PEARSON EDEXCEL A-LEVEL BIOLOGY B · 9BI0

BIOLOGY



MARK SCHEME

TOPIC 4: EXCHANGE AND TRANSPORT

CIRCULATION

SCORE	PERCENTAGE
/179	%

STEMUP

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Mark Scheme

Q1.

Question Number	Answer	Additional Guidance	Mark
	1. idea that initiates electrical activity over atria ; 2. causes atria to contract / eq ; 3. {forcing / eq} the (oxygenated) blood into the left ventricle / eq ; 4. electrical activity from SAN {received by AVN / travels through {bundle of His / Purkyne fibres / eq }} ; 5. causing left ventricle to contract (forcing blood into aorta) / eq ;	1. **ACCEPT** initiates impulse / initiates depolarisaton 2. **ACCEPT** systole for contract 4. **ACCEPT** Purkinje for Purkyne 5. **ACCEPT** systole for contract **NOT** left and right	**(4)**

Q2.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to the following: • because {cholesterol / fatty acids} are hydrophobic (so cannot be carried in bloodstream) (1) • phospholipid tails are hydrophobic so {cholesterol / fatty acids} can be carried inside lipoprotein (1) • {protein / phospholipid heads} in lipoprotein are hydrophilic (enabling transport in bloodstream) (1)	ACCEPT non-polar ACCEPT non-polar ACCEPT polar	

Q3.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to two of the following: • more men than women are affected and heart disease increases with age **(1)** • gender because {presence of oestrogen in women / more men than women smoke} **(1)** • age because {more time to develop atherosclerosis / less active lifestyle / higher blood pressure / less elastic arteries} **(1)**	**Accept** pieced together answer	**(2)**

Q4.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to two of the following: • the { atheroma / plaque / (blood) clot} blocks the (coronary) artery **(1)** • therefore the heart {cells / muscle} are deprived of {oxygen / glucose} **(1)** • therefore respiration cannot take place **(1)**	**Accept** atherosclerosis results in the (coronary) artery being blocked **Accept** they (heart cells) are deprived of oxygen / less oxygen {reaches / transported to} the cells / ischaemia / reduction in flow of oxygenated blood	**(2)**

Q5.

Question Number	Answer	Additional Guidance	Mark
(i)	time of cardiac cycle read from graph and divided into 60	60 ÷ 0.8 = 75 (beats per minute)	(1)

Question Number	Answer	Mark
(ii)	**The only correct answer is C** ***A*** *is not correct because the aortic pressure is higher than the ventricular pressure* ***B*** *is not correct because the aortic pressure is higher than the ventricular pressure between 0.10 s to 0.13 s* ***D*** *is not correct because the aortic pressure is higher than the ventricular pressure between 0.37 s and 0.43 s*	(1)

Question Number	Answer	Mark
(iii)	**The only correct answer is A** ***B*** *is not correct because 0.13 s is when the semi-lunar valve opens* ***C*** *is not correct because 0.37 s is when the semi-lunar valve closes* ***D*** *is not correct because 0.43 s is when the atrio-ventricular valve opens*	(1)

Q6.

Question Number	Answer	Additional Guidance	Mark
(i)	127.6 – 130.4 beats per minute / bpm	**Accept** any number between and including 127.6 and 130.4 beats per minute / bpm	(1)

Question Number	Answer	Additional Guidance	Mark
(ii)	A description that makes reference to four of the following: • exercise {increases carbon dioxide / lowers pH / increases H^+ / increases lactate} in blood (1) • detected by chemoreceptors in the {carotid artery / aorta / aortic body / carotid body} (1) • impulses sent to {medulla / cardio acceleratory centre / cardiac control centre} (1) • impulses along sympathetic {nervous system / nerve / neurone} (1) • noradrenaline {is released onto / stimulates} SA node (1)	**Do not accept** signal / message **Do not accept** signal / message **Accept** adrenaline stimulates SA node	**(4)**

Q7.

