15. Control and Coordination

15.1 Control and Coordination in Mammals

Paper 4

Marking Scheme

Q1.

(a)(i)	receptor ;	1
(a)(ii)	intermediate neurone ; **A** relay neurone / motor neurone	1
(a)(iii)	Schwann ;	1
(b)	*any **four** from:* *differences* *myelinated neurone* 1 faster (impulse transmission) ; **ora** *explanation* 2 myelin (sheath), insulates (the axon) / prevents movement of ions ; 3 nodes of Ranvier / gaps with no myelin sheath, have voltage-gated channels **or** nodes of Ranvier / gaps with no myelin sheath, allow movement of ions ; 4 depolarisation / action potential, occurs only at nodes of Ranvier / gaps with no myelin sheath; **ora** 5 action potentials jump from node to node / saltatory conduction ; **ora** 6 longer local circuits / local circuits occur between nodes ; **ora**	4
(c)(i)	1 **A** voltage-gated <u>and</u> **B** ligand-gated / not voltage-gated **or** **A** opens in response to, depolarisation / arrival of an action potential <u>and</u> **B** opens in response to binding of, acetylcholine / neurotransmitter ; 2 **A** for calcium ions <u>and</u> **B** for sodium ions ;	2

(c)(ii)	*any **four** from:* 1 no Ca^{2+} enter (presynaptic, knob / neurone) ; 2 vesicles do not, move towards / fuse with, presynaptic membrane ; 3 no, ACh / neurotransmitter, released **or** no exocytosis of, ACh / neurotransmitter ; 4 ACh / neurotransmitter, does not bind to, receptor / ion channel **B** ; 5 Na^+ does not enter postsynaptic neurone / ion channel **B** does not open ; 6 postsynaptic membrane not depolarised **or** no action potential generated **or** impulse not transmitted ;	4
(c)(iii)	*any **two** from:* 1 inside more negative (charge) **or** membrane hyperpolarised / membrane potential decreases / potential difference increases ; 2 harder to / cannot, reach threshold ; 3 no depolarisation of membrane / harder to depolarise membrane **or** no / fewer / harder to generate, action potentials / impulses ;	2

Q2.

(a)(i)	**1** *similarity:* both involve a (signalling), chemical / ligand / molecule ; **2** *difference:* endocrine chemical / hormone, travels in blood / circulatory system (but paracrine chemical travels by diffusion) ;	**2**
(a)(ii)	**1** (ACh) travels a short distance by diffusion ; **2** across, synapse / synaptic cleft / neuromuscular junction ;	**2**
(b)	*any **three** conclusions from:* **1** palmitate-exposed cells, release / secrete, molecule / chemical / substance ; **2** (this) molecule switches on stress genes in, new / other, muscle cells ; **3** molecule is not, destroyed / denatured, by, boiling / high temperature ; **4** (so) molecule is not a protein ; **5** molecule is, lipid / lipid-soluble / hydrophobic / non-polar ; **6** AVP ;	**3**
(c)	*any **three** from:* **1** less actin ; **2** less myosin ; **3** less troponin ; **4** less tropomyosin ; **5** fewer / smaller, sarcomeres / myofibrils / myofilaments / mitochondria / ribosomes ; **6** less of other named protein ;	**3**

Q3.

	*any **six** from:* **1** sucrose binds to, receptor protein / (chemoreceptor) cell surface receptor ; **2** *ref. to* second messenger ; **3** (chemoreceptor cell) Na^+ entry / membrane depolarises ; **4** receptor / generator, potential ; **5** Ca^{2+} ions enter (chemoreceptor cell) ; **6** (named) neurotransmitter vesicles, move towards / fuse with, (presynaptic) membrane ; **7** (named) neurotransmitter, release / exocytosis, into (synaptic) cleft ; **8** (named) neurotransmitter binds to receptor on, sensory neurone / postsynaptic membrane ; **9** Na^+ enters (through ligand-gated channel) → depolarisation ; **10** *ref. to* threshold for action potential ; **11** AVP ;	**6**

Q4.

<table>
<tr><td>(a)(i)</td><td>X – Schwann (cell) ; Ignore myelin sheath (as not a cell)

Y – cell body ; A cytoplasm</td><td>2</td></tr>
<tr><td>(a)(ii)</td><td>intermediate neurone ; A relay neurone / sensory neurone</td><td>1</td></tr>
<tr><td>(b)</td><td><table><tr><th>correct order</th><th>letter of stage</th></tr><tr><td>1</td><td>C</td></tr><tr><td>2</td><td>F</td></tr><tr><td>3</td><td>A</td></tr><tr><td>4</td><td>E</td></tr><tr><td>5</td><td>J</td></tr><tr><td>6</td><td>I</td></tr><tr><td>7</td><td>G</td></tr><tr><td>8</td><td>B</td></tr><tr><td>9</td><td>H</td></tr><tr><td>10</td><td>D</td></tr></table>
C F A E all above J ;
C F A E in correct order ;

I G B H between J and D ;
I G B H in correct order ;</td><td>4</td></tr>
</table>

Q5.

<table>
<tr><td>(a)(i)</td><td>A = dendrite(s) ;
B = nuclei ;
C = synaptic knob(s) ;</td><td>3</td></tr>
<tr><td>(a)(ii)</td><td>1 rat has, myelin sheath / Schwann cell / myelinated axon / myelinated neurone ;

2 (rat has) saltatory conduction OR (rat) impulse / action potential, jumps / leaps / AW, from (one) <u>node of Ranvier</u> to, the next / another ;</td><td>2</td></tr>
<tr><td>(b)</td><td>any three from:

snail / Fig. 1.3
1 greater depolarisation OR
(membrane potential) gets more positive / has higher increase / has higher peak ;

2 action potential, slower / takes longer / takes more time OR
longer time to return to resting potential ;

3 longer (absolute / relative) <u>refractory period</u> ;

4 longer hyperpolarisation ;

5 AVP ;</td><td>3</td></tr>
</table>

Q6.

(a)	*any **four** from:* 1 respiration rate decreases / less ATP produced ; 2 reduces activity of (named) enzymes / description ; 3 reduces movement of, Ca^{2+} / Na^{+} / ACh / neurotransmitter ; 4 (*in neuromuscular junction*) less / no, acetylcholine broken down acetylcholine remains attached to receptors acetylcholinesterase, less active / inactive ; 5 (*in sarcomere*) fewer / no, Ca^{2+} bind to troponin fewer / no, cross bridges formed fewer / no, power stokes ; 6 (*in sarcomere*) less / no, detachment of myosin heads (from actin) fewer / no, cross bridges broken ATPase / myosin head, less active / inactive hydrolysis of ATP, slower / stops ; 7 AVP ; e.g. shivering / reduced blood flow to muscle / energy diverted for thermoregulation (*idea*)	**4**

(b)	*any **three** from:* 1 Na^{+} channels don't open **A** Na^{+} do not