

# **Topic 5 Biology**

**Booklet 2 of 4**

## **Revision Questions**

**Abiotic & Biotic  
Factors, Sampling &  
Succession**

**MARK SCHEME**

Question Number	Answer	Mark
3(a)	ref to biotic factors involve {organisms / living} abiotic are {physical / chemical / non-living} (factors) / eq ;	(1)

Question Number	Answer	Mark
3(b)(i)	B ;	(1)

Question Number	Answer	Mark
3* (b)(ii) QWC	<p>(QWC - Spelling of technical terms (<i>shown in italics</i>) must be correct and the answer must be organised in a logical sequence)</p> <ol style="list-style-type: none"> <li>1. ref to {several / many / more than 2} readings ;</li> <li>2. ref to use of random quadrat positions ;</li> <li>3. description of suitable process to give random positions / eq ;</li> <li>4. ref to {known / stated} area of quadrat ;</li> <li>5. number of individuals in each quadrat {counted/ recorded} / eq ;</li> <li>6. description of how mean density calculated using total count e.g. total number (of each species) divided by total area sampled ;</li> </ol>	<p>maximum (3)</p>

Jan 2010

Question Number	Answer	Mark
3(b)(iii)	<p><b>(Abiotic)</b> light intensity / light duration / availability of oxygen(in rock pools) / length of exposure (to air) / length of submersion / temperature / presence of toxic chemicals / height above sea level / slope/ aspect / wave action / pH / any other suitable e.g. ;</p> <p><b>(Biotic)</b> predators / availability of food organisms / disease / parasites / competition for a named resource / any other suitable e.g. ;</p>	(2)

Question Number	Answer	Mark
3(b)(iv)	B ;	(1)

Question Number	Answer	Mark
3(b)(v)	<p><b>Statement A</b> 1. data on two species only / eq ;</p> <p><b>Statement B</b> Accept any 3 of the following</p> <ol style="list-style-type: none"> <li>2. idea of density of both species changes as height changes ;</li> <li>3. as height increases <i>L. littorea</i> tends to increase, <i>L. obtusata</i> tends to decrease / eq ;</li> <li>4. no <i>L. obtusata</i> above 2 m, {very few / almost no} <i>L. littorea</i> below 0.5 m ;</li> <li>5. competition not a (significant) factor as both species can be found at same height ;</li> <li>6. ref to both are {plentiful / high density} between 0.5 and 1.5 m ;</li> </ol> <p><b>Statement C</b></p> <ol style="list-style-type: none"> <li>7. idea of density of species changes as height changes ;</li> <li>8. ref to no {information / data} for other factors ;</li> </ol>	<p>sub-max (3)</p> <p>maximum (4)</p>

Jan 2010

Question Number	Answer	Mark
7(a)	<ol style="list-style-type: none"> <li>1. reference to {carbon / organic / eq} compounds in plant material ;</li> <li>2. idea that digestion provides respiratory substrates ;</li> <li>3. carbon dioxide released (from respiration) ;</li> <li>4. (this carbon dioxide is) available for photosynthesis ;</li> <li>5. reference to woodlice {eaten / decompose} ;</li> </ol>	max (3)

Question Number	Answer	Mark
7(b)(i)	A ;	(1)

Question Number	Answer	Mark
7(b)(ii)	<ol style="list-style-type: none"> <li>1. {wavelength / colour / frequency} of light ;</li> <li>2. light intensity / shading ;</li> <li>3. temperature ;</li> <li>4. moisture content of {air / substratum / eq} / humidity ;</li> <li>5. {pH / chemical composition / eq} of {substratum / eq} ;</li> <li>6. air currents / wind / eq ;</li> <li>7. texture of substratum / eq ;</li> <li>8. reference to {oxygen / carbon / methane} ;</li> </ol>	max (2)

Question Number	Answer	Mark						
7(c)(i)	<table><tr><td>8</td><td>3</td></tr><tr><td>9</td><td>1</td></tr><tr><td>10</td><td>1</td></tr></table> <p>All three answers correct to 1 significant figure ;</p>	8	3	9	1	10	1	(1)
8	3							
9	1							
10	1							

