

GCE

Biology

Unit **F215**: Control, Genomes and Environment

Advanced GCE

Mark Scheme for June 2015

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All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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1. Annotations used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

| Annotation | Meaning |
|---|---|
|  | Correct answer |
|  | Incorrect response |
|  | Benefit of Doubt |
|  | Not Benefit of Doubt |
|  | Error Carried Forward |
|  | Given mark |
|  | Underline (for ambiguous/contradictory wording) |
|  | Omission mark |
|  | Ignore |
|  | Correct response (for a QWC question) |
|  | Blank Page |
|  | Response that contradicts previous correct response |

| Question | | | Answer | Marks | Guidance |
|----------|-----|------|---|-------|---|
| 1 | (a) | (i) | <p><i>division type 1</i> <u>mitosis</u></p> <p>and</p> <p><i>division type 2</i> <u>meiosis</u> ;</p> | 1 | <p>Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>ACCEPT correct spelling only</p> <p>ACCEPT correct spelling only CREDIT meiosis I and II DO NOT CREDIT meiosis I / meiosis II alone</p> |
| 1 | (a) | (ii) | <p>A (DNA) replication ;</p> <p>B cytokinesis ;</p> | 2 | <p>Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>IGNORE stages of cell division</p> <p>IGNORE cell division / stages of cell division</p> |

| Question | | Answer | Marks | Guidance |
|----------|-----|--|-------|---|
| 1 | (b) | <p>A1 independent assortment / random segregation , of (homologous) chromosomes / bivalents;</p> <p>A2 in , metaphase I / meiosis I ;</p> <p>A3 of chromatids in , metaphase II / meiosis II ;</p> <p>A4 (so) homologous chromosomes , have different alleles / come from different parents ;</p> <p>A5 produces large number of allele combinations ;</p> <p>C1 <u>crossing over</u> / (formation of) chiasma(ta) ;</p> <p>C2 in , prophase I / meiosis I ;</p> <p>C3 (so) <u>chromatids</u> will have new combination of <u>alleles</u> ;</p> <p>C4 amount of variation depends on distance between crossover points ;</p> <p>M1 mutation ;</p> <p>M2 changes the (DNA) nucleotide/ base, sequence ;</p> <p>M3 DNA checks (during duplication) did not recognise damage ;</p> <p>M4 <i>idea of</i> differences in (named) protein(s) ;</p> <p>N1 non-disjunction ;</p> <p>N2 homologous chromosomes do not separate (in metaphase I) ;</p> <p>N3 one , more / less , chromosome present ;</p> <p>F1 random, mating / fusion of gametes/ fertilisation ;</p> <p>F2 gametes are not genetically identical;</p> <p>F3 produces large number of (allele) combinations ;</p> | 8 max | <p>A1 ACCEPT Random assortment / independent segregation</p> <p>A2 /A3 DO NOT CREDIT metaphase /meiosis, I and II</p> <p>A2 /A3 ACCEPT correct anaphase stage linked to segregation</p> <p>A2 must be in context of independent assortment / random segregation</p> <p>A4/ A5 DO NOT CREDIT genes</p> <p>A4 ACCEPT pairs of chromosomes / maternal and paternal chromosomes, have different alleles/ come from different parents</p> <p>A5 ACCEPT different combinations of, chromatids /chromosomes, in gametes</p> <p>CREDIT figures e.g. for humans 2^{23} possible combinations</p> <p>C1 DO NOT CREDIT between sister chromatids</p> <p>C2 DO NOT CREDIT prophase / meiosis, I and II</p> <p>C2 must be in context of crossing over</p> <p>C3 ACCEPT shuffles / swaps/exchanges, <u>alleles on chromatids</u></p> <p>C4 e.g. more variation the further apart the crossovers occur</p> <p>M2 IGNORE 'pairs'</p> <p>M2 CREDIT deletion,/substitution/ addition, of, base / nucleotide</p> <p>M3 ACCEPT proof reading did not recognise damage</p> <p>M4 e.g. change in, amino acid sequence/primary structure</p> <p>N1 CREDIT inversion / translocation (chromosome mutation)</p> <p>N2 CREDIT description of inversion / translocation</p> <p>N3 CREDIT examples of chromosome changes e.g. Trisomy 21</p> <p>F2 ACCEPT gametes are genetically different</p> <p>F3 DO NOT CREDIT produce large number of gene combinations</p> |

