

| Question Number | Answer | Additional guidance | Mark |
|-----------------|---|-------------------------|------------|
| 1(a) | <ol style="list-style-type: none"> 1. Chromosomes / eq (continue to) condense ; 2. Nuclear envelope breaks down ; 3. Spindles (fibres) form ; 4. Nucleolus breaks down / eq ; | 1 IGNORE become visible | (3) |

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| 1(b) | <ol style="list-style-type: none"> 1. (pH sensitive cells) detect a change in blood pH / eq ; 2. These are in the {carotid body / carotid artery / aortic body / aorta / medulla } ; 3. Alter impulse rate to brain / eq ; 4. Ref to cardiac centre ; 5. in medulla ; 6. Change impulse rate of SAN ; | | (4) |

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| 1(c) | <ol style="list-style-type: none"> 1. Idea that reproduce rapidly / {robust/hardy} so many can be formed rapidly ; 2. Easy to culture / eq ; 3. (HeLa cells) susceptible to disease / HPV / eq ; 4. Genome known / eq ; 5. Idea that they have no Hayflick limit ; | <ol style="list-style-type: none"> 2. ACCEPT cheaper (as continual supply) 3. ACCEPT other named disease 4 ACCEPT ref to (HeLa) cells are human | (3) |

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| * 1(d) | <p>(QWC – spelling of technical terms must be correct and the answer must be organised in a logical sequence)</p> <ol style="list-style-type: none"> 1. Phospholipid bilayer ; 2. Idea of its hydrophobic properties inhibit movement of ions across membrane ; 3. Na⁺ gated channel present ; 4. To allow Na⁺ to enter during depolarisation / to open when local currents occur ; 5. K⁺ channels ; 6. To allow K⁺ to diffuse ; 7. Sodium–potassium pump / eq ; 8. To {export Na⁺/ import K⁺} ; 9. Role of pump in neurone membrane ; 10. Idea that only parts of the membrane may be involved e.g. nodes of Ranvier ; | <p>QWC emphasis is logical sequence IGNORE myelin sheath comments?</p> <p>3. ACCEPT voltage-gated / protein channels</p> <p>9 ACCEPT role with regard to the resting potential ; 10. ACCEPT salutatory condition ;</p> | (6) |

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| 1(e) | <ol style="list-style-type: none"> 1. Idea of double stranded only in HeLa ; 2. Idea of too many H bonds in HeLa / {complementary bases / base pairs} ; 3. Thymine only found in HeLa genetic material / uracil only in poliovirus ; 4. Sugar present in HeLa is deoxyribose / ribose in poliovirus / eq ; | 1 ACCEPT double helix in HeLa only | (3) |

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| 1(f) | <ol style="list-style-type: none"> 1. brown shown as dominant / white shown as recessive e.g. use of upper and lower case; <p>Parental generation:</p> <ol style="list-style-type: none"> 2. both types shown as homozygous ; <p>F1:</p> <ol style="list-style-type: none"> 3. All shown as heterozygous ; <p>F2:</p> <ol style="list-style-type: none"> 4. Genetic diagram to show that 75% are brown / 25% are white ; | <p>This could be gleaned from gametes</p> <p>4. Diagram should show genotypes</p> | (4) |

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| 1(g) | 1. Allow continual division (of hybrid) ; 2. Idea of continual production of (monoclonal) antibodies ; | 1. ACCEPT division is rapid / eq; | (2) |

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| 1(h) | 1. Modification of {genome / DNA / eq} ; 2. Ref to the addition of {genetic material / eq} from another {organism / species / eq} / eq ; | | (2) |

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| 1(i) | D (2^{50}) ; | (1) |

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| 1(j) | Any two for 1 mark: Carbon/hydrogen/oxygen/nitrogen ; ; | ACCEPT as chemical symbols | (2) |

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| 2(a) (i) | B ; | | (1) comp |
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| 2 (a) (ii) | B ; | | (1) comp |
| Question Number | Answer | Additional Guidance | Mark |
| 2 (a) (iii) | C ; | | (1) comp |
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| 2 (b) (i) | C ; | | (1) comp |
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| 2 (b) (ii) | D ; | | (1) comp |
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| 2 (c) | nucleus ; | ACCEPT chloroplast, mitochondria | (1) clerical |

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| 2 (d) (i) | Advantage any one from: <ol style="list-style-type: none"> prevent child dying late in pregnancy / eq idea of less stress for parents / eq parents can prepare for child { with / without } achondroplasia / eq idea of making an informed choice ; Disadvantage any one from: <ol style="list-style-type: none"> risk of miscarriage of healthy child / eq idea of more stress for parents / eq cost / eq risk of false { negatives / positives } / eq ; | <ol style="list-style-type: none"> CCEPT may choose termination CCEPT risk of spontaneous abortion | (2) p |

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| 2 (d) (ii) | <ol style="list-style-type: none"> genotype of parents shown ; alleles in the gametes shown ; possible genotype of children shown AND corresponding phenotypes shown ; (probability =) $1/4$ / 25% / 1 in 4 / 0.25 ; | <ol style="list-style-type: none"> NOT a ratio e.g. 1:4 ACCEPT $1/3$, 33(.3)% , 1 in 3, 0.3 this assumes AA dies | (4) p |

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| * 3(a) QWC | <p>(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)</p> <ol style="list-style-type: none"> 1. {damage / eq} to {endothelial cells/ epithelial cells / lining / eq} of artery ; 2. ref to inflammatory response ; 3. ref to migration of white blood cells into area / eq ; 4. build up of cholesterol /eq ; 5. reference to formation of atheroma / plaque ; 6. reference to {calcium salts / fibrous tissue} ; 7. ref to {loss of elasticity (of artery) / narrowing of lumen} / eq ; 8. idea that this process is self-perpetuating ; | (4) |

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| 3(b)(i) | {the alleles / eq} present (in an organism) / eq ; | (1) |

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| 3(b)(ii) | a (different) form of one gene / eq ; | (1) |

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| 3(c) | <p>Any two from: More saturated fat / more cholesterol / more salt / obesity / more alcohol / more age / male / post-menopausal women / high blood pressure / smoking / diabetes / less activity / stress ;</p> | (1) |

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| 3(d) | <ol style="list-style-type: none"> 1. muscle {inflammation / pain / eq} ; 2. liver {damage / failure/ eq} ; 3. joint {aches / pains/ eq} ; 4. nausea/constipation/diarrhoea ; 5. kidney {damage / failure / eq} ; 6. cataracts ; 7. diabetes ; 8. allergies / skin inflammation / skin rash / eq ; 9. respiratory problems / persistent cough / eq ; 10.headaches / dizziness / depression ; | (2) |