

Question Number	Answer	Additional Guidance	Mark
1(a)	idea of organisms that breed to produce fertile offspring ;	<b>Ignore</b> reproductively isolated <b>Ignore</b> viable	(1)

Question Number	Answer	Additional Guidance	Mark
1(b)	<ol style="list-style-type: none"> <li>1. idea of geographical isolation ;</li> <li>2. idea of different {environmental conditions / habitats / eq} ;</li> <li>3. reference to different selection pressures ;</li> <li>4. idea that mutation resulted in {adaptation / increased survival} ;</li> <li>5. idea of {decrease in gene flow / different alleles} ;</li> <li>6. ref to reproductive isolation ;</li> <li>7. credit suitable example e.g. different songs, incompatible genitals ;</li> </ol>		(4)

Question Number	Answer	Additional Guidance	Mark
1(c)	<ol style="list-style-type: none"> <li>1. idea of descending from common ancestor ;</li> <li>2. idea of living in similar habitats ;</li> <li>3. idea of similar (environmental) {conditions / factors} ;</li> <li>4. idea of similar selection pressures ;</li> <li>5. idea that both well-adapted ;</li> <li>6. idea that mutations have not changed appearance ;</li> <li>7. idea of similar gene pool ;</li> </ol>	<p><b>Accept</b> same for similar throughout</p> <p><b>2. Accep</b> place / environment / area</p>	(3)

Question Number	Answer	Additional Comments	Mark
2(a)	<ol style="list-style-type: none"> <li>only (alpha) 1-4 glycosidic bonds in amylose / (alpha) 1-6 only found in amylopectin ;</li> <li>only amylopectin has side branches / only amylose is {coiled / eq} ;</li> <li>Amylopectin is a {larger / eq} molecule than amylose ;</li> </ol>	ACCEPT 1 - 1-6 and 1-4 in amylopectin	(2)

Question Number	Answer	Additional Comments	Mark
2(b)	<ol style="list-style-type: none"> <li>different individuals in the {colony / eq} take on specific {roles / jobs / eq} ;</li> <li>example given e.g. queen produces offspring ;</li> </ol>	<p>ACCEPT 1 - division of labour</p> <p>ACCEPT 2 - dominance by queen, {few of the males / kings} involved in breeding</p>	(2)

Question Number	Answer	Additional Comments	Mark
2(c) (i)	idea that body temperature of animal mimics the ambient temperature ;	ACCEPT - body temp follows environmental temperature	(1)

Question Number	Answer	Additional Comments	Mark
2(c) (ii)	<ol style="list-style-type: none"> <li>Lack of insulating layer: idea that does not impede transfer of heat energy / allows exchange of heat energy more easily ;</li> <li>A marked reduction in sweat glands: idea that they do not need to cool down OR less water lost ;</li> </ol>	ACCEPT 1 - enables heat transfer between environment and naked mole rat	(2)

Question Number	Answer	Additional Comments	Mark
2(d)	<ol style="list-style-type: none"> <li>(cancer causing) gene identified / eq ;</li> <li>gene {cut / isolated / eq} from DNA / eq ;</li> <li>using a {restriction / eq} enzyme / eq ;</li> <li>gene in {vector / named vector} ;</li> <li>mechanism for getting {gene/vector} into host cells (of mice) / eq ;</li> </ol>	<p>ACCEPT 4 – named examples including retrovirus, virus, liposome</p> <p>ACCEPT 5 - reference to (micro)injection, microprojectiles, electroporation, gene gun, inhaler</p>	(2)

Question Number	Answer	Additional Comments	Mark
*2(e)	<p>QWC – Spelling of technical terms (<i>shown in italics</i>) must be correct and the answer must be organised in a logical sequence</p> <ol style="list-style-type: none"> <li>{ <i>neurone</i> (cell) surface membrane exposed / no <i>myelination</i> / eq} at nodes of <i>Ranvier</i> ;</li> <li>Nodes are the site of clusters of { <i>sodium-gated channel proteins</i> / <i>potassium channels</i> } ;</li> <li>Which {open / close} when <i>impulse</i> arrives / eq ;</li> <li>Allowing <i>depolarisation</i> at nodes / eq ;</li> <li>idea that <i>myelin</i>/eq acts as an (electrical) <i>insulator</i> (on <i>neurone</i> surface between nodes) ;</li> <li>reference to <i>Schwann</i> cell ;</li> <li>idea that <i>impulse/depolarisation</i> ‘jumps’ to next node ;</li> <li>Reference to this being <i>saltatory conduction</i> ;</li> <li>idea that this happens between the <i>myelin</i> layers of the <i>Schwann</i> cell ;</li> </ol>	ACCEPT 3 - influx of sodium ions	(5)

Question Number	Answer	Additional Comments	Mark
2(f)	<ol style="list-style-type: none"> <li>idea of heart working less efficiently ;</li> <li>idea of less oxygen absorbed at lungs / eq ;</li> <li>less blood pumped to brain ;</li> <li>concentration gradient (for oxygen) at brain reduced / eq ;</li> <li>less oxygen in blood (in brain) diffuses into brain tissue / eq ;</li> <li>idea of less oxygen in brain tissue due to continual (aerobic) respiration ;</li> </ol>		(3)