Question Number	Answer	Additional Guidance	Mark
(i)	• (other : pulmonary) 2.5 : 1 / 2.5 / 1 : 0.4 / 0.4 (pulmonary : other) 1 : 2.5 / 2.5 / 0.4 : 1 / 0.4	**DO NOT ACCEPT** with units	(1) GRAD

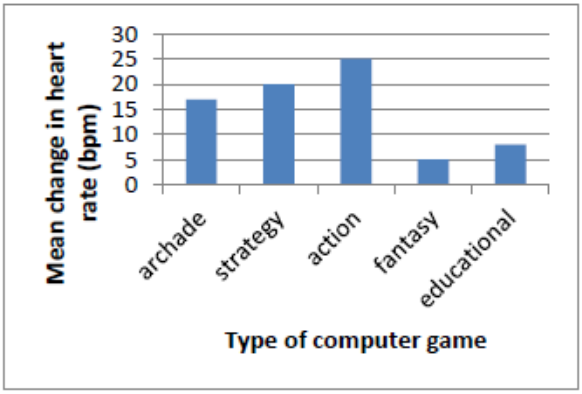
Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to the following: • (partial pressure of oxygen is low in) pulmonary artery is carrying deoxygenated blood to lungs (1) • (partial pressure of oxygen is high in) arterial blood is carrying oxygenated blood to the {body / cells / tissues} (1)	**NB** piece together **ACCEPT** deoxygenated as it has come back from the body **ACCEPT** oxygenated as it has been through lungs	(2) EXP

Q8.

Question Number	Correct Answer	Additional guidance	Mark
	B		**(1)**

Q9.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	An explanation that makes reference to four of the following: • all games must be played for the same length of time to make a valid comparison (1) • a recovery period is needed for the heart rate to return to normal before each subsequent game (1) • repeats should be { at the same time of day / under the same conditions } to avoid effect of other variables (1) • games should be tested in a different sequence each time, to account for effects of fatigue (1) • more individuals should be tested, other than the student himself, to obtain valid results (1)		**(4)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(ii)	• bar chart (1) • x-axis: type of computer game and y-axis: mean change in heart rate (1)		**(2)**

Q10.

Question Number	Answer	Additional Guidance	Mark
(i)	• substitution of values into equation • answer given to 3 or 4 sig figs	$4/3 \times \pi \times 11 \times 11 \times 11$ / 5572.453 5570 / 5572 ACCEPT 5580 / 5575 for 1 mark	

Question Number	Answer		Mark
(ii)	An explanation that makes reference to two of the following: • because (in the LDL) there is less protein (contained in a larger volume) (1)	ACCEPT converse statements for HDL	
	• because the protein is denser than the phospholipid (in the LDL) (1) • (the LDL has) {a larger hole in the middle / fewer molecules in relation to its size} (1)	ACCEPT types of protein in HDL are denser than the types in LDL	

Question Number	Answer	Additional Guidance	Mark
(iii)	An explanation that makes reference to four of the following: • because cholesterol is a risk factor (1) • (because of raised LDLs) more cholesterol in the blood (1) • {cholesterol / plaque / atheroma} builds up in (walls of) artery (1) • reducing the flow of blood to the heart {tissue / cells} (1) • therefore lack of oxygen for (aerobic) respiration (in heart cells) (1)		

Q11.

Question Number	Answer	Additional Guidance	Mark
(i)	• calculate sum of d^2 and divide (1) • calculate square root (1)	50 ÷ 2 = 25 5.0 Correct answer gains full marks, with no working shown.	(2)

Question Number	Answer	Additional Guidance	Mark
(ii)	An answer that makes reference to the following: • one axis labelled mean heart rate with units, linear scale starting at 0 (not broken scale), bars labelled and covers at least half the grid (1) • accurate plot and standard deviations (1)		(2)

Question Number	Answer	Additional Guidance	Mark
(iii)	An answer that makes reference to two of the following: • for valid comparison / to get a valid result (1) **and any one from the following:** • temperature because {water fleas are ectotherms / affects heart rate} (1) • {carbon dioxide / pH} affects heart rate (1) • time of measuring because water fleas may fatigue (1) • acclimatisation to allow equal time for substances to take effect (1)	Accept to ensure the treatment is the only factor affecting heartrate	**(2)**

Q12.

