GCE

Biology

Advanced GCE **F212**

Molecules, Biodiversity, Food and Health

Mark Scheme for June 2010

Oxford Cambridge and RSA Examinations

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Question			Expected Answer	Mark	Additional Guidance
1	(a)	(i)	<table><tr><th>reagent</th><th>observation</th><th>molecule</th><th>present or absent</th></tr><tr><td>ethanol and water</td><td>white emulsion</td><td>lipid</td><td>present</td></tr><tr><td>Benedict's solution</td><td>brick-red precipitate</td><td><u>reducing</u> sugar / lactose / glucose / galactose / monosaccharides</td><td>present ;</td></tr><tr><td>biuret I and II</td><td>lilac colour</td><td>protein / named milk protein</td><td>present ;</td></tr><tr><td>iodine solution</td><td>yellow / brown</td><td>starch / amylose</td><td>absent ;</td></tr></table>	3	One mark per correct row. **IGNORE** 'yes', 'no' and ticks and crosses **DO NOT CREDIT** if anything incorrect is written in any box in the molecule column. e.g. 'starch or cellulose' = 0 mark **ACCEPT** maltose **DO NOT CREDIT** sucrose **ACCEPT** casein / lactoglobulin / lactalbumin / polypeptide **IGNORE** amylopectin
1	(a)	(ii)	milk is already, cloudy / an emulsion / white / AW **;**	1	**ACCEPT** idea of difficulty in detecting change because of the appearance of milk
1	(a)	(iii)	(one) glycerol / glyceride **;** 3 fatty acids **;** ester bond (between glycerol and fatty acid) **;**	3	**ACCEPT** marking points from clearly labelled diagram but **DO NOT CREDIT** if contradicted in text. **IGNORE** individual atoms on diagram and look for correct position of labels **MAX 2** if phosphate group included (as could be confused with phospholipid) **ACCEPT** on diagram if 3 shown and at least one labelled **ACCEPT** triglycerides are esters

Question			Expected Answer	Mark	Additional Guidance
1	(b)				**MARK THE FIRST RESPONSE ON EACH NUMBERED LINE**
		1	(thermal) insulation **;**		***1*** **ALLOW** 'warmth'
		2	energy, store / source / release **;**		***2*** **CREDIT** answers that refer to the idea of lipid as a respiratory substrate but **DO NOT CREDIT** 'for respiration' unqualified **IGNORE '**fat contains energy' without further qualification **DO NOT CREDIT** refs to producing energy or to quick energy release **ACCEPT** 'provides energy'
		3	protection **;**		
		4	membranes / phospholipid bilayer / control entry and exit into cells **;**		***4*** **CREDIT** ref to cholesterol in membranes
		5	(steroid) hormones / named steroid hormone **;**		
		6	buoyancy **;**		
		7	waterproofing **;**		
		8	source of water (from respiration) **;**		
		9	(electrical insulation) in myelin / around neurones / around axons / around dendrons **;**		***9*** **CREDIT** nerve fibres / saltatory conduction **IGNORE** nerves
		10	aid, absorption / storage / production, of, fat soluble / A / D / E / K, vitamins **;**	**3**	
1	(c)	(i)	saturated **;**		Assume answers refer to animal fats unless otherwise stated **ACCEPT** reverse argument **IGNORE** ref to fats and oils (as stated in question)
			(fatty acids have) no / fewer, double bonds **;**		**ACCEPT** 'fatty acids are not kinked'
			solid at room temperature **;**	**1 max**	**ACCEPT** reasonable temperature quoted

Question			Expected Answer	Mark	Additional Guidance
1	(c)	(ii)			
		1	(death rate for) men greater (at any concentration) / AW **;**		***1*** **ACCEPT** ora
		2	(death rates) rise with increasing cholesterol / AW **;**		***2*** **ACCEPT** 'positive correlation' (between death and cholesterol)
		3	death rate for men, initially / AW, falls **;**		***3*** **ACCEPT** 4.8 or below as 'initially'.
		4	steep(er) / AW, rise (in, males / both) at higher cholesterol levels **;**		***4*** Answers must refer to latter part of graph only (5.7 or above). **ACCEPT** difference (between sexes) greater at high concentration
		5	comparative figures with unit for (blood) cholesterol to support any of the above points **;**		***5*** There are 3 ways of getting this mark: • values for both sexes at single concentration • two values for single sex at two concentrations • subtraction / calculation, that shows comparison **IGNORE** terms like 'about' See table for acceptable examples of x and y values – if intermediate cholesterol values are used, refer to the graph for the data
				3 max	

