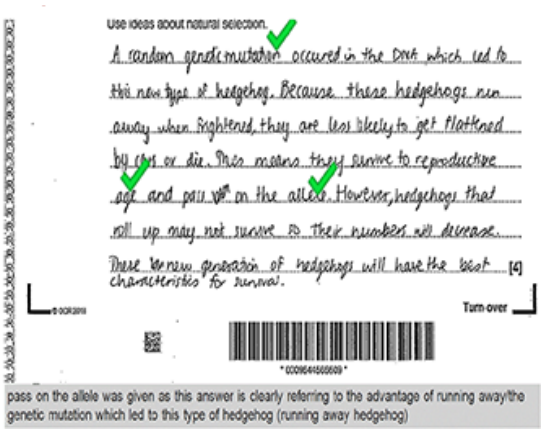
Mark scheme – Natural Selection and Evolution (H)

Question			Answer/Indicative content	Marks	Guidance
1			D	1 (AO 2.1)	**Examiner's Comments** Usually candidates scored on this AO2.1 question, choosing D. Candidates who had difficulty applying their understanding often chose B, incorrectly linking their knowledge of the use of DNA in classification.
			Total	**1**	
2			C	1 (AO 1.1)	
			Total	**1**	
3			C ✓	1 (AO1.1)	
			Total	**1**	
4			B ✓	1 (AO1.1)	
			Total	**1**	
5			C ✓	1 (AO2.1)	
			Total	**1**	
6			C ✓	1 (AO1.1)	
			Total	**1**	
7			B ✓	**1 (AO1.1)**	**Examiner's Comments** This question tested recall of knowledge AO1.1. Many candidates incorrectly chose C. This was a very common response indicating that candidates knew the names of the scientists involved but thought that Darwin and Wallace worked together on the theory of evolution by natural selection. It is important for candidates to realise that theories can develop with research from scientists who are conducting this work independently.
			Total	**1**	
8			B ✓	**1 (AO1.2)**	
			Total	**1**	

9	a	i	Yes (no marks) cooler than black/grey skin **OR** Yes (no marks) lighter skin is cooler **OR**	1 (AO3.2a)	argument must support decision

			No (no marks) zebra skin was similar temperature to the other barrels **OR** No (no marks) idea it is warmer than the barrel covered by the white skin / ORA ✓		
		ii	paint the barrels different colours rather than using the skins / use the same type of skin painted different colours **OR** idea to make sure that thicknesses/SA/V /volume/temperature of water in barrel need to be controlled ✓	1 (AO3.3a)	**ALLOW** use painted towels to cover barrels **ALLOW** for same type of skin e.g. hair-free skin
	b	i	**Any two from:** zebras with stripes attracts less/fewer insects / ORA✓ narrower stripes attract less insects / ORA ✓ stripe width for least number of insects/optimum protection is about 8cm / stripe width for most number of insects is about 25cm ✓	2 (AO2x3.1a)	**ALLOW** insect bites for insects **IGNORE** length of stripe **ALLOW** width range between 5-10cm for least number of insects / most number of insects is 22-27cm
		ii	stripe width of 8cm because it is the lowest point on the graph/fewest number of insects ✓	1 (AO3.2a)	**ALLOW** width tolerance between 7-9cm and least number of insects (on tape)
		iii	**Any three from:** stripes developed as a mutation / variation for skin stripes ✓ (animals with stripes) less likely to be bitten by insects / more healthy / spread less pathogens / ORA ✓ (striped animals) more likely to survive ✓ (striped animals) more likely to reproduce ✓ pass on allele/gene for stripes / ORA ✓ process occurs over many generations ✓	3 (AO3 x 2.1)	**ALLOW** some more striped than others **ALLOW** offspring produced / breed together **IGNORE** selective breeding **ALLOW** pass on advantageous gene **IGNORE** trait is passed on / genes are passed on **IGNORE** over time
			Total	**8**	

