Mark Scheme - Classification and Evolution

20			*Fertility* breed GM stock with non-modified stock (1) see if offspring fertile (1) if so they should be classed as the same species (1) **ora** *Morphology* Compare several individuals from GM and non-GM groups (1)	3	Marks awarded should be from **one** outlined investigation **and** the conclusion from its results. If more than one investigation suggested, mark the first investigation and **IGNORE** the others.

			in respect of several physical structures (1) if similar they should be classed as one species (1) **ora** *Ecology* observe how both function in the wild (1) occupy the same or different niche(s) (1) if same niche they should be classed as one species (1) **ora** *Genetics* compare DNA (1) by electrophoresis (1) same pattern should be classed as one species (1) **ora**		
			Total	**3**	
21			*chimpanzee has (relatively)* smaller / shorter / thinner, thumb ⟩ longer / narrower, palm ⟩ thicker fingers ⟩ wider wrists ⟩	**2 max**	**ACCEPT** ora for human **IGNORE** size **IGNORE** creases **IGNORE** longer fingers **IGNORE** less space between fingers **Examiner's Comments** Most candidates were able to gain one mark. No scale was given on the figure so general references to size did not gain credit. Most correct responses referred to thumb length or palm length. Answers that discussed the pattern of lines on the palm were not credited. Responses needed to refer to either the chimpanzee or the human to avoid ambiguity, for example, 'the length of the thumb' on its own, gained no credit.
			Total	**2**	
22		i	*Felis* ✓	1(AO2.1)	**Mark the first answer.** If any additional answer is given then = 0 marks Need first letter upper case, rest lower case. **Examiner's Comments**

					This was well-answered with most candidates writing '*Felis*' with a capital '*F*' for the genus name.
		ii	intraspecific ✓ variation ✓	2(AO2.1 x2)	If additional terms are given then = max 1 for complete correct answer. **ALLOW** intra-species **IGNORE** phenotypic / genetic / species **DO NOT ALLOW** variance / variety **Examiner's Comments** The correct answer of 'intraspecific variation' gained 2 marks. Many candidates scored one for writing 'genetic variation'. **Misconception** Wrong answers included evolution and natural selection. Candidates may have missed the command word '*describe*' and thought they needed to *explain* the cause of the differences instead. **OCR support** An exhaustive list of command words used in Cambridge Technicals is provided in this resource. It illustrates the use of many of the command words by applying them to an everyday object, a chair. https:/www.ocr.org.uk/Images/273311-command-verbs-definitions.pdf **AfL** Students could be shown the command words resource and be asked to make their own Biology version, by • listing all the command words used on this examination paper

					• using each command verb to write about a cell rather than a chair.
		iii	**1** can produce fertile offspring ✓ **2** (still) similar in appearance / not enough phenotypic difference(s) ✓ **3** have only been, separated / isolated, for a short time ✓ **4** genetically similar ✓	max 2(AO2.5 x4)	**2 ALLOW** physically alike / similar characteristics **2 ALLOW** similar cytochrome c (protein) sequence **3 ALLOW ora** would need to be, separated / isolated, for a long(er) time **4 ALLOW** genotypically similar **Examiner's Comments** Candidates successfully applied their knowledge of the biological species concept to the novel context, suggesting that the Scottish and European wildcats could still interbreed to produce fertile offspring and shared many phenotypic and genetic similarities.
			Total	**5**	
23			synthetic ✓ *Escherichia* ✓ phylogeny / phylogenetics ✓	3(AO 1.1, 2.1)	**Examiner's Comments** Most candidates gained 1 mark for *Escherichia.* Fewer than a fifth were familiar with synthetic biology and less than 10% wrote 'phylogeny' in the final space – many candidates left it blank.
			Total	**3**	
24			Telmatobius ✓	1	must be written with a capital T note: the spelling must be correct **DO NOT ALLOW** if species name included **Examiner's Comments** This was a straightforward starter question about the binomial system for naming organisms. With careful reading the majority of candidates responded correctly with Telmatobius. Common errors were to add the species name or to call it 'amphibian'.
			Total	**1**	
25		i	*Amanita* ✓	1	First letter must be a capital, the rest must be lower case.

					Examiner's Comments Most candidates selected the correct name and wrote it with a capital letter.
		ii	*one from* 1 (starch) digestion in the regions where the, fungus / hyphae, not present ✓ 2 *enzymes / they, are* released / diffuse away, from the fungus **or** extracellular / secreted ✓	1	1 **ACCEPT** breaks down (starch) in the, region / area / agar, around the fungus **Examiner's Comments** It was surprisingly rare for candidates to apply their knowledge of kingdom Fungi to realise that digestion here is extracellular, involving enzymes being secreted by the hyphae and acting outside of them. Some referred to 'it' and their subsequent answer did not make it clear whether the answer referred to the enzymes or the fungus.
			Total	**2**	
26			*Column 1* / *Column 2* Class / Animalia Order Genus ✓ / *sumatrensis* ✓	2	*If additional incorrect answer given, then 0 marks* One mark per correct column. **ACCEPT** Animal / phonetic spelling / in lower case 'sumatrensis' must be all in lower case **DO NOT CREDIT** if the 's' is clearly upper case **DO NOT CREDIT** D. sumatrensis **DO NOT CREDIT** Sumatran / sumatran **Examiner's Comments** In the classification table the categories of taxa were correctly stated by the majority but the actual classification groups within the taxa posed more problematical: in particular identifying 'Animalia' as the correct kingdom. Eukaryota was a common error. Although many candidates correctly stated the species as 'sumantrensis', very many were not credited the mark because of using a capital letter.
			Total	**2**	
27			* **Level 3 (5–6 marks)** Full and detailed evaluation of the claim using all of the data in Table 5.1. Learner demonstrates a holistic	6	**Indicative scientific points may include:** **Support for conclusion (that common and soprano pipistrelle are distinct species)**

			judgement of the data providing evidence for and against the claim. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Detailed evaluation of the claim using most of the data in Table 5.1. Sound judgement is made on a range of aspects of the data. *There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.* **Level 1 (1–2 marks)** An evaluation of the claim is attempted using some of the information in Table 5.1. Simple conclusions are drawn citing limited aspects of the data. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** No response or no response worthy of credit.		• echolocation ranges do not overlap • genetic basis for echolocation suggests genetic difference between populations • idea that different species are likely to have genetic differences. **Information that could be used in support or to challenge** • Mean wing span is very similar • Could indicate difference, though not significant • Could be due to environmental factors, where the populations live • Habitats overlap • Could indicate same species in different areas • Could be different species adapted to slightly different environments. **Challenge to conclusion** • same mean body mass, could be same species • same colour, could be same species • potential environmental cause of body mass variation implies weak challenge to conclusion. **ALLOW** a comment on whether the researcher's conclusion is supported.
			Total	**6**	
28		i		4	**One mark** for level numbers **all** correct in Column 1.