Question Number	Answer	Additional guidance	Mark
(a)(i)	1. (protein in thin filament) - actin / G actin ; 2. (protein in thick filament) - myosin ;		**(2)**

Question Number	Answer	Additional guidance	Mark
(a)(ii)	1. {Ca^{2+} / calcium ions} bind to troponin ; 2. troponin {changes shape / moves / eq} ; 3. this displaces tropomyosin (away from myosin) / eq ;	ACCEPT 3 – pulls/shifts/moves tropomyosin	**(2)**

Question Number	Answer	Additional guidance	Mark
(a)(iii)	acetylcholine / {noradrenaline / eq } ;	ACCEPT – ACh, noradrenalin, norepinephrine	**(1)**

Question Number	Answer	Additional guidance	Mark
(b)	1. the higher troponin T, the longer the stay / eq ; 2. reliability of prediction decreases as troponin T concentration increases ; 3. because {range / eq} increases ; 4. least reliable for 6.0+ as range is largest ; 5. one range stated e.g. for 6.0+ it is 7 to 11 days ; 6. reference to range overlapping between 4.0-5.9 and 6.0+ ; 7. idea that 6.0+ is too wide a category for conc. of troponin T ; 8. idea that the higher the troponin T, the greater the damage to the heart ;	ACCEPT 1 - converse ACCEPT 2 - converse, less reliable at high troponin T ACCEPT 3 - range of the length of stay, range of data ACCEPT 4 - converse for 1.0-3.9 / 4.0-5.9	(3)

Q13.

Question Number	Answer	Additional Comments	Mark
(a)(i)	Actin = 14 (%) ; Myosin = 10 (%) ;	**For Actin Accept** 28 (%)	**(2)**

Question Number	Answer	Additional Comments	Mark
(a)(ii)	1. {Ca^{2+} / eq} bind to troponin ; 2. troponin molecules {changes shape / moves / eq} ; 3. idea that this displaces tropomyosin ;	**3. Ignore** comments on exposing myosin binding sites	**(2)**

Question Number	Answer	Additional Comments	Mark
(a)(iii)	{right / R} atrium ;		**(1)**

Question Number	Answer	Additional Comments	Mark
(b)(i)	The higher the concentration of troponin T in the blood, the higher the mean number of days in hospital / eq ;	**Accept** the longer the stay in hospital **Accept** the higher the concentration of troponin T in the blood, the more severe the CVD is **T1 (1)**	

Question Number	Answer	Additional Comments	Mark
(b)(ii)	1. idea that the conclusion is valid ; 2. as there is no overlap between the range of data for each concentration of troponin T / eq ; 3. the validity (of the conclusion) becomes less the higher the concentration of troponin T / eq ; 4. (because) the data becomes less reliable at higher concentrations of troponin T / eq ; 5. idea that the range of data becomes greater ;	**Accept** comments relating to spread of data or standard deviations	**(2)**

Q14.

Question Number	Answer	Additional Guidance	Mark
(i)	substitution	Accept point mutation	**(1)**

Question Number	Answer	Additional Guidance	Mark
(ii)	1 in 50	Accept other correct probabilities e.g. 2% or 0.02	**(1)**

Question Number	Answer	Additional Guidance	Mark
(iii)	An explanation that makes reference to the following: • (excess prothrombin means) more thrombin (1) • therefore increased {conversion / catalysis} of fibrinogen to fibrin (1) • fibrin {is insoluble / traps blood cells / forms mesh / forms net} (1)	Accept if there is more fibrin it is more likely to clot	**(3)**

Q15.

