

Question Number	Answer	Additional guidance	Mark
<b>1(a)</b>	<ol style="list-style-type: none"> <li>1. alpha glucose in starch and beta glucose in cellulose;</li> <li>2. only {starch / amylopectin} can be branched / cellulose only a linear molecule ;</li> <li>3. starch contains two types of molecule, cellulose only one ;</li> <li>4. alternate monomers rotated through 180° in cellulose only ;</li> <li>5. only {amylopectin / starch} can have 1-6 glycosidic bonds / cellulose has 1-4 glycosidic bonds only ;</li> </ol>	<p>ACCEPT 3 - the two named molecules of starch – amylose and amylopectin</p> <p>ACCEPT 5 – starch can have 1-6 &amp; 1-4 glycosidic bonds but cellulose only 1-4</p>	<b>(2)</b>

Question Number	Answer	Additional guidance	Mark
<b>1(b)(i)</b>	<ol style="list-style-type: none"> <li>1. thermoreceptors in hypothalamus / eq ;</li> <li>2. detect the increase in (core) blood temperature / eq ;</li> <li>3. reference to heat loss centre activated ;</li> <li>4. reference to autonomic nervous system ;</li> <li>5. reference to impulses down motor neurones ;</li> <li>6. to {effectors / named effector} / eq ;</li> <li>7. detail of method of heat loss / eq ;</li> </ol>	<p>ACCEPT 5 - effector neurone for motor neurone</p> <p>ACCEPT 7 – vasodilation of blood vessels, sweat released, heat loss from blood through radiation</p>	<b>(4)</b>

Question Number	Answer	Additional guidance	Mark
<b>1(b)(ii)</b>	<ol style="list-style-type: none"> <li>1. (shivering) is muscle contraction ;</li> <li>2. which uses {respiration / ATP / eq} ;</li> <li>3. which release heat (to warm body) / eq ;</li> </ol>	<p>ACCEPT 2 - oxidative phosphorylation, ATP being converted to ADP and Pi</p>	<b>(2)</b>

Question Number	Answer	Additional guidance	Mark
<b>1(c)</b>	<ol style="list-style-type: none"> <li>1. (cancer causing) gene identified / eq ;</li> <li>2. gene {cut / isolated / eq} from DNA / eq ;</li> <li>3. using a {restriction / eq} enzyme / eq ;</li> <li>4. gene in {vector / named vector} ;</li> <li>5. mechanism for getting {gene / vector} into host cells (of naked mole rats) / 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>	<b>(3)</b>

Question Number	Answer	Additional guidance	Mark
<b>*1(d)</b>	<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>1. idea that this air has higher CO<sub>2</sub> content ;</li> <li>2. {CO<sub>2</sub> level in blood increases / pH of blood falls / eq} ;</li> <li>3. change detected by chemoreceptors in {carotid body / carotid artery / aortic body / aorta / medulla} ;</li> <li>4. reference to {ventilation centre / eq} (in medulla) ;</li> <li>5. sends more impulses along neurones / eq ;</li> <li>6. to intercostal muscles / diaphragm / eq ;</li> <li>7. causing an increased {ventilation rate / rate of breathing / depth of breathing} / eq ;</li> </ol>	<p>ACCEPT 2 - high, higher (for CO<sub>2</sub>)</p> <p>ACCEPT 4 – respiratory centre, inspiratory centre for ventilation centre</p> <p>ACCEPT 5 – impulses sent more often</p>	<b>(5)</b>

Question Number	Answer	Additional guidance	Mark
<b>1(e)</b>	<ol style="list-style-type: none"> <li>1. naked mole rat's {incisors / eq} grow through {skin / lip} without {damage / eq} ;</li> <li>2. lead to new {coatings / permanent seal /eq} at {skin / bone / metal} interface ;</li> <li>3. so soft tissue is {not damaged / eq } (by the prosthetic) / eq ;</li> </ol>		<b>(2)</b>
Question Number	Answer	Additional guidance	Mark
<b>1(f)</b>	gonadotrophin-releasing (hormone) and anterior pituitary / gonadotrophins and {ovaries / testes} ;	ACCEPT - testosterone and testes ACCEPT - gonads for testes or ovaries	<b>(1)</b>

Question Number	Answer	Additional guidance	Mark
<b>1(g)</b>	<ol style="list-style-type: none"> <li>1. idea of irregularity of flagellum ;</li> <li>2. Idea of irregularity associated with mid-region ;</li> </ol>	ACCEPT 1 – no or more than one flagellum ACCEPT 2 – not enough mitochondria	<b>(2)</b>