| Question | | | Answer | Marks | Guidance |
|----------|--|--|--------------|-----------|--|
| | | | QWC ; | 1 | <p>Awarded for one change and consequence of that change</p> <p>Award if ONE of the following has been awarded</p> <p>mp A1 or A2 or A3 <u>and</u> mp A4 or A5 OR mp C1 or C2 <u>and</u> mp C3 or C4 OR mp M1 or M2 <u>and</u> mp M3 or M4 OR mp N1 or N2 <u>and</u> mp N3 OR mp F1 or F2 <u>and</u> mp F3</p> |
| | | | Total | 12 | |

| Question | | | Answer | Marks | Guidance |
|----------|-----|------|--|-------|--|
| 2 | (a) | (i) | <p>1 peak in , 1988 / 1994 ;</p> <p>2 trend decrease after 1994 ;</p> <p>3 ref. decrease and then increase , 1988 to 1994 ;</p> <p>4 fluctuations (within pattern) ;</p> <p>5 overall increase from 1965 to 2002 ;</p> | 3 max | <p>IGNORE ref to population figures</p> <p>1 ACCEPT increases until / highest number in, 1988/1994</p> <p>4 ACCEPT 'goes up and down' / oscillates</p> |
| 2 | (a) | (ii) | <p><i>accurate because</i></p> <p><i>idea that</i> actual number of elk shot is recorded ;</p> <p><i>method not valid because</i></p> <p><i>idea that</i> number of elk shot / hunting success , varies independently of population size ;</p> | 2 | <p>ACCEPT elks shot are counted / reported</p> <p>CREDIT suitable reason e.g. numbers of licences issued / number of hunters set quotas to hunt illegal hunting if weather suitable for hunting only younger / older / diseased / larger, elk killed</p> <p>IGNORE length of time spent hunting</p> |

| Question | | | Answer | Marks | Guidance |
|----------|-----|-----|---|-------|---|
| 2 | (b) | (i) | <p>1 <i>idea that population size is determined by <u>limiting factor</u>(s) ;</i></p> <p><i>Before 1995, population increases due to</i></p> <p>2 example of factor that is not limiting population ;</p> <p><i>Before 1995, population levels off because</i></p> <p>3 reaches <u>carrying capacity</u> ;</p> <p><i>Before 1995, population becomes limited by</i></p> <p>4 intraspecific competition for named resource;</p> <p>5 interspecific competition for named resource;</p> <p><i>Population can decline at any time/ dips, due to</i></p> <p>6 severe weather / natural disaster ;</p> <p>7 decrease before 1995 not due to wolves (as none present) ;</p> <p>8 decrease after 1995 (probably) due to wolves;</p> <p>9 <i>idea that</i> effect of wolves on population may be debatable ;</p> | 6 max | <p>IGNORE ref to abiotic / biotic factors throughout</p> <p>2 e.g. plenty of, enough, food Less / no predation Less / no overcrowding/ enough space less hunting</p> <p>2 IGNORE water / nutrients/ availability of food</p> <p>4 CREDIT description of intraspecific</p> <p>5 CREDIT description of interspecific</p> <p>4 & 5 CREDIT any suitable limiting factor eg competition for, food / space / mates/ overcrowding</p> <p>6 CREDIT ref to parasites/disease/ drought/floods/fires</p> <p>9 e.g. lack of data in 1996 and 1997 makes it difficult to form conclusions</p> |
| | | | QWC ; | | 1 |

