| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 1 | (a) | (i) | 57 / 57.3 **;** **;** | **2** | **Award 2 marks for a correct answer**<br>**ACCEPT** 57.25 for 2 marks<br>If answer is incorrect then allow 1 working mark for<br>655 – 280 or for seeing 375 anywhere in the working |
| | | | | | |
| | (a) | (ii) | *description (D)*<br>**D1** number of **,** waders / birds **,** decrease (in area 2) **;**<br>**D2** (numbers decrease) in **,** all / four **,** species **;**<br>**D3** unlike / different to **,**<br>area 1 / where hedgehogs absent **;**<br>**D4** (area 1) two species increase /<br>only two species decrease **;**<br>**D5** quote any two % change figures **;**<br><br>*explanation (E)*<br>**E1** hedgehogs are **,** secondary consumers / 'predators' **;**<br>**E2** hedgehogs **,** stop birds breeding /<br>reduce offspring (one year) **;**<br>**E3** *idea of* fewer **,** new adults / breeders (next year) **;**<br>**E4** *idea of* more deaths than 'births' **;** | **6 max** | **D1** **CREDIT** 'it' as number **ACCEPT** 'amount'<br>**D2** **CREDIT** the four names if all said to decrease<br><br>**D4** **CREDIT** lapwing and redshank increase /<br>only dunlin and snipe decrease<br>**D5** Percentage change figures:<br>area 1 area 2<br>lapwing +24 -31<br>redshank +51 -41<br>dunlin -31 -56<br>snipe -10 -57<br>Look for ecf from 4(a)(i) if snipe in area 2 incorrect<br><br>**E1** **IGNORE** hedgehogs eat eggs as given in question<br><br>**E3** Look for idea of future / knock-on effect |
| | | | | | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 1 | (a) | (iii) | **1** plenty of / enough , food / birds' eggs / space ;<br>**2** breed rapidly / breed successfully / young survive ;<br><br>**3** no / few , predators ;<br>**4** few die (young / before breeding) ;<br><br>**5** *idea that* hedgehogs are introduced species ;<br>**6** invasive / fill vacant niche /<br>not reached carrying capacity ;<br><br>**7** these hedgehogs restricted to island ;<br>**8** cannot , emigrate / leave island (so numbers build up) ; | **4 max** | **Mark the first suggestion on each numbered line. Award 1 mark for a factor and a further mark for a related explanation**<br><br>**1 CREDIT** little competition for food |
| | | | | | |
| 1 | (b) | | *idea that the following may be ethically wrong*<br><br>**1** killing hedgehogs ;<br>**2** letting hedgehogs , kill / decrease number of , waders ;<br>**3** introducing hedgehogs to island (upset the ecosystem) ;<br>**4** catching / moving , hedgehogs might cause suffering ;<br><br>**5** doing nothing ; | **3 max** | **CREDIT ORA** *idea preventing these is ethically right*<br>**IGNORE** 'right to life' and 'playing God'<br><br>**2 CREDIT ORA** need to conserve waders<br><br>**4** *'the other methods are cruel'* = 1 mark (mp 4)<br>*'moving hedgehogs elsewhere causes problem somewhere else'* = 1 mark (mp 4)<br>**5 CREDIT ORA** idea of human responsibility |
| | | | | | |
| | | | | **15** | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 2 | (a) | | ecosystem ;<br>producers / autotrophs ;<br>primary ;<br>trophic level(s) ;<br>biotic / living ;<br>minerals / elements ; | 6 | **DO NOT CREDIT** plants<br><br>**DO NOT CREDIT** tropic<br><br>**CREDIT** named, element / ion, e.g. nitrogen, nitrate<br>**ACCEPT** symbol e.g. N / $NO_3^-$<br>**ACCEPT** nutrient<br>**DO NOT CREDIT** energy / waste products |
| 2 | (b) | (i) | | | |
| | | 1 | limiting / density-dependent, factors ; | | |
| | | 2 | carrying capacity ; | | |
| | | 3 | intraspecific competition ; | | ***3*** **ACCEPT** description<br>e.g. ● "competition with other members of the same species"<br>● "competition with other (small) squirrels" |
| | | 4 | for, food / nesting sites ; | | ***4*** **ACCEPT** they run out of food |
| | | 5 | interspecific competition ; | | ***5*** **ACCEPT** description<br>e.g. "competition with other species" |
| | | 6 | with, deer / tree shrew / giant squirrel ; | | |
| | | | *larger squirrel populations* | | |
| | | 7 | attract more predators ; | | ***7*** **DO NOT CREDIT** predation alone, must be linked to larger squirrel population |
| | | 8 | parasites / diseases, spread more easily ; | | ***8*** **DO NOT CREDIT** disease alone, must be linked to larger squirrel population |
