Question Number	Acceptable Answer	Additional Guidance	Mark
1(a)	• Idea that {cell body / centron} in middle / dendrites at both ends (1)		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
1(b)	An explanation that makes reference to five of the following: • reference to Schwann cells covering the axon in myelinated neurone (1) • {myelin/Schwann cells} provide insulation (1) • {action potential/depolarision} at nodes of Ranvier (1) • local currents occur over a longer distance (1) • reference to saltatory conduction (1) • impulse jumps from node to node (1)		**(5)**

(Total for Question 1 = 6 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
2(a)	B		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
2(b)	An explanation that makes reference to three of the following: • MRI gives better resolution (1) • therefore more detail can be seen (1) • no use of X–rays (1) • therefore {safer / less risk of mutation / eq} (1) • therefore can be used more often (1)		**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
2(c)	An explanation that makes reference to the following: • increased neural activity of {cerebellum / cerebrum} (1) • more oxygen needed so increase in {blood flow / oxyhaemoglobin} (1) • less {radio wave / signal} absorbed (1)		**(3)**

(Total for Question 2 = 7 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
3(a)	17.0 ÷140 (1) =121.43 cm^3 (1)		**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
3(b)(i)	An explanation that shows elements of reasoning /justification in the form of a linked response from the following points: • the higher pressure is in the left ventricle / lower pressure is in the right ventricle (1) • because the left ventricle has more muscle (1) • because it needs a higher pressure to get blood through the aorta to the body (except lungs) (1)	Allow appropriate structural consequential comments for right ventricle.	**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
3(b)(ii)	D		**(1)**

(Total for Question 3 = 6 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
4(a)	B		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
4(b)	D		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
4(c)	B		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
4(d)(i)	B		**(1)**

Question Number	Indicative content	
***4(d)(ii)**	Answers will be credited according to candidate's 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. An explanation that makes reference to the following: • cyanide inhibits cytochrome oxidase so it can no longer accept electrons • electrons stop moving along the electron transport chain • so no movement of hydrogen ions into intermembrane space • so no movement of protons down gradient / no chemiosmosis • NADH/FADH can no longer give up electrons and regenerate NAD/FAD so Krebs cycle stops • so no production of ATP from Krebs cycle or electron transport chain • so cellular processes have no energy source / reference to named muscle contraction e.g. heart muscle being prevented	
Level	Mark	Descriptor
	0	No awardable content
Level 1	1-2	Demonstrates isolated elements of biological knowledge and understanding to the given context with generalised comments made. The explanation will contain basic information with some attempt made to link knowledge and understanding to the given context.
Level 2	3-4	Demonstrates adequate knowledge and understanding by selecting and applying some relevant biological facts/concepts to provide the explanation being presented. Lines of argument occasionally supported through the application of relevant evidence (scientific ideas, processes, techniques and procedures). The explanation shows some linkages and lines of reasoning with some structure.

Level 3	5-6	Demonstrates comprehensive knowledge and understanding by selecting and applying relevant knowledge of biological facts/concepts to provide the explanation being presented. Line(s) of argument supported throughout by sustained application of relevant evidence (scientific ideas, processes, techniques and procedures). The explanation shows a well-developed and sustained line of reasoning which is clear, coherent and logically structured.

(Total for Question 4 = 10 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
5(a)	C		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
5(b)(i)	58- 45 = 13 (13÷58)×100 (1) = 22.4% (1)		**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
5(b)(ii)	An answer that makes reference to the following: • mass higher in A (compared with B) for both studies (1) • the difference is less in repeat study / mass lower in repeats (of both A and B (1)		**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
5(c)	An answer that makes reference to four of the following points: • plants grown in pots containing same {soil / pH / minerals / water}as these factors can affect growth (1) • one group under lamp emitting red light and one group under a lamp emitting far red light / one group under lamp emitting red and far red light at same intensity and one group under lamp emitting far red light at higher intensity than red(1) • keep temperature the same in both as enzymes involved in growth (1) • reference to {several groups of pots / multiple plants} to ensure results are {reliable / suitable for valid statistical analysis} (1) • use {cloned / genetically identical} plants of same species as genes can affect growth (1)		**(4)**