| Question | | | Answer | Marks | Guidance |
|----------|-----|------|---|-----------|--|
| 2 | (b) | (ii) | <p><i>re-introduction of wolves is conservation because</i></p> <p>1 restoring the <u>ecosystem</u> (to its original form) or maintains <u>biodiversity</u> ;</p> <p>2 helps the (global) wolf population ;</p> <p>3 active / dynamic / sustainable, management / maintenance ;</p> <p>4 prevents over-population by the elk ;</p> <p>5 prevents over-grazing or damage to, habitat / ecosystem ;</p> | 2 max | <p>ACCEPT controls/ increases, <u>biodiversity</u></p> <p>ACCEPT wolves do not become extinct / increase in number</p> <p>'Actively maintains biodiversity' = MP1 and 3</p> <p>ACCEPT wolves, limit / control, elk population or lack of wolves causes elk population to grow</p> <p>ACCEPT if wolves absent, elk would damage habitat / other species may become extinct</p> |
| | | | Total | 14 | |

| Question | | | Answer | Marks | Guidance |
|----------|-----|------|---|-------|--|
| 3 | (a) | | AAA TCT GGT ; | 1 | |
| 3 | (b) | (i) | <p>the correct bases inserted in all 3 rows before box ;</p> <p>correctly identifying the last base in each sequence as the labelled base ;</p> <pre> 5 T T [T] 6 T T T [C] 7 T T T C [C] </pre> | 2 | |
| 3 | (b) | (ii) | <p>electrophoresis ;</p> <p>(negatively-charged DNA) moves towards , positive electrode / anode ;</p> <p>smallest/smaller (fragments) move, fastest / faster ; ora</p> <p>resolution on gel sufficient to register 1, nucleotide / base;</p> | 3 max | <p>ACCEPT positive, end /terminal</p> <p>IGNORE ref to distance</p> <p>ACCEPT lightest / shortest</p> <p>ACCEPT description ' machine detects fragments to one base in length'</p> <p>IGNORE pair</p> |
| 3 | (c) | (i) | <p><u>contraction</u> of smooth muscle ;</p> <p>circular (muscle) ;</p> <p>extra mucus production ;</p> <p>inflammation ;</p> | 2 max | <p>ACCEPT involuntary muscle / non-striated muscle</p> <p>ACCEPT blocked by mucus / build-up of mucus</p> <p>ACCEPT swelling / oedema</p> <p>IGNORE scarring</p> |

| Question | | | Answer | Marks | Guidance |
|--------------|-----|-------|--|-----------|---|
| 3 | (c) | (ii) | (reduced diameter means) increased , resistance to air flow / friction ; <i>idea that</i> exhalation is passive / no (muscular) force behind exhalation / requires additional, force / pressure, to exhale; | 1 max | ACCEPT 'breathes harder' |
| 3 | (d) | | (mutation) change in (DNA) nucleotide/ base, sequence ; (mutation causes) change in, amino acid sequence / primary structure (of protein) ; change in , tertiary structure/ 3D shape / binding site , of <u>receptor</u> ; salmeterol unable to bind ; <i>idea that</i> no response triggered in cell / no second messenger system activated ; | 3 max | IGNORE triplet/codon/gene / frameshift DO NOT CREDIT active site ACCEPT salmeterol not complementary shape to <u>receptor</u> ACCEPT salmeterol cannot bind as easily e.g. adeny cyclase not activated IGNORE 'has no effect' |
| 3 | (e) | (i) | (mutation resulted in) <u>receptor</u> having complementary shape to montelukast ; montelukast able to bind ; (whereas) salmeterol cannot ; montelukast may have a different <u>receptor</u> ; | 2 max | DO NOT CREDIT active site IGNORE fit ACCEPT attach ACCEPT cannot bind as easily ACCEPT montelukast receptors not damaged |
| 3 | (e) | (ii) | not reliable because, sample size too small / only 62 children in study; or could be reliable because 31 is quite a large sample ; | 1 | Note <i>31 is a suitable number for a phase 1 trial</i> |
| 3 | (e) | (iii) | (epithelial) cells lining cheek ; | 1 | ACCEPT (named) white blood cells in saliva / salivary gland cells |
| Total | | | | 16 | |