June 2010

Question Number	Answer	Mark
7(c)(ii)	<ol style="list-style-type: none"> <li>1. woodlice move about / eq ;</li> <li>2. (therefore) difficult to count / eq ;</li> <li>3. some might be {counted more than once / missed out} / eq ;</li> </ol>	max (2)

Question Number	Answer	Mark
7(c)(iii)	<ol style="list-style-type: none"> <li>1. for results to be (scientifically) valid ;</li> <li>2. only one factor needs to be varied / eq ;</li> <li>3. other factors need to be kept constant / eq ;</li> <li>4. reference to {many / biotic / eq} factors (in a garden) ;</li> <li>5. (these factors are) {difficult to control / eq} ;</li> <li>6. reference to difficult to set test factor values ;</li> </ol>	max (3)

June 2010

Question Number	Answer	Mark
5(a)(i)	(abiotic factors) are non-living / eq ;	(1)

Question Number	Answer	Mark
5(a)(ii)	C ;	(1)

Question Number	Answer	Mark
5(b)(i)	C ;	(1)

Question Number	Answer	Mark
5(b)(ii)	<ol style="list-style-type: none"> <li>1. make it {easier / easy} to {estimate / measure / calculate / count} / eq ;</li> <li>2. reference to more precise ;</li> <li>3. idea of each section would be 4% ;</li> </ol>	max (2)

Question Number	Answer	Mark			
5(b)(iii)	<table><tr><td>(water) mint</td></tr><tr><td>(common) duckweed</td></tr><tr><td>(soft) rush</td></tr></table> <p>one correct 1 mark ; three correct 2 marks ;;</p>	(water) mint	(common) duckweed	(soft) rush	(2)
(water) mint					
(common) duckweed					
(soft) rush					

Jan 2011

Question Number	Answer	Mark
5(b)(iv)	<ol style="list-style-type: none"> <li>1. {saturation / eq} not measured / depth of water does not give saturation data / eq ;</li> <li>2. no data on other {factors / variables / conditions} ;</li> <li>3. other {factors / variables / conditions} may be {affecting distribution / not controlled / confounding} ;</li> <li>4. named example / eq ;</li> <li>5. idea of only one set of data taken ;</li> </ol>	max (3)

*Jan 2011*

Question Number	Answer	Mark
3(a)	B ;	(1)

Question Number	Answer	Mark
3(b)	D ;	(1)

Question Number	Answer	Mark
*3(c) QWC	<p>(QWC - Spelling of technical terms (<i>shown in italics</i>) must be correct and the answer must be organised in a logical sequence)</p> <p>succession described:</p> <ol style="list-style-type: none"> <li>1. reference to lichens and mosses as <u>pioneer</u> community ;</li> <li>2. able to grow in {little / no} soil / eq ;</li> <li>3. (that) breaks up (rock) fragments / forms {thin / shallow / eq} soil;</li> <li>4. reference to {plants / eq} with {small / short / eq} roots ;</li> <li>5. (able to) grow in {thin / shallow / eq} soil / eq ;</li> <li>6. idea that changes in soil structure enable {trees / shrubs} to grow / eq ;</li> </ol> <p>general points:</p> <ol style="list-style-type: none"> <li>7. reference to soil able to {hold / retain / contain / eq} {water / minerals} ;</li> <li>8. as plants {lose leaves / die / decay / eq} ;</li> <li>9. reference to {organic matter / humus / eq} {increases / released / eq} ;</li> <li>10. reference to competition effects ;</li> </ol>	(5)



Question Number	Answer	Mark
3 (d)	<p>1. climax (community) ;</p> <p>Any three from:</p> <p>2. includes (both) animals and plants / has many species / has high biodiversity / eq ;</p> <p>3. reference to {interaction / eq} between species / eq ;</p> <p>4. idea of balanced equilibrium of species ;</p> <p>5. reference to {dominant / codominant} (plant or animal) species ;</p> <p>6. reference to stable if no {change to environment / human influence} ;</p>	(4)