blood cholesterol (mmol dm^{-3})	deaths per 10 000	
	women	men
3.6	13.2 - 14.1	31.2 - 32.1
4.3	15.0 - 15.9	26.0 - 26.9
4.8	14.0 - 14.9	24.0 - 24.9
5.2	15.1 - 16.0	24.6 - 25.5
5.7	17.4 - 18.3	25.8 - 26.7
6.2	17.8 - 18.7	33.2 - 34.1
6.7	23.5 - 24.3	31.3 - 32.2
7.3	22.0 - 22.9	44.1 - 45.0
8.2	31.7 - 32.6	59.5 - 60.4

Must include (blood) cholesterol units **Any figure within a particular range is acceptable**

Question			Expected Answer	Mark	Additional Guidance
1	(c)	(iii)			**Mark first two in list**
		1	coronary heart disease / CHD / cardio-vascular diseases / heart attack / cardiac arrest / myocardial infarction / MI / angina **;**		***1*** **DO NOT CREDIT** heart disease alone or 'conary' **ACCEPT** hypertension / high blood pressure
		2	atherosclerosis / atheroma **;**		***2*** **DO NOT CREDIT** arteriosclerosis
		3	stroke **;**		
		4	Type 2 diabetes **;**		
				2	
			Total	**16**	

Question			Expected Answer	Mark	Additional Guidance
2	(a)		placing, living things / organisms / named organisms, into, groups / categories / taxa / named taxonomic groups **;** based on / AW, similarity / difference **;**	2	**ACCEPT** 'grouping living things' Look for the idea of similar organisms being placed in the same group or different organisms being placed in different groups
2	(b)	(i)		3 max	**ACCEPT suitable examples for mps 1 to 4**
		1	morphology / anatomy / (observable / physical) features / appearance / AW **;**		***1*** **CREDIT** cell features e.g. nucleus / membrane-bound organelles / cell wall / prokaryotic-eukaryotic features / unicellular
		2	biochemistry / cytochrome C **;**		***2*** **CREDIT** component of cell wall
		3	genes / DNA / genetics / RNA **;**		***3*** **IGNORE** chromosomes
		4	behaviour / physiology / embryology **;**		***4*** **ACCEPT** 'how they feed' / nutrition / 'how they reproduce'
		5	idea of shared, evolutionary past / phylogeny **;**		***5*** **ACCEPT** 'how closely related' **IGNORE** refs to interbreeding / fertile offspring
2	(b)	(ii)	T S R W U Q **; ; ;**	3	**Mark the order of letters** (ignoring the dotted lines) All 6 in correct order = 3 marks If any incorrect, then credit T S in order at beginning = 1 mark U Q in order at end = 1 mark R before W anywhere in the sequence = 1 mark

Question			Expected Answer	Mark	Additional Guidance
2	(c)				**ACCEPT phonetic spellings throughout** **ACCEPT** alternative terms for names of kingdoms and domains throughout (e.g. plants / plantae)
		1	3 domains **AND** 5 kingdoms **;**		
		2	domains are, bacteria / eubacteria, **AND**, archaea / archaebacteria, **AND**, eukarya / eukaryotes **;**		***2*** **ACCEPT** 'eukaryota'
		3	kingdoms are prokaryotes **AND** protoctists **AND** fungi **AND** plants **AND** animals **;**		***3*** **DO NOT CREDIT** protists / protozoa
		4	eukaryotes split into different kingdoms / all eukaryotes are in the same domain **;**		
		5	all prokaryotes are in the same kingdom / prokaryotes split into different domains **;**		
		6	domain classification based on, rRNA / ribosomes / RNA polymerase / protein synthesis / enzymes / flagella / membrane structure **;**	**4 max**	***6*** **IGNORE** RNA unqualified **DO NOT CREDIT** other forms of RNA **ACCEPT** any detail of protein synthesis
			Total	**12**	