<table>
<tr><td></td><td></td><td></td><td>
<table>
<tr><th>Sequence of Levels ✓</th><th>Level</th><th>Name</th></tr>
<tr><td>4</td><td>Order</td><td>Artiodactyla</td></tr>
<tr><td>7</td><td>Species</td><td>scrofa ✓</td></tr>
<tr><td>5</td><td>Family</td><td>Suidae</td></tr>
<tr><td>1</td><td>Kingdom</td><td>Animal(ia) ✓</td></tr>
<tr><td>6</td><td>Genus</td><td>Sus ✓</td></tr>
<tr><td>2</td><td>Phylum</td><td>Chordata</td></tr>
<tr><td>3</td><td>Class</td><td>Mammalia</td></tr>
</table>
</td><td></td><td>DO NOT ALLOW if scrofa is given capital S.

ALLOW “Animals”

DO NOT ALLOW if Sus is given lower-case initial s.</td></tr>
<tr><td></td><td></td><td>ii</td><td>science knowledge / it, advances / improves / grows / AW (1)</td><td>1</td><td>“Develop” is in the question.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>5</td><td></td></tr>
<tr><td>29</td><td></td><td></td><td>universal / recognised worldwide / AW ✓

know which, genus / species, it belongs to ✓

idea of different common name for the same organism ✓</td><td>max 1</td><td>ACCEPT no language barrier

ACCEPT ref to showing evolutionary relationships (e.g. shows common ancestry)

Examiner's Comments

Most candidates stated that the advantage of the binomial naming system is that it is used as a universal language and therefore avoids confusion over different common names for the same organism.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>1</td><td></td></tr>
<tr><td>30</td><td></td><td></td><td>any two from:
eukaryotic (cells) ✓
detail of eukaryotic feature ✓

aquatic ✓
most are unicellular / few multicellular ✓
autotrophic or heterotrophic ✓</td><td>2 max (AO1.1)</td><td>e.g. (named) membrane-bound organelle, 80S ribosomes, linear DNA, DNA with histones</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>2</td><td></td></tr>
<tr><td>31</td><td>a</td><td>i</td><td>C / ribosomes</td><td>1</td><td></td></tr>
<tr><td></td><td></td><td>ii</td><td>Any two from:</td><td>2</td><td></td></tr>
</table>

<table>
<tr><td></td><td></td><td></td><td>A rough endoplasmic reticulum
D Golgi apparatus
E secretory vesicle
F mitochondrion (1)(1)</td><td></td><td></td></tr>
<tr><td></td><td>b</td><td></td><td>C/A then D then E (1)(1)(1)</td><td>3</td><td>letters must be in correct order, if not all correct:
allow one mark if C/A as first letter given
allow one mark for E as last letter given
allow one mark for D in the middle

IGNORE B as this is plasma membrane rather than an organelle</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>6</td><td></td></tr>
<tr><td>32</td><td></td><td>i</td><td>Ministeria ✓</td><td>1
(AO2.1)</td><td>DO NOT ALLOW ‘Ministeria vibrans’ or ‘M. vibrans’</td></tr>
<tr><td></td><td></td><td>ii</td><td><table><tr><th>species</th><th>kingdom</th><th>cell wall molecule</th></tr><tr><td>S. tuberosum</td><td>Plants / Plantae</td><td>cellulose</td></tr><tr><td>C. pallens</td><td>Fungi</td><td>chitin</td></tr></table>✓ ✓</td><td>2
(AO3.1)</td><td>1 mark per column</td></tr>
<tr><td></td><td></td><td>iii</td><td>Ref. to nucleoid OR loop / circular OR free in the cytoplasm ✓

not associated with, histones / proteins OR is naked ✓

only one, molecule / chromosome / OR ref to plasmids ✓</td><td>1 max
(AO1.1)</td><td>IGNORE refs to no nucleus

DO NOT ALLOW single strand</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>4</td><td></td></tr>
<tr><td>33</td><td></td><td>i</td><td>1 protoctista ✓

2 nucleus / (named) membrane-bound organelles , so</td><td>42 max
AO3.1
AO3.2</td><td>1 ALLOW protista

2 IGNORE eukarya
2 IGNORE peptidoglycan

4 IGNORE autotrophic</td></tr>
</table>

			eukaryotic / not prokaryotic ✓ **3** unicellular so not plant(ae) ✓ **4** cell wall / chloroplast / starch grains, so not animal(ia) ✓ **5** cellulose cell wall / chloroplast , so not fungi ✓		**5** ALLOW cell wall not chitin so not fungi **5** IGNORE autotrophic
		ii	(nucleic acid) base sequence / amino acid sequence ✓ genes / DNA / RNA / cytochrome C ✓	1 AO2.1	**ALLOW** genetic material **IGNORE** chromosomes / RNA polymerase / ribosomes **DO NOT CREDIT** haemoglobin
			Total	**5**	
34	a	i	ribosome(s) ✓	**1**	***If additional incorrect answer given, then 0 marks*** **Examiner's Comments** Candidates did not appreciate the term 'component' so although many candidates realised it was RNA they didn't realise that the component would be a ribosome or that it was ribosomal RNA. Incorrect responses included nucleus, or a variety of different parts of the cell including cell surface membrane, cytoplasm or DNA.
		ii	(Eu)bacteria ✓ Archaea(bacteria) ✓	**2**	*In either order* **DO NOT ACCEPT** bacterium **ACCEPT** phonetic spelling **Examiner's Comments** Most candidates were able to identify at least one of the two domains correctly, usually 'Archaea'. The most common incorrect answers were Prokaryotes or Prokarya and Protoctists, but also Plantae and Animalia. This indicates that there is some confusion over the Domains classification system.
		iii		**2 max**	***Mark the first two answers but*** **IGNORE** multicellular **DO NOT ACCEPT** microtubule / cytoskeleton / centriole

			nucleus ✓ DNA with, histones / (associated) proteins ✓ linear DNA ✓ (named) membrane bound organelles ✓ 80s ribosomes ✓		**IGNORE** chromosome **IGNORE** chloroplast **ACCEPT** large(r) ribosomes **Examiner's Comments** Most candidates gave one correct answer, usually 'nucleus', and many gave a correct second answer, usually 'membrane bound organelles' or a named organelle. Many candidates stated 'multicellular' which suggested a lack of understanding that many unicellular organisms also belong to this domain. A few candidates did not specify 'linear DNA', or that ribosomes were 'larger' or '80s'.
	b		**1** scientific, conferences / meetings ✓ **2** peer review / approving the work for publication / publication in (reputable) scientific journal ✓ **3** replication of work (by others to see if the same results are obtained) ✓ **4** look for more (supporting) evidence (e.g. from other peoples' work / investigating other molecules) ✓	**2 max**	**2** **ACCEPT** analysing the procedures and data of the investigation **3** **ACCEPT (others)** repeat the experiments **4** Other molecules could include cytochrome C **Examiner's Comments** This question was relatively well answered with the best responses including two clear validation methods such as replication of work and peer review. Most candidates only referred to one method, usually the replication of work or the additional supporting evidence. A few candidates mistakenly discussed why his work was accepted rather than validated.
			Total	**7**	
35			A	1	**Examiner's Comments**