Question Number	Answer	Mark
6(a)(i)	<ol style="list-style-type: none"> <li>1. (rate of) {production of / energy incorporated into / eq} {biomass / organic material / organic molecules / tissue} ;</li> <li>2. reference to {losses in respiration / GPP- R} ;</li> <li>3. in {producers / plants / eq} ;</li> </ol>	(2)

Question Number	Answer	Mark
6(a)(ii)	<ol style="list-style-type: none"> <li>1. correct readings from graph indicated e.g. (11 and 1) ;</li> <li>2. correct subtraction e.g. (11-1 / 10) ;</li> <li>3. correct division (by 1) x 100/1 to give 1000% ;</li> </ol> <p>[correct answer = 3 marks]</p>	(3)

Question Number	Answer	Mark
6(b)	<ol style="list-style-type: none"> <li>1. idea that the rate of {(bio)chemical / metabolic / photosynthetic / named} reactions increases ;</li> <li>2. idea of increase in {movement / kinetic energy} of {enzyme / substrate / molecules / particles} / eq ;</li> <li>3. idea of (increase in reaction rate) because of more enzyme substrate interaction ;</li> </ol>	(2)

Jan 2012

Question Number	Answer	Mark
6(c)	<ol style="list-style-type: none"> <li>1. (between January and April) NPP increases as light increases ;</li> <li>2. idea of a correlation between NPP and light ;</li> <li>3. idea that the changes in NPP are occurring after the changes in light / peak light is April and peak NPP is May ;</li> <li>4. reference to increase in light increases {(rate of) photosynthesis / (ATP) energy available for Calvin Cycle / eq} ;</li> <li>5. credit correct details of photosynthesis e.g. light results in excitation of electrons ;</li> <li>6. idea that there is no real correlation between temperature and NPP / reference to temperature fluctuating ;</li> <li>7. idea that the temperature affects how quickly enzymes work ;</li> <li>8. reference to NPP falling (from May) but temperature remaining high ;</li> <li>9. reference to (light / temperature) limiting factor ;</li> </ol>	(4)

Question Number	Answer	Mark
6(d)	<p>Any two biotic factors e.g.</p> <ol style="list-style-type: none"> <li>1. grazing / {consumers / herbivores / named herbivore} / eq ;</li> <li>2. trampling / eq ;</li> <li>3. shading by {plants / named plant} / eq ;</li> <li>4. competition from other plants / eq ;</li> <li>5. disease / eq ;</li> </ol>	(2)

Jan 2012

Question Number	Answer	Mark
<b>3(a)</b>	<ol style="list-style-type: none"> <li>1. idea of taller (growing) plants could {develop / grow} in the clear areas ;</li> <li>2. idea of loss of {low-growing plants / clear zones} ;</li> <li>3. idea that different animals appear ;</li> <li>4. reference to (secondary) succession ;</li> <li>5. reference to climax community (of the taller plants) ;</li> </ol>	<b>(3)</b>

Question Number	Answer	Mark
<b>3(b)(i)</b>	<ol style="list-style-type: none"> <li>1. named abiotic factor ;</li> <li>2. appropriate description of how named factor affects the {number / distribution / growth / eq} of these plants ;</li> <li>3. appropriate explanation ;</li> </ol>	<b>(3)</b>

Question Number	Answer	Mark
<b>3(b)(ii)</b>	<ol style="list-style-type: none"> <li>1. idea of no {(inter) breeding / reproduction / mating / eq} (between the <i>B. Selene</i>);</li> <li>2. (because) {geographical / physical} barrier / eq ;</li> <li>3. idea of different behaviour ;</li> <li>4. idea of incompatible genitalia ;</li> <li>5. idea of each population having a {discrete / eq} gene pool e.g. restricted gene flow, different mutations, different alleles ;</li> </ol>	<b>(3)</b>

Question Number	Answer	Mark
<b>3(b)(iii)</b>	<ol style="list-style-type: none"> <li>1. {low-growing plants would die out / eq } / {taller plants would outgrow the low-growing plants / eq} ;</li> <li>2. idea of (<i>B. Selene</i>) unable to feed e.g. no nectar (for the adults) ;</li> <li>3. (<i>B.selene</i>) unable to lay eggs / eq ;</li> <li>4. no suitable plants for {caterpillars / eq } to feed on / eq ;</li> <li>5. idea of very little {variation / genetic diversity / eq} in a small population ;</li> </ol>	<b>(3)</b>