| Question | | | Answer | Marks | Guidance |
|----------|-----|-------|---|-------|--|
| 4 | (a) | (i) | geographic(al) ; | 1 | <p>Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>ACCEPT ecological IGNORE physical / barrier</p> |
| 4 | (a) | (ii) | genetic drift ; | 1 | <p>Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> |
| 4 | (a) | (iii) | <p><i>C because</i></p> <p>has the greatest change in allele frequency / described;</p> <p>smaller population / fewer individuals ;</p> <p><i>idea that more , subject to founder effect / unrepresentative at start ;</i></p> <p><i>(more subject to genetic change because)</i> each random mating more significant or each individual forms a greater proportion of gene pool or each individual has greater effects on gene pool (than in large population) or easier to lose allele from gene pool;</p> | 2 max | <p>If C not identified then no marks awarded Look for comparative points with other populations</p> <p>ACCEPT p and q for allele eg 'frequency of allele in C changed by 0.20 whilst it changed by 0.02 in A and 0.14 in B' ACCEPT figs as %</p> <p>ACCEPT smallest /fewest</p> |

| Question | | | Answer | Marks | Guidance | | | | | | | | | | | | | | | | | | | | |
|-----------------------|-------|----------------------|--|-------|--|------------------|-------|----------------------|-----------------------|----------------------|-------|--------|------------------|-----------------------|-----|--------|------------------|---------------------|-----|--------|-----|----------------------|-------|--------|-----|
| 4 | (b) | (i) | 1401 ; ; ; | | <p>Correct answer = 3 marks</p> <p>Award 2 max if answer not given to the nearest whole number or is incorrect or missing, then</p> <p>CREDIT correct working in table columns as follows: both figures in one column correct = 1 mark. (N.B. Minus sign required for column 1)</p> <p>ALLOW ecf from any incorrect column to 2 max</p> <table border="1"> <thead> <tr> <th>Phenotype of fly</th> <th>O - E</th> <th>(O - E)²</th> <th>$\frac{(O - E)^2}{E}$</th> </tr> </thead> <tbody> <tr> <td>red eye, yellow body</td> <td>- 354</td> <td>125316</td> <td>348 (348.100)</td> </tr> <tr> <td>pink eye, yellow body</td> <td>341</td> <td>116281</td> <td>323 (323.003)</td> </tr> <tr> <td>red eye, ebony body</td> <td>369</td> <td>136161</td> <td>378</td> </tr> <tr> <td>pink eye, ebony body</td> <td>- 356</td> <td>126736</td> <td>352</td> </tr> </tbody> </table> | Phenotype of fly | O - E | (O - E) ² | $\frac{(O - E)^2}{E}$ | red eye, yellow body | - 354 | 125316 | 348 (348.100) | pink eye, yellow body | 341 | 116281 | 323 (323.003) | red eye, ebony body | 369 | 136161 | 378 | pink eye, ebony body | - 356 | 126736 | 352 |
| Phenotype of fly | O - E | (O - E) ² | $\frac{(O - E)^2}{E}$ | | | | | | | | | | | | | | | | | | | | | | |
| red eye, yellow body | - 354 | 125316 | 348 (348.100) | | | | | | | | | | | | | | | | | | | | | | |
| pink eye, yellow body | 341 | 116281 | 323 (323.003) | | | | | | | | | | | | | | | | | | | | | | |
| red eye, ebony body | 369 | 136161 | 378 | | | | | | | | | | | | | | | | | | | | | | |
| pink eye, ebony body | - 356 | 126736 | 352 | | | | | | | | | | | | | | | | | | | | | | |
| 4 | (b) | (ii) | <p><i>reject hypothesis because</i> calculated χ^2 value / 1401 , is (much) larger than , critical value / 11.35 ;</p> | 3 | <p>ALLOW ecf for a correct explanation that corresponds to the candidate's incorrect calculation for (b)(i)</p> <p>CREDIT <i>idea</i> that probability that these results are due to chance is (much) less than 1% / 0.01</p> | | | | | | | | | | | | | | | | | | | | |
| | | | | 1 | | | | | | | | | | | | | | | | | | | | | |