					There is some evident confusion with taxonomy. Despite many candidates choosing the correct option, D was a common suggestion.
			Total	**1**	
36		i	fossils (1) *idea that* fossils deeper in the ground are older than those near the surface (1)	2	**ALLOW** reference to radiometric dating **IGNORE** refs to carbon dating as time-scale is too great
		ii	Any two from similar tail segments lateral spines (1)	1	
		iii	no scale given on figure (1) *idea that* comparison in absolute length cannot be made (1) *idea that* comparison in relative length (compared with body length) could be valid (1) maturity / age, of specimen unknown (1) *idea that* only one individual of each species observed (1)	2	
		iv	*adaptation and explanation must both be present to be awarded the mark* tail for, swimming / movement (1) **OR** segments, for flexibility / moving tail / swimming (1)	1	**ALLOW** streamlined shape for movement in water
			Total	**6**	
37	a	i	action potential / nervous impulse, in sensory neurone ✓ synapse / described ✓ relay / intermediate, neurone ✓ (nervous impulse in) motor	3 max	

			neurone, passes to / AW, effector / muscle ✓		
		ii	*idea of* maintains balance / efficiency of movement ✓	1	
		iii	kinetic / movement, energy converted ✓ to, electrical energy / action potential ✓ *idea of* movement of statolith moves sensory hairs ✓ membrane of sensory hairs depolarises ✓	3 max	
	b		*Support is weak because* *idea that* clasification based on phylogeny ✓ statocysts could, have evolved on more than one occasion / be an example of convergent evolution ✓	2	
			Total	**9**	
38			sequence of , amino acids / DNA bases / RNA bases ✓ the smaller the, number of differences / percentage difference, the more closely related they are ✓ **ORA** reference to named protein e.g. cytochrome c ✓	2 (AO1.2)	**ALLOW** the more similar the sequence the more closely related
			Total	**2**	
39	a	i	fossils in, known-age / Jurassic, strata / rocks	1	
		ii	DNA / cytochrome c	1	
	b	i	carbon dioxide diffuses down concentration gradient out of the respiring cell (1) carried through body from cell (to tracheoles) by blood passing out via tracheoles /	4	

			trachea / spiracles (1) respiration generates heat (1) hot gases expand and are less dense so rise up by convection through the mound to vents at mound-top (1)		
		ii	*shape,* large or increased surface area to volume ratio (1) smallest area exposed to greatest heat (1)	2	Response **must** be linked to context of avoiding overheating / needing to get rid of heat.
			Total	**8**	
40		i	genetic polymorphism / proportion of heterozygotes / proportion of gene variants ✓	1 (AO1.1)	**CREDIT** number of polymorphic genes **Examiner's Comments** Less than 1 in 4 responses achieved this relatively straightforward AO1 mark.. Some candidates appeared to miss the significance of 'genetic' and suggested various sampling techniques or Simpson's index of diversity. Others appeared to attach little significance to 'diversity' and described DNA sequencing techniques or the Hardy-Weinberg principle.
		ii	(many) alleles lost (when population dropped) ✓ **ora** (modern population) descended from few survivors / AW ✓	2 (AO2.5)	**ALLOW** few alleles were left after drop in population **ALLOW** cheetahs still alive descended from a small gene pool **IGNORE** founder effect unqualified **Examiner's Comments** This was a relatively low scoring question. Most responses did not address the question that was asked but rather attempted to explain what a genetic bottleneck was or to discuss the consequences of low genetic diversity. Those candidates that did address the question usually achieved 1 mark, often for referencing the loss of alleles when the population crashed. However, some such responses did not achieve this mark because of imprecise references to reductions in allele frequency, rather than number of alleles or because of conflation of 'genes' with 'alleles'. Fewer

					candidates discussed the idea that the modern population were all descended from the diminished original. Some responses hinted that candidates thought the genetic bottleneck had occurred within the last 100 years, perhaps misunderstanding the significance of 'relatively recently' in terms of the existence of the species.
		iii	*idea that* one individual or allele has proportionally higher effect on small population ✓ (more likely that) <u>alleles</u> will be lost from population ✓ (population) more vulnerable / likely to become extinct due , to environmental change / AW ✓	2 max (AO1.2)	**IGNORE** founder effect unqualified **ALLOW** example of environmental change E.g. might become extinct because of (new) disease **IGNORE** event **<u>Examiner's Comments</u>** Genetic drift seems to be poorly understood on the part of candidates. Many responses appeared to confuse genetic drift with speciation or inbreeding depression; others discussed the decreased likelihood of meeting another cheetah. Around a quarter of responses achieved 1 mark and very few scored both. Some of the candidates that appeared to know what genetic drift was went no further than stating that genetic drift affects small populations, which added little or nothing to the information given in the question.
			Total	**5**	
41	a	i	sympatric ✓	1(AO1.2)	
		ii	*idea that* individuals choose to mate only with other individuals with similar sized beaks ✓	1(AO1.2)	**CREDIT** sexual selection **ALLOW** different , mating seasons / courtship rituals
		iii	(DNA) found in all organisms ✓ some / AW , sequences highly conserved ✓ comparison (of DNA between species) ✓ similar (base) sequence indicates recent common ancestor ✓ **ora**	2(AO1.1)	**ALLOW** look at similarities in DNA **IGNORE** closely related

<table>
<tr><td></td><td>b</td><td></td><td>similar ideas to Darwin ✓
arrived at independently ✓
presented / published (paper) , together ✓
idea of increased weight of evidence ✓</td><td>2
max(AO1.1 AO2.3)</td><td><u>Examiner's Comments</u>