Question Number	Answer	Additional guidance	Mark
<b>1(h)</b>	<ol style="list-style-type: none"> <li>1. idea of high levels of inbreeding ;</li> <li>2. low level of genetic diversity / eq ;</li> <li>3. idea that there is some variation because more than one male is involved in ;</li> <li>4. unfamiliar males used as mates (by queen) / eq ;</li> <li>5. fusion of colonies / eq ;</li> <li>6. arrival of a dispersal phenotype (from a different colony) ;</li> <li>7. mutations / eq ;</li> </ol>	<p>ACCEPT 1 – accept idea in context of only one queen/female breeds</p> <p>ACCEPT 2 – restricted gene pool, low genetic variation</p>	<b>(3)</b>

Question Number	Answer	Additional guidance	Mark
<b>1(i)</b>	<ol style="list-style-type: none"> <li>1. reduces inbreeding (depression) / eq ;</li> <li>2. increases outbreeding / outbreeding qualified ;</li> <li>3. (leading to) increase in genetic diversity ;</li> <li>4. idea of colony size regulation ;</li> <li>5. idea of increase in fecundity ;</li> <li>6. idea of increased chance of survival ;</li> </ol>	<p>ACCEPT 1 - less genetic drift</p> <p>ACCEPT 2 – disperser/new comer more likely to breed</p> <p>ACCEPT 3 – increased genetic variation, increase in variety of alleles</p> <p>ACCEPT 6 – appropriate ref to natural selection, due to environmental changes</p>	<b>(2)</b>

Question Number	Answer	Additional guidance	Mark
<b>1(j)</b>	<p>Paired responses:</p> <ol style="list-style-type: none"> <li>1. reduced sensitivity to chemical pain / disconnection of 'pain nerves' ;</li> <li>2. high CO<sub>2</sub> in air (of tunnels) ;</li> <li>3. haemoglobin has higher affinity for oxygen / brain can tolerate eq ;</li> <li>4. low O<sub>2</sub> levels (in tunnels) / eq ;</li> <li>5. increased number of oxytocin receptors in brain ;</li> <li>6. overcrowding / eq ;</li> <li>7. non-pigmented ;</li> <li>8. lack of UV light ;</li> <li>9. outbreeding mechanisms such as disperser;</li> <li>10. low genetic diversity ;</li> <li>11. hairless/ naked/ reduction of sweat gland / loose skin / no insulating layer / poikilothermic ;</li> <li>12. due to nature of its temperature environment / eq ;</li> <li>13. teeth arrangement / eq ;</li> <li>14. for digging underground ;</li> <li>15. keen sense of smell/reduce eyesight / ref to circadian rhythms ;</li> <li>16. dark conditions ;</li> <li>17. division of labour ;</li> <li>18. for the survival of the eusocial colony ;</li> </ol>	<p>ACCEPT1 - lack or receptor for chemical pain</p> <p>ACCEPT 3 – ref to brain's hypoxia response, neurones or brain resistance to hypoxia</p> <p>ACCEPT13 - forward of lips or long</p>	<b>(4)</b>

Question Number	Answer	Mark
<b>2(a)</b>	<ol style="list-style-type: none"> <li>1. correct measurements of wall without plaque = {8 +/- 1} (mm) ;</li> <li>2. correct measurements of wall with plaque = {25 +/- 2} (mm);</li> <li>3. correct calculation ;</li> </ol>	<b>(3)</b>

Question Number	Answer	Mark
<b>2(b)(i)</b>	<ol style="list-style-type: none"> <li>1. reference to decrease in (energy /ATP) (with time) ;</li> <li>2. idea that the drop in the fall of (energy /ATP) gets less with time ;</li> <li>3. credit correct manipulation of figures ;</li> </ol>	<b>(2)</b>

Question Number	Answer	Mark
<b>2(b)(ii)</b>	<ol style="list-style-type: none"> <li>1. idea of {less / no / eq} oxygen (available) ;</li> <li>2. idea of {less / no / eq} {respiratory substrate / glucose / eq} ;</li> <li>3. {less / no/ eq} (cellular/ aerobic) respiration / eq ;</li> </ol>	<b>(2)</b>

Question Number	Answer	Mark
<b>2(b)(iii)</b>	<ol style="list-style-type: none"> <li>1. idea that at 8 minutes insufficient {energy / ATP} is available for contraction ;</li> <li>2. idea that after 20 minutes the {energy / ATP} levels are too low to sustain cell survival ;</li> <li>3. credit correct value for {energy / ATP} availability read from graph e.g. 50-52 % at 8 min / 22-24% at 20 min ;</li> <li>4. credit one other named use of {energy / ATP} e.g. active transport</li> <li>5. idea that lactic acid {inhibits contraction / inhibits enzymes / eq} ;</li> </ol>	<b>(3)</b>

Question Number	Answer	Mark
<b>2(b)(iv)</b>	<ol style="list-style-type: none"> <li>1. idea that (restored blood flow) provides (muscle /cells) with oxygen / removes lactic acid / eq ;</li> <li>2. (aerobic) respiration {rate increases / restarts / eq} ;</li> </ol>	<b>(2)</b>