Question			Expected Answer	Mark	Additional Guidance
3	(a)		young / elderly / HIV infected / malnourished / post-operative / on immunosuppressants / leukaemia / undergoing cancer treatment / anorexics **;** immature / compromised / weak / AW, immune system **;**	**2**	**IGNORE** prompt lines and mark the answer as a whole **ACCEPT** AW for young / elderly etc **IGNORE** 'ill' or 'unfit' **IGNORE** any reference to populations e.g. those living in vicinity of outbreak **ACCEPT** description **ACCEPT** no immunity
3	(b)	(i)			**DO NOT CREDIT** 'mould' – penalise once only
		1	bacteria / (bacterial) cells, divide / increase in number / multiply / reproduce / proliferate / replicate **;**		***1*** **IGNORE** 'growth' **DO NOT CREDIT** 'mitosis'
		2	(secrete) enzymes / named enzyme **;**		***2*** **DO NOT CREDIT** excrete Answer should **not** imply intracellular enzymes
		3	food, digested / broken down **;**		
		4a	protein / named protein / polypeptides → peptides / amino acids		
			OR		
		4b	fat / triglycerides → fatty acids		***4b*** **IGNORE** cholesterol
			OR		
		4c	starch / amylose / glycogen → glucose / sugar **;**		***4c*** **ACCEPT** other correct carbohydrate breakdown
		5	production / release / excretion / secretion, of, toxins / named toxin / waste products **;**		
		6	(causes) change in, appearance / smell / texture / taste **;**	**3 max**	***6*** **CREDIT** suitable example e.g. 'goes mushy'

Question			Expected Answer	Mark	Additional Guidance
3	(b)	(ii)			Idea of 'more' is needed for all marking points but it can be stated once and linked to more than one point. • e.g. 'more bacteria secreting enzymes' = mp 2 and 4 **ACCEPT** converse argument throughout **ACCEPT** 'fungi' / 'mould' in place of bacteria as question stem does not specify
		1	bacteria, reproduce / AW, more rapidly / faster **;**		***1*** **IGNORE** 'grow' **IGNORE** 'more easily' or 'effectively' **DO NOT CREDIT** if the candidate thinks there is no reproduction at 5°C
		2	(so) more bacteria present **;**		
		3	more, toxins / waste, produced / released / AW **;**		
		4	more enzymes, secreted / AW **;**		***4*** **DO NOT CREDIT** excreted
		5	enzyme, action faster / works better / more effective, at higher temperatures **;**		***5*** **IGNORE** optimum
		6	(substrate and enzymes have) more kinetic energy **;**		
		7	more, enzyme-substrate complexes / ESC / (successful) collisions between substrate and active site **;**	**3 max**	

Question			Expected Answer	Mark	Additional Guidance
3	(b)	(iii)	max 2 for 2 distinct methods max 2 for 2 **correctly linked** explanations Only credit the explanation mark if the method mark has been awarded.		Where more than one method is given, mark first on line and assume explanation linked with that **DO NOT CREDIT** chilling or freezing (as in question)
		M1 **E1**	salting **;** lack of <u>water</u> due to, osmosis / low water potential (outside cell) **;**		***M1*** **IGNORE** drying ***E1*** **ALLOW** low Ψ / high solute potential
		M2 **E2**	sugar **;** lack of <u>water</u> due to, osmosis / low water potential (outside cell) **;**		***M2*** **IGNORE** drying ***E2*** **ALLOW** low Ψ / high solute potential
		M3 **E3**	(air / freeze) drying **;** *idea that* enzymes cannot mobilise / intracellular transport impaired / reactions have no medium in which to occur / (microbes) cannot move **;**		
		M4 **E4**	pickling / (use of) vinegar **;** (low pH) denatures / changes tertiary structure of / changes 3D shape of, enzymes / proteins **OR** substrate no longer fits active site / active site shape changes / prevents ESC **;**		***E4*** **DO NOT CREDIT** high pH
		M5 **E5**	heat treatment / cooking **;** denatures / changes tertiary structure of / changes 3D shape of, enzymes / proteins **OR** substrate no longer fits active site / active site shape changes / prevents ESC **;**		***M5*** **ACCEPT** pasteurising **IGNORE** canning for this mp ***E5, E 6 & E7*** **ACCEPT** 'kills bacteria' or 'kills microbes' as a reason supporting heat treatment, irradiation or smoking **only once**
		M6 **E6**	irradiation / UV / gamma rays / X-rays / <u>ionising</u> radiation **;** destroys / damages / changes / mutates, DNA / genes / genetic material **;**		***M6*** **CREDIT** radiation if correctly qualified in explanation
		M7 **E7**	smoking **;** (so exposed to) antibacterial / named antibacterial, chemical(s) **;**		***M7*** **CREDIT** addition of, sulphites / sodium benzoate / alcohol
		M8 **E8**	vacuum packing / canning / bottling **;** microorganisms cannot respire <u>aerobic</u>ally **;**		***E8*** **IGNORE** 'denaturing' as a consequence of canning / bottling
				4	

