

Question number	Answer	Additional guidance	Mark
3(a)(i)	An answer that includes the following points		Graduate (2)
	Label	Part	
	L	dendrites	
	M	cell body / centron	
	N	axon	
	O	(pre)synaptic {endings /knob/bulb}	
		all correct 2 marks 1 or 2 or 3 correct 1 mark 0 correct 0 marks accept dendrite / dendron accept axon terminal do not accept synapse(s)	

Question number	Answer	Additional guidance	Mark
3(a)(ii)	D is the correct answer - A in not correct because lidocaine inhibits sodium ion channels - B in not correct because lidocaine inhibiting sodium ion channels - C in not correct because lidocaine inhibiting sodium ion channels		Computer (1)

Question number	Answer	Additional guidance	Mark
5(a)	An explanation that includes two of the following points: - because of semiconservative replication (1) - both (parent / original) strands acting as a <u>template</u> (for synthesis of new strands) (1) - because a <u>complementary</u> strand is made against each parent strand / description of binding of <u>complementary</u> nucleotides to parent strands (1)	ACCEPT nucleotide with adenine binds with thymine (on template) etc IGNORE complementary bases NB a complementary strand is made against each template strand = 2 marks	(2)

Question number	Answer	Additional guidance	Mark
5(b)	A description that includes three of the following points: - to produce {a (poly)peptide chain / (correct) order of amino acids} (1) - mRNA involved in transcription and tRNA involved in translation (1) - mRNA carries a <u>copy</u> of the gene {out of the nucleus / into the cytoplasm / to the ribosomes} (1) - tRNA holds the specific amino acid {in place / until the peptide bonds have formed} (1)	PIECE TOGETHER ACCEPT {(genetic) code / DNA base sequence / DNA bases / DNA / genetic instructions} NB copy is the noun not the verb ACCEPT appropriate / corresponding / particular / a certain for specific carries specific amino acid to the mRNA	(3)

Question number	Answer	Additional guidance	Mark
5(c)(i)	An answer that includes the following points: Advantage: {visual / clear / easy / simple} (way of presenting data / to understand) (1) Disadvantage: - cannot {compare / interpret} (polygons with) different shapes (but similar size) (1)	ACCEPT areas of polygons cannot be {compared / (easily) determined} values for {percentages / mass / proportions} not given IGNORE confusing unless qualified	(2)

Question number	Answer	Additional guidance	Mark
*5(c)(ii)	Indicative content: - DNA would increase - because DNA synthesis / replication will take place / each new cell will need a copy of the DNA - DNA would decrease - as only one of each molecule in each cell - description of change in glycogen / lipids / other molecules - explanation for change in glycogen / lipids linked to energy requirements (once) - glycogen decreases as broken down into glucose - change in lipids linked to role in membranes - change in glucose linked to energy requirements - change in phospholipids linked to membrane requirements - increase in proteins - needed (as enzymes) in DNA synthesis/ structural proteins - increase in mRNA - as there will be more transcription for protein synthesis - increase in tRNA / rRNA - as there will be more for translation Stage 1: Bacterial cell preparing to divide - proportion of other components would decrease - if increase in DNA Stage 2: One of the two daughter cells formed - proportion of components would be the same as in the cell preparing for division - once DNA split between two cells Stage 3: One of the daughter cells as it increases in size - proportion of DNA will decrease as other components increase Cells at end of process / cell prepares to divide again - Voronoi diagram would look identical to the one in diagram / original as cells are genetically identical	Level 1 Simple description / explanation 1 mark = one description of a change 2 marks = one simple explanation of a change Level 2 Explanations of changes, not necessarily linked clearly to stages / proportions 3 marks = explanations of changes in two {molecules / Voronoi diagram} 4 marks = explanations of changes in three {molecules / Voronoi diagram} Level 3 Explanations linked to a stage and proportion on the diagram 5 marks = explanations of changes in four {molecules / Voronoi diagram} with some link made to the stages 6 marks = four explanations of {molecules / Voronoi diagram} with some link made to the stages and either includes 'other' molecules or the relative changes in proportion / area in diagram	(6)