Very few candidates seemed aware of Wallace, often linking him to genetics or DNA. This question was often omitted.</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>6</td><td></td></tr>
<tr><td>42</td><td>a</td><td></td><td>biological molecule
nucleic acid / (nuclear) DNA / mtDNA / RNA (1)

idea that in samples from two species sequence similarity in any of the above can imply an evolutionary relationship, difference / divergence in sequence implies evolutionary distance (1)

biological molecule
proteins / polypeptides / cytochrome C / haemoglobin (1)
idea that in the same protein from two species, amino acid / primary sequence similarity implies evolutionary relationship, difference / divergence in sequence implies evolutionary distance (1)</td><td>4</td><td>ALLOW named proteins commonly used</td></tr>
<tr><td></td><td>b</td><td></td><td><table><tr><th>Deduction</th><th>Supporting observation(s)</th></tr><tr><td>characteristics are passed on to the next generation</td><td rowspan="2">E (1)</td></tr><tr><td>there is a struggle for existence (1)</td></tr><tr><td>individuals with beneficial characteristics are among the</td><td>F and G and H (1)</td></tr></table></td><td>3</td><td></td></tr>
</table>

			few who survive		
			Total	**7**	
43	a	i	differences completed correctly ✓ squares of differences completed correctly ✓	2	**IGNORE** all negative signs in Difference of ranks column **DO NOT ALLOW** negatives in Difference squared column **ALLOW ECF** for mp 2

Rank of hair density	Difference in ranks (d)	Difference squared (d^2)
2	2	4
1	0	0
7	0	0
10	0	0
4	4	16
3	0	0
8	1	1
6	0	0
9	(-)7	49
5	0	0

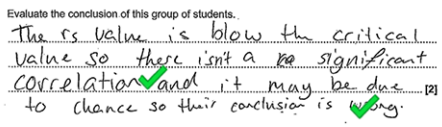
Examiner's Comments

Candidates were asked to complete the table by making a number of simple calculations. Most able candidates did this successfully. A number of candidates were unable to rank the hair density correctly and therefore the difference in ranks was incorrect. These candidates could still achieve a mark if they correctly squared the difference they had calculated. A few made errors in calculating the square of the difference.

		ii	rs = 0.576 / 0.58 ✓✓	2	**ALLOW** ECF from table **ALLOW** one mark for working e.g. n(n2-1) = 990 ✓ 6x70/10(99) ✓

					0.57 = one mark (incorrect rounding) 0.580 = one mark (for incorrect rounding) 0.6 = one mark (rounding too far) **Examiner's Comments** Candidates were asked to calculate Spearman's rank correlation coefficient. Many candidates managed to do this successfully. If the values in the table were incorrect the error was carried forward to enable candidates to achieve these marks using their own data from the table in part (i). Less able candidates often struggled to carry out this calculation correctly. Sometimes this was because they did not transfer data accurately into the table.
	b	i	further away from the river less water (available) / ORA ✓ transpiration causes water loss ✓ hairs, trap water vapour / reduce transpiration / reduce loss of water (vapour)✓ reduced water (vapour) potential gradient from inside to outside leaf ✓	2 max	**DO NOT ALLOW** 'further from source' 'no source' **DO NOT ALLOW** hairs prevent water (vapour) loss **Examiner's Comments** This question asked candidates to explain how leaf hairs enabled the plant to conserve water in the context of differing water availability at different distances from the river. More able candidates had a good idea that leaf hairs could reduce water loss. They also understood that this was required because there was less water available further from the river. Less able candidates often became confused and wrote about leaf hairs absorbing water from the less humid environment. Some even seemed to think that leaves closer to the river had more hairs which helped the leaf to lose water. **Exemplar 7** (d) The students concluded that there is a positive correlation between distance of the tree from the river and mean leaf hair density. (i) Suggest reasons for this positive correlation. As you get further from the river, less water is available from the soil so the plant trees would need hairy leaves so as to reduce the rate of transpiration by trapping water & to stop it from leaving via stomata as vapour. [2] In this exemplar the candidate has written a clear and concise response. It shows a clear understanding that water is less available further away from the river and that the leaf hairs will reduce transpiration. The candidate goes on to

					explain that transpiration is loss of water vapour via the stomata.
		ii	same / similar, size / age, trees ✓ same / similar, size / age, leaves ✓ repeated leaves from each tree **and** calculate mean ✓ record results at same, time of year / day ✓ ensure leaves selected are from, same side / same height / evenly distributed around tree ✓ systematic sampling / sample at set distances (from river) / described ✓	3 max	**Examiner's Comments** This question asked for candidates to describe ways to improve the validity of their sampling techniques. Validity is all about controlling the variables around the collection of data so that the data are not affected by inconsistencies. The technique is valid if it measures what it is supposed to measure. There was a wide range of responses. It was clear that many candidates did not really understand the meaning of the term 'validity'. Few candidates achieved full credit and many responses described ways to improve repeatability. In many cases the responses were not well phrased. **Exemplar 8** Suggest **three** ways in which the students could improve the validity of their sampling method. 1 Use leaves from the same height from the trees ✓ 2 Use similar size trees ✓ 3 Use similar ~~s~~ leaves of a similar area. ✓ [3] In this exemplar the candidate has given three clear statements. Each statement describes a way to remove a variable to ensure the data collected are comparable. This makes the sampling techniques valid.
	c		their conclusion is incorrect ✓ reject (the student's), hypothesis / H1 ✓ there is no, relationship / correlation, (between leaf hair density and distance from river) / the pattern seen is due to chance ✓	2 max	**ORA** accept the null hypothesis / H_0 **Examiner's Comments** Candidates were asked to evaluate a conclusion. It was clear that many candidates did not really know how to interpret the results of a statistical test. If the calculated value of Spearman's rank is below the critical value then we can say that there is no correlation. Many candidates seemed to suggest that because the calculated value was close to the critical value that was OK. Less able candidates become very confused and compared the

					calculated value to 5% or even to 9. ⓘ Definitions of the terms associated with practical work are available in the practical skills handbook. **Exemplar 9**  Evaluate the conclusion of this group of students. The rs value is blow the critical value so there isn't a no significant correlation and it may be due to chance so their conclusion is wrong. [2] This exemplar shows a rare case where the candidate has a good understanding of how to interpret the results of a statistical test. The candidate makes clear that the calculated result is below the critical value and states that this means there is no significant correlation.
	d		continuous ✓	1	**Examiner's Comments** This question asked for the pattern of variation shown. The correct pattern is 'continuous' variation. There was a wide range of responses and lower ability candidates simply described the pattern rather than stating a name for the pattern.
			Total	**12**	
44		i	positive correlation **or** the higher the body mass the, longer / higher, the lifespan ✓	1 (AO2.2)	**ALLOW** 'as body mass increases lifespan increases' **DO NOT ALLOW** 'increase in body mass **causes** them to live longer' **IGNORE** weight / size for mass
		ii	lifespan is greater than expected for its mass / AW ✓	1 (AO3.2)	**IGNORE** weight / size for mass **ALLOW** 'longer / higher / bigger, than expected' **Examiner's Comments** Many candidates answered correctly but some wrote that the lifespan was greater than expected without referring to mass, and some referred to size instead of mass which was not precise enough.
			Total	**2**	