Question			Expected Answer	Mark	Additional Guidance
3	(c)		**This is a QWC question** **Ignore sections and mark as continuous prose**		Assume candidate is talking about mycoprotein unless otherwise stated. **CREDIT** ora for beef throughout. **IGNORE** use of figures alone when awarding mps **1, 3, 6, 7, 9** – look for **descriptive statement**, e.g. • '12 g of protein' = no mark • 'only 12 g protein' = 1 mark (mp 9)
		1	low(er) / less, energy (than beef) **;**		
		2	useful for, slimming / weight control / AW **;**		***2*** **ACCEPT** preventing obesity **ACCEPT '**less energy to burn off *during exercise*' **DO NOT CREDIT** 'burn off' unqualified
		3	low(er) / less, (total) fat **;**		
		4	(very) low / (much) less, saturated fat **;**		
		5	lower, cholesterol **OR** lower risk of, (coronary) heart disease / CHD / cardio-vascular diseases / heart attack / cardiac arrest / myocardial infarction / MI / angina / atherosclerosis / atheroma **/** stroke / hypertension **;**		
		6	contains carbohydrate / AW **;**		***6*** **ACCEPT** 'more carbohydrate than beef' **IGNORE** 'carbs'
		7	low(er) / less, iron content **;**		
		8	(increased risk of) anaemia / fewer RBCs / less haemoglobin / reduced oxygen carrying capacity of blood **;**		***8*** **IGNORE** answers phrased in terms of role of iron alone e.g. 'haemoglobin contains iron' = 0 Answers must show consequence of deficiency e.g. 'less haemoglobin' = 1
		9	low(er) / less, protein **;**		
		10	(mycoprotein provides) more balanced diet **;**		
		11	need larger intake to meet requirements / AW **;**	**7 max**	
			QWC – award for 2 clear references to the table **;**	**1**	Award for 2 sets of comparative figures (stated or calculated) with units – 'content per 100g' not needed **IGNORE** vague terms like 'about' as long as figs are correct
			Total	**20**	

Question			Expected Answer	Mark	Additional Guidance
4	(a)	(i)			**Mark the first response** but do not award the mark if a further answer is incorrect or contradictory **DO NOT CREDIT** refs to length as given in stem
		1	(m)RNA is single stranded / DNA is double stranded **;**		***1*** **ACCEPT** DNA is a double helix (as stranded is implied) **for this mp** **DO NOT CREDIT** DNA is a double *molecule*
		2	(m)RNA is non helical / DNA is helical **;**	1	***2*** **ACCEPT** (mRNA) not twisted / not coiled / not spiral / straight / ora
4	(a)	(ii)			**Mark the first response to (a)(ii)** – but but do not award the mark if a further answer is incorrect or contradictory
		1	RNA contains ribose **and** DNA contains deoxyribose **;**		
		2	RNA contains, uracil / U, **and** DNA contains, thymine / T **;**		***2*** **DO NOT CREDIT** thyamine
		3	3 / more than 1, forms of RNA **;**		***3*** **ACCEPT** 'one form of DNA'
		4	RNA is, single stranded / non helical, **and** DNA is, double stranded / helical **;** *if not already* ***awarded*** *as answer in (i)*	1	
4	(a)	(iii)	gene **;**	1	**IGNORE** allele / operon
4	(a)	(iv)	too big to / does not, fit through pore (in nuclear envelope) **;**	1	**ACCEPT** 'too long to fit … pore'
4	(a)	(v)	*idea that* only copies one, gene / section / part / AW, (of DNA) **;** *idea that* DNA comprises many, genes / alleles **;**	2	e.g. mRNA only codes for 1 protein **DO NOT CREDIT** '1 DNA molecule contains *all* the genes' 'mRNA only codes for 1 protein but DNA codes for many proteins' = 2 marks