(Total for Question 5 = 9 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
6(a)	C		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
6(b)(i)	Length measured from diagram correctly (1) z-z line =3.0 cm then this is 3.0×10^{-3} M ÷ 2.0×10^{-6}m = 1500 magnification (1)		**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
6(b)(ii)	B		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
6(b) (iii)	An explanation that makes reference to the following: • actin and myosin molecules remain the same length (1) • these slide past each other / sarcomere is shorter / Z lines move closer together (1)		**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
6(c)	An explanation that makes reference to four of the following: • person B has more slow twitch fibres than person A (1) • slow twitch are more efficient at aerobic respiration because they have more mitochondria (1) • slow twitch have many capillaries to give good oxygen supply (1) • slow twitch have lots of myoglobin to store oxygen (1) • therefore less likely to build up lactate (1)		**(4)**

(Total for Question 6 = 10 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
7(a)	• 2.03 – 1.53 = 0.5 ÷ 2.03 x 100 (1) • = 24.63% (1)		**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
7(b)	An explanation that makes reference to three of the following: • moving shadow and touch are perceived as presence of {danger / predator} (1) • response to touch is greater than to shadow because touch perceived as {more dangerous/ closeness of predator} (1) • response in tube is greater than response out of tube because tube provides physical surface to assist {contraction/ withdrawal} (1) • worm has receptors and those for light generate less response than those for touch (1) • when out of tube, a shadow stimulus affects all of a worm but a touch stimulus affects part of a worm (1)		**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
7(c)(i)	An answer that makes reference to the following: • prevents wasting energy (1) • allows maximum feeding effort (1)		**(2)**

Question Number	Acceptable Answer	Additional Guidance	Mark
7(c)(ii)	An explanation that makes reference to the following: • there is less response because there is less depolarisation of the post–synaptic membrane (1) • because there are fewer calcium ions entering the pre synaptic membrane so fewer vesicles fuse with the presynaptic cell membrane (1) • so less neurotransmitter diffuses across the synaptic cleft (1) • therefore less binding to the receptors on the post–synaptic membrane so fewer sodium channels open (1) • resulting in no {action potential / impulse} in the post–synaptic neurone leading to no withdrawal response (1)	Allow description of sodium ion movement	**(5)**

(Total for Question 7 = 12 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
8(a)	D		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
8(b)	An explanation that makes reference to: • muscles can only work in one direction (1) Plus one from: • therefore a need to create opposite forces (1) • so must have extensors and flexors (1)		**(2)**

<table>
<tr><th>Question Number</th><th colspan="2">Indicative content</th></tr>
<tr><td>8(c)</td><td colspan="2">Answers will be credited according to candidate's 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.

Supports

• this is true after 10 months because there is a significant decrease for the slow twitch
• if muscle is {mainly slow twitch / has fewer fast twitch}
• Ca-ATPase will take longer to transport calcium ions into the sarcoplasmic reticulum

Does not support

• ageing has {no / little} effect on fast twitch fibres
• there is little difference between the fast and slow twitch up to 10 months
• appropriate comment on the difference between the data related to the variation as shown by the error bars</td></tr>
<tr><td>Level</td><td>Mark</td><td>Descriptor</td></tr>
<tr><td></td><td>0</td><td>No awardable content</td></tr>
<tr><td>Level 1</td><td>1-2</td><td>Limited scientific judgement made with a focus on one side of the argument only.

A conclusion may be attempted, demonstrating isolated elements of biological knowledge and understanding but with limited evidence to support the judgement being made.</td></tr>
<tr><td>Level 2</td><td>3-4</td><td>A scientific judgement is made through the application of relevant evidence to both sides of the argument.