Question Number	Answer	Additional Guidance	Mark
	A description that makes reference to five of the following: • (myogenic means) no external nerve impulses / doesn't require nerve impulse / no stimulation from brain / generated from within heart (1) • (contraction initiated by) SAN (1) • {depolarisation / wave of excitation} causes {atria to contract / atrial systole} (1) • delay at the AVN (1) • (depolarisation) through the {bundle of His / Purkyne fibres} (1) • (depolarisation) causing {ventricle to contract / ventricular systole} from base/apex of heart (1)	**ACCEPT** no outside stimulation (needed to contract heart) **ACCEPT** impulses	**(5)**

Q16.

Question Number	Answer	Additional Guidance	Mark
	form a {plug / mesh / scab / barrier / thrombus} to seal the {blood vessel / wound} / release {clotting factors / thromboplastin}	**ACCEPT** to stop bleeding / to prevent {infection / microorganisms entering} **DO NOT ACCEPT** prothrombin / thrombin / fibrinogen / fibrin	**(1)**

Q17.

Question Number	Correct Answer	Additional guidance	Mark
(a)	Numerator = 219.34 (1) Denominator = 5 (1) Standard deviation = 6.6 (1)	Correct answer gains full marks	**(3)**

Question Number	Correct Answer	Additional guidance	Mark
(b)	An explanation that makes reference to the following: • S.D. shows variation from the mean (1) • a larger S.D. means greater spread, smaller S.D. is more reliable representation of the data (1) • therefore although ranges of A and B are the same, the S.D. shows there is more variation in the data for method B (1)	S.D. indicates spread of data	**(3)**

Question Number	Correct Answer	Additional guidance	Mark
(c)	An explanation that makes reference to the following: • for method A if there is an error made it is multiplied by four, when calculating pulse rate per minute (1) • for method B counting for one minute may lead to inaccuracy due to loss of concentration (1) • both methods are measuring pulse rate rather than heart rate (1)		**(3)**

Q18.

Question Number	Answer	Additional Guidance	Mark
(i)	• correct identification of pressure when the valve closes (1) • conversion of cm^2 into m^2 (1) • correct calculation of force (1)	Example of calculation: 0.8 kPa **Accept** reading between 0.6 – 0.8 **(one mark)** 0.00035 m^2 or 3.5×10^{-4} **(one mark) 0.00028 N (three marks)** **Accept** final answer between **0.00021 – 0.00028 Accept** correct standard form 2.1×10^{-4} to 2.8×10^{-4} Correct answer with no working gains full marks **ECF for mp 3** if either or both wrong graph reading / wrong area conversion	**3 exp**

Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to four of the following points: • pressure rises in the atrium during contraction (of ventricle) (1) • (because) blood is flowing back into the **atrium** (1) • lower pressure in aorta / lower pressure in ventricle / lower pressure in systemic (circulatory system) (1) • therefore less oxygenated blood flows to muscles / slower flow of oxygen to muscles (1) • so there is less respiration (in muscles) (1)	**Accept** pressure in atrium rises during systole **Accept** valve prevents backflow into **atrium** **Accept** less / slower (deoxygenated) blood to lungs **Accept** less ATP produced / more anaerobic respiration	**4 expert**

Q19.

Question Number	Answer	Mark
	The only correct answer is A ***B*** *is not correct because there are 5 monocytes and 8 neutrophils* ***C*** *is not correct because there are 3 lymphocytes, 5 monocytes and 8 neutrophils* ***D*** *is not correct because there are 3 lymphocytes*	**(1)**

Q20.