45		i	4.7 ✓✓	2 (AO2.6)	*Max 1 if answer not given to 2 s.f.* **IGNORE** sign If answer incorrect **ALLOW** 1 mark for 4.8 or 4.9 **Examiner's Comments** Most candidates scored on this question, either getting the full 2 marks for 4.7 or getting one mark for 4.8 or 4.9 as a result of dividing by the female length rather than the male. The majority of candidates answered to 2 significant figures as instructed.
		ii	little / nothing (can be concluded) ✓ because no (named) statistical test done ✓	2 max (AO3.1)	**IGNORE** 'not significant' *If no other marks awarded*, **ALLOW** *1 mark only for…* (probably) not significant because , error bars / standard deviations , overlap **Examiner's Comments** Less than 1% of candidates gave the full correct answer, i.e. that, without performing a statistical test, nothing can be concluded. However, around a third of responses gained 1 mark by stating that the difference was probably not significant because the error bars overlapped. Although not strictly true, this approach is obviously being taught by centres. Many responses included phrases like 'low significance' or 'not very significant'. These largely meaningless terms gained no credit. Candidates are advised to stick with the absolute term: the difference is or is not significant. A number of candidates confused the percentage difference in height (4.7%) with the 5% probability used to determine significance and gained no marks.
		iii	*No, because…* *idea that* standard deviation is not the same as range ✓	1 (AO3.2)	**ALLOW** e.g. SD does not include all outliers / error bars don't show range **Examiner's Comments** Around half of responses stated, correctly, that the information did not support the candidate's answer and a majority of these gained a mark. A minority,

					however, believed that the reason the candidate's answer was not supported was that the mean length was that of the longest cheetah. The other half of responses incorrectly stated that the information did support the candidate's answer, usually because they interpreted the error bars as range bars.
		iv	environment ✓ genes / genetic / alleles , and environment ✓ <u>many</u> genes / polygenic ✓ age ✓	2 max (AO2.1)	**ALLOW** suitable example, e.g. diet **Note** 'genes and environment' = 2 marks **IGNORE** refs to mutation **<u>Examiner's Comments</u>** About half of responses achieved 2 marks. However, many wrote unnecessarily long explanations. The command word 'state' ought to have directed candidates to answer quickly with short, direct, statements. On this occasion a three-word answer 'genes and environment' easily achieved both marks. Many candidates missed the significance of the context of the question, i.e. that body length displays continuous variation and that any contribution from genes is likely to be minimal in the relatively genetically homogenous cheetah population; hence, answers that focussed on genetic variation alone achieved no credit. Responses that did not answer the question, such as lengthy discussions of the potential advantage of longer body length in males, received no credit.
			Total	**7**	
46	a	i	number of seeds per pot ✓ size of pot ✓ type of soil / compost used ✓ mass of soil / compost used ✓ temperature ✓ light intensity ✓ oxygen / carbon dioxide concentration ✓ AVP ✓	Max 2	e.g. depth of planting

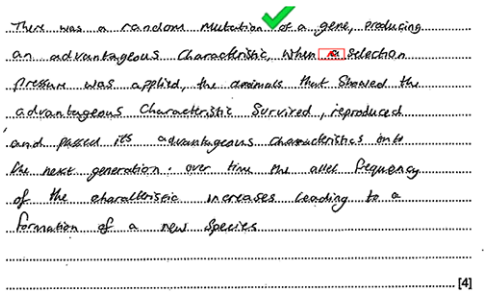
		ii	% moisture on horizontal axis and number seedlings germinated on vertical axis✓ both axes clearly labelled with unit for moisture✓ plots for separate species clearly distinguished✓ points plotted accurately✓	4	**ACCEPT** either line graph with two lines or bar chart with two bars at each moisture level
	b	i	correct data entered into all cells in table ✓ $\Sigma d^2 = 2$ ✓	1	<table><tr><td>60</td><td>4</td><td>42</td><td>5</td></tr><tr><td>80</td><td>5</td><td>33</td><td>4</td></tr><tr><td></td><td></td><td></td><td></td></tr></table>
		ii	0.9 ✓✓	2	Two marks for correct answer If answer incorrect allow one mark for work showing formula completed correctly $r_s = 1 - \frac{6 \times 2}{5(25-1)}$
		iii	the correlation (between moisture and germination) is not significant (at the p = 0.05 / 95% confidence level)✓	1	
			Total	**11**	
47			* **Level 3 (7–9 marks)** Extensive reference has been made to the (pre-) historical circumstances of both populations. Inferences have been clearly drawn in terms of natural selection. Learner demonstrates a holistic grasp of the Darwinian theory and the information given; reaching reasoned conclusions that explain how the different phenotypic frequencies occurred. *There is a well-developed line of reasoning which is*	9	**Indicative scientific principles may include:** **Europeans:** • (pre-agricultural) gene pool / genetic variation, included mutant / non-intolerance, allele • availability of milk acted as (positive) selection pressure • individuals / groups, with mutant / non-intolerance, allele had better, chance of survival / success in reproduction • directional selection • mutant / non-intolerance, allele accumulated (in gene pool) • genetic drift (in small prehistoric population) • mutant / non-intolerance, allele is dominant

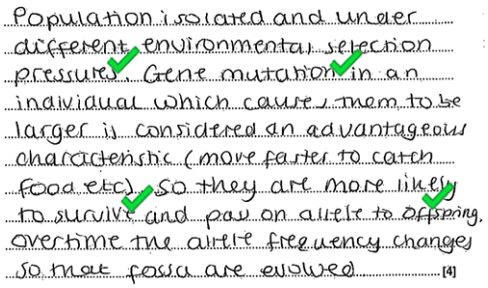
			clear and logically structured. The information presented is relevant and substantiated. **Level 2 (4–6 marks)** Reference has been made to the (pre-) historical circumstances of both populations. Some inferences have been drawn in terms of natural selection. There is partial structuring of the ideas with the connections between Darwinian theory and information generally clear. Conclusions are used to explain how the different phenotypic frequencies occurred. *There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.* **Level 1 (1–3 marks)** Reference has been made to the (pre-) historical circumstances of at least one of the populations. At least one inference has been stated in terms of natural selection. The ideas expressed are poorly structured but some relevant points are made. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.*		• so expressed in heterozygotic individuals (increasing phenotype frequency). **Australian aborigines:** • ancestral population pre-agricultural • so no selection for mutant / non-intolerance, allele • no suitable mammals to domesticate / milk • island, so no borders for suitable mammals to come in • no contact / breeding, with non-Aboriginal peoples • no gene flow (from other human populations) • no selection pressure • to increase mutant / non-intolerance, allele / phenotype, frequency.