Question Number	Answer	Additional Comments	Mark
2(g)	gonadotrophin-releasing (hormone) stimulates gonadotrophin release / gonadotrophin stimulates ovulation / testosterone stimulates {sperm production / (male) secondary sexual characteristics / other named example} ;		(1)

Question Number	Answer	Additional Comments	Mark
2(h)	<ol style="list-style-type: none"> <li>idea of effect on mitochondria ;</li> <li>(therefore) reduced {energy / ATP / eq} for flagellum movement ;</li> </ol>	ACCEPT 1 - less efficient /fewer / none	(2)

Question Number	Answer	Additional Comments	Mark
2(i)	1. idea that fat is an energy store ; 2. reduces dependence on external food source / eq ; 3. enables disperser to travel / eq ; 4. (metabolic) water is released (on oxidation) / eq ; 5. acts as a thermal insulator / eq ;	ACCEPT 1 - energy-rich	(3)

Question Number	Answer	Additional Comments	Mark
2(j)	1. idea that unfamiliar males are likely to be genetically different ; 2. idea that this is outbreeding ; 3. idea that this increases genetic diversity ;	ACCEPT 3 - producing offspring that are genetically different	(2)

Question Number	Answer	Additional Comments	Mark
2(k)	the order of the {bases / genes and non-coding sequences / eq} in the DNA (of the naked mole rats) is found / eq ;	ACCEPT - exons and introns	(1)

Question Number	Answer	Additional Comments	Mark
2(I)	Paired responses: 1. reduced sensitivity to chemical pain / disconnection of 'pain nerves' ; 2. Idea of pain relief e.g. dealing with post traumatic pain, post surgical pain, joint pain after a knee operation ;  3. haemoglobin has higher affinity for oxygen ; 4. idea of dealing with reduced oxygen situations such as due to a heart attack or stroke ;  5. naked mole rat {incisors / eq } grow through skin (of lip) without damage ; 6. idea of better prosthesis e.g. new {coatings / permanent seal} at {skin / bone / metal} interface, soft tissue not damaged, avoid infection ;  7. high protein stability / does not (easily) lose 3D shape ; 8. (so) reduced effect of oxidative {damage / stress} / reduced effect of oxygen-containing free radicals / live healthily into old age ;  9. cell overcrowding early warning gene / ref. to two tiered contact inhibition / presence of gene p16 ; 10.idea of cancer prevention e.g. cancer resistance, future cancer therapy ;  11.naked mole rat neurones display immature {characteristics / physiological properties} / brain cells that cope with {low oxygen / hypoxia} ; 12.to treat people with temporary loss of oxygen to brain e.g. heart attack, stroke, drowning / to prevent permanent brain damage ;  13.high levels of oxytocin receptors in {brain / nucleus accumbens}; 14.idea of links to autism ;  15.naked mole rats do not experience menopause ; 16.ref to osteoporosis {treatment / prevention} (without side effects) ;  17.circadian rhythms / sleep patterns of naked mole rats ; 18.idea that may help with sleep disorders ;		(4)

Question Number	Answer	Additional guidance	Mark
<b>3(a)(i)</b>	<ol style="list-style-type: none"> <li>reference to {polymerase chain reaction / PCR} ;</li> <li>polymerase (enzyme) {added / eq} ;</li> <li>idea of need for primers and nucleotides ;</li> <li>{90-98} (°C) → {50-65} (°C) → {70-75} (°C) ;</li> <li>idea that cycle needs to be repeated {several times / to make several copies of DNA / eq} ;</li> </ol>	<b>1. Acce</b> as a ref to PCR machine	<b>(4)</b>

Question Number	Answer	Additional guidance	Mark
<b>3(a)(ii)</b>	(DNA) {profiling / fingerprinting / (gel) electrophoresis} ;	<b>Ignore</b> Southern blotting, PCR <b>Accept</b> DNA profile / DNA fingerprint	<b>(1)</b>

Question Number	Answer	Additional guidance	Mark
<b>3(b)</b>	<ol style="list-style-type: none"> <li>idea of work appearing in a (Scientific) journal or being presented at a conference ;</li> <li>idea that validity or reliability is considered ;</li> <li>by other scientists / ref to peer review ;</li> </ol>	<b>1. Accep</b> publishing a paper, scientific meeting	<b>(2)</b>

Question Number	Answer	Additional guidance	Mark
<b>3(c)(i)</b>	<ol style="list-style-type: none"> <li>reference to different {conditions / environments /eq} (in each region) ;</li> <li>idea of different selection pressures ;</li> <li>idea of {restricted gene flow / separate gene pools} ;</li> <li>reference to reproductive isolation;</li> </ol>	<b>1. Acce</b> appropriate named factor e.g. temperature  <b>3. Igno</b> different allele frequency	<b>(2)</b>

Question Number	Answer	Additional guidance	Mark
<b>3(c)(ii)</b>	<ol style="list-style-type: none"> <li>1. idea of different {alleles/ gene pool} ;</li> <li>2. idea that this leads to {new / different} phenotypes ;</li> <li>3. idea of new {allele / gene} can be {advantage / disadvantage} ;</li> <li>4. reference to (advantageous) {(mutated) gene / (new) allele} passed onto offspring ;</li> </ol>	<p><b>1. Ignore</b> allele frequency</p> <p><b>2. Accept</b> traits / characteristics / features</p>	<b>(2)</b>