10			all organisms show variation / mutation causes variation ✓ **Any three from:** the blue tits with the longer beaks get more food / ORA ✓ they are more likely to survive / ORA ✓ they reproduce and pass on the alleles for longer beaks / ORA ✓ over many generations beak length increases in the blue tit population / ORA ✓	4 (AO 1.1) (AO 2.1 x3)	**ALLOW** description of variation in beak length in the original population **ALLOW** the blue tits with the longer beaks get access bird feeders **IGNORE** pass on genes **ALLOW** idea of many repeats of cycle **Examiner's Comments** The AO2.1 aspect to this question was well answered by many candidates. Lower ability candidates wrote a generic description of natural selection, not appreciating they needed to link their answers to blue tits. The first AO1.1 marking point was often missed, with most candidates limiting their marks by not mentioning mutation or variation. Most candidates were able to say that the longer beaks could better access food, leading to better chance of survival. Even the higher ability candidates were not able to distinguish between gene and allele and many referred also to the passing on of characteristics, phenotypes or traits instead of the allele. It is important that candidates demonstrate an understanding that the specific allele is passed on during reproduction, rather than just referencing the gene. Very few candidates explained the change in the allele frequency over many generations, and loose descriptions such as eventually, overtime or a few generations did not score.
			Total	**4**	
11		i	in country/advantage/where badgers live, if it rolls up in a ball then will provide more protection / less attacks from badgers/predators ✓ in cities/disadvantage/many roads, it will be run over by cars ✓	**2 (AO 2 × 2.1)**	**ALLOW** in country/advantage/where badgers live hedgehogs have defence against predators/badgers **ALLOW** hedgehogs have a reduced risk of being eaten **Examiner's Comments** This AO2.1 question was answered well overall. Candidates did not gain marks if they didn't correctly link their responses specifically to country or city areas. Just referring to roads was insufficient, however, candidates referring to many roads gained a mark as this distinguished the difference between city and country areas. The terms rural and urban were acceptable alternatives to country and city, in candidates' explanations. A

					common error was to say the rolling up was camouflage without explaining the answer.
		ii	hedgehogs that run away are more likely to survive / less likely to get run over ✓ to they will reproduce ✓ pass on the allele/gene for running away ✓ over time/many generations (running away will become more common) ✓	**4 (AO 4 ×2.1)**	**ALLOW** ORA for each marking point **ALLOW** reference to how change occurred e.g. mutation for running away **ALLOW** offspring produced / breed together **ALLOW** pass on advantageous gene **IGNORE** trait is pass on / genes are passed on **Examiner's Comments** This application of knowledge of natural selection question usually resulted in candidates gaining at least two marks. This was usually for identifying that the hedgehogs that could run away had a higher survival rate and could go on to breed. Higher ability candidates were able to link this to the advantageous gene and some could refer to the process occurring over time. Fewer candidates scored the last two marking points because they referred not to the advantageous gene, but in general to genes, mutation (not mutated gene) or to the trait or characteristic or behaviour of running away, and, for the last point, stating that because run away hedgehogs survived to breed, their numbers exceeded the numbers of roll up ones, simply because the roll up ones died. Examination technique needs candidates to focus on applying their knowledge to a new scenario, and to answer the question asked, not to talk in generic terms. **Exemplar 1**  Use ideas about natural selection A random genetic mutation occured in the DNA which led to this new type of hedgehog. Because these hedgehogs run away when frightened, they are less likely to get flattened by cars or die. This means they survive to reproductive age and pass on the allele. However, hedgehogs that roll up may not survive so their numbers will decrease. Those new generation of hedgehogs will have the best characteristics for survival. [4] Turn over pass on the allele was given as this answer is clearly referring to the advantage of running away/the genetic mutation which led to this type of hedgehog (running away hedgehog) This candidate has been credited 3 marks. A mark is gained for identifying that a mutation has occurred to produce the running away hedgehog. They have gained a second mark for recognising

					they survive to reproductive age. Many candidates just referred to breeding or producing offspring which were deemed acceptable responses for that particular marking point. Also a third mark was gained for 'pass on the allele' has been given as they clearly understand that it is referring to the advantage of running away/genetic mutation for the advantageous gene. The candidate has not gained a mark for the new generation of hedgehogs as this does not reference the idea of the process repeating over several generations/overtime.
			Total	**6**	