Question Number	Answer	Mark
<b>1(a)</b>	<ol style="list-style-type: none"> <li>1. idea of the {role / purpose / interaction / eq} of {organism / sea anemone / species / eq} ;</li> <li>2. reference to trophic level(s) ;</li> <li>3. it is a predator/ controls population of prey / eq ;</li> <li>4. it is prey / provides food for other animals / eq ;</li> <li>5. provide {shelter / home /eq} for some animals / eq ;</li> </ol>	<b>(3)</b>

Question Number	Answer	Mark
<b>1(b)</b>	<ol style="list-style-type: none"> <li>1. idea of reduces surface area (to volume) ;</li> <li>2. idea of less water loss e.g. dehydration, drying out ;</li> <li>3. idea of reduces visibility (to predators) ;</li> <li>4. idea of protection from {predators / carnivores / named eg} ;</li> <li>5. idea that there is no need for the tentacles to be exposed ;</li> <li>6. energy {will be conserved /will not be wasted/ eq} ;</li> </ol>	<b>(3)</b>

Question Number	Answer	Mark
<b>1(c)(i)</b>	C – systematic ;	<b>(1)</b>

Question Number	Answer	Mark
<b>1(c)(ii)</b>	<ol style="list-style-type: none"> <li>1. idea of no indication that temperature has an effect e.g. little variation, only 2°C ;</li> <li>2. idea that distribution is influenced by height (above low water mark) ;</li> <li>3. idea of more likely to dry out at higher levels ;</li> <li>4. idea of food availability differs e.g. less at higher levels, more at lower levels ;</li> <li>5. idea of more likely to be eaten at lower levels ;</li> </ol>	<b>(3)</b>

Question Number	Answer	Mark
<b>1(c)(iii)</b>	<ol style="list-style-type: none"> <li>1. plot graph(s) of numbers of anemones against {height and temperature / abiotic factors / eq} ;</li> <li>2. reference to correlation ;</li> <li>3. idea of using statistical analysis ;</li> <li>4. named appropriate statistical test ;</li> </ol>	<b>(2)</b>

Question Number	Answer	Additional guidance	Mark
<b>6(a)(i)</b>	1. idea of (a sequence of) changes in {a community / organisms / species / plants} ;  2. over a period of time / eq ;	<b>1. Accept</b> the idea of species replacing or succeeding each other  <b>2. Accept</b> gradually	<b>(2)</b>

Question Number	Answer	Additional guidance	Mark
<b>6(a)(ii)</b>	1. idea of final {stage / sere / community} ;  2. feature of community described e.g. self-sustaining , stable, one dominant species, a few codominant species ;	<b>1. Accept</b> at the end of succession  <b>2. Ignore</b> named example	<b>(2)</b>

Question Number	Answer	Additional guidance	Mark
<b>6(b)(i)</b>	1. idea of conservation of {genetic diversity / genetic variation / biodiversity} ;  2. idea of extinction ;  3. idea of aesthetic reasons ;  4. idea that these plants may be useful e.g. as medicines ;  5. idea that other animals depend on these plants as a {source of food / habitat} ;	<b>1. Accept</b> gene pool         <b>5. Accept</b> part of a food chain <b>Ignore</b> survival	<b>(2)</b>

Question Number	Answer	Additional guidance	Mark
<b>6(b)(ii)</b>	grazing / remove saplings / mowing / eq ;	<b>Accept</b> burning	<b>(1)</b>

Question Number	Answer	Mark
<b>6(c)(i)</b>	C systematic ;	<b>(1)</b>



Question Number	Answer	Additional guidance	Mark
<b>6(c)(ii)</b>	<ol style="list-style-type: none"> <li>1. comparison (of the value) to the critical value indicates no significance / stronger correlation the nearer the value is to 1.0 / 0.565 is too low / eq ;</li> <li>2. idea that sample size too small ;</li> <li>3. idea that {there is no correlation between height and width / other factors affect height / other factors affect width / eq} ;</li> </ol>	<ol style="list-style-type: none"> <li><b>1. Ignore</b> plus and minus numbers</li> <li><b>2. Accept</b> not enough data</li> </ol>	(2)