| Question | | | Answer | Marks | Guidance |
|----------|-----|-------|---|---------------------|---|
| 4 | (b) | (iii) | <p>(autosomal) <u>linkage</u> or genes / alleles, are <u>linked</u> ; on same chromosome ; linked <u>alleles</u> inherited together ; Ry and rY (on chromosomes in heterozygotes) ; crossing-over produced (rare) recombinants ; tight linkage / two genes close together ;</p> | <p>3 max</p> | <p>DO NOT CREDIT sex linkage IGNORE epistasis</p> <p>ACCEPT annotated drawing ACCEPT recombinant phenotypes described ACCEPT loci close together</p> <p>Note <i>'The alleles R & y and r & Y are inherited together'</i> = 2 marks (mps 3 & 4) <i>'The alleles for red eyes and ebony body, and pink eyes and a yellow body, are inherited together'</i> = 2 marks (mps 3 & 4)</p> |
| | | | Total | 11 | |

| Question | | Answer | Marks | Guidance |
|----------|-----|---|--------------|---|
| 5 | (a) | <p>1 $\frac{\text{herbivore / primary consumer,energy}}{\text{producer energy}} \times 100$;</p> <p>Plus any 3 of the following:</p> <p>2 (a sample of) producers collected ;</p> <p>3 (a sample of) herbivores /primary consumers collected;</p> <p>4 (collected from) the same area ;</p> <p>5 (measure) biomass / dry mass (of individual or population) ;</p> <p>6 energy content calculated of producer and herbivore ;</p> <p>7 use of calorimeter / described;</p> | <p>4 max</p> | <p>1 CREDIT $\frac{\text{trophic level 2 energy}}{\text{trophic level 1 energy}} \times 100$;</p> <p>CREDIT sample figures. e.g. if producer energy 20 000 kJ m⁻² and herbivore 2000 kJ m⁻² calculation is 2000 / 20000 x 100 = 10%</p> <p>CREDIT $\frac{\text{Energy available after transfer}}{\text{Energy available before transfer}} \times 100$</p> <p>IGNORE ref to productivity</p> <p>CREDIT named examples for 2 and 3</p> <p>ACCEPT 'organisms at each trophic level collected' for 1 mark</p> <p>5 ACCEPT wet / fresh, mass 5 IGNORE mass unqualified / pyramids of biomass</p> <p>6 ACCEPT expressed as J/KJ/MJ, per gram IGNORE calories per gram</p> <p>7 e.g. burn sample, in oxygen / in measure temperature increase ACCEPT use of published tables for energy values of, fresh /wet, mass</p> |

| Question | | Answer | Marks | Guidance | | | | | | | | | | | | | | |
|--|--------|--|-------|----------|--|---|---|---|--|-------|---|-------|--------------------------------------|---|--|---|---|---|
| 5 | (b) | <table border="1"> <thead> <tr> <th>Goal</th> <th>Letter</th> </tr> </thead> <tbody> <tr> <td>improving soil that is low in nutrients for the growing of wheat</td> <td>F</td> </tr> <tr> <td>preventing the spoilage of fruits after picking</td> <td>E</td> </tr> <tr> <td>reducing the impact of a fungal disease on yields from cucumber plants</td> <td>A / B</td> </tr> <tr> <td>producing strawberry plants that grow quicker and fruit earlier</td> <td>A / B</td> </tr> <tr> <td>making sugar syrup from waste starch</td> <td>D</td> </tr> <tr> <td>producing large amounts of a fungus for food</td> <td>C</td> </tr> </tbody> </table> | Goal | Letter | improving soil that is low in nutrients for the growing of wheat | F | preventing the spoilage of fruits after picking | E | reducing the impact of a fungal disease on yields from cucumber plants | A / B | producing strawberry plants that grow quicker and fruit earlier | A / B | making sugar syrup from waste starch | D | producing large amounts of a fungus for food | C | 6 | <p>Mark the first answer in each box. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>ACCEPT A / B</p> <p>ACCEPT C</p> |
| Goal | Letter | | | | | | | | | | | | | | | | | |
| improving soil that is low in nutrients for the growing of wheat | F | | | | | | | | | | | | | | | | | |
| preventing the spoilage of fruits after picking | E | | | | | | | | | | | | | | | | | |
| reducing the impact of a fungal disease on yields from cucumber plants | A / B | | | | | | | | | | | | | | | | | |
| producing strawberry plants that grow quicker and fruit earlier | A / B | | | | | | | | | | | | | | | | | |
| making sugar syrup from waste starch | D | | | | | | | | | | | | | | | | | |
| producing large amounts of a fungus for food | C | | | | | | | | | | | | | | | | | |