Question Number	Answer	Additional Guidance	Mark
(i)	Correct answer with units gains 2 marks 1 beat = 0.81 sec / 60 ÷ 74 / eq ; 8.1 seconds ;	**ACCEPT** 8.11 seconds	**(2)**

Question Number	Answer	Mark
(ii)	mV / millivolts / eq ;	**(1)**

Mark Scheme

Q1.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to five of the following: • {impulse / depolarisation / wave of excitation} starts at SAN / pacemaker (1) • takes 0.03s to travel to AVN (1) • atrial systole takes 0.07s / takes 0.07s for atria to contract (1) • delay at AVN (1) • {0.16s / 0.17s at septum / Bundle of His} / {0.17s / 0.22s at Purkyne fibres (1) • ventricular systole ends at 0.22s / ventricles {contract / depolarise} from base / upwards (1) • atrioventricular valves {open during atrial systole / atrial contraction} / {close during ventricular systole / ventricular contraction} (1)	**DO NOT ACCEPT** signal / message	**(5)**

Q2.

Question Number	Acceptable Answer	Additional guidance	Mark
(i)	An answer that makes reference to the following: percentage increase calculated (1)	<u>Example of calculation</u> % increase = 1.85 x 100 / 0.9 = 205.555% = 206%	**(1)**

Question Number	Acceptable Answer	Additional guidance	Mark
(ii)	An explanation that makes reference to the following: • because tissue fluid accumulates and prevents gas exchange (1) • therefore less oxygen uptake and carbon dioxide removal makes patient feel breathless (1)		**(2)**

Question Number	Acceptable Answer	Additional guidance	Mark
(iii)	A description that makes reference to the following: • excess tissue fluid is absorbed by the lymphatic system (1) • lymphatic system drains into the veins (1)		**(2)**

Q3.

Question Number	Answer	Additional Guidance	Mark
(i)	• 1.52×10^7		**(1)**

Question Number	Answer	Additional Guidance	Mark
(ii)	A description that makes reference to three of the following: • damage to {endothelium} caused by {high blood pressure / toxins / smoking} (1) • inflammatory response and arrival of {macrophages / white blood cells} (1) • deposits of {cholesterol / calcium} (1) • formation of {atheroma / plaque} (1)	**DO NOT ACCEPT** fat / lipid	**(3)**

Q4.

Question Number	Answer	Additional Guidance	Mark
(i)	**C** monocyte | eosinophil	**A** is incorrect because cell J is not an eosinophil and cell K is not a lymphocyte **B** is incorrect because cell J is not a lymphocyte and cell K is not a neutrophil **D** is incorrect because cell J is not a neutrophil and cell K is not a monocyte	(1)

Question Number	Answer	Additional Guidance	Mark
(ii)	**D** 50 : 3	**A** is incorrect because there are about 50 erythrocytes and 3 leukocytes **B** is incorrect because there are about 50 erythrocytes and 3 leukocytes ie the ratio is the wrong way round **C** is incorrect because there are 3 leucocytes	(1)

Q5.

Question Number	Answer	Mark
	The only correct answer is C ***A*** *is not correct because erythrocytes transport oxygen and platelets prevent entry of bacteria* ***B*** *is not correct because erythrocytes transport oxygen and platelets prevent entry of bacteria* ***D*** *is not correct because leucocytes are involved in defence*	**(1)**

Q6.

Question Number	Answer	Additional Guidance	Mark
	• obtain duration of one heart beat by dividing number of seconds in one minute by heart rate (1) • subtract duration of ventricular systole (1)	Example of calculation 60 ÷ 72 = 0.83 / 0.833 0.83 – 0.06 = 0.77 / 0.773 0.83 – 0.05 = 0.78 / 0.783 Correct answer gains full marks, with no working shown	**(2)**

Q7.

Question Number	Acceptable Answer	Additional Guidance	Mark
	• correct numerical calculation (1) • correct units (1)	Example of Calculation: 22 ÷ 120 =0.183 beats per minute per minute / beats minutes^{-2}	**(2)**

Q8.

Question Number	Correct Answer	Additional guidance	Mark
(b)(i)	A		**(1)**

Question Number	Correct Answer	Additional guidance	Mark
(b)(ii)	C		**(1)**

Question Number	Correct Answer	Additional guidance	Mark
(c)	5 squares = 1 beat • 1 beat per second x 60 (1) • 60 beats per minute (1)	Correct answer gains full mark	**(2)**

Q9.