Question			Expected Answer	Mark	Additional Guidance
4	(b)	(i)			
		1	non-competitive (inhibitor) ;		
		2	(α-amanitin / inhibitor / toxin) fits into, allosteric site / a place other than active site ;		
		3	active site changes, shape / configuration / conformation / structure ;		3 **ACCEPT** 'distortion of active site'
		4	substrate no longer, fits / complementary to, active site ;	2 max	*4* Mark to be awarded in context of active site (although need not be repeated if stated in mp 3) **IGNORE** ESC
4	(b)	(ii)			
		1	inhibits production of mRNA / mRNA not produced ;		*1* **CREDIT** prevents transcription
		2	prevents protein synthesis / AW ;		*2* **CREDIT** translation
		3	e.g. of, specific named protein / (vital) process, that may be affected ;	2 max	*3* e.g. respiration / photosynthesis (as question refers to 'an organism') / haemoglobin / cytochrome C oxidase
4	(c)	(i)	sequence / order, of amino acids ;	1	**IGNORE** number / organisation
	(c)	(ii)			**ALLOW** phonetic spelling
			A = ionic ;		
			B = hydrogen ;		
			C = disulfide (bond / bridge) ;	3	**DO NOT CREDIT** disulfate
4	(d)	1	increased kinetic energy ;		*1* must contain the idea of more than normal
		2	(any part of protein molecule) vibrates ;		
		3	hydrophilic / hydrophobic / hydrogen / ionic, bonds / interactions, break ;		*3* **IGNORE** Van der Waals **DO NOT CREDIT** if disulfide / covalent / peptide bonds are included
		4	change in, 3D shape / conformation (of protein) ;		*4* **IGNORE** tertiary / structure (as in question) **IGNORE** refs to, active site / enzymes
		5	denatures ;	3 max	
			Total	**17**	

Question			Expected Answer	Mark	Additional Guidance
5	(a)	(i)	mucus traps, bacteria / microbes / pathogens / microorganisms / viruses / spores **;** cilia, sweep / move / waft, mucus / bacteria / pathogens / microorganisms / viruses / spore, upwards / AW **;**	**2**	For both marking points **ACCEPT** ora for what would happen if they didn't work **IGNORE** ref to dirt / dust / etc **ACCEPT** answers that imply out of airways e.g. to the throat / coughed / swallowed

Question			Expected Answer	Mark	Additional Guidance
5	(a)	(ii)	*stage A* 1 phagocyte, attaches / binds / AW, to bacterium / pathogen ; 2 receptor (on phagocyte), attaches to / binds to / recognises / AW, antigen (on bacterium) ; *stage B* 3 bacterium, engulfed / enters by endocytosis / enters by phagocytosis / AW ; 4 (formation of) phagosome / phagocytic vacuole ; *stage C* 5 lysosomes, fuse with / join with / move towards (phagosome) ; 6 release / secrete, enzymes / lysins / named enzyme / hydrogen peroxide / free radicals (into phagosome) ; *stage C/D* 7 bacterium, digested / broken down / hydrolysed ; 8 (to) amino acid / sugar / glucose / fatty acid / glycerol ; *stage D* 9 absorbed / AW, into, cytoplasm / cytosol ; 10 by, (facilitated / simple) diffusion / active transport ;	6 max	**IGNORE** stage letters and look for correct sequence **DO NOT CREDIT** steps that are biologically out of sequence, e.g. mp6 before mp5. Penalise once only. **ACCEPT** 'bacteria' throughout *2* **CREDIT** PAMP / antibody marker / complement marker, as AW for antigen *3* **DO NOT CREDIT** 'eaten' **IGNORE** pseudopodia or any other structure *5* **DO NOT CREDIT** 'binds with' *7* **DO NOT CREDIT** destroyed (as in the question) **IGNORE** refs to antigen presentation as this happens after the stage shown in the diagram
5	(b)	(i)	plasma (cell) ;	1	**ACCEPT** B lymphocyte **ACCEPT** effector cell **DO NOT CREDIT** lymphocyte unqualified

