

Question Number	Answer	Mark
1(a)(i)	The only correct answer is B - lipid and protein <i>A is incorrect because water does not contain carbon</i> <i>C is incorrect because water does not contain carbon</i> <i>D is incorrect because water does not contain carbon</i>	(1)

Question Number	Answer	Mark
1(a)(ii)	The only correct answer is A - bacteria and fungi <i>B is incorrect because viruses are not decomposers</i> <i>C is incorrect because maggots are not microorganisms</i> <i>D is incorrect because viruses are not decomposers</i>	(1)

Question Number	Answer	Additional Guidance	Mark
1(b)(i)	1. (high temperatures) { kill microorganisms / denature enzymes / changes shape of active site / eq } ; 2. therefore enzymes { will not be released / will be inactive / eq } ; 3. therefore bonds between { organic molecules / eq } will not be broken down / eq ;	1 DO NOT ACCEPT {enzymes start to / microorganisms} denature 2 ACCEPT substrate can no longer bind to active site 3 ACCEPT named bonds and named organic molecules	(2)

Question Number	Answer	Additional Guidance	Mark
1(b)(ii)	1. no oxygen (available for microorganisms) ; 2. therefore no aerobic respiration ; 3. therefore no energy for { chemical reactions / growth of microorganisms } / eq ;	1 IGNORE less oxygen 2 ACCEPT (only) anaerobic respiration 3 ACCEPT less energy . . .	(2)

Question Number	Answer	Additional Guidance	Mark
1(b)(iii)	1. (vinegar) { is an acid / is acidic / has a low pH } ; 2. enzymes are denatured / active site has changed shape / eq ; 3. due to { ionisation of the R groups / changes in bonding within active site / eq } ;	2. DO NOT ACCEPT {enzymes start to / microorganisms} denature	(2)

Question Number	Answer	Additional Guidance	Mark
1(b)(iv)	1. idea that presence of salt draws water out of the microorganisms ; 2. by osmosis (out of food or microorganism); 3. dehydrating the microorganisms / no solvent for enzymes / eq ;	1. IGNORE out of food 2. IGNORE references to water concentration DO NOT ACCEPT incorrect references to water potential etc	(2)

Question Number	Answer	Mark
2(a)(i)	The only correct answer is C – oxygen <i>A is incorrect because GALP is produced in the light-independent reaction</i> <i>B is incorrect because hydrogen ions form reduced NADP</i> <i>D is incorrect because water is used not produced</i>	(1)

Question Number	Answer	Mark		
2(a)(ii)	The only correct answer is - D <table><tr><td>Reduced NADP</td><td>ATP</td></tr></table> <i>A is incorrect because carbon dioxide does not come from the light-dependent reaction</i> <i>B is incorrect because the NADP is reduced</i> <i>C is incorrect because carbon dioxide does not come from the light-dependent reaction</i>	Reduced NADP	ATP	(1)
Reduced NADP	ATP			

Question Number	Answer	Additional Guidance	Mark
2(b)(i)	1. (μmol) {concentration / moles} of named { substrate / product } ; 2. (m^{-2}) area of leaf / eq ; 3. (s^{-1}) (extent of reaction) in one second / per unit time / eq ;	1. IGNORE amount e.g. glucose, oxygen, GALP, GP, CO_2 3. ACCEPT explanation of calculating extent of reaction in one second	(3)

Question Number	Answer	Additional Guidance	Mark
2(b)(ii)	1. as nitrates (from soil) ; 2. taken up (by roots from soil) by active transport ; 3. {transported / eq} in the {xylem / transpiration stream} ;	Penalise {wrong form of nitrogen / formula} once 1. ACCEPT ammonium (ions) 2. IGNORE diffusion	(2)

Question Number	Answer	Additional Guidance	Mark
2(b)(iii)	1. (nitrogen / nitrates) used to make {chlorophyll / amino acids} ; 2. more chlorophyll results in more light absorption / eq ; 3. amino acids used to make RUBISCO ; 4. RUBISCO catalyses {carbon fixation / eq} ; 5. (the more nitrogen) the more RUBISCO, the faster the rate of photosynthesis / eq ;	ACCEPT ribulose biphosphate carboxylase throughout 4. ACCEPT description of carbon fixation e.g.binding of carbon dioxide to RuBP 5. PIECE TOGETHER ACCEPT a description on increased rate of photosynthesis	(3)