| Question | | Answer | | Marks | Guidance |
|--------------|-----|--|---|-----------------------|---|
| 5 | (c) | Description | Name | | <p>Mark the first answer in each box. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>IGNORE innate / instinctive / learnt (as stated in Q)</p> <p>DO NOT CREDIT negative chemotaxis ACCEPT taxes</p> <p>CREDIT insight (learning) / latent (learning)/ intelligent learning / <u>observational</u> learning</p> |
| | | Sparrows initially fly away from fruit bushes on which shiny CDs are hung, particularly when the CDs move in the wind. | escape reflex | ; | |
| | | After a few days the sparrows start visiting the fruit bushes again, and do not fly away even when the CDs move. | habituation | ; | |
| | | Carrot flies move towards chemicals released by carrot plants. | (positive chemo-) taxis | ; | |
| | | Raccoons learn to remove lids from containers of grain in a barn. | operant conditioning / trial and error (learning) | ; | |
| | | A line of young chicks follow their mother into a cornfield. | imprinting | ; | |
| Total | | | | 5 15 | |

| Question | | | Answer | Marks | Guidance |
|----------|-----|------|---|-------|---|
| 6 | (a) | (i) | <p>1 (hormone) binds to <u>receptor</u> ;</p> <p>2 causing , cascade of events / enzyme reactions ;</p> <p>3 may involve switching , on / off, genes ;</p> <p>4 only , present / needed , in small , concentrations / quantities (to have an effect) ;</p> <p>5 may have effect on more than one , location / target tissue ;</p> <p>6 <i>idea that</i> effect may involve interaction of more than one hormone ;</p> | 2 max | <p>IGNORE prompt lines and mark as prose</p> <p>1 ACCEPT (hormone) complementary shape to <u>receptor</u></p> <p>1 ACCEPT attach</p> <p>1 IGNORE fit</p> <p>3 CREDIT ref to changing gene expression</p> |
| 6 | (a) | (ii) | <p>1 (most) plant cells retain ability to differentiate / <u>totipotent</u> ;</p> <p>2 plants have , meristems / meristematic tissue ;</p> <p>3 <i>idea that</i> plant cells can de-differentiate and then differentiate into a different cell type;</p> <p>4 (most) animal cells are , differentiated / not totipotent / not pluripotent / only able to differentiate into the same type(s) of cell / are multipotent;</p> | 2 max | <p>2 ACCEPT named meristematic tissue e.g. shoot apex / root apex / cambium</p> <p>4 ACCEPT 'stem cells found in few (named) tissues' 'bone marrow cells only differentiate into blood cells'</p> |

| Question | | | Answer | Marks | Guidance |
|----------|-----|-------|---|-------|---|
| 6 | (a) | (iii) | <p>1 (inter-species / triploid) hybrids , are sterile / cannot reproduce sexually;</p> <p>2 polyploidy (in the hybrid) provides duplicate of each chromosome ;</p> <p>3 (polyploidy) allows the hybrid to , carry out meiosis / form gametes or (polyploidy) restores fertility / overcomes sterility ;</p> <p>4 (hybrids are) <u>reproductively isolated</u> (from other species);</p> <p>5 increased, cell size / grain size, increases yield;</p> <p>6 sterile hybrids expensive for farming (especially in developing countries);</p> <p>7 (plants) stronger/more vigorous/ healthier;</p> | 2 max | <p>1 CREDIT hybrid from named examples e.g. einkorn (wheat) x , wild / goat , grass emmer (wheat) x wild grass</p> <p>2 IGNORE ref to 'more than two sets of chromosomes' as this is given in Q</p> <p>3 ACCEPT 'chromosome number doubling restores fertility'</p> <p>3 ACCEPT can reproduce sexually</p> <p>4 ACCEPT gametes incompatible with other species</p> <p>5 ACCEPT seed size</p> <p>7 must be a comparative statement 7 ACCEPT less prone to disease / greater hybrid vigour 7 IGNORE pest resistance</p> |

