

Topic 5 Biology

Booklet 4 of 4

Revision Questions

**Evolution, Speciation &
Determining the Time of
Death**

MARK SCHEME

Question Number	Answer	Mark
6(a)	<ol style="list-style-type: none"> 1. idea that individuals of a species can {interbreed / eq} ; 2. to produce fertile {offspring / eq} ; 3. the {hybrids / offspring} can flower and produce viable seeds / eq ; 	max (3)

Question Number	Answer	Mark
6(b)(i)	<ol style="list-style-type: none"> 1. {variety / eq} of alleles ; 2. in a gene pool / eq ; 	(2)

Question Number	Answer	Mark
6(b)(ii)	<ol style="list-style-type: none"> 1. different alleles in each of the two {populations / eq} ; 2. each {population / species} is adapted to live {in different environmental conditions / at different altitudes / eq} ; 3. there will have been different mutations in each population ; 4. reference to alleles from different {species / eq} will mix / hybrids receive alleles from both { species / eq} ; 	max (2)

June 2010

Question Number	Answer	Mark
*6(c) QWC	<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"> 1. reference to original population increasing in size and spreading into a wider diversity of {habitats / eq} ; 2. reference to mutations ; 3. leading to diversity in flowering times / eq ; 4. (and) other plant features / eq ; 5. reference to reproductive isolation ; 6. restriction in gene flow / eq ; 7. between extremes of population / eq ; 8. reference to different environmental factors in each region ; 9. each region has different selection pressures / eq ; 10. idea of plants adapted to a region ; 11. reference to survival and breeding ; 12. reference to change in allele frequencies (over time) ; 13. (leads to) differences between gene pools / eq ; 	<p>max (6)</p>

June 2010

Question Number	Answer	Mark
7(a)(i)	(the total of) all the alleles in a {population / eq} ;	(1)

Question Number	Answer	Mark
7(a)(ii)	the {proportion of / number of times occurring / eq} for one allele within a {gene pool / population / eq} ;	(1)

Question Number	Answer	Mark
7(b)(i)	<ol style="list-style-type: none"> 1. if allowed to interbreed / eq ; 2. sub-species could (probably) produce fertile offspring / eq ; 	(2)

Jan 2011

Question Number	Answer	Mark
7(b)(ii)	<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"> 1. reference to a few (<i>ancestral</i>) boar reaching the island ; 2. reference to (two populations) {<i>geographical</i> separation / separated by the sea / volcanic eruptions / eq} ; 3. populations {cannot <i>interbreed</i> / eq} ; 4. idea of gene flow between populations {prevented / restricted} ; 5. only a small number (on island) of other boar for breeding / reference to <i>founder</i> effect / eq ; 6. reference to {restricted / limited / eq} variety of <i>alleles</i> / eq ; 7. reference to <i>mutations</i> ; 8. different {<i>environmental</i> conditions / <i>selection pressures</i> / eq} on island different from mainland ; 9. reference to changes in <i>allele frequencies</i> ; 10. (leads to) {<i>phenotypic</i> / <i>physiological</i> / <i>physical</i> / <i>behavioural</i>} changes ; 11. reference to possibility of (<i>allopatric</i>) <i>speciation</i> ; 	<p>max (5)</p>

Jan 2011

Question Number	Answer	Mark
7(b)(iii)	<ol style="list-style-type: none"> 1. reference to {bands / eq} produced ; 2. reference to {bands / eq} at certain {positions / eq} ; 3. common {bands / eq} contain similar {DNA fragments / eq} ; 4. idea that the more similar the patterns the {closer the relationship / more likely to have {recent / eq} common ancestor} ; 5. idea that very few differences if still a sub-species ; 	max (3)

Jan 2011

Question Number	Answer	Mark
1(a)(i)	C ;	(1)

Question Number	Answer	Mark
1(a)(ii)	A ;	(1)

Question Number	Answer	Mark
1(a)(iii)	D ;	(1)

Question Number	Answer	Mark
1(b)(i)	<ol style="list-style-type: none"> 1. reference to graph ; 2. line (graph) / eq ; 3. {Y / vertical} and {X / horizontal} axes correctly described. e.g. mass versus time / rate versus temperature ; 4. idea of using same scale for axes (for both plants) ; 5. idea of plotting each {temperature / species (plant)} separately ; 	(3)