Question Number	Answer	Additional Guidance	Mark
3(a)(i)	mutation in bacteria (present in sharks) / (resistant) bacteria taken up (from the water) / eating contaminated food / eq ;		(1)

Question Number	Answer	Additional Guidance	Mark
3(a)(ii)	1. idea that (resistant) bacteria can be consumed (in shark meat) ; 2. increasing the number of resistant bacteria in human population / eq ; 3. idea that { genes for resistance can be spread to other bacteria / resistant bacteria will outcompete non-resistant bacteria } ; 4. idea that these bacteria cause disease because they cannot be treated (with antibiotics) ;		(2)

Question Number	Answer	Additional Guidance	Mark
3(b)	{ sulfamethoxazole / bacteriostatic antibiotics } prevent the growth of bacteria and { gentamicin / bactericidal antibiotics } kill bacteria / eq ;	ACCEPT multiplying / reproducing - equiv to growth destroy - equiv to kill IGNORE modes of action given	(1)

Question Number	Answer	Additional Guidance	Mark
3(c)(i)	1. mRNA will not {bind / eq} to ribosomes ; 2. {tRNA will not be able to bind / wrong tRNA will bind / eq} to codons (on mRNA) ; 3. { wrong / no / eq } amino acids will line up ;	3. ACCEPT translation will not take place / error in translation / incorrect translation / eq	(2)

Question Number	Answer	Mark
3(c)(ii)	The only correct answer is C – peptide <i>A is incorrect because ester bonds form during lipid synthesis</i> <i>B is incorrect because glycosidic bonds form during carbohydrate synthesis</i> <i>D is incorrect because phosphodiester bonds do not form during translation</i>	(1)

Question Number	Answer	Additional Guidance	Mark
3(c)(iii)	1. idea that {human ribosomes are different from bacterial ribosomes / antibiotics cannot bind to human ribosomes} ; 2. idea that enzymes in human cells are different from those in bacteria ; 3. idea that these antibiotics cannot enter human cells ; 4. idea that human cells have enzymes that can break down these antibiotics ;	e.g. human cells have 80S and bacteria have 70S ribosomes, antibiotics bind to only 70S ribosomes	(2)

Question Number	Answer	Additional Guidance	Mark
3(d)	1. sulfamethoxazole has a similar structure to PABA / eq ; 2. therefore binds to dihydropteroate synthetase / reacts with dihydropteroate diphosphate ; 5. therefore no dihydropteroic acid made ; 6. idea that there is no {substrate / dihydropteroic acid} to synthesise folic acid ;	ACCEPT description of similarity e.g. both have an H₂N group attached to a ring structure 2 ACCEPT PABA cannot bind DO NOT ACCEPT dihydropteroic acid 3. PABA and sulfamethoxazole join together (by condensation reaction / by a peptide bond); 4. and this structure cannot {bind to dihydropteroate synthetase / react with dihydropteroate diphosphate} ; 6. ACCEPT idea that a different molecule will be made that cannot be converted to folic acid	(3)

Question Number	Answer	Mark
3(e)	The only correct answer is D – peptidoglycan <i>A is incorrect because amylopectin is in starch</i> <i>B is incorrect because cellulose is present in plant cell walls</i> <i>C is incorrect because glycogen is a storage molecule</i>	(1)

Question Number	Answer	Additional Guidance	Mark
4(a)	1. (total number of squirrels) = $2\,500\,000 + 140\,000 / 2\,640\,000$; 2. (percentage) = $5 / 5.3 / 5.303$ (%) ;	2 ACCEPT ecf for $(140\,000 \times 100) \div 2\,500\,000 = 56$ (%) NB If no working is shown: $5 / 5.3 / 5.303$ (%) scores 2 marks 56 (%) scores 1 mark	(2)

Question Number	Answer	Additional Guidance	Mark
4(b)	1. idea that areas occupied by red squirrels (in 1945) are occupied by grey squirrels (in 2010) ; 2. idea that areas occupied by red squirrels (in 1945) are occupied by both squirrels (in 2010) ; 3. idea that areas occupied by both squirrels (in 1945) are occupied by grey squirrels (in 2010) ;	IGNORE refs to numbers of squirrels throughout ACCEPT (overall) an increase in distribution of grey squirrels if no other mark points awarded	(3)