Question			Expected Answer	Mark	Additional Guidance
5	(b)	(ii)	**This is a QWC question**		**CREDIT** a correctly labelled diagram that is clearly an antibody **CON** if diagram and text are contradictory MPs 3, 5, 6, 8, 10 are stand alone but **DO NOT CREDIT** if context is clearly incorrect. e.g. 'constant region gives specificity' **AWARD** mp 2 but not mp 5
		1	Y-shaped molecule / light and heavy chains / disulfide bonds / 4 polypeptide chains **;**		
		2	constant region **;**		
		3	marker for / binds to, phagocytes / AW **;**		***3*** **ACCEPT** ref to opsonisation
		4	variable region **;**		
		5	(antibody) specificity **;**		
		6	(has) complementary shape to antigen (on pathogen) **;**		'Complimentary shape to specific antigen' = 2 marks (mps **5 & 6**)
		7	hinge (region) **;**		
		8	allows flexibility **;**		***8*** **IGNORE** 'movement' unqualified
		9	more than one variable region :		***9*** **DO NOT CREDIT** from diagram unless more than one is explicitly labelled or clearly keyed (e.g. by shading)
		10	allows, agglutination / description of agglutination **or** attachment to more than one, pathogen / antigen **;**		
		11	neutralisation / blocking pathogen's binding sites **;**	**6 max**	***11*** **ACCEPT** ref. to antitoxin
			QWC – award when 2 marks are given in any two of the grouped sections **;**	**1**	2 marks had been awarded from 2 of the following groups of marks (4 marks in total) mps 2 & 3 mps 4 & 5/6 mps 7 & 8 mps 9 & 10

Question			Expected Answer	Mark	Additional Guidance
5	(b)	(iii)	*type of immunity* *artificial active* ☐ *artificial passive* ☐ *natural active* ☐ *natural passive* ✔ ;	1	**DO NOT CREDIT** if more than 1 box is ticked **DO NOT CREDIT** a cross **DO NOT CREDIT** a tick that has been crossed out and is a 'hybrid' tick
			Total	**17**	

Question			Expected Answer	Mark	Additional Guidance
6	(a)	1	biodiversity (of heathland) ;		
		2	rare / endangered, species / plants / animals / fungi / organisms / named organism ;		
		3	rarity of (this) habitat ;		
		4	example of current *legal* status ;		***4*** e.g. National Park / SSSI / protected species / National Nature Reserves / NNR / other *legal* example
		5	(likely) reduction in size of, habitat / ecosystem / heathland ;		***5*** **IGNORE** 'habitat destruction' alone. Must refer to extent or size of destruction.
		6	effect of reduced size on viability (of whole ecosystem) ;		
		7	effect on, movement / spread, of, species / named species / plants / animals ;		***7*** **CREDIT** effect on wildlife corridors Answers could refer to limiting species spread or introduction of species
		8	a method of minimizing impact / AW / named example ;		***8*** e.g. 'toad tunnels' / relocation of population 'build toad tunnels so that the toads can still move between the two areas of heathland' = 2 marks (mps 7 and 8)
				3 max	
6	(b)	(i)			
		1	*idea of* (collect in) different / wider, area ;		***1*** **ALLOW** several transects e.g. another path
		2	(collect at) different, times of day / times of year / weather conditions ;		
		3	use of named, collecting / identifying, technique ;		***3*** e.g. (sweep) net / photographs / feeding stations **IGNORE** pooter (as could only catch larvae) / light trap / use of key / single transect
		4	method of ensuring that individuals not counted again ;		***4*** This mark refers to an initial or the only sample – it is **not** linked to mp 5
		5	mark-release-recapture / capture-recapture, technique ;		***5*** **CREDIT** count marked individuals in 2nd sample / population = no. in 1st sample x no. in 2nd sample / no. retrapped in 2nd sample
				3 max	