			0 marks No response or no response worthy of credit.		
			Total	**9**	
48			(named) chemicals (1) folding (1) stings (1)	2	**ALLOW** 2 named chemicals
			Total	**2**	
49		i	anatomical ✓	**1**	***Mark the first answer only. If additional incorrect answer given, then 0 marks*** **ACCEPT** anatomy **Examiner's Comments** A minority of candidates scored this mark for identifying the adaptation as an anatomical adaptation. A range of answers were seen; 'physiological' was the most common mistake.
		ii	***Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.*** ***In summary:*** *Read through the whole answer. (Be prepared to recognise and credit unexpected approaches where they show relevance.)* *Using a 'best-fit' approach based on the science content of the answer, first decide which of the level descriptors,* ***Level 1****,* ***Level 2*** *or* ***Level 3****, best describes the overall quality of the answer.* *Then, award the higher or lower mark within the level, according to the* ***Communication Statement*** *(shown in italics):*		

			○ award the higher mark where the Communication Statement has been met. ○ award the lower mark where aspects of the Communication Statement have been missed. • ***The science content determines the level.*** ***•The Communication Statement determines the mark within a level.*** ***A level annotation should be used where all marks for a level have been achieved eg for 6 marks*** **L3** ***If a candidate has achieved 5 marks then they have reached level 3 but with one mark omitted*** **e.g L3** ^ ***The same principle should be applied to level 2 and level1*** ***No marks (0) should have a cross*** **Level 3 (5–6 marks)** Provides a full and accurate description of natural selection **and** describes the role of regulatory gene(s) and mentions a correct role of a structural gene. *There is a well-developed line of reasoning, which is clear*	**6**	**Indicative scientific points may include** *Natural selection* • mutations (e.g. of pigment gene, and of regulatory genes) • selection pressure of prey availability • the adaptation helped tigers hide from prey / ref to camouflage • striped tigers had a greater survival probability and were more likely to reproduce • beneficial alleles were passed on to the next generation • the allele frequency for the relevant genes would have increased with each generation • after many generations, all tigers within a population were striped *Roles of regulatory genes* • (regulatory) genes control, the pattern / where pigments produced / expression of other genes • genes switched on or off during development (i.e. epigenetic changes / transcription factors) • correct roles for epistasis – e.g. recessive epistasis preventing expression of pigment gene • ignore role of hox genes as not relevant • ignore 'genes for striped fur' or 'striped pattern' alone as this is neither a structural or regulatory gene role

			and logically-structured and uses scientific terminology at an appropriate level. The information presented is relevant and substantiated. **Level 2 (3–4 marks)** Provides a description of natural selection with few errors or omissions **and** mentions a correct role of a structural gene (e.g. for fur colour / pigmentation) *There is a line of reasoning presented with some structure and use of appropriate scientific language. The information presented in the most part relevant and supported by some evidence.* **Level 1 (1–2 marks)** Provides an outline of natural selection *There is an attempt at a logical structure with a line of reasoning.* *The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit.*		**Examiner's Comments** Fewer than 5% of candidates accessed Level 3 on this question. The majority of the rest only accessed Level 1 due to the fact that they were able to identify that the evolution of a tiger with striped fur was due to natural selection, but they did not correctly identify a mutation in a structural gene as being the main cause. Many students who fell into this category wrote about a 'mutation in a gene for striped fur' rather than naming the structural gene as being responsible for fur colour or producing a coloured pigment. In a few cases, candidates correctly identified a structural gene, and gave a developed example of how regulatory genes may contribute to stripes, giving access to Level 3. However, the role of regulatory genes in controlling gene expression is an area which was poorly understood by the majority of candidates. The other main weakness in response to this question lies in the identification of the correct selection pressure for stripes being better adaptation for hunting due to camouflage. Only approximately 50% of candidates identified this. The Communication mark within a level was given in most cases, except where the odd candidate left out large amounts of detail or incorporated lots of irrelevant material.
			Total	**7**	
50		i	*Fossa has …* longer , legs ✓ different (shaped / size) , ears ✓ (proportionally) bigger eyes ✓	1 max (AO2.3)	*Mark the first response only* *Assume 'it' refers to mongoose* **IGNORE** references head / body / shape **ALLOW ora** for mongoose throughout **ALLOW** longer tail / larger jaw **Examiner's Comments** The vast majority of candidates achieved this mark. Some were even able to correctly refer to

					proportional sizes. Those few responses that did not gain a mark tended to refer to differences not visible in the figure or vague differences in body shape.
		ii	1 allopatric speciation ✓ 2 different , selection pressure / environmental conditions (from mainland) ✓ 3 (random) mutation ✓ 4 (fossa-like) individuals with , mutation / (new) feature , survive / reproduce ✓ **ora** 5 beneficial / AW , <u>alleles</u> passed on ✓ 6 <u>directional</u> selection	4 max (AO2.5)	**3 ALLOW** pre-existing genetic variation **4 IGNORE** best adapted / fittest **<u>Examiner's Comments</u>** This question differentiated well between candidates of differing abilities and two marks were most commonly scored. The best responses outlined the natural selection of cat-like features using technical terms. Many responses were not credited marks because they did not use the term 'alleles' correctly. Some conflated 'alleles' with 'genes' while others merely referred to traits, characteristics or features. Answers that ignored the context completely struggled to gain full marks as generic references to selection pressures or survival of the best adapted were not credited without a link to the Madagascar/fossa-like context. A minority of responses did not address the question, which the evolution of the fossa, and devoted their entire answer to issues of speciation, gaining little credit. Use of the A Level key term, 'directional selection', was rare. Exemplar 9  This was a random mutation of a gene, producing an advantageous characteristic, when selection pressure was applied, the animals that showed the advantageous characteristic survived, reproduced and passed its advantageous characteristics on to the next generation, over time the allele frequency of the characteristic increases leading to a formation of a new species [4] This response ignores the context of the question and simply discusses natural selection in generic terms. One mark has been credited for discussing mutations but, although the response alludes to