Question Number	Answer	Mark
1(b)(ii)	<ol style="list-style-type: none"> 1. idea of controlling a variable ; 2. reference to {optimum / suitable / eq} temperature (for germination) ; 3. idea of using {viable / live / eq} seedlings OR making sure that seeds {germinate / eq} ; 4. reference to validity of the investigation ; 	(2)

Question Number	Answer	Mark
1(b)(iii)	<ol style="list-style-type: none"> 1. sea plantain / <i>Plantago maritima</i> / <i>Plantago</i> ; <p>Any three from:</p> <ol style="list-style-type: none"> 2. idea of different latitudes have different (mean) temperatures ; 3. {sea plantain / <i>Plantago maritima</i> / <i>Plantago</i>} grows {better / eq} at all (three) temperatures / eq ; 4. {bog sedge / <i>Kobresia simpliciuscula</i> / <i>Kobresia</i>} does not grow very well at {lower temperatures / 10°C and 14°C} / eq ; 5. credit appropriate comparative manipulated figures ; 	(4)

Question Number	Answer	Mark
4(a)	A ;	(1)

Question Number	Answer	Mark
*4(b) QWC	<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"> 1. idea of <i>geographical isolation</i> e.g. <i>physical barrier</i> between Corsican and mainland birds / <i>allopatric speciation</i> ; 2. idea that there are different <i>selection pressures</i> (between Corsica and the mainland) ; 3. an example of selection pressure e.g. food source, different habitats ; 4. idea that <i>mutations</i> occurred ; 5. Idea that this results in <i>adaptation</i> to the conditions ; 6. these {<i>alleles</i> / <i>genes</i>} passed on (to <i>offspring</i>); 7. idea of change in <i>gene pool</i> e.g. increasing <i>frequency</i> of (these) <i>alleles</i>, changes in <i>gene pool</i> ; 8. reference to <i>reproductive isolation</i> (of Corsican nuthatches from mainland nuthatches) ; 9. idea that birds on mainland could live in all regions as there is no restriction on <i>gene flow</i> ; 	(5)

Jan 2012

Question Number	Answer	Mark
4(c)(i)	<p>ACCEPT the converse in the context of <i>S. europaea</i>, if clearly expressed</p> <ol style="list-style-type: none"> reference to <i>S. whiteheadi</i> adapted to {colder / mountainous} regions ; (if climate warms) {food supply / pine seeds / invertebrates} less available ; idea of {small population / only 2500 pairs} (of <i>S. whiteheadi</i>) ; idea of limited {gene pool / genetic diversity / variety of alleles} ; idea that all the <i>S. whiteheadi</i> will be adversely affected ; idea that the <i>S. whiteheadi</i> cannot fly to other regions ; 	(3)

Question Number	Answer	Mark
4(c)(ii)	<ol style="list-style-type: none"> idea that <i>S. whiteheadi</i> have a variety of food sources e.g. can change their feeding habits, eat seeds and invertebrates} ; idea that {more / different} {invertebrates / seeds / food / eq} might become available ; idea that they have another allele that gives a survival advantage ; idea that they could migrate (NOT south, somewhere warmer) ; 	(2)

Question Number	Answer	Mark
4(d)	<ol style="list-style-type: none"> idea of captive-breeding programmes ; reference to {conserve / preserve / eq} {alleles / genes / gene pools} ; reference to {re-introduction / releasing of <i>S. whiteheadi</i> into suitable habitats} ; 	(2)

Jan 2012

Question Number	Answer	Additional guidance	Mark
7(a)	<ol style="list-style-type: none"> idea of less {stress / trauma / discomfort / depressed / eq} (for the animals) ; idea that animals are more likely to breed in natural environment ; idea that animals may require large areas ; idea that problems of releasing animals back into the wild is avoided eg habituation ; idea that {disease is less likely / disease will not wipe out population} ; idea of allowing (natural) {interspecific relationships / communities} to exist ; idea of allowing (natural) {intraspecific relationships / family / social / eq} {structure/ behaviour} ; (because) large numbers of animals needed / wider gene pool / eq ; idea that (natural) {diet / food / eq} available ; 	<p>Accept converse argument throughout</p> <p>6. Accept reference to maintaining their niche</p>	(3)

