

Question Number	Answer	Additional Guidance	Mark
1(a)(i)	1. life expectancy is likely to be lower than {Aa / heterozygote} ;  2. because of higher chance of (developing) malaria / eq ;  <b>OR</b>  3. life expectancy may be {higher / same } than {aa / homozygous recessive} ;  4. because of {less / similar} severity of anaemia ;		(2)

Question Number	Answer	Additional Guidance	Mark
1(a)(ii)	1. idea they (heterozygotes) are less likely to have { malaria / anaemia } ;  2. idea that { Plasmodium / parasite / eq } unable to reproduce (and cause wider infection)  <b>OR</b> lower (functional) red blood cell count / blocking of blood vessels causes {pain / cell death / eq} ;	2 <b>ACCEPT</b> parasite will die	(2)

Question Number	Answer	Additional Guidance	Mark
1(b)	<b>(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)</b>  1. reference to change in primary structure ;  2. reference to different R group ;  3. leading to different named bond e.g. ionic, hydrogen, disulfide ;  4. different { folding / secondary / tertiary / 3D structure / globular } ;  5. suggested change in properties of the haemoglobin e.g. change in solubility, flexibility, affinity for oxygen / eq ;	<b>QWC emphasis is on logical sequence</b> <b>Maximum of 3 from Mps 1 to 4</b>  1. <b>IGNORE</b> sequence of amino acids  3. <b>ACCEPT</b> type or position of bonds <b>IGNORE</b> peptide  5. <b>ACCEPT</b> {less/no} oxygen will bind to haemoglobin	(4)

Question Number	Answer	Additional Guidance	Mark
2(a)	<ol style="list-style-type: none"> <li>involves prophase, metaphase, anaphase and telophase ;</li> <li>idea that produces two nuclei ;</li> <li>idea that these are genetically identical to original ;</li> </ol>	IGNORE ref to 46 chromosomes unqualified IGNORE ref to body cells/somatic cells unqualified  <ol style="list-style-type: none"> <li>NOT if cytokinesis or interphase included as part of mitosis</li> <li>ACCEPT produces two cells</li> <li>ACCEPT parental ACCEPT clones (of parent) IGNORE repair, growth, asexual reproduction</li> </ol>	(2)

Question Number	Answer	Additional Guidance	Mark
2(b)	<ol style="list-style-type: none"> <li>(SAN) is myogenic / description given ;</li> <li>electrical activity from SAN causes atria to contract / eq ;</li> <li>idea that activity of SAN can be changed by nerve impulses e.g controlled by medulla ;</li> <li>credit detail of nervous control e.g. more impulses from accelerator increases heart rate ;</li> </ol>	<ol style="list-style-type: none"> <li>ACCEPT more { impulses from sympathetic / noradrenaline} increases heart rate more { impulses from vagus / more impulses from parasympathetic / acetylcholine} decreases heart rate</li> </ol>	(3)

Question Number	Answer	Additional Guidance	Mark
2(c)	<ol style="list-style-type: none"> <li>idea that lactase gene {activated / transcribed} ;</li> <li>(synthesis of) lactase / eq ;</li> <li>hydrolysis of lactose / glycosidic bonds broken ;</li> <li>to produce glucose AND galactose ;</li> </ol>		(3)

Question Number	Answer	Additional Guidance	Mark
2(d)	<ol style="list-style-type: none"> <li>idea that a better model than guinea pigs or mice ;</li> <li>idea of animal rights ;</li> <li>easy to culture / eq ;</li> <li>(HeLa cells) susceptible to disease / HPV / eq ;</li> </ol>	<ol style="list-style-type: none"> <li>ACCEPT ref to only HeLa {cells/DNA} are human</li> <li>ACCEPT {fewer / no} ethical issues welfare of animals</li> <li>ACCEPT cheaper (as continual supply)</li> </ol>	(2)