					marking points 2 and 4, as these are context-dependent, the marks have not been given. Exemplar 10  Population isolated and under different environmental selection pressures ✓ Gene mutation in an individual which cause them to be larger is considered an advantageous characteristic (more faster to catch food etc) ✓ so they are more likely to survive and pass on allele to offspring ✓ overtime the allele frequency changes so new fossil are evolved [4] This response achieves full marks for the following marking points: 2 – recognising the context of an environment different from the African mainland, 3, 4 – recognising the context of a vacant large predator niche, and 5.
		iii	mutation / genetic diversity ✓ natural / directional , selection ✓ *idea that* environment / selection pressure , is <u>different</u> from the 'other' population ✓ time ✓	3 max (AO1.2)	**IGNORE** refs to isolation **ALLOW** genetically different / large gene pool **ALLOW** e.g. different food source **ALLOW** many generations **<u>Examiner's Comments</u>** This question was poorly answered with many candidates failing to appreciate the significance of 'other' in the question and, hence, listing methods of reproductive isolation. Mutation and different environmental conditions were the most commonly seen correct answers but references to natural selection and time were rare.
			Total	**8**	
51			*No waxy cuticle* *idea that* water loss is not a problem / wax production wastes energy /AW ✓ *Stem tissue contains air spaces* buoyancy / (allows it to) float / increases gas exchange / more light near	3 (AO2.1)	**ALLOW** does not impede flow of materials through cell wall / shorter diffusion distance / easier gas exchange / faster gas exchange / gas exchange more efficient

			surface of water / AW✓ *Thin, flexible stem* less support needed / plant is supported by water / can move more (in water) without breaking / AW ✓		e.g. less likely to be damaged / not damaged by, water currents / aquatic animals **Examiner's Comments** The majority of candidates gained at least one mark for this question, with a high proportion gaining 2. Only a few candidates mentioned that the production of a waxy cuticle wastes energy as water loss is not a problem. However, many candidates correctly related the presence of air spaces in the stem to aiding buoyancy and the flexibility of the stem to being able to move without breaking.
			Total	**3**	
52		i	224 ✓	1 AO2.2	*haploid number = 28* *x 2 for diploid number = 56* *x 2 after DNA replication = 112* *x 2 strands per molecule = 224*
		ii	a cross drawn anywhere between sporophyte and spores ✓	1 AO2.5	
		iii	many mitochondria ✓ to supply , energy / ATP , for movement ✓ **OR** enzymes / acrosome ✓ (enzymes) to , penetrate / AW , egg ✓	2 AO2.1	*Mark the first suggestion given but ignore partially achieved marking points* **DO NOT CREDIT** make energy **ALLOW** to digest outer layer / break through membrane **DO NOT CREDIT** break down egg cell wall
			Total	**4**	
53		i	genetic (biodiversity) ✓	**1**	**Examiner's Comments** Many candidates correctly named this type of biodiversity as genetic. Incorrect answers included 'variation' or suggested 'environmental', 'habitat' or 'species'.
		ii	allows for adaptation to changing environment ✓	**1 max**	**ACCEPT** in the context of an example e.g. species survival when, a / new, disease introduced

			provides variation for natural selection ✓ can offer, camouflage / protection from predators ✓		**Examiner's Comments** Many suggested that the colour variation was an adaptation to the environment but did not indicate the crucial idea of a *changing* environment. Camouflage was a popular correct answer.
			Total	**2**	
54			there is a lower water potential inside root hair (cells) ✓ actively transport / pump, (mineral) ions / salts, into root hair(s) (cells) **or** root hair(s) (cells) store / contain, (mineral) ions / salts / solutes ✓	2	**IGNORE** ref to large surface area and short diffusion path **IGNORE** ref to solute potential / isotonic **ACCEPT** Ψ for water potential 'it' or 'they' = root hairs **IGNORE** ref to roots or root cells unqualified as hairs **ACCEPT** root hair, has / creates, a lower water potential (than soil) **ACCEPT** maintains / sets up / establishes, a (steep) water potential gradient Look for a comparison in water potential between the cell and the soil **IGNORE** solutes / sugars / hydrogen ions **ACCEPT** named ions **ACCEPT** named ions **ACCEPT** named solutes e.g. sugars **Examiner's Comments** This question highlighted the failure of many candidates to use the correct scientific terminology. In particular was the use of 'concentration gradient' without showing an appreciation of, or even mentioning, water potential, despite the previous parts of the question being on that subject. Where active transport was mentioned some thought it was the water that was pumped into the cell or that transpiration was also involved. Many candidates understood the principal of reducing the water potential of the root hair cells but failed to gain credit by referring to the roots or the plant without specifying the 'root hair cells'.They also talked about the large surface area of root hair cells, which also failed to gain credit.
			Total	**2**	
55		i	1.7 mm (1)	1	

		ii	× 50 (1)(1)		**ALLOW** 1 mark for correct working e.g. 80 / 1.6 **ALLOW** answer in the range of 48–51
		iii	air spaces give buoyancy (1) supported by (surrounding) water (1)	2	
			Total	**5**	
56		i	*three from* similar, niche / lifestyle / AW (1) similar selection pressure (1) *idea that* wings are advantage for survival in both bats and birds (1) alleles for 'wings' more likely to be passed to next generation (1)	3	**ALLOW** 'same' **ALLOW** 'same' **ALLOW** 'genes'
		ii	*idea that* echolocation not needed for an animal active during the day where reduced visibility is not an issue (1)	1	
			Total	**4**	
57		i	*idea that* the third diagram shows that the resistant, bacteria / colonies, were already present (on the original plate) **or** these (resistant) bacteria on the original plate continued to grow when flooded with penicillin ✓	1	**IGNORE** penicillin will kill them so in order for them to survive the mutation must have already happened **IGNORE** no time for natural selection to take place − as these are explanations and not evidence **Examiner's Comments** Most candidates found this question challenging, tending to repeat or rephrase the stem of the question. Vague or ambiguous references to being exposed to penicillin were insufficient as they needed to clearly refer to the original colonies that survived when the original petri dish was flooded with penicillin. The candidates needed to take careful note of the diagrams and the information provided in order to make an informed statement.
		ii	natural <u>selection</u> ✓	1	**CREDIT** directional <u>selection</u> **IGNORE** evolution / survival of the fittest / binary fission / mutation