Question Number	Answer	Additional Guidance	Mark
1(a)	C;		(1)

Question Number	Answer	Additional Guidance	Mark
1(b)	1. reference to mitosis ; 2. (followed by) cytokinesis / {cells divide into 2 cells / eq}; 3. reference to repeated (many times) ;	<b>Not</b> meiosis <b>Ignore</b> binary fission, asexual reproduction	(2)

Question Number	Answer	Additional Guidance	Mark
1(c)(i)	1. idea that each (small) square represents 1% ; 2. {count / determine} number of squares containing <i>Pleurococcus</i> ; 3. credit an indication of how the percentage was calculated ;		(2)

Question Number	Answer	Additional Guidance	Mark
1(c)(ii)	A ;		(1)

Question Number	Answer	Additional Guidance	Mark
1(c)(iii)	1. idea of obtaining more data (outside) ; 2. reference to processing the data eg plotting a (scatter) graph, correlation test ; 3. credit correct reference to interpretation of {test / graph}; 4. reference to an extended study eg laboratory experiments ; 5. idea that the extended study would be repeated ; 6. Idea of looking at results of previous studies ;	<b>Do not credit</b> ref to collecting data at different times of day <b>Accept</b> Spearman's rank, Pearson's correlation  eg draw a line of best fit	(3)

Question Number	Answer	Additional Guidance		Mark
1(c)(iv)	1. suitable named factor ;  2. description of the possible effect on {numbers / distribution} ;	Ignore predators		(2)
		snails / grazers /herbivores / primary consumers	less as being eaten	
		disease on trees	less as smaller habitat	
		disease in <i>Pleurococcus</i>	less as being destroyed	
		competition (from other organisms)	less due to lack of resources eg light, space	

Question Number	Answer	Additional Guidance	Mark
4(a)(i)	NPP = 4680 ; R = 5720 ;	<b>NB</b> If there are no answers in the box, look for answers in the space below question If answers are the wrong way round, award 1 mark If both answers are wrong, <b>accept</b> R = 10168.9 / 10169	(2)

Question Number	Answer	Additional Guidance	Mark
4(a)(ii)	1. NPP = GPP - R / eq; 2. 55% (GPP energy) is lost / eq ; 3. energy lost as heat / eq ; 4. to provide energy for {active transport / any other named energy-requiring process} ; 5. NPP is {(stored) energy / energy available for next trophic level / eq} ;	<b>Accept</b> correct description in words  eg movement (opening of flowers, turning of leaves), glycolysis <b>Ignore</b> idea that energy is <b>used</b> for respiration unqualified <b>Accept</b> biomass	(3)

Question Number	Answer	Additional Guidance	Mark
4(b)	1. cattle {are primary consumers / herbivores / eat grass / eat plants / eq} ; 2. (therefore) gain energy (available as NPP) ; 3. idea of grazing capacity of the grassland ; 4. idea of affect on yield of {meat / milk / eq} ; 5. idea of changing to a more {efficient / NPP yielding} crop ;	<b>Accept</b> idea that farmer is ensuring that there is enough NPP available for his cattle <b>Accept</b> growth rate	(3)

Question Number	Answer	Additional Guidance	Mark
4(c)	1. idea of variation over short periods of time; 2. idea that whole year gives an {average / overall / eq} value ; 3. idea that biomass includes {all / undigestible / inedible / eq} organic material ; 4. idea that rate of productivity may influence how much grazing is possible ;	eg more NPP on a sunny day, seasonal	(2)