Question number	Answer	Additional guidance	Mark
5(a)	An explanation that includes the following points: - because the mutated gene results in a faulty (CFTR) protein (1) - so chloride ions do not move out of the cells (1) - decreasing the water potential inside the cell (1) - therefore water (leaves the mucus / enters the cells) by <u>osmosis</u> (1)	ACCEPT less effective ACCEPT reduced movement of chloride ions / sodium ion channel not inhibited / sodium ions not prevented from entering cell ACCEPT decreasing (osmotic potential / solute potential) / increasing solute concentration IGNORE decreasing water concentration	(3)

Question number	Answer	Additional guidance	Mark
5(b)	An explanation that includes five of the following points: - because the mucus blocks the airways (1) - therefore (air flow to lungs / gas exchange) is reduced (1) - because mucus prevents <u>pancreatic</u> enzymes from entering the small intestine (1) - therefore large food molecules not broken down (and cannot be absorbed) (1) - because the mucus prevents sperm passing through the cervix (1) - therefore sperm cannot reach the egg cell (1)	ACCEPT duodenum / gut / digestive tract named enzyme secreted by pancreas ACCEPT named large food molecule ACCEPT reach the (oviducts / fallopian tubes)	(5)

Question number	Answer	Mark
5(c)(i)	C 40 The only correct answer is C. <i>A is incorrect because</i> <i>B is incorrect because</i> <i>D is incorrect because</i>	(1)

Question number	Answer	Additional guidance	Mark
5(c)(ii)	An explanation that includes the following points: - because (the graph shows that) the level of CFTR protein function varies between 3 and 18% (1) - because (the graph shows that) individuals diagnosed with cystic fibrosis have a range in concentration of chloride ions in sweat (1) - therefore the CFTR protein must be affected to different extents (by different mutations) (1)		(2)

Question number	Answer	Additional guidance	Mark
3(a)	98 (g of protein per person) (1) 686 (g) (1)	Bald answer of 686 = 2 marks Bald answer of {98 / number with the adjacent numbers 686} = 1 mark	(2)

Question number	Answer	Additional guidance	Mark
3(b)(i)	transcription and translation (1)		(1)

Question number	Answer	Additional guidance	Mark
3(b)(ii)	A description that includes four of the following points: mRNA - is a copy of the (genetic) {code / information / sequence / DNA / gene} (1) - mRNA {moves / carries code} {out of the nucleus / to the ribosomes} (1) tRNA {binds to / carries} its specific amino acid (1) (tRNA) anticodon {binds / pairs} with (mRNA) codon (1) - holds the amino acid {in place / until the peptide bonds have formed} (1)	ACCEPT appropriate / particular / a certain	(4)

Question number	Answer	Additional guidance	Mark
8(a)	(70 % of adults $\Rightarrow$) 5,655,159,356 (1) 6×10^9 (1) OR (70 % of adults approximately $\Rightarrow$) 5,600,000,000 (1) 6×10^9 (1)	ACCEPT 5.66×10^9 / 5.7×10^9 5,7 . 10^9 etc ACCEPT 5.6×10^9 Bald correct answer score two marks Bald answer that scores 1 mark: - incorrectly expressed standard form of right magnitude with correct rounding e.g. 57×10^8 - correct standard form but too many decimal places e.g. 5.655×10^9 - correct values to max of 3 figs but not in standard form e.g. 5,660,000,000	(2)

Question number	Answer	Additional guidance	Mark
8(b)	An answer that includes two of the following points: (regular) exercise / active / sport {low / no} alcohol low {saturated fat / cholesterol / LDL} (in diet) low sugar / appropriate number of calories (in the diet) low salt (in diet) high fibre (in diet) high antioxidants (in diet) no smoking	ACCEPT more / less / increase / decrease throughout ACCEPT high HDL DO NOT ACCEPT low HDL / high LDL etc	(1)

Question number	Answer	Additional guidance	Mark
8(c)(i)	a change in one variable is reflected (by a change) in another variable (1)	ACCEPT increases / decreases factors / data relationship / in a similar manner / pattern / tendency DO NOT ACCEPT causation / causes / affects / results in / leading to / followed by	(1)