Question Number	Answer	Additional Guidance	Mark
(i)	• calculation of volume (1) • calculation of cardiac output (1) • conversion to $dm^3\ min^{-1}$ (1) OR • change units for radius (1) • calculation of volume (1) • calculation of cardiac output (1)	$= \frac{4}{3} \times 3.142 \times 0.001$ $= 0.004189 \times 200$ $= 0.0000008379\ (dm^3\ min^{-1})$ **Accept** 8×10^{-7} / 8.4×10^{-7} / 8.38×10^{-7} / 8.379×10^{-7} / 0.0000008 / 0.00000084 / 0.000000838 Correct answer gains full marks, with no working shown. 8 / 8.4 / 8.38 / 8.379 to wrong power of 10 gets 2 marks Ecf if diameter used instead of radius 0.1mm = 0.001 dm $= \frac{4}{3} \times 3.142 \times 0.001$ $= 4.189 \times 10^{-9} \times 200\ (dm^3\ min^{-1}) = 8.38 \times 10^{-7}$ **Accept** 8×10^{-7} / 8.4×10^{-7} / 8.379 $\times 10^{-7}$ / 0.0000008 / 0.00000084 / 0.000000838 / 0.0000008379	**(3)**

Question Number	Answer	Additional Guidance	Mark
(ii)	more cells that need supply of {glucose / oxygen} (1)		(1)

Q10.

Question Number	Answer	Additional Guidance	Mark
(i)	A 0.14 s *B is incorrect as the valve has already closed* *C is incorrect as the valve is open* *D is incorrect as the valve is open*		1
(ii)	D sinoatrial node, atrioventricular node, bundle of His *A is incorrect as the impulse starts at the* sinoatrial node *B is incorrect as the impulse starts at the* sinoatrial node *C is incorrect as the bundle of His is after the* atrioventricular node		1

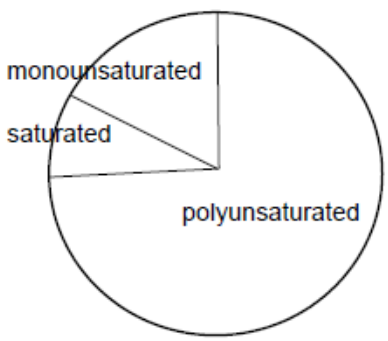
Q11.

Question Number	Answer	Additional Guidance	Mark
(i)	• 1.3 N (1)		1
(ii)	An explanation that makes reference to three of thefollowing: • arteries stretch more / (have weaker collagen whichmeans that) less force produces a longer extension (1) • because the elastic constant is lower (1) • and (blood in arteries) has high pressure (1) • and less force is required to break the artery (1)	**Allow** less elasticity in arteries **Allow** arterial blood has high hydrostatic pressure	3

Q12.

Question Number	Answer	Additional Guidance	Mark
	An answer that makes reference to 5 from: • the mean clotting time has increased for both drugs / for drug A and drug B (1) • there is little variation in the control group (1) • there is high variation with drug B (1) • drug B does not change clotting rate for some (blood types) as there is overlap with the controlgroup (1) • drug B has a slower clearance time so patients would be at risk of bleeding (1) • drug A would be better as it works for all samples and is cleared from body faster / will allow blood toclot sooner after dialysis (1)	piece together **Allow** low range in control group / withno drug **Allow** largest range / drug B has morespread / variation than drug A **Allow** drug A increased clotting timefor all samples as there is no overlapwith control	**5**

Q13.