<table>
<tr><th colspan="3">Question</th><th>Expected Answer</th><th>Mark</th><th>Additional Guidance</th></tr>
<tr><td>6</td><td>(b)</td><td>(ii)</td><td>
<table>
<tr><th>species</th><th>n</th><th>n/N</th><th>$(n/N)^2$</th></tr>
<tr><td>Grayling (Hipparchia semele)</td><td></td><td></td><td></td></tr>
<tr><td>Large Heath (Coenonympha tullia)</td><td></td><td><u>0.3548</u></td><td></td></tr>
<tr><td>Gatekeeper (Pyronia tythonus)</td><td></td><td></td><td></td></tr>
<tr><td>Green Hairstreak (Callophrys rubi)</td><td></td><td></td><td></td></tr>
<tr><td>Silver-studded Blue (Plebeius argus)</td><td></td><td></td><td></td></tr>
<tr><td>Small Heath (Coenonympha phamhylus)</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td>Sum (Σ)</td><td>0.31633 OR 0.31217</td></tr>
<tr><td></td><td></td><td>1 - Σ</td><td>D = 0.68367 OR 0.68783</td></tr>
</table>
;
;
;</td><td>3</td><td>Original table on question paper had incorrect figure in $(n/N)^2$ column for Grayling row. Answers for mps 2 & 3 take this into account.

ACCEPT ecf from incorrect answer for Σ (whether decimal places or rounding)</td></tr>
<tr><td>6</td><td>(b)</td><td>(iii)</td><td></td><td>2</td><td>IGNORE refs to relative robustness of habitat</td></tr>
<tr><td></td><td></td><td>1</td><td>many species present / high species richness / all species evenly represented / high species evenness / high biodiversity ;</td><td></td><td>1 ACCEPT ‘types of butterfly’ as AW for species
IGNORE ‘individuals’ or ‘organisms’</td></tr>
<tr><td></td><td></td><td>2</td><td>(so) should not be developed / development should be modified / development should be reconsidered / should be conserved / AW ;</td><td></td><td>2 DO NOT CREDIT ref to ‘planning’ alone (as given in question)
2 IGNORE responses that imply uncertainty about the development. e.g. ‘could’ ‘might’ ‘may’</td></tr>
</table>

<table>
<tr><th colspan="3">Question</th><th>Expected Answer</th><th>Mark</th><th>Additional Guidance</th></tr>
<tr><td>6</td><td>(c)</td><td>(i)</td><td>
<table>
<tr><th>species</th><th>letter</th></tr>
<tr><td>Grayling (Hipparchia semele)</td><td>A ;</td></tr>
<tr><td>Large Heath (Coenonympha tullia)</td><td>D ;</td></tr>
<tr><td>Gatekeeper (Pyronia tythonus)</td><td>F ;</td></tr>
<tr><td>Green Hairstreak (Callophrys rubi)</td><td>B ;</td></tr>
<tr><td>Silver-studded Blue (Plebeius argus)</td><td>C ;</td></tr>
<tr><td>Small Heath (Coenonympha phamhylus)</td><td>E</td></tr>
</table>
</td><td>5</td><td>DO NOT CREDIT if more than one letter given against any individual species</td></tr>
<tr><td>6</td><td>(c)</td><td>(ii)
1

2

3</td><td>(is) same <u>genus</u> ;

have, features / characteristics / appearance / behaviour / biochemistry / physiology / anatomy / genes / genetic makeup / DNA, that are, similar / in common ;

(share a) common, ancestor / phylogeny ;</td><td>2 max</td><td>1 DO NOT CREDIT vague statements like ‘could be in the same genus’
IGNORE Coenonympha

2 IGNORE ‘similar’ on its own
DO NOT CREDIT ‘same’
IGNORE specific examples (e.g. orange wings / large spot)

3 ACCEPT closely related ;</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>18</td><td></td></tr>
</table>

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