Question number	Answer	Additional guidance	Mark
8(c)(ii)	An explanation that includes three of the following points: - because {high / increase in} blood pressure can increase (the risk of) CVD (1) - because {high / increase in} blood pressure can damage the endothelial cells, (triggering the process) (1) - because the {study / results} will no longer be valid (1) - and therefore any {conclusions / comparisons} (about gum disease / inflammation / chemical and CVD) would not be valid (1)	ACCEPT causes CVD / is a (risk) factor for CVD / plaque formation ACCEPT endothelium / endothelial lining ACCEPT converse in correct context investigation / experiment will not be able to determine if damage due to {gum disease / inflammation / the chemicals} ACCEPT converse in correct context DO NOT ACCEPT neutrophils	(3)

Question number	Answer	Additional guidance	Mark
8(c)(iii)	8.1 / 8.13 (1)		(1)

Question number	Answer	Additional guidance	Mark
8(c)(iv)	An explanation that includes the following points: - because damage to endothelial cells, triggers {an inflammatory response / build up of white blood cells / blood clotting} (1) - and a build up of {cholesterol / atheroma / plaque} (1) {atheroma / blood clot} {blocks / narrows / reduces blood flow in} a {(blood) vessel / named blood vessel / lumen} (1)	DO NOT ACCEPT caused by blood clotting	(3)

Question number	Answer	Additional guidance	Mark
8(c)(v)	An answer that includes four of the following points: • (overall in both males and females) as the number of neutrophils in the saliva increases the proportion of healthy endothelial cells decrease (1) • the data is more spread {for a low count / below 2.5} neutrophils (1) • (more) males have a low neutrophil count • (overall) males have the <u>lower</u> proportion of healthy endothelial cells (1) • there are no {error bars / S.D.} to {determine / know} the {significance / strength of the relationship} (1)	NB Ignore explanations ACCEPT (weak) negative correlation there are fewer healthy endothelial cells when the count is (high / above 2.5) ACCEPT converse for low count ACCEPT converse for high count ACCEPT converse for high count or females ACCEPT converse for <u>higher</u> healthy cells / females	(4)

Question number	Answer	Additional guidance	Mark
4(a)	An explanation that includes three of the following points: - gills are important whilst the tadpole is getting oxygen from water / gills not used when oxygen is obtained from air (1) - lungs increase their role as developing frog starts using oxygen in the air / lungs develop from the start so that they are functional when the frog uses oxygen in the air (1) - skin is used to get oxygen in {all stages of development / tadpoles and (decreases in) frogs} (1) - credit an explanation of why the skin is useful (1)	ACCEPT frog uses lungs to get oxygen from air NB piece together e.g. skin can be used because tadpole as {large surface area (to volume ratio) / thin skin / short diffusion distance} skin used less in adult frog as {smaller surface area (to volume ratio) / thicker skin} oxygen can be obtained from water through skin when adult is in water	(3)

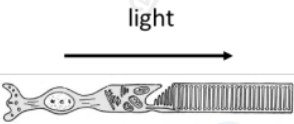
Question number	Answer	Additional guidance	Mark
4(b)	An answer that includes the following points: (similarity) both have two {atria (and one ventricle) / (atrioventricular) valves} (1) (difference) frog has one ventricle (and mammals have two) / frog has three chambers (but human heart has four) (1)	ACCEPT atriums for atria left and right atrium ACCEPT frog has no {wall / muscle / septum / separation} (between ventricles)	(2)