Question Number	Answer	Additional Guidance	Mark
6(a)	<ol style="list-style-type: none"> <li>idea that as the {distance from the front edge of the glacier / time} increases, the {complexity / biodiversity / size / eq} of the organisms increases ;</li> <li>reference to (primary) succession ;</li> <li>idea that {algae / lichens / pioneer species} are (the first) organisms to colonise bare rock / eq;</li> <li>idea that {algae / lichen / pioneer species} improve conditions for plants ;</li> <li>idea of competition (limiting species present) ;</li> </ol>	<ol style="list-style-type: none"> <li>ACCEPT idea that climax community only reached at distance from glacier edge</li> <li>NOT secondary succession</li> <li></li> <li>including e.g. change rock into soil / increase humus content of soil / increase water content</li> <li>e.g. newer species outcompete previous species</li> </ol>	(3)

Question Number	Answer	Additional Guidance	Mark
6(b)(i)	<ol style="list-style-type: none"> <li>1. the {role / interaction / eq} of an { <i>Epilobium latifolium</i> / organism / species} within its { ecosystem / habitat / environment } ;</li> <li>2. (<i>Epilobium latifolium</i>) is a producer ;</li> <li>3. idea that <i>Epilobium latifolium</i> provides {food / energy} for other organisms (herbivores / primary consumers / decomposers) ;</li> <li>4. idea that <i>Epilobium latifolium</i> improves soil e.g. holds soil structure together, increases nutrients ;</li> <li>5. idea that <i>Epilobium latifolium</i> provides {shelter / (micro) habitat} for organisms ;</li> </ol>	<ol style="list-style-type: none"> <li>1. IGNORE community</li> <li>3. NOT prey</li> <li>4. IGNORE food in soil ACCEPT adds organic matter, humus</li> <li>5. ACCEPT named organism e.g. insects</li> </ol>	(3)

Question Number	Answer	Additional Guidance	Mark
6(b)(ii)	<ol style="list-style-type: none"> <li>1. idea of using a transect (from front edge of glacier);</li> <li>2. credit method of sampling (along transect) ;</li> <li>3. credit appropriate method of selecting sample sites (along transect) ;</li> <li>4. description of estimate of abundance e.g. number of plants, percentage cover</li> <li>5. idea of using more than one transect ;</li> <li>6. credit appropriate method of recording quantitative data ;</li> </ol>	<ol style="list-style-type: none"> <li>2. e.g. clumps touching transect, quadrat (on transect), number of plants along perpendicular</li> <li>3. e.g. set distance, regular, systematic, flip-flop quadrats NOT random</li> <li>5. IGNORE references to repeating investigation</li> <li>6. e.g. tally chart, table, graph</li> </ol>	(4)

Question Number	Answer	Additional Guidance	Mark
6(b)(iii)	<ol style="list-style-type: none"> <li>1. credit appropriate named abiotic factor;</li> <li>2. credit appropriate method of measurement of factor ;</li> <li>3. credit appropriate description of where reading should be taken ;</li> <li>4. idea of taking several readings and getting an average / eq ;</li> </ol>	<ol style="list-style-type: none"> <li>1. e.g. light, soil pH, water content, mineral content, temperature, salinity, wind IGNORE CO<sub>2</sub>, O<sub>2</sub>, rainfall, humidity</li> <li>2. CE applied e.g. light {probe / sensor / meter / data logger}, {water gauge / drying out soil samples}</li> <li>3. CE applied e.g. reading taken at height of plant, soil sample around roots, quadrat</li> </ol>	(3)



Question Number	Answer	Additional Guidance	Mark
3(a)(i)	<p>1. solution should contain (all) the {mineral / ions} that duckweed needs ;</p> <p>2. at the minimum concentration / eq ;</p> <p>Any two correctly named ion and its corresponding function :</p> <p>e.g. {nitrate (ions) / <math>\text{NO}_3^{2-}</math>} for {amino acids / protein / nucleic acid / ATP / chlorophyll / eq}</p> <p>{magnesium ions / <math>\text{Mg}^{++}</math>} for chlorophyll</p> <p>{calcium ions / <math>\text{Ca}^{++}</math>} for {cell wall / pectate / middle lamella / eq}</p> <p>{phosphate (ions) / <math>\text{PO}_4^{3-}</math>} for { nucleic acid /ADP / ATP / NAD /phospholipid / eq} ; ;</p>	<p><b>1 IGNORE</b> nutrients</p> <p><b>2 ACCEPT</b> in excess</p> <p><b>IGNORE</b> carbon dioxide and wrong formulae</p> <p><b>NOT</b> nitrogen</p> <p><b>NOT</b> magnesium</p> <p><b>NOT</b> calcium</p> <p><b>ACCEPT</b> membrane</p> <p><b>NOT</b> phosphorous</p>	(3)
3(a)(ii)	<p>1. idea of {extrapolation / drawing a line of best fit / eq} (to estimate number of fronds after 10 days) ;</p> <p>2. read value from graph / eq ;</p> <p>3. idea of subtracting { 50 / 10} from the number of fronds after 10 days ;</p>	<p><b>NB</b> Apply this mark scheme even if they describe weighing the fronds and calculating the mass increase</p> <p><b>2 IGNORE</b> time refs.</p>	(2)

