web ;		**4 ACCEPT** food source for local population
		5	maintain / increase gene pool ;		
		6	genetic resource / availability to breed with domestic chickens ;		**6 CREDIT** description, e.g. 'source of desirable genes' or 'source of genetic variation' **6 ACCEPT** specific example of genetic resource e.g. disease resistance / strong bones / longevity / heat tolerance / idea of domesticating wild population
				2 max	

Question			Expected Answer	Mark	Additional Guidance
6	(b)	(i)			**Mark the first two answers only**
		1	reduces / prevents (infectious) disease **;**		**1 IGNORE** illness
		2	prevent, problems / named problem, with gut **;**		**2** e.g. diarrhoea
		3	digest food more, efficiently / easily / quickly **;**		
		4	greater proportion of, food / energy, can contribute to growth **;**		**4 ACCEPT** faster growth as AW for contribute to growth **4 IGNORE** larger chickens
		5	reduce risk of transmitting, pathogens / named pathogen, to humans **;**	**2 max**	**5 ACCEPT** 'meat less likely to be infected with bacteria'
6	(b)	(ii)			
		1	(antibiotic) resistant, pathogens / bacteria **;**		**1 ACCEPT** microorganisms / microbes **1 IGNORE** germs **1 DO NOT CREDIT** immune
		2	antibiotics kill useful, bacteria **;**		**2 DO NOT CREDIT** if any ref to viruses
		3	*idea of:* antibiotic passing into human food **;**	**1 max**	
			Total	**13**	

Question			Expected Answer	Mark	Additional Guidance
7	(a)				**CREDIT** marking points from a clearly labelled diagram
		1	sequence / chain, of amino acids **;**		**1 IGNORE** polypeptide
		2	(amino acids) joined by peptide bonds **;**		
			secondary		
		S1	alpha / α, helix **;**		
		S2	small regions of, beta / β, pleated sheet / fold **;**		
		S3	hydrogen / H, bonds **;**		**S3** Must be in context of secondary structure
			tertiary		
		T1	secondary structure / helix / polypeptide chain, undergoes further, coiling / folding **;**		**T1 ACCEPT** polypeptide chain folds further
		T2	*3 bonds / interactions from:* disulfide / ionic / hydrogen / hydrophobic or hydrophilic **;**		**T2 IGNORE** if clearly in context of secondary or quaternary structures **T2** H bond must be in context of tertiary structure
		T3	hydrophilic R groups on outside (of molecule) / hydrophobic R groups on inside (of molecule) **;**		
			quaternary		
		Q1	4, polypeptides / subunits **;**		
		Q2	2, alpha / α, chains **and** 2, beta / β, chains **;**		'contains 2 α and 2 β polypeptides' = 2 marks (Q1 and Q2)
		Q3	1 haem (group) per polypeptide / 4 haems (per molecule) **;**		**Q3 IGNORE** protein in ref to 1 haem (group) per polypeptide
		3	prosthetic group (is) haem, (which) contains Fe^{2+} **;**		**3 ACCEPT** iron ion / Fe^{+} / Fe^{3+} **3 DO NOT CREDIT** iron / Fe unqualified
				6 max	
			QWC - correct refs to secondary, tertiary and quaternary structure **;**	**1**	1 **S** mark and 1 **T** mark and 1 **Q** mark

Question			Expected Answer	Mark	Additional Guidance
7	(b)				Assume answer refers to collagen unless stated If the answer mentions only collagen, assume that the candidate thinks any features mentioned also apply to haemoglobin.
			(collagen has)		
		1	amino acid, chain / sequence **;**		**1 IGNORE** polypeptide **1 IGNORE** repeating units
		2	peptide bonds **;**		
		3	helical / helix **;**		**3 DO NOT CREDIT** if candidate refers to collagen having an α helix
		4	*3 bonds / interactions from:* disulfide / ionic / hydrogen / hydrophobic or hydrophilic **;**		
		5	quaternary structure **;**		**5 IGNORE** primary /secondary / tertiary
		6	more than one polypeptide / subunit **;**		**6 ACCEPT** polypeptides but **DO NOT CREDIT** 3 polypeptides if number in haemoglobin not specified
				4 max	
			Total	**11**	

Question			Expected Answer	Mark	Additional Guidance
8		1	antibodies **;**		**ACCEPT** minor mis-spellings so long as word can not be confused with another word in the list
		2	natural **;**		
		3	artificial **;**		
		4	natural **;**		
		5	antigen **;**		
		6	vaccination **;**	**6**	
			Total	**6**	

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