Question Number	Answer	Additional guidance	Mark
7*(b)	<p>(QWC– Spelling of technical terms (<i>in italics</i>) must be correct)</p> <ol style="list-style-type: none"> 1. reference to <i>succession</i> ; 2. reference to (<i>forensic</i>) <i>entomology</i> ; 3. example of {insect / eq} e.g. <i>fly</i>, <i>beetle</i>, <i>wasp</i> ; 4. idea that the {types / <i>species</i> / life cycle stages} (of insects) are used ; 5. reference to {<i>decomposition</i> / <i>decay</i> / eq} ; 6. idea that there are different stages of {<i>decomposition</i> / <i>decay</i> / eq} ; 7. detail of {<i>decomposition</i> / <i>decay</i> / eq} e.g. production of <i>gases</i>, <i>liquefaction</i> of <i>tissue</i>, <i>bloating</i>, <i>discolouration</i> ; 8. reference to rate of {<i>succession</i> / <i>insect development</i> / <i>decomposition</i>} influenced by {external factor / appropriate named factor} ; 9. idea that insect and decomposition information is used to determine time of death ; 	<p>Penalise spelling once</p> <p>1. Accept in context of either insects or decomposition</p> <p>3. Named insect must be spelt correctly</p> <p>6. Accept if 2 or more stages listed</p> <p>8. Named <i>factor</i> must be spelt correctly</p>	(5)

Question Number	Answer	Additional Guidance	Mark
8(a)(i)	<ol style="list-style-type: none"> 1. (successful interbreeding) produces offspring; 2. (same species produce) fertile (offspring); 3. credit reason why offspring of different species might be infertile ; 	<p>Accept converse throughout</p> <p>Ignore viable</p> <p>eg genetic incompatibility, different number of chromosomes, poor quality gametes , low number of gametes</p>	(3)

Question Number	Answer	Additional Guidance	Mark
8(a)(ii)	<ol style="list-style-type: none"> 1. reference to reproductive isolation ; 2. different breeding times; 3. do not recognise {courtship displays / songs / eq} ; 4. physically incompatible eg genitalia ; 		(3)

Question Number	Answer	Additional Guidance	Mark
8(b)	<ol style="list-style-type: none"> 1. idea that the two species share the same habitat ; 2. idea that the two species experience the same environmental conditions ; 3. (therefore) the same selection pressures ; 4. idea that they are both well-adapted (to their environment) ; 5. idea that no mutations have happened that {improve / change} their {phenotypes / survival}; 6. {no / few} changes in allele frequency / gene pool is stable ; 7. idea that there has been very little change in environment (over the years) ; 	<p>Accept similar</p> <p>NB this needs to be in the context of both species being subjected to the same selection pressures</p> <p>Accept similar</p>	(3)

Question Number	Answer	Additional guidance	Mark
4(a)(i)	1. (75% of 6100 =) 4575 (squirrels) ;		(1)

Question Number	Answer	Additional guidance	Mark
4(a)(ii)	1. (Total number of alleles in black squirrels = $6100 \times 2 =$ 12200 ; 2. ($4575 \div 12200 =$) 0.375 / 0.38 / 0.4;	Correct answer only gains full marks CE to be applied from 4(a)(i) CE from mp 1 e.g. $4575 \div 6100 = 0.75$ Accept 37.5 %	(2)

Question Number	Answer	Additional guidance	Mark
4(b)	<ol style="list-style-type: none"> idea that the allele for {black fur could increase / grey fur could decrease} if there was a disease ; because the disease would act as a selection pressure ; idea that the black squirrels would survive and pass the black fur alleles onto their offspring ; idea that black squirrels will out-compete the grey ones as they are more resistant to disease ; idea that if the grey squirrels are wiped out the frequency of b will {decrease in the total population / stay the same in the black population} ; idea that it will not change at all if there is no disease ; idea that it will not change if the black squirrel is not immune to a particular disease that occurs ; idea that it will not change if the scientists were wrong ; 	<p>Accept B will increase / b will decrease</p> <p>Accept B will be passed on . . . converse</p>	(4)