Question Number	Answer	Additional Guidance	Mark
*3(b)	<p>(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)</p> <ol style="list-style-type: none"> <li>1. idea of using {solution of ions / complete medium} ;</li> <li>2. idea of using a {range of / minimum of 5} temperatures ;</li> <li>3. idea that different temperatures will be achieved using {waterbaths / incubators / eq} ;</li> <li>4. idea of determining growth over a period of time ;</li> <li>5. credit appropriate named example of how growth is to be assessed eg {number / size / mass } of {fronds / plants}, length of roots ;</li> <li>6. credit named control variable e.g. same concentration of (each) inorganic ions ;</li> <li>7. idea of repeats to calculate a {mean / average} ;</li> </ol>	<p>QWC with an emphasis on logical sequence</p> <p>2. <b>ACCEPT</b> 5 quoted temperatures in between 1°C and 70°C  <b>IGNORE</b> room temp if 6 or more values given</p> <p>5. <b>IGNORE</b> height / refs to germination</p> <p>7 <b>ACCEPT</b> for reliability</p>	(5)

Question Number	Answer	Mark
8(a)	C $\text{kJ m}^{-2} \text{year}^{-1}$	(1)

Question Number	Answer	Mark
8(b)	B $\text{NPP} = \text{GPP} - \text{R}$	(1)

Question Number	Answer	Additional Guidance	Mark
8(c)	<ol style="list-style-type: none"> <li>idea that light is reduced by the deeper water ;</li> <li>idea that carbon dioxide levels might be lower deeper down ;</li> <li>idea that temperature might be lower deeper down ;</li> <li>idea that {photosynthesis / eq} will be reduced ;</li> <li>idea that less {glucose / hexose / GALP / GP / eq } produced to convert into {biomass / NPP / eq} ;</li> <li>idea that GPP goes down but respiration {stays the same / increases} ;</li> </ol>	<p><b>NB ACCEPT</b> converse of mp 1 - 5 if in context of shallow water</p> <p><b>5 IGNORE</b> energy</p>	

Question Number	Answer	Additional Guidance	Mark
3(a)	1. (rate at which) energy {incorporated / eq} into {biomass / organic matter} ;  2. by { plants / producers} ;	<b>1 NOT</b> energy produced, converted, turned into <b>ACCEPT</b> organic material, organic molecules  <b>2 ACCEPT</b> by photosynthesis	(2)
3(b)	1. GPP {depends / eq} on photosynthesis ; 2. higher the temperature the higher the GPP / eq ; 3. enzymes in (photosynthesis / chemical reaction ) {can work faster / more kinetic energy / eq } ; 4. higher the {precipitation / eq} the higher the GPP / eq ; 5. idea that water is needed for the light-dependent reaction ; 6. role of water in transport of { mineral ions / named mineral ion / amino acids / sucrose / eq } ;	1 needs to be a clear statement  <b>2 ACCEPT</b> converse  <b>3 ACCEPT</b> increased enzyme activity  <b>4 ACCEPT</b> converse  <b>5 ACCEPT e.g.</b> photolysis, H <sup>+</sup> donor, replacing electrons	(5)