Question Number	Answer	Additional Guidance	Mark
4(c)(i)	1. competition for food ; 2. competition for { space / habitat / shelter / territory / eq } ; 3. niches {overlap / eq} ; 4. grey squirrels attack red squirrels / eq ;	1. ACCEPT description IGNORE nutrients 2. ACCEPT description IGNORE niche, mates 3. DO NOT ACCEPT same niche 4. ACCEPT grey squirrels are predators	(2)

Question Number	Answer	Additional Guidance	Mark
4(c)(ii)	In the grey squirrels: 1. antibodies {bind/eq} to virus ; 2. (antibodies binding to virus) will result in phagocytosis ; 3. macrophages destroy virus with enzymes / eq ; 4. (antibodies binding to virus) will {inactivate virus / prevent the binding of virus to host cells / eq} ; In the red squirrels: 5. idea immune system is weaker ; 6. no plasma cells to produce antibodies ; 7. idea that the virus will be able to {infect / destroy / eq} host cells ; 8. no killer cells to destroy infected cells / eq ;	2. ACCEPT opsonisation, agglutination, 4. DO NOT ACCEPT antibodies {kill / destroy} virus 6. DO NOT ACCEPT B cells	(4)

Question Number	Answer	Additional Guidance	Mark
* 5(a)	1. DNA sample taken from parents using {blood / hair / skin / faeces / claw / eq} ; 2. amplification of the DNA from all three tigers using { PCR / polymerase chain reaction } / eq ; 3. credit details of PCR ; 4. DNA cut into fragments using restriction enzymes / eq ; 5. reference to (gel) electrophoresis ; 6. credit details of (gel) electrophoresis ; 7. comparison of the DNA bands from the three tigers ;	QWC emphasis on logical sequence 1. IGNORE method of taking DNA from dead tiger 3. e.g. primers added, different temperatures used for different stages 6. e.g. electric current applied, use of agarose gel	(6)

Question Number	Answer	Additional Guidance	Mark
5(b)(i)	1. body temperature measured on discovery / eq ; 2. body temperature decreases (with time after death) ; 3. (body temperature of dead animal) depends on {ambient temperature / position of body / wounds / eq} ; 4. idea of {working backwards to estimate time of death / using a cooling curve for appropriate ambient temperature} ;	2. ACCEPT body loses heat	(3)

Question Number	Answer	Additional Guidance	Mark
5(b)(ii)	1. (state of) rigor ; 2. idea of looking at the degree of rigor ; 3. idea that (ambient / body) temperature has to be taken into account ; 4. idea that this method has time limitations ; OR 5. (stage of) decomposition ; 6. idea that decomposition occurs in a specific sequence ; 7. idea that ambient temperature has to be taken into account ; 8. credit details or what would be looked for ; OR 9. (forensic) entomology / the study of insects ; 10.idea that insects colonise the body in a specific sequence ; 11.stage in life cycle depends on ambient temperature ; 12.credit details of what would be looked for;	NB each set of mps can be credited anywhere in the answer 1. ACCEPT rigor mortis / muscle contraction Degree of rigor mortis = 2 marks 4. e.g. changes in rigor occur in first few hours 8. e.g. {decomposers / insects} arrive in specific sequence, body becomes bloated 12. e.g description of life cycle, eggs collected and hatched for identification	(3)

Question Number	Answer	Additional Guidance	Mark
6(a)	1. (atherosclerosis results in) coronary artery being blocked / reduced blood flow in the coronary artery / eq ; 2. heart {cells / tissue / muscle} die as a result of a lack of oxygen / eq ; 3. resulting in lack of oxygen to the brain / eq ;	2. ACCEPT conditions become anaerobic results in heart attack / infarction	(2)

Question Number	Answer	Additional Guidance	Mark
6(b)	1. idea that less air can enter {lungs / alveoli / air sacs} ; 2. therefore the oxygen concentration gradient (between lungs and blood) is lower / eq ; 3. therefore diffusion of oxygen into the blood is reduced / eq ;	1. ACCEPT less oxygen	(2)