A conclusion is made, demonstrating linkages to elements of biological knowledge and understanding, with occasional evidence to support the judgement being made.</td></tr>
</table>

Level 3	5-6	A scientific judgement is made, which is supported throughout by sustained application of relevant evidence from the analysis and interpretation of the scientific information. A conclusion is made, demonstrating sustained linkages to biological knowledge and understanding with evidence to support the judgement being made.

(Total for Question 8 = 9 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
9(a)	An explanation that makes a reference to the following: • serotonin cannot be broken down faster than produced (1) • therefore activity of the two enzymes that produce serotonin must be similar to the activity of enzyme 3 (1) • one of the enzymes must be rate limiting (1)		**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
9(b)	An explanation that makes a reference to three of the following: • SSRIs bind to {channel / reuptake} proteins (1) • serotonin levels remain high in synapse (1) • serotonin binds to receptor proteins in post-synaptic membrane (1) • depolarisation of post-synaptic membrane (1) • {action potentials / impulses / transmission} continues (1)		**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
9(c)(i)	• neither patients nor {doctors /scientists / eq} know which treatment the patients were given (1)		**(1)**

Question Number	Acceptable Answer	Additional Guidance	Mark
9(c)(ii)	An answer that makes reference to three of the following: • idea that SSRI works best (1) • placebo works faster than SJW (1) • SJW and placebo effect {wear off / level / end at 12 / same final score / fall then rise / eq} (1) • correct comparative manipulation of figures to support analysis (1)		**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
9(c)(iii)	An explanation that makes reference to two of the following pairs: • use more patients / increase sample size / repeat the trial (1) • to increase reliability (1) **and/or** • consider sample selection to use same age / gender / ethnicity / lifestyle / health of patients (1) • to control biotic variables (1) **and/or** • extension of time for trial (1) • to ensure SSRIs continue to reduce HRSD score or not / SJW continue to decrease HRSD score or not (1) **and/or** • use of statistical analysis (1) • to see if the differences are significant (1)		**(4)**

(Total for Question 9 = 14 marks)

Question Number	Acceptable Answer	Additional Guidance	Mark
10(a)	volume change e.g. 0.5 dm^3 in 1 minute (1) correct conversion to ml from dm^3 (1) answer 500 ÷ 90 = 5.5 (1)	Correct answer gains full marks, no working shown	**(3)**

Question Number	Acceptable Answer	Additional Guidance	Mark
10(b)(i)	An explanation that makes reference to five of the following: • anaerobic respiration occurs during exercise because oxygen supply to cells is limited (1) • therefore glycolysis used to produce ATP (1) • glycolysis also produces lactate (1) • oxygen consumption is higher at end of exercise than at rest because lactate is converted back to pyruvate (1) • pyruvate enters Krebs cycle (1) • oxygen used in electron transport chain / oxidative phosphorylation as final hydrogen electron acceptor / to form water (1)	Allow some lactate is converted into glycogen (1)	**(5)**

Question Number	Acceptable Answer	Additional Guidance	Mark
10(b)(ii)	An explanation that makes reference to five of the following: • High CO_2 in the blood stimulates the respiratory centre (1) • Increase in lactate / fall in pH stimulates the respiratory centre (1) • Reference to chemoreceptors in the medulla/carotid bodies/aortic bodies (1) • More impulses sent to diaphragm and intercostal muscles (1) • Resulting in an increase in the rate and depth of breathing (1) • pH returns to normal as CO_2 is removed and ventilation rate decreases (1)		**(5)**

Question Number	Acceptable Answer	Additional Guidance	Mark
10(c)	An answer that makes reference to four of the following: • For high risk, an increase in exercise reduces incidence of type II diabetes (1) • For low risk, an increase in exercise has no effect on incidence of type II diabetes (1) • Reference to correlation in correct context (1) • A causal relationship is {shown by the high risk group and level of exercise / not shown by the low risk group and level of exercise} (1) • Other factors may cause type II diabetes, e.g. obesity, diet, age, ethnicity (1)	Accept high risk = family history low risk = no family history	**(4)**

(Total for Question 10 = 17 marks)