					Examiner's Comments This question elicited the following incorrect answers on a frequent basis: binary fission, mutation, evolution and mitosis. Some misunderstood the question and referred to antibiotic resistance, immunity or vaccination.
			Total	**2**	
58		i	editing of primary, mRNA / transcript ✓ not present in mature mRNA ✓ not translated ✓ regulatory, sequences / genes ✓	2 max(AO 1.2)	**IGNORE** introns are non-coding (as this is not an explanation) **ALLOW** introns removed **ALLOW** used to make , tRNA / rRNA **Examiner's Comments** Many candidates offered descriptions of what 'non-coding' might mean rather than explaining the reasons why some sections did not code for a polypeptide.
		ii	not selected against / AW ✓	1(AO 2.5)	**ALLOW** doesn't affect survival
			Total	**3**	
59			***Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.*** **Level 3 (5–6 marks)** Explains how genetic variation, differential survival and the passing on of alleles to the next generation act to increase the proportion of the population with a beak length of around 11mm and makes appropriate use of the graph data to support explanation. *There is a well-developed line of reasoning which is clear and logically structured. The*	6(AO2.5 3.2)	**Indicative points may include** *AO2.5* Genetic variation • pre-existing • sexual reproduction • meiosis • mutation Differential survival • overproduction of offspring • finches with extreme beak depth less likely to survive • reason for birds with very small or large beaks not surviving Inheritance

			information presented is relevant and substantiated. **Level 2 (3–4 marks)** Explains how natural selection acts to increase the proportion of the population with a beak length of around 11mm. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Explains how natural selection favours those in the population with an average phenotype **OR** that natural selection favours finches with a beak length of around 11 mm. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* *0 marks* *No response or no response worthy of credit.*		• survivors possess alleles for average beak depth • alleles for average beak depth more likely to be inherited by offspring • increase frequency of these alleles from one generation to the next *AO3.2* Use of figures from graph • bell-shaped curve • skewed to right • beak depth with peak survival is 11.2 mm • no birds survived with beaks of 7.4 mm or less • no birds survived with beaks of 11.6 mm or more **Examiner's Comments** The majority of the candidates were able to use the data in the graph correctly and they were able to outline that birds with very small or very large beaks did not survive whereas those with average beak sizes did. Most of the candidates had to explain the process in more detail, by including details about the importance of genetic variation or inheritance of alleles for average beak size. Many candidates successfully referred to the graph within their answers and so were able to access the higher levels. A few candidates did not seem to appreciate the fact that extremely large beak sizes were being selected against as well as extremely small ones. There was a small but significant number of candidates that discussed the data in the graph as if the x-axis represented time, rather than beak size.
			Total	**6**	
60			adapted to occupy the (oil spill) , niche / environment ✓ outcompete other , bacteria / species ✓ oil is acting as selective agent / selection of bacteria	1 max (AO2.5)	**Examiner's Comments** This was also a challenging contextual question for candidates to achieve a mark in as responses had to offer something not already included in the question. Many candidates did not appreciate from the context that there would not always be oil

			that were able to digest oil ✓		present in the area, merely that oil spills happened with some regularity, hence answers like 'they can gain nutrition from the oil' were not credited without further explanation.
			Total	**1**	
61		i	*two from* babies / infants (1) elderly / infirm (1) immuno-compromised / on immunosuppressant drugs / HIV positive (1) known to have been exposed (to the infection) (1)	2	
		ii	*two from* (antibiotic is) selective pressure (1) (bacterial) gene pool / AW, has variation (1) (only) some bacteria have resistance / some bacteria are more resistant than others (1) *two from* when exposed (to antibiotic) most-resistant survive (1) surviving bacteria continue to reproduce to make a resistant population (1) *idea that* over many generations there is an increase in proportion of resistant bacteria (under continued antibiotic pressure) (1) antibiotic becomes ineffective / new antibiotic needed (1)	4	**IGNORE** increase in number of resistant bacteria.
			Total	**6**	
62		i	3140 ✓ ✓	2	**Correct answer = 2 marks**, even if no working shown. • If the answer is incorrect or has not been rounded to 3 sig. figs., then **award 1 mark** for seeing **either**

					$\frac{1652 - 51}{x}$ or $\frac{1601}{x}$ where x = any number **or** an unrounded answer (e.g. 3139.2156 or 3139) • If the incorrect peak has been chosen, then **award 1 mark only for a correct answer which is correctly expressed to 3 sig. figs.** Using 1649 the correct answer is 3130 Using 1593 the correct answer is 3020 **Examiner's Comments** Candidates should be encouraged to always show their working for calculations. Those who did were frequently able to be awarded a mark for working despite having the incorrect answer. Most were able to select the correct figures but were unable to manipulate them correctly. Calculation of percentage increase, decrease or change proves to be challenging for candidates.
		ii	was lower (in 1993) **or** has increased / is higher (in 2012) ✓ *(in 2012)* 52% or 0.52 ✓	2	**IGNORE** ref to raw data **ACCEPT** 'over 4 x greater in 2012' **ACCEPT** 52.4% **Examiner's Comments** In contrast, most candidates performed this calculation correctly and were able to make a suitable comment relating to its increase since 1993.
		iii	*two of* 1 (trend is) decrease in (number of) deaths (since 2007) ✓ 2 consistent / steady / large / dramatic, decrease in (deaths from *S. aureus* specified as) MRSA (from	2	**IGNORE** raw data quotes 2 *idea that* non-specified fluctuates **Note** 'a large decrease in the number of deaths from MRSA' = 2 marks (mps 1 & 2) 3 e.g. isolating MRSA cases / dress code for

			2007) ✓ 3 ref to better specific cross-infection control measure in health care ✓ 4 any correct processed data comparing either years or cause of death using figures from table 6 ✓		health professionals / hygiene measures / pre operation screening 4 *MRSA* e.g. decrease of, 1301 / approx. 260 per year 2012 value is, 18.3% / approx. 20% / approx. ⅕, of 2007 value a drop of, 82% / approx. 80%, from 2007 to 2012 *total* e.g. decrease of, 1495 / approx. 39 per year 2012 value is, 27.1% / approx. 25% / approx. ¼, of 2007 value a drop of, 73% / approx. 70% / approx. 75%, from 2007 to 2012 **Examiner's Comments** Most candidates observed the correct trend but did not clearly distinguish between total certificates mentioning *S. aureus*, those mentioning ***S. aureus*** specified as MRSA and those mentioning *S. aureus* not specified as resistant. Data quoted was frequently raw data rather than processed. Measures to prevent cross-infection were only credited if they were specific rather than vague references to 'better hygiene'.
			Total	**6**	

Year	% death certificates mentioning *S. aureus*		Total number of death certificates mentioning *S. aureus*
	***S. aureus* not specified as resistant**	***S. aureus* specified as MRSA**	
2007	22 or 22.4	78 or 77.6	2052
2008	18	82	1500
2009	38 or 37.7	62 or 62.3	1253
2010	49 or 49.5	51 or 50.5	960
2011	43 or 42.9	57 or 57.1	638
2012	48 or 47.6	52 or 52.4	557