| | | | | max 4 | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 2 | (b) | (ii) | species richness & evenness decrease **; ora**<br><br>(richness) 29 → 26 (species) **;**<br><br>(evenness) large numbers of, 2 / some, species,<br>but, low numbers / none, of other species **;** | **max 2** | **ACCEPT** they both, decrease / decline / fall<br>**or** they were higher at start<br>**ACCEPT** 6 → 4 **or** 2 fewer (from table)<br>**or** 3 fewer (from text)<br><br>**CREDIT** suitable named e.g.s from table |
| 2 | (c) | (i) | rare initially / AW **;**<br><br>prey, numbers have reduced / have become extinct /<br>have left the area **;**<br><br>idea of slower reproductive rate / AW **;** | **max 1** | **ACCEPT** that there weren't very many at start<br><br>**DO NOT CREDIT** 'lack of food' unless has indicated that food is an animal<br><br>**ACCEPT** don't breed as fast / don't have as many offspring |
| 2 | (c) | (ii)<br>**1** | aesthetic / amenity / recreational, value **;** | **max 3** | **Mark the FIRST suggestion on each numbered line**<br>***1*** **ACCEPT** description,<br>e.g. beautiful / so people will visit /<br>so people will use it for leisure |
| | | **2** | (eco)tourism **;** | | ***2*** **ACCEPT** description, e.g. raise money from visitors |
| | | **3** | to, preserve biodiversity / preserve genetic diversity /<br>stop extinction **;** | | ***3*** **ACCEPT** description, e.g. keep more species |
| | | **4** | ref. interactions between species /<br>need to preserve whole habitat **;** | | ***4*** **ACCEPT** description,<br>e.g. if habitat destroyed there will be a knock-on effect on many species |
| | | **5** | (rainforest species / preserve gene pool as)<br>could be useful, in future / as potential,<br>for, medicine / genetic engineering / AW **;** | | ***5*** **ACCEPT** for drugs, pharmaceuticals, GM or GM e.g. (like crop improvement) |
| | | **6** | to support indigenous peoples / AW **;** | | ***6*** **ACCEPT** let native people continue to live in forest<br>income for indigenous people |
| | | **7** | to stop effect of deforestation on,<br>atmosphere / climate / soil **;** | | ***7*** **ACCEPT** to stop, $CO_2$ % rising / global warming / erosion<br>**or** forest acts as C, sink / store |
| | | **8** | AVP **;** | | ***8*** e.g. ● habitat for pollinators<br>● habitat for predators of pests<br>**DO NOT CREDIT** 'right to life' |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 2 | (d) | | | | **LOOK FOR** key ideas expressed in different ways |
| | | | *management practices* | | |
| | | **M1** | coppicing / pollarding / description ; | | ***M1*** **CREDIT** coppicing with standards / rotational coppicing |
| | | **M2** | selective felling / description ; | | ***M2*** **ACCEPT** only some trees cut down |
| | | **M3** | rotational felling / description ; | | ***M3*** **ACCEPT** cycle of felling different areas |
| | | **M4** | strip felling ; | | |
| | | **M5** | replant after felling ; **(max 2)** | | |
| | | | *explanation of benefits re. sustainability* | | |
| | | **B1** | preserves / prevents disruption to, habitat / ecosystems / nesting sites ; | | |
| | | **B2** | maintains / increases, species diversity / biodiversity ; | | |
| | | **B3** | prevents, soil erosion / leaching ; | | |
| | | **B4** | less disturbance by machinery ; | | |
| | | **B5** | AVP ; **(max 2)** | | ***B5*** **CREDIT** specific benefits linked to a practice<br>e.g. • faster recovery due to seeding from untouched areas nearby (M3)<br>• pollarding so deer can't eat shoots (M1) |
| | | | | **max 4** | |
| | | | **Total** | **20** | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 3 | (a) | (i) | DNA / gene / genetic , fingerprinting / profiling / analysis ;<br>DNA / protein / gene , sequencing ;<br>electrophoresis ; | 1 max | **IGNORE** gene testing / gene probing / gene mapping / genome sequencing |
| | | | | | |
| 3 | (a) | (ii) | rarely / do not , produce seed / cross-pollinate / interbreed ;<br>only reproduce asexually ; | 1 max | |
| | | | | | |
| 3 | (a) | (iii) | vegetative propagation ; | 1 | **IGNORE** asexual reproduction (as given in the question) |
| | | | | | |
| 3 | (b) | | **1** genetically identical / little genetic variation ;<br>**2** all susceptible / none resistant , to this disease ;<br><br><br><br><br>**3** beetles , move / fly , from tree to tree<br>**or** beetles are vector ;<br>**4** trees grow , in clonal patch / close together<br>**or** disease spreads through , suckers / roots<br>**or** connected by , suckers / roots ;<br>**5** the beetles only , live on / target , elm trees ;<br><br>**6** attempts at control contributed to spread ;<br>**7** as **more** trees became diseased then<br>**more** tree surgery was necessary<br>(contributing to spread of problem) ;<br>**8** as **more** trees became infected then<br>**more** , saws / equipment , were contaminated ; | 4 max | **1** **IGNORE** clone<br>**2** **IGNORE** all susceptible to 'disease' in general. Only credit if **one particular** disease is implied<br>e.g. the / new / fungus / same , disease<br>**DO NOT CREDIT** immune instead of resistant<br><br>**3** **IGNORE** simple repetition of text 'beetles spread disease' |
| | | | | | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 3 | (c) | (i) | **1** less / no **,** movement of water<br>**or** less / no **,** water reaches leaves **;**<br><br>**2** less / no **,**<br>minerals / nitrate / phosphate / magnesium / iron **;**<br><br>**3** less / no **,** chlorophyll formation **;**<br><br>**4** chlorophyll breakdown / leaf senescence **;** | **2 max** | **2** **CREDIT** correct symbols $NO_3^-$, $PO_4^{2-}$, $Mg^{2+}$, $Fe^{2+}$, $Fe^{3+}$<br>**IGNORE** nutrients<br>**IGNORE** reference to other substances such as sugars |
| | | | | | |
| 3 | (c) | (ii) | **1** less / no **,** photosynthesis **;**<br>**2** less / no **,** sugar(s) / amino acid(s) /<br>assimilates / organic molecules **;**<br><br>**3** <u>roots</u> cannot **,** respire / do active transport / metabolise **;**<br><br>**4** the falling leaves carry the fungus **;** | **2 max** | **2** **CREDIT** named sugars, e.g. sucrose **,** glucose **,** hexose<br>**IGNORE** nutrients / food |
| | | | | | |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 3 | (d) | 1 | cut plant material into , explants / small pieces ; | | 1 **DO NOT CREDIT** a single cutting |
| | | 2 | example of part of plant used e.g. leaf / stem / root / bud / meristem / dividing region at tip of plant ; | | |
| | | 3 | sterilise explant ; | | |
| | | 4 | (with) bleach / sodium hypochlorite / alcohol ; | | |
| | | 5 | place on , agar / growth medium ; | | 5 **CREDIT** place in aerated solution |
| | | 6 | containing , glucose / amino acids / nitrates / phosphates ; | | 6 **IGNORE** polymers / carbohydrates |
| | | 7 | callus **or** mass of , undifferentiated / totipotent , cells ; | | 7 **DO NOT CREDIT** description of single cell |
| | | 8 | high auxin **and** cytokinin (for callus formation) ; | | |
| | | 9 | subdivide callus / sub-culturing ; | | 9 **IGNORE** ref. single cells |
| | | 10 | treat to induce , roots / shoots ; | | |
| | | 11 | change plant hormone ratio ; | | 11 **CREDIT** description , e.g. high auxin to give roots or (relatively) high cytokinin to give shoots (auxin : cytokinin ratio = 100 : 1 for roots, 4 : 1 for shoots, or similar figures) |
| | | 12 | transfer to , greenhouse / soil / less controlled environment / non-sterile environment ; | | |
| | | 13 | ref. aseptic conditions (anywhere within stages 5-11) ; | **6 max** | 13 Do not award for sterilising explant (which is mp3) |
| | | | **QWC – described in logical sequence of steps** ; | **1** | **Award QWC for sequence of marks as follows:** either mp 1 or 2 **then** 1 mark from mps 5 – 8 **then** 1 mark from mp 9 - 12 |

| Question | | | Expected Answers | Marks | Additional Guidance |
|---|---|---|---|---|---|
| 3 | (e) | | | | **CREDIT** the first answer on each prompt line |
| | | | *advantages* | | |
| | | | **1** quick ; | | **1 IGNORE** ref. large numbers alone |
| | | | **2** disease-free / virus-free , stock created ; | | |
| | | | **3** plants have same feature / uniform plants created ; | | **3** refers to plant phenotype<br>e.g. plants , grow at same rate / grow to same height |
| | | | **4** can reproduce infertile plants ; | | |
| | | | **5** can reproduce plants that are hard to grow from seed ; | | |
| | | | **6** create whole plants from GM cells ; | | |
| | | | **7** production , not determined by seasons /<br>at any time / anywhere in the world ; | | |
| | | | **8** (plantlets small) can be transported easily /<br>grown in small space ; | | |
| | | | **9** can save rare species from extinction ; | | |
| | | | *disadvantages* | | |
| | | | **10** expensive / labour intensive , process ; | | |
| | | | **11** process can fail due to microbial contamination ; | | |
| | | | **12** all offspring susceptible to *same* ,<br>pest / disease /<br>named environmental factor (e.g. drought) ; | | **12 IGNORE** all are susceptible to disease in general<br>(as in 3b) |
| | | | **13** no / low / little , genetic variation ; | **4** | **13 IGNORE** loss of alleles |
| | | | | | |
| | | | | **22** | |