Question Number	Answer	Mark
1(a)	cross next to degree of muscle concentration ; cross next to signs of decomposition ;	(2)

Question Number	Answer	Mark
1(b)	<ol style="list-style-type: none"> idea of SD {measures / shows} {spread / range / eq} of data ; Idea of most readings are within $\{\pm 1 \times \text{SD} / \pm 2 \times \text{SD}\}$ e.g. approx 60% readings within $(+/-) 1 \times \text{SD}$ / approx 90% readings within $(+/-) 2 \times \text{SD}$; idea that as length of time increases, SD increase / eq ; idea of more variability (in temperature) as time increases / eq ; comment on change in reliability of time of death with time / eq ; estimate (of time of death) can only be within a {4 / 5 / 6 / 7} hour period ; use of manipulated data ; 	max (4)

Question Number	Answer	Mark
1(c)	<p>three from the following:</p> <p>{(body) mass/ BMI / weight / eq} {(subcutaneous) fat /eq} surface area, {ambient / eq } temperature immersion in water age (of person at death) skin colour thickness of hair gender clothing blood loss humidity air movement {core / body} temperature at time of death ;;;</p>	(3)

June 2010

Question Number	Answer	Mark
4(a)	<ol style="list-style-type: none"> 1. fibrous - long / linear / straight (chains), globular - compact / spherical / eq ; 2. globular are folded and fibrous are not / eq ; 3. globular are soluble and fibrous are not / eq ; 4. fibrous -involved in {structural / eq} and globular are not ; 5. globular - involved in {catalysis / metabolism / eq} and fibrous are not ; 	(2)

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

Question Number	Answer	Mark
4(b)(ii)	<p>Any two from:</p> <ol style="list-style-type: none"> 1. physical damage / eq ; 2. immersion in water / eq ; 3. (external) temperature / eq ; 4. burning / eq ; 5. electrocution / eq ; 6. reference to {clothing / eq} ; 7. wind / air movements / eq ; 	(2)

Question Number	Answer	Mark
4(c)	<ol style="list-style-type: none"> 1. reference to not {all / both / eq} muscles {contract / relax / reach (full) rigor / eq} at same {time / rate / eq} ; 2. idea of jaw muscle contracting before leg muscle / eq ; 3. idea of jaw muscle reaches {full contraction / rigor} before leg muscle / eq ; 4. jaw starts contraction {0.5 / 0.8 / 0.9} hours before leg OR jaw reaches (full) rigor 2.5 hours before leg ; 5. reference to {full contraction / rigor} in muscle does not last very long ; 6. idea of leg is still contracting while jaw is relaxing / eq ; 	(4)

Question Number	Answer	Mark
5(a)	B – forensic entomology ;	(1)

Question Number	Answer	Mark
5(b)(i)	D – temperature ;	(1)

Question Number	Answer	Mark
5(b)(ii)	<ol style="list-style-type: none"> 1. idea that the body has been dead for a while ; 2. (because) more than one species of insect present / eq ; 3. reference to succession (of insect species) ; 4. idea that life cycle {times / stages} of the insects are {known / used / eq} ; 5. idea that life cycle times depend on (environmental) temperature ; 6. credit specific ref to information in table e.g. blowfly cycle complete ; 	(3)

Question Number	Answer	Mark
5(c)(i)	<ol style="list-style-type: none"> 1. idea that a drop in body temperature is linked to time after death e.g. algor mortis ; 2. idea that factors affect temperature drop e.g. environmental temperature, body size, clothing ; 3. (useful because) time of death can be calculated if (ambient) temperature known / eq ; 4. only useful for short period of time following death e.g. 24 hours, a day ; 	(2)

Question Number	Answer	Mark
5(c)(ii)	<ol style="list-style-type: none">1. idea that body decomposes in a specific sequence (with time) ;2. idea that factors affect decomposition e.g. environmental temperature, wounds ;3. (not useful) if all the body has decomposed / eq ;	(2)

