

| Question Number | Answer | Additional Comments | Mark |
|-----------------|-----------------------|---------------------|------|
| 1(a) (i) | (terminal) dendrite ; | | (1) |

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| 1(a) (ii) | B ; | | (1) |

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| 1(b) (i) | 1. Increasing eugenol concentration increase percentage inhibition / positive correlation ; 2. Description of non linear correlation ; 3. Credit correct manipulation of the data e.g. 0.8 mmol dm ⁻³ increase causes percentage inhibition to increase by {x 2.7 / eq} ; | ACCEPT 2 - greatest increase is between 0.2 & 0.4 | (2) |

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| 1(b) (ii) | 72.5 / 73.0 / 75 (%) ; ; | ACCEPT - for 1 mark (65 + 80) ÷ 2 or 145 ÷ 2 if answer incorrect | (2) |

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| *1(c) | <p>QWC – Spelling of technical terms (shown in italics) must be correct and the answer must be organised in a logical sequence</p> <ol style="list-style-type: none"> 1. higher concentration of Na⁺ outside of neurone / eq ; 2. sodium ions move in causing a depolarisation / eq ; 3. eugenol may affect { Na⁺ / voltage-dependent } gates / eq ; 4. eugenol reduces influx of Na⁺ / eq ; 5. (so) depolarisation less likely to occur / eq ; 6. no impulse transmitted along neurone / eq ; 7. idea of no transmission to next neurone ; 8. idea of pain not being sensed as impulse stopped before entering CNS ; | <p>ACCEPT 7 - no release of neurotransmitter</p> | <p>(6)</p> |

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

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

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| 2(c) (i) | idea that body temperature of animal mimics the ambient temperature ; | ACCEPT - body temp follows environmental temperature | (1) |

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

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

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| *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"> {<i>neurone</i> (cell) surface membrane exposed / no <i>myelination</i> / eq} at nodes of <i>Ranvier</i> ; Nodes are the site of clusters of {<i>sodium-gated channel proteins</i> / <i>potassium channels</i>} ; Which {open / close} when <i>impulse</i> arrives / eq ; Allowing <i>depolarisation</i> at nodes / eq ; idea that <i>myelin</i>/eq acts as an (electrical) <i>insulator</i> (on <i>neurone</i> surface between nodes) ; reference to <i>Schwann</i> cell ; idea that <i>impulse/depolarisation</i> 'jumps' to next node ; Reference to this being <i>saltatory conduction</i> ; idea that this happens between the <i>myelin</i> layers of the <i>Schwann</i> cell ; | ACCEPT 3 - influx of sodium ions | (5) |

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| 2(f) | 1. idea of heart working less efficiently ; 2. idea of less oxygen absorbed at lungs / eq ; 3. less blood pumped to brain ; 4. concentration gradient (for oxygen) at brain reduced / eq ; 5. less oxygen in blood (in brain) diffuses into brain tissue / eq ; 6. idea of less oxygen in brain tissue due to continual (aerobic) respiration ; | | (3) |

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| 2(g) | gonadotrophin-releasing (hormone) stimulates gonadotrophin release / gonadotrophin stimulates ovulation / testosterone stimulates {sperm production / (male) secondary sexual characteristics / other named example} ; | | (1) |

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| 2(h) | 1. idea of effect on mitochondria ; 2. (therefore) reduced {energy / ATP / eq} for flagellum movement ; | ACCEPT 1 - less efficient / fewer / none | (2) |

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| 2(i) | <ol style="list-style-type: none"> 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) |

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| 2(j) | <ol style="list-style-type: none"> 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) |

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| 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) |

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| 2(I) | <p>Paired responses:</p> <ol style="list-style-type: none"> 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 ; | | |