| Question | | Answer | Marks | Guidance |
|--------------|-----|---|---|----------|
| 6 | (b) | <p><i>cress seedlings</i></p> <p>C1 apical cells / apex/ tip(of shoot), produce , auxin / IAA ;</p> <p>C2 diffusion / active transport (down shoot / through parenchyma) ;</p> <p>C3 greater auxin (concentration) on shaded side of stem ;</p> <p>C4 auxin causes cell <u>wall</u> loosening ;</p> <p>C5 auxin causes cell , elongation / expansion ;</p> <p>C6 further detail of changes in cell wall ;</p> <p><i>Human</i></p> <p>H1 retina / rods / receptors, detect light / AW ;</p> <p>H2 action potentials/ depolarisation/nervous impulse, along sensory neurone (membrane) ;</p> <p>H3 intermediate neurone (in brain) / (somatic) motor neurone / neuromuscular junction ;</p> <p>H4 correct ref to detail of synaptic transmission;</p> <p>H5 depolarisation / contraction, of muscle fibre(s);</p> <p>H6 correct ref to detail of muscle contraction;</p> | <p>C1 ACCEPT secretes /releases</p> <p>C2 CREDIT PIN (polar auxin transport)</p> <p>C3 ACCEPT auxin, moves to / collects on, shaded side C3 IGNORE found on shaded side</p> <p>C4 ACCEPT cell <u>walls</u> become,stretchy / less rigid C4 IGNORE weakened cell <u>walls</u></p> <p>C6 e.g. H⁺ ions pumped into cell wall / low pH to allow enzymes to work / bonds broken within cellulose in wall</p> <p>H1 IGNORE ref to cones</p> <p>H2 / H3 DO NOT CREDIT signals / messages H2 IGNORE ref to optic nerve</p> <p>H3 CREDIT ref to relay neurone</p> <p>H5 ACCEPT muscle cell</p> <p>H6 e.g. actin and myosin slide over each other</p> | |
| | | | 7 max | |
| Total | | | 13 | |

| Question | | | Answer | Marks | Guidance |
|----------|-----|-------|---|-------|---|
| 7 | (a) | (i) | <p><i>increased blood pressure</i></p> <p>B1 (small) blood vessels / capillaries, burst / break ;</p> <p>B2 bleeding causes (localised) build up of pressure (leading to cell death) or blood / oxygen , supply , reduced / stopped ;</p> <p>B3 cells cannot <u>respire</u> (leading to cell death) ;</p> <p><i>thrombosis</i></p> <p>T1 thrombus / clot , interrupts / reduces, blood flow ;</p> <p>T2 (cells) deprived of , oxygen / glucose ;</p> <p>T3 cells cannot <u>respire</u> (leading to cell death) ;</p> | 4 max | <p>B1 CREDIT haemorrhage / aneurism / arterioles / arteries B1 IGNORE veins / venules B1 IGNORE destroys / damages blood vessels B2 e.g. bleeding leads to cell compression</p> <p>B2 ACCEPT brain deprived of , oxygen / glucose</p> <p>B3 DO NOT ACCEPT <u>respire</u> less</p> <p>'Clot results in less oxygenated blood to cells' = T1 and T 2</p> <p>T2 ACCEPT brain deprived of , oxygen / glucose T3 DO NOT ACCEPT <u>respire</u> less</p> |
| 7 | (a) | (ii) | <p><i>idea that</i> (if the stroke has been caused by a bleed) then the drug will, increase the bleeding / be ineffective as a treatment (to prevent bleeding) ;</p> | 1 | <p>e.g. 'the drug makes the problem worse'</p> <p>DO NOT CREDIT 'not effective in reduction of blood pressure'</p> |
| 7 | (a) | (iii) | <p><i>idea of</i> disruption of , oxygen / glucose , supply (to brain cells) for <u>aerobic respiration</u> ;</p> <p><i>lack of oxygen / glucose / blood / damage to</i></p> <p><u>cerebellum</u> resulting in problems with coordination / movement ;</p> <p><u>cerebrum</u> / <u>cerebral hemisphere(s)</u> / <u>cerebral cortex</u> , resulting in loss of , memory / speech ;</p> <p><u>medulla</u> (oblongata)/ <u>cerebrum</u> / <u>cerebellum</u>, resulting in paralysis (of body below the neck) ;</p> | 4 | <p>Can be awarded at any point in the answer.</p> <p>Effect must be correctly linked to the part of the brain responsible.</p> <p>ACCEPT Broca's / Wernicke's, area / hippocampus</p> <p>ACCEPT cerebral hemisphere(s) / cerebral cortex / corpus callosum</p> |