Question Number	Answer	Additional Guidance	Mark
6(a)	1. idea that the temperature of the {body / core} changes (with time after death) ; 2. idea that {core} temperature depends upon the {ambient / eq} temperature ; 3. idea that {other post-death changes / muscle contraction / insect life cycles / decomposition / eq} depend on (ambient / body) temperature ;	1 ACCEPT cooling	(3)

Question Number	Answer	Additional Guidance	Mark
6(b)(i)	Correct answer gains all 3 marks 1. line drawn between 25°C (core) and 15°C (ambient) ; 2. line drawn from centre of circle through the intersect of line 1 with diagonal ; 3. time of death = {23 - 24} ;	1 ACCEPT within the next scale line 2 CE applies 3 CE applies	(3)

Question Number	Answer	Additional Guidance	Mark
*6(b)(ii)	<p>(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)</p> <p>Clothing</p> <p>1. for the clothed body the {estimate was too short / eq } ;</p> <p>2. because the clothing would {reduce heat loss / body would cool more slowly / temperature would drop slower / eq} ;</p> <p>3. idea that clothing would {insulate / trap the heat / eq} ;</p> <p>Position</p> <p>4. for the body curled up the {estimate was too short / eq } ;</p> <p>5. because {heat loss is reduced / body would cool more slowly / temperature would drop slower / eq} ;</p> <p>6. as the (exposed) surface area was smaller/ eq ;</p> <p>Air movement</p> <p>7. for the moving air {the estimate was too long / eq } ;</p> <p>8. as moving air {speeds up heat loss / body would cool faster / temperature would drop faster / eq } ;</p>	<p>QWC emphasis is clarity of expression</p> <p>ACCEPT converse arguments for Mps other than 1, 4 and 7</p> <p>1 ACCEPT time of death was earlier / died longer ago</p> <p>4 ACCEPT time of death was earlier / died longer ago</p> <p>7 ACCEPT time of death was more recent / died later</p> <p>IGNORE submersion in water</p>	(6)

Question Number	Answer	Additional Guidance	Mark
7(a)	<ol style="list-style-type: none"> 1. Idea that {body / core / eq} temperature drops after death ; 2. (rate / extent) of temperature drop depends on {ambient / eq} temperature ; 3. Idea that ambient temperature {fluctuates (over time) / does not stay constant} ; 4. Idea that the sooner after death the more accurate the (estimate of) time of death ; 	<p>2 IGNORE body temperature drops to ambient temperature ACCEPT idea that if body temperature has already reached ambient temperature there will be no further fall</p>	(3)

Question Number	Answer	Additional Guidance	Mark
7(b)(i)	<ol style="list-style-type: none"> 1. correct values read from graph (37.5 & 36.27) ; 2. (correct subtraction) = 1.23(°C) ; 	<p>Correct answer only scores 2 marks</p> <p>2 IGNORE + or - signs ACCEPT ECF for 36.26 to 36.28 e.g. 36.28 = 1.22(°C)</p>	(2)

Question Number	Answer	Additional Guidance	Mark
7(b)(ii)	1. idea that calculations of time of death are based on {average body temperature / 37°C } ; 2. body temperature at time of death will depend on time of day / eq ; 3. idea that therefore the calculated value for time of death may not be accurate ;	3 ACCEPT therefore the estimate will have to be a range of times ACCEPT take into account 1.23°C range	(2)

Question Number	Answer	Additional Guidance	Mark
*7(c)	<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"> 1. idea of using {a range / at least five} temperatures ; 2. description of temperature control e.g. water bath, incubator ; 3. idea that timing starts when eggs hatch into first instar maggots ; 4. and ends when the (third instar) maggots begin to pupate / eq ; 5. idea that several {eggs / maggots} should be used at each temperature ; 6. idea of providing food for maggots ; 7. reference to appropriate controlled variable e.g. humidity, mass of food, species ; 8. reference to plotting data on a graph of temp against time (for first instar to become a pupa); 	<p>Emphasis is on clarity of expression</p> <p>1 ACCEPT a min of -10°C and a max of 50°C</p> <p>5 ACCEPT minimum of 3 eggs / maggots</p> <p>7 IGNORE light, pH, amount of food, oxygen</p>	(5)