Question Number	Answer	Additional Guidance	Mark
* 6(c)	1. HIV reduces the activity of the immune system ; 2. because the virus destroys { T helper / CD4 } cells ; 3. idea that TB is resistant to destruction by macrophages ; 4. idea that antigen presentation to T helper cells is impaired (further) ; 5. therefore { B / T killer } cells cannot be activated / eq ; 6. no antibodies (from plasma cells) for { opsonisation / agglutination / eq } ; 7. no { perforins / enzymes / eq } (from T killer cells) to destroy virus-infected cells ; 8. idea that TB is an opportunistic infection ; 9. credit description of how TB results in death ;	QWC emphasis on clarity of expression 1. ACCEPT weakened immune system / reduced T cell count 2. ACCEPT T killer cells destroy infected T helper cells 3. ACCEPT macrophages destroyed 4. ACCEPT T helper cells are not activated 6. DO NOT ACCEPT kills TB 9. e.g. high fever, lung damage, organ failure	(6)

Question Number	Answer	Mark
7(a)(i)	The only correct answer is B – 3 <i>A is incorrect because statements 1, 2 and 4 relate to topography</i> <i>C is incorrect because statements 1, 2 and 4 relate to topography</i> <i>D is incorrect because statements 1, 2 and 4 relate to topography</i>	(1)

Question Number	Answer	Additional Guidance	Mark
7(a)(ii)	endemic (species) ;	ACCEPT endemism	(1)

Question Number	Answer	Additional Guidance	Mark
7(b)(iii)	1. (soil) pH ; 2. (soil) sample removed ; 3. credit use of { indicator solution / pH probe / pH meter } ; OR 4. (soil) mineral ion content ; 5. (soil) sample removed ; 6. credit use of chemical testing kits ; OR 7. (soil) water / moisture ; 8. (soil) sample removed ; 9. description of determining water content ; OR 10.air spaces (in soil) ; 11.(soil) sample removed ; 12.description of measuring { drainage rate / volume with and without air } ;	ACCEPT inserting probe into soil for 2 marks 4. ACCEPT salinity 9. e.g. moisture {probe / meter}, weighing soil then drying and reweighing ACCEPT inserting probe into soil for 2 marks	

	OR 13. (soil) {structure / type} ; 14. (soil) sample removed ; 15. description of measuring {size of soil particles / extent of sand and clay / humus content / eq} ; OR 16. (soil) temperature ; 17. soil <i>in situ</i> measured / eq ; 18. description of measuring temperature ;	18. ACCEPT inserting {temperature probe / thermometer} into soil = 2 marks	(3)
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Question Number	Answer	Additional Guidance	Mark
8(a)	1. GPP increases and then starts to {level off / increase more slowly / eq} / eq ; 2. R increases (throughout) / eq ; 3. NPP increases and then decreases / eq ;	1. ACCEPT GPP increases (throughout) but at different rates 2. DO NOT ACCEPT linearly / steadily	(3)

Question Number	Answer	Additional Guidance	Mark
8(b)(i)	1. idea that tree is increasing in size so more { ATP / energy } is needed ; 2. credit example of what energy is needed for ;	2. e.g. active transport / chemical reactions / mineral ion uptake / new cells / cell division / metabolism IGNORE growth	(2)

Question Number	Answer	Additional Guidance	Mark
8(b)(ii)	1. idea that the number of leaves is increasing ; 2. therefore greater surface area to absorb more light ; 3. more {ATP / reduced NADP} generated in the light-dependent reaction / eq ; 4. more GALP made in the light-independent reaction / eq ; 5. so more {organic matter / protein / biomass / cellulose} synthesised from {GALP / sugar / glucose} / eq ;	1. ACCEPT more / larger leaves 2. ACCEPT more chlorophyll / chloroplasts to absorb light 3. ACCEPT (non-cyclic) photophosphorylation 4. ACCEPT Calvin cycle 5. ACCEPT more energy converted into {biomass / organic matter}	(3)

Question Number	Answer	Additional Guidance	Mark
8(b)(iii)	1. $NPP = GPP - R$ / eq ; 2. GPP increase is {steady / slow / eq} but R is increasing faster ; 3. idea that R (continues to) increases as the tree is larger ; 4. idea that a larger tree requires more { ATP / energy } ; 5. idea that although there are more leaves GPP is not increasing (very much) ; 6. because the top leaves are shading the lower leaves ;	2. ACCEPT (with time) increase in R is greater than increase in GPP	(4)