Question Number	Answer	Additional Guidance	Mark
(i)	• pie chart drawn showing lipid content of safflower oil, labelled	 saturated section less than monounsaturated and polyunsaturated three quarters by eye	(1)

Question Number	Answer	Additional Guidance	Mark
(ii)	• percentage of polyunsaturated lipids in 500 g {beef / oil} calculated (1) • 355 (g) (1)	Example of calculation: (3 + 1) × (500 ÷ 100) = 20 75 × (500 ÷ 100) = 375 Correct answer with no working gains full marks	(2)
(iii)	An explanation that makes reference to the following: • because plant products will contain less {cholesterol / saturatedlipids} (than animal products) (1) • therefore there will be less cholesterol (in the blood stream) to {build up / form a plaque / form an atheroma} in an artery (1)	**ACCEPT** converse explanation **ACCEPT** more polyunsaturated lipids	(2)

Q14.

Question Number	Answer	Additional Guidance	Mark
	A description that makes reference to two of the following: • {increasing mass / more} (snake venom) decreases clotting time (1) • {small mass / 0.002 µg} of snake venom has a shorter clotting time (than Xa) (1) • {larger masses / 0.004 µg and over / 0.02 and 0.04} has little effect on clotting time (1)	**ACCEPT** clotting time is faster converse **ACCEPT** takes less time / faster rate **ACCEPT** 0.004 µg has slight increase and 0.02 µg and 0.04 µg has slight decrease	**(2)**

Q15.

Question Number	Acceptable Answer	Additional Guidance	Mark
	An explanation that makes reference to the following: • { stress / fear } causes the adrenal glands to release adrenaline into the bloodstream (1) • because of impulses along sympathetic nerve (1) • from the { cardiac control centre / medulla (oblongata) } in the brain (1) • increase in heart rate caused by increased rate of depolarisation of SAN (1) • due to release of noradrenaline at SAN (1) ATP than other cells		**(5)**

Q16.

Question Number	Indicative content
*(i)	Answers will be credited according to candidates' deployment of knowledge and understanding of the material in relation to the qualities and skills outlined in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant.

	Indicative content • Dox decreases the concentration of (all) amino acids shown • largest actual decrease is glu and asp (3.6 μmol cm^{-3}) • smallest actual decrease is ser (0.9 μmol cm^{-3})) • relative decrease is least for pro (16.67%) • relative decrease is greatest for asp (85.71%) • data not available for all amino acids • polar and non-polar amino acids are affected • polar amino acids affected most (total 14.4 μmol cm^{-3} compared to total 11.7 μmol cm^{-3} / mean 2.4 μmol cm^{-3} compared to mean 1.95 μmol cm^{-3}) • effect on non-polar amino acids is within a {narrower range for actual decrease / wider range for percentage decrease}

	Level 1 : comments on overall effect of Dox 1 mark = level 1 comment only 2 marks = level 1 comment backed up with figures / level 2 comment but no figures given Level 2 : comments on effect of Dox on polar and non-polar amino acids 3 marks = level 2 comment only / level 1 comment with a level 2 calculation (= actual decrease in concentration) 4 marks = level 2 comment backed up with a level 2 calculation Level 3 : comments about amino acids within the group of polar / non-polar amino acids 5 marks = level 3 comment / level 2 comment with a level 3 calculation (= percentage decrease in calculation) 6 marks = comment backed up with a level 3 calculation

Level 0	Marks	No awardable content
Level 1	1-2	An answer may be attempted but with limited interpretation or analysis of the scientific information with a focus on mainly just one piece of scientific information. The answer will contain basic information with some attempt to describe the data shown in the graph
Level 2	3-4	An answer will be given with occasional evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The answer shows some linkages and lines of scientific reasoning with some structure between the graph and the different types of amino acids
Level 3	5-6	An answer is made which is supported throughout by sustained application of relevant evidence of analysis, interpretation and/or evaluation of both pieces of scientific information. The answer shows a well-developed and sustained line of scientific reasoning which is clear and logically structured.

