

Question Number	Answer	Additional Guidance	Mark
1(a)(i)	<ol style="list-style-type: none"> idea that potassium (ion) gradient is greater than sodium (ion) gradient ; Credit correct comparative manipulation of the data ; idea of concentration gradients act in different directions / eq ; 	<p>1 ACCEPT steeper, higher for greater</p> <p>2 ACCEPT e.g (K⁺ gradient is greater than gradient for Na⁺) by 10 mmol dm⁻³, ratio e.g. 1:10 and 30:1</p>	(2)

Question Number	Answer	Additional Guidance	Mark
1(a)(ii)	<ol style="list-style-type: none"> idea that proteins act as channels ; <p>Repolarising:</p> <ol style="list-style-type: none"> (most voltage-dependent) { sodium / Na⁺ } { channels / eq } closed ; sodium ions cannot (continue to) enter { neurone / cytoplasm / eq } ; <p>Resetting after hyperpolarisation:</p> <ol style="list-style-type: none"> (voltage-dependent) { potassium / K⁺ } { channels / eq } close ; sodium-potassium pump imports (two) potassium ions and exports (three) sodium ions / eq ; 	<p>IGNORE: descriptions of depolarisation/action potentials</p> <p>1 ACCEPT gates for channels</p>	(4)

Question Number	Answer	Additional Guidance	Mark
1(b)	<ol style="list-style-type: none"> idea that Ca²⁺ enters synaptic bouton ; vesicles containing neurotransmitter / eq ; { move towards / fuse with presynaptic membrane / eq } / reference to exocytosis (of neurotransmitter) ; 	<p>1 ACCEPT for 1: knob, button, presynaptic neurone for bouton, through presynaptic membrane</p> <p>3 ACCEPT neurotransmitter released into synaptic {gap / cleft}</p> <p>IGNORE: vesicles being released</p>	(3)

Question Number	Answer	Additional Guidance	Mark
2(a)(i)	<p>correct answer with units gains full marks</p> <p>1. $5 \div 90$;</p> <p>2. $= \{ 0.056 / 0.06 \}$ au min⁻¹ ;</p> <p>OR</p> <p>3 $[(0.3 \div 30) + (3.7 \div 30) + (1 \div 30) \div 3]$;</p> <p>4 = $\{0.054 / 0.05\}$ au min⁻¹ ;</p>	<p>ACCEPT answer expressed as e.g. 3.6 au per hour</p> <p>2 ACCEPT au/min, au per min</p>	(2)

Question Number	Answer	Additional Guidance	Mark
2(a)(ii)	<p>1. idea that rate of use is greater than uptake from gut ;</p> <p>2. idea that L-Dopa leaves the blood into tissues ;</p> <p>3. L-Dopa crosses the blood-brain barrier / eq ;</p> <p>4. converted to dopamine / eq ;</p> <p>5. L-Dopa is broken down / eq ;</p>	<p>1 IGNORE: less being absorbed, running low in gut unqualified</p> <p>4 ACCEPT L-Dopa is a precursor to dopamine</p> <p>5 ACCEPT metabolised for broken down</p>	(4)

Question Number	Answer	Additional Guidance	Mark
2(b)(i)	<p>when{ touched / eq } the tentacles { not pulled into body / remain outside body / eq } ;</p>	<p>ACCEPT: no response when touched / no reaction to stimulus</p>	(1)

Question Number	Answer	Additional Guidance	Mark
2(b)(ii)	<p>1. use habituated sea anemone / eq ;</p> <p>2. idea of stimulate after leaving for different lengths of time ;</p> <p>3. idea of repetition at each different time ;</p> <p>4. note time when anemone responds to being touched / eq ;</p>	<p>2 ACCEPT examples given</p> <p>4 ACCEPT note time when withdraws tentacles into body</p>	(3)

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

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

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

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

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

Question Number	Answer	Additional Guidance	Mark
3(f)	<ol style="list-style-type: none"> contains basis / eq ; contain phosphate (groups) ; have a pentose sugar ; reference to phosphodiester bonds ; idea of discrete strands ; 	<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"> ACCEPT both have (4) bases / nucleotides ACCEPT 5C sugar ACCEPT phosphoester ACCEPT linear 	(3)

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

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

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

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

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