Question number	Answer	Additional guidance	Mark
*4(c)	Indicative content: Gas exchange surfaces - both lungs and skin are used as gas exchange surface - therefore surface area increased / more oxygen can be absorbed - more blood goes to lungs than skin - because more gas exchange occurs in lungs than skin - skin has large surface area / permeable to oxygen / moist (for gas exchange) Circulatory system - oxygenated blood from lungs passes into right atrium - most of blood pumped from the heart to the cells is oxygenated - to supply the cells with oxygen <u>for respiration</u> - to ensure cells receive enough oxygen for metabolic demands - some of this blood is pumped to the skin <u>cells</u> / lung <u>cells</u> / heart <u>cells</u> - therefore supplying these cells with oxygen - blood from skin and cells return to the left atrium - one ventricle is sufficient because large proportion of blood pumped to the gas exchange surfaces / frog has relatively low oxygen demands / frog is relatively small	Level 1: Descriptions 1 mark = one relevant comment from either the diagram or own knowledge 2 marks = three descriptions of the information shown in the diagram OR description of gas exchange surfaces Level 2: Simple explanations for diagram 3 marks = one explanation 4 marks = two explanations Level 3: Detailed explanations for diagram 5 marks = three explanations that includes: why more deoxygenated blood goes to the lungs than the skin OR why more blood from the lungs goes to the cells OR why one ventricle is sufficient 6 marks = three explanations that includes TWO from: why more deoxygenated blood goes to the lungs than the skin why more blood from the lungs goes to the cells why one ventricle is sufficient	(6)

Question Number	Answer	Additional Guidance	Mark
2(a)	- increasing temperature increases heart rate; - temperature affects the {metabolism / respiration / enzyme activity / eq}; - increasing temperature causes an increase in kinetic energy / eq ; - this leads to more collisions / eq between enzymes and substrates; - more ESCs formed / eq ; {heart rate increasing} supplies more {oxygen / glucose / eq};	ACCEPT positive correlation mp2 ACCEPT ref to rate of reaction if in context of enzymes mp6 IGNORE ref to blood supply only	(4)

Question Number	Answer	Additional Guidance	Mark
2(b)	1. repeat on more <i>Daphnia</i> / eq (at each temperature); 2. use same (size / species / type / mass / age / eq) of <i>Daphnia</i> ; 3. control of a named abiotic variable (other than temperature); 4. use a standardised method to count heart beats for a specified time / description of method;	IGNORE repeat using same <i>Daphnia</i> /repeat only IGNORE refs to using a wider or narrower range of temperature mp2-IGNORE similar mp2 ACCEPT from same source / location mp3 eg volume of water / pH / acclimatisation time IGNORE acclimatise only mp4 eg dots on paper and count for a specified time	(2)

Question Number	Answer	Additional Guidance	Mark
2(c)	1. they are transparent / have a visible (heart / organs / eq); 2. they are (simple organisms / do not feel pain / have a simple nervous system / eq); 3. idea that they are cheap / easy to obtain / abundant / eq;	MP2 IGNORE comments on ethics unless qualified mp2 IGNORE -invertebrates/no backbone	(2)

Question Number	Answer	Additional Guidance	Mark
6(a)(i)	The correct answer is D  A is not correct because rod cells are organised with the outer segment at the back of the retina and the synaptic region at the front of the retina B is not correct because is not correct because rod cells are organised with the outer segment at the back of the retina and the synaptic region at the front of the retina C is not correct because is not correct because rod cells are organised with the outer segment at the back of the retina and the synaptic region at the front of the retina		(1)

Question Number	Answer	Additional Guidance	Mark
6(a)(ii)	The correct answer is B rhodopsin is bleached producing opsin and trans-retinal A is not correct because rhodopsin is not bleached to produce cis-retinal C is not correct because rhodopsin is not formed from cis-retinal D is not correct because rhodopsin is not formed when light enters rod cells		(1)

Question Number	Answer		Additional Guidance	Mark
6(a)(iii)	The correct answer is A	membrane permeability to sodium ions	activity of the sodium ion pump	
		decreases	no change	
	B is not correct because activity of the sodium ion pump remains constant C is not correct because membrane permeability to sodium ions decreases D is not correct because membrane permeability to sodium ions decreases and activity of the sodium ion pump remains constant			(1)

Question Number	Answer	Additional Guidance	Mark
6(b)(i)	1. the greater dose the greater the increase in diameter; 2. the greater the dose the longer lasting the effect / eq; 3. the greater the dose the more rapid the increase in dilation / eq;	ACCEPT increasing either drops or concentration in place of greater dose	(3)