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Question Number	Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to the following: • a decrease in some amino acids may mean that {certain proteins cannot be formed / less protein made} (1) • if these proteins are involved in heart muscle structure then it will be weaker (1) • these proteins may affect heart muscle function (1)	ACCEPT named example e.g. actin, myosin, collagen ACCEPT named example e.g. collagen, haemoglobin, myoglobin, cytochromes	

Question Number	Answer	Additional Guidance	Mark
(iii)	An explanation that makes reference to the following: • heart will not be able to pump as well (1) • so less {oxygenated blood / oxygen} will be delivered to the {cells / tissues / organs / named example} (1) • example of a consequence of this (1)	ACCEPT less carbon dioxide removed / lowers blood pH e.g. less aerobic respiration, build-up of lactic acid / fatigue / breathlessness	

Q17.

Question Number	Answer	Additional Guidance	Mark
	An explanation that makes reference to the following: • because the numbers of erythrocytes to leucocytes can be determined (1) • and compared to the {normal / healthy / known CML} (smear) (1)	**ACCEPT** red blood cells to white blood cells named white blood cell	(2)

Q18.

Question Number	Acceptable Answer	Additional Guidance	Mark
(i)	A (P)		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(ii)	An explanation that makes reference to the following: • (no P wave on trace) sinoatrial node / SAN not functioning (1) • causing lack of electrical activity in the atria (1) • failing to pass electrical signal to the atrioventricular node (1)		**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(iii)	• normal ECG trace rate is 60 beats per minute and person with Sick Sinus Syndrome rate is 50 beats per minute (1) • so difference 10 beats per minute (1)		**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
(iv)	An explanation that makes reference to the following: • sinoatrial node is not working causing a slower heart beat rate (1) • causing lack of oxygen to { brain / muscles } (1)		**(2)**

Q19.

Question Number	Answer	Mark
(a)	1. heart rate increases / eq ; 2. {stroke volume / eq} increases / eq ; 3. {SAN /eq} activity increases / ; 4. AVN time delay decreases / eq ; 5. idea that more blood returning (to the heart) causes {heart / muscle} to stretch ; 6. idea that ventricles contract with greater force ;	**(4)**

Question Number	Answer	Mark
(b) (i)		**(2)**

Approximate value for	**0.1 dm^3**	**0.5 dm^3**	**6 dm^3 min^{-1}**	**6 breaths min^{-1}**	**12 breaths min^{-1}**
Resting breathing rate					☒
Resting tidal volume		☒			

Question Number	Answer	Mark
(b)(ii)	1. more {peaks / eq} in the same time / higher frequency / distance between (consecutive) peaks would decrease ; 2. idea of distance from peak to trough would increase ;	**(2)**

Question Number	Answer	Mark
(c)	Any **two** from the following: 1. how often they play 2. age 3. body size / BMI / eq 4. gender / eq 5. fitness level / eq 6. health status / eq 7. lifestyle e.g. smoker or swimmer ; ;	**(2)**

Q20.

Question Number	Answer	Additional Guidance	Mark
*	**(QWC – Spelling of technical terms must be correct and the answer must be organised in a logical sequence)** 1. increase in *respiration* rate in *muscle* cells ; 2. more {CO_2/*carbonic* acid/eq} in blood ; 3. more {*lactate* / *lactic acid*} in blood / eq ; 4. idea that *chemoreceptors* in *medulla* stimulated ; 5. ref to *cardiovascular* control centre in *medulla* ;	**QWC emphasis is on spelling** 2 OR 3 **ACCEPT** reduced blood pH 4. **ACCEPT** in *aorta, carotid*	

	6. ref to *autonomic nervous system /sympathetic nerve* ; 7. more *impulses* from {*medulla / cardiovascular* control centre} to SAN OR along neurones to SAN ; 8. More {*noradrenaline / norepinephrine*} released onto SAN ; 9. SAN (excitation) rate increased / eq ; 10. (causing an) increased {heart rate / eq} / eq ; 11. Comment on other mechanism e.g. presence of adrenaline, stretch receptor role ;	6. **ACCEPT** *accelerator* nerve 10. **ACCEPT** beats per min for heart rate	**(6)**