

Question Number	Answer	Mark
1(a)	A bacteria and fungi	(1)COMP

Question Number	Answer	Mark
1(b)(i)	A none	(1)COMP

Question Number	Answer	Mark
1(b)(ii)	D validity	(1)COMP

Question Number	Answer	Additional Guidance	Mark
1(b)(iii)	<ol style="list-style-type: none"> 1. ref to hydrolysis ; 2. by {enzymes / cellulase} / eq ; 3. produced by microorganisms / eq ; 4. into(β) glucose ; 5. uptake of glucose into microorganisms / eq ; 6. idea that glucose is used in {respiration / fermentation} ; 7. releasing carbon dioxide into the atmosphere / eq ; 8. idea that some of glucose (solution) soaks into ground ; 		(4)EXP

Question Number	Answer	Additional Guidance	Mark
1(b)(iv)	<ol style="list-style-type: none"> 1. to make investigation valid ; 2. idea that {temperature / heat energy} affects {rate of enzyme reactions / enzyme activity / rate of decomposition} ; 3. increase in {heat / kinetic} energy results in more {collisions / energetic collision / enzyme-substrate complexes / eq} ; 4. idea that high temperature results in enzyme {denaturing / becoming denatured} ; 5. (so) decomposition would stop / eq ; 	4. ACCEPT bacteria killed / eq	(4)EXP

Question Number	Answer	Additional Guidance	Mark
2(a)(i)	NPP = 4680 ; R = 5720 ;	NB 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, accept R = 10168.9 / 10169	(2)

Question Number	Answer	Additional Guidance	Mark
2(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} ;	Accept correct description in words eg movement (opening of flowers, turning of leaves), glycolysis Ignore idea that energy is used for respiration unqualified Accept biomass	(3)

Question Number	Answer	Additional Guidance	Mark
2(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 ;	Accept idea that farmer is ensuring that there is enough NPP available for his cattle Accept growth rate	(3)

Question Number	Answer	Additional Guidance	Mark
2(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
3(a)	1. (rate of) { energy incorporated into / production of / eq} {biomass / organic material} ; 2. in {plants / producers} ;	2. Accept from photosynthesis	(2)

Question Number	Answer	Additional Guidance	Mark
3(b)(i)	1. very little GPP in seagrass / majority present in {microphytobenthos and phytoplankton / phytoplankton} ; 2. (roughly) equal distribution (of GPP) between microphytobenthos and phytoplankton ;	1. Accept only 2.5 to 5% in seagrass, 95% in micro and phyto, more than 50% or about 55% of phyto 2. Accept about 50% in each Accept idea that GPP in microphytobenthos is slightly lower than in phytoplankton	(2)

Question Number	Answer	Additional Guidance	Mark
3(b)(ii)	1. idea of obtaining a value from the chart e.g. percentage, area, degrees, ratio ; 2. idea of how to use this to calculate GPP ;	Ignore units 1. Accept appropriate figures in range 50 – 55 % 2. Accept e.g. (percentage) multiplied by 8.4×10^6 NB $\frac{\text{angle} \times 840 \times 10^6}{360} = 2 \text{ marks}$ $\frac{\text{area of segment} \times 840 \times 10^6}{\text{area of circle}} = 2 \text{ marks}$	(2)

Question Number	Answer	Additional Guidance	Mark
3(b)(iii)	<ol style="list-style-type: none"> 1. {more / fast / high / eq} photosynthesis ; 2. water less {cloudy / churned up } / shallow water / high light penetration / eq ; 3. high {nutrient / carbon dioxide} levels in the sea / eq ; 4. {high / optimum} temperatures ; 5. high light intensity (in this area) / eq ; 6. idea of less respiration ; 	<p>2. Accept less current, less tidal</p>	(2)
Question Number	Answer	Additional Guidance	Mark
3(c)	<ol style="list-style-type: none"> 1. $NPP = GPP - R$ / eq ; 2. energy lost as heat / eq ; 3. named use of energy (released by respiration); 	<p>1. Accept correct description in words</p> <p>3. Accept e.g. movement, opening of flowers, glycolysis, metabolic processes</p>	(2)

Question Number	Answer	Mark
4(a)	B – bacteria ; C – fungi ;	(2)

Question Number	Answer	Mark												
4(b)	<table border="1"> <thead> <tr> <th>Statement</th> <th></th> <th>False</th> </tr> </thead> <tbody> <tr> <td>Compost formation involves respiration by microorganisms.</td> <td>✓</td> <td></td> </tr> <tr> <td>I added nitrate fertiliser so that the microorganisms could synthesise nucleic acids.</td> <td>✓</td> <td></td> </tr> <tr> <td>My compost heap only contains one trophic level only.</td> <td></td> <td>✓</td> </tr> </tbody> </table> <p>1 mark each correct row ;;;</p>	Statement		False	Compost formation involves respiration by microorganisms.	✓		I added nitrate fertiliser so that the microorganisms could synthesise nucleic acids.	✓		My compost heap only contains one trophic level only.		✓	(3)
Statement		False												
Compost formation involves respiration by microorganisms.	✓													
I added nitrate fertiliser so that the microorganisms could synthesise nucleic acids.	✓													
My compost heap only contains one trophic level only.		✓												

Question Number	Answer	Mark
4(c)	<ol style="list-style-type: none"> 1. ref to increase in temperature for first 4 weeks ; 2. idea of heat (energy) related to temperature change ; 3. ref to {metabolism / respiration / named metabolic reaction} ; 4. appropriate comment on changes in numbers of microorganisms ; 5. ref to decrease in temperature after 4 weeks ; 6. comment on {enzymes denaturing / eq} ; 7. idea that {substrate / eq} {is running out / has run out} ; 	(4)

Question Number	Answer	Mark
4(d)	<ol style="list-style-type: none"> 1. idea that {heat is lost from outer surface of compost heap / temperature will vary in different parts of the compost heap} ; 2. idea that long thermometer measures {internal / core / eq} (temperature) of heap ; 3. this improves validity (of the method) ; 4. repeated readings to obtain {mean / average} ; 5. this improves reliability (of the results) ; 	(3)