Question Number	Answer	Additional Guidance	Mark
* 2(e)	<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"> <li>idea that {motor neurone / cell body / nucleus} is destroyed ;</li> <li>depolarisation does not occur in the neurone / (insufficient so ) no action potential set up in the neurone ;</li> <li>detail of (depolarisation / action potential) not occurring in neurone e.g. Idea <math>\text{Na}^+</math> does not diffuse into neurone ;</li> <li>{neurotransmitter / named neurotransmitter} not{released / produced / eq} at junction with muscle / eq ;</li> <li>detail of lack of neurotransmitter release e.g. vesicles (containing neurotransmitter) do not {move / fuse} with {presynaptic membrane / eq} / eq ;</li> <li><math>\text{Ca}^{2+}</math> not released into muscle cytoplasm ;</li> <li><math>\text{Ca}^{2+}</math> not released from sarcoplasmic reticulum ;</li> <li>no <math>\text{Ca}^{2+}</math> to {activate / eq} troponin ;</li> <li>idea that muscle does not contract ;</li> </ol>	<p>QWC emphasis is clarity of expression</p> <ol style="list-style-type: none"> <li>Accept idea of damage to myelin sheath/Schwann cells</li> <li>CCEPT <math>\text{Na}^+</math> / cation channels {non-functional / eq}</li> <li>CCEPT {neurotransmitter / named neurotransmitter} not{released / produced / eq} at {motor neurone presynaptic membrane / motor end plate}</li> <li>CCEPT <math>\text{Ca}^{2+}</math> not released into sarcoplasm</li> </ol>	(6)

Question Number	Answer	Additional Guidance	Mark
2(f)	<ol style="list-style-type: none"> <li>1. contains basis / eq ;</li> <li>2. contain phosphate (groups) ;</li> <li>3. have a pentose sugar ;</li> <li>4. reference to phosphodiester bonds ;</li> <li>5. idea of discrete strands ;</li> </ol>	<p>NB If candidates consider viral genetic material in terms of DNA produced from RNA then still works</p> <ol style="list-style-type: none"> <li>1. ACCEPT both have (4) bases / nucleotides</li> <li>3. ACCEPT 5C sugar</li> <li>4. ACCEPT phosphoester</li> <li>5. ACCEPT linear</li> </ol>	<b>(3)</b>

Question Number	Answer	Additional Guidance	Mark
2(g)	<ol style="list-style-type: none"> <li>1. smooth shown as dominant / wrinkled shown as recessive e.g. use of upper and lower case ;</li> </ol> <p><b>Parental generation:</b></p> <ol style="list-style-type: none"> <li>2. both types shown as homozygous ;</li> </ol> <p><b>F1:</b></p> <ol style="list-style-type: none"> <li>3. all shown as heterozygous ;</li> </ol> <p><b>F2:</b></p> <ol style="list-style-type: none"> <li>4. genetic diagram to show that 75% are smooth / 25% are wrinkled ;</li> </ol>	<p>these could be gleaned from gametes</p> <ol style="list-style-type: none"> <li>4. diagram should show genotypes</li> </ol>	<b>(4)</b>

Question Number	Answer	Additional Guidance	Mark
2(h)	<ol style="list-style-type: none"> <li>all the {DNA / eq} found in {a human / the human species / eq} ;</li> <li>idea of genes {on different chromosomes / different positions on same chromosome} ;</li> </ol>	<ol style="list-style-type: none"> <li>ACCEPT all the bases / introns and exons for DNA eq ACCEPT population for species</li> <li>ACCEPT locus/loci for position</li> </ol>	(2)

Question Number	Answer	Additional Guidance	Mark
2(i)	<ol style="list-style-type: none"> <li>product (of p53 gene) {stops / eq} development of tumour cells / eq  OR product {stops / regulates} progression {of cell cycle / towards mitosis} ;</li> <li>acts as an inhibitor of {transcription / protein synthesis / eq} / eq ;</li> <li>idea that {DNA / eq} repair ;</li> <li>idea that leads to apoptosis ;</li> </ol>	<ol style="list-style-type: none"> <li>ACCEPT product stops tumour cells growing/ dividing</li> <li>ACCEPT keeps it in interphase / named mitotic stage / interferes with mitosis progress</li> <li>ACCEPT shortens telomeres</li> </ol>	(2)

Question Number	Answer	Additional Guidance	Mark
2(j)	<ol style="list-style-type: none"> <li>protein / glycoprotein ;</li> <li>reference to this being CD4 ;</li> <li>found on cell (surface) membrane / eq ;</li> <li>that acts as a {receptor / named receptor} for HIV / eq ;</li> </ol>	<ol style="list-style-type: none"> <li>IGNORE ref to haemoglobin</li> <li>ACCEPT receptor for gp120</li> </ol>	(2)

Question Number	Answer	Mark
2(k)	200 (nucleotides) ;	Clerical (1)