Question Number	Answer	Additional Guidance	Mark
3(c)	1. credit two values that lie in the range: greater than 0 to 11000 ; 2. appropriate justification based on temperature ; 3. appropriate justification based on precipitation ;	<b>1NB</b> (actual value is 126-3100) <b>ACCEPT</b> below 850	(3)

Question Number	Answer	Additional Guidance	Mark
3(d)	1. (trophic level 2) 2300 - 1500 / 800 (kJ) ; 2. (trophic level 3) 760 - 690 / 70 (kJ) ; 3. $((70 \div 800) \times 100) = 8.8 / 8.75 (\%)$	<b>Correct answer gains three marks</b>  <b>3 ALLOW</b> ecf for two values used	(3)

Question Number	Answer	Mark
3(a)	<p><b>3(a). The only correct answer is C – role of a species in an ecosystem</b></p> <p><i>A is not correct because niche is about role not distribution and abundance</i></p> <p><i>B is not correct because niche is about role not location</i></p> <p><i>D is not correct because niche is about role not trophic level</i></p>	(1)

Question Number	Answer	Additional guidance	Mark
3(b)	<ol style="list-style-type: none"> <li>1. idea of testing water samples and {noting down observing / eq} (the different) species present ;</li> <li>2. idea of using an (oxygen) probe / chemical testing kit ;</li> <li>3. idea that the lowest level of oxygen with species present is minimum level tolerated ;</li> <li>4. idea that all other {variables / named variable} must be {controlled / monitored / eq} ;</li> </ol>	Accept appropriate lab based experiment that includes all species being added to each concentration and survival looked for	(3)

Question Number	Answer	Mark
3(c)(i)	<p><b>3(c)(i). The only correct answer is C – species richness</b></p> <p><i>A is not correct because endemism describes organisms found in a specific area</i></p> <p><i>B is not correct because genetic diversity describes the genetic variation of a species</i></p> <p><i>D is not correct because taxonomy concerns classification</i></p>	(1)

Question Number	Answer	Mark
3(c)(ii)	<p><b>3(c)(ii). The only correct answer is C – mayfly nymph</b></p> <p><i>A is not correct because blood worm are found in polluted areas where the oxygen content will be low to avoid competition</i></p> <p><i>B is not correct because freshwater shrimp can tolerate low pollution levels and will therefore not be in unpolluted areas to avoid competition</i></p> <p><i>D is not correct because tubifex worms are found in polluted areas where the oxygen content will be low to avoid competition</i></p>	(1)

Question Number	Answer	Additional guidance	Mark
3(c)(iii)	<ol style="list-style-type: none"> <li>1. idea that species adapted to {low oxygen levels / polluted water} will avoid competition ;</li> <li>2. for {space / food / substratum / eq} ;</li> <li>3. idea that there will be predators of some of the species ;</li> <li>4. idea that the polluted water provided other {nutrients / food / eq} required by these species ;</li> </ol>	1 Accept converse	(3)

Question Number	Answer	Mark
<b>3(c)(iv)</b>	<p><b>3(c)(iv). The only correct answer is D – tubifex worm</b></p> <p><i>A is not correct because caddis fly need relatively high levels of oxygen so cannot survive in polluted water</i></p> <p><i>B is not correct because hoglouse need relatively high levels of oxygen so cannot survive in polluted water</i></p> <p><i>C is not correct because stone fly nymph need high levels of oxygen so cannot survive in polluted water</i></p>	<b>(1)</b>

Question Number	Answer	Additional guidance	Mark
<b>3(d)(i)</b>	idea that the {tube / syphon / eq} will absorb oxygen from the {air / above the water} ;	<p>Accept tail / flagellum</p> <p>Accept haemoglobin has a high affinity for oxygen / metabolism is very low / adapted to respire anaerobically</p>	<b>(1)</b>

Question Number	Answer	Additional guidance	Mark
<b>3 (d)(ii)</b>	<p>1. anatomical / structural / physical ;</p> <p>2. because it has the {tube / syphon / eq} ;</p> <p><b>OR</b></p> <p>3. behavioural ;</p> <p>4. because it has to be close to the surface of the water / eq ;</p>	2 Accept tail / flagellum	<b>(2)</b>