| Question | | | Answer | Marks | Guidance |
|----------|-----|-----|--|-------|---|
| 7 | (b) | | <p><i>producing nicotine is (selectively) advantageous as</i></p> <p>A1 stops , plant being eaten / loss of leaf area ;</p> <p>A2 so plant , survives / does breed / (still) produces seeds;</p> <p>A3 <i>idea that</i> gene must be advantageous to be selected for</p> <p>or gene is linked to another gene that is selected for ;</p> <p><i>producing nicotine is (selectively) disadvantageous</i></p> <p>D1 decreases , reproductive success / number of seeds ;</p> <p>D2 metabolic resources diverted to nicotine production;</p> | 3 max | <p>mp must be in correct context (ie advantage/ disadvantage) to be awarded</p> <p>A1 ACCEPT deters / kills, grazers / insects</p> |
| 7 | (c) | (i) | postsynaptic membrane(s) (in , neurone / neuromuscular junction) ; | 1 | <p>ACCEPT sarcolemma</p> <p>DO NOT CREDIT postsynaptic knob</p> |

| Question | | | Answer | Marks | Guidance |
|----------|-----|------|--|-------|--|
| 7 | (c) | (ii) | <p><i>Effect</i></p> <p>Nicotine slows down rate of / stops, transmission of, action potentials / nervous impulses;</p> <p>Plus any 2 of the following:</p> <p><i>Explain</i></p> <p>binds to <u>receptor</u>;</p> <p>(nicotine) has the same response / opens Na⁺ channels / causes depolarisation ;</p> <p>nicotine remains in receptor for longer ;</p> <p><i>idea that <u>receptor</u>,</i> remains in refractory stage for longer / unable to return to standby condition / cannot be reactivated ;</p> | 3 max | <p>IGNORE 'nervous system slows down' / 'acts as a depressant'</p> <p>ACCEPT competes with acetylcholine for the <u>receptor</u> DO NOT CREDIT active site DO NOT CREDIT 'acts as competitive inhibitor' DO NOT CREDIT binds to receptor permanently</p> <p>ACCEPT causes action potential in next neurone / mimics, action / effects, of acetylcholine IGNORE 'mimics acetyl choline' alone</p> <p>IGNORE delays refractory stage ACCEPT permanently in refractory stage</p> |

| Question | | | Answer | Marks | Guidance |
|--------------|-----|------|--|-----------|---|
| 7 | (d) | (i) | in xylem (by), cohesion-tension / transpiration (stream); in phloem (by), translocation / mass flow ; | 2 | ALLOW transport in phloem from roots only if clearly in the context of being associated with transport of (stored) assimilates from roots |
| 7 | (d) | (ii) | <i>idea that</i> neonicotinoids have , little / no , effect (on humans) ; | 1 | e.g. they don't harm humans neonicotinoids, do not bind/ not complementary, to receptors neonicotinoids broken down in digestion concentrations used in insecticides , very low / not high enough, to affect humans neonicotinoids not present in part of plant consumed by humans neonicotinoids break down before plant consumed |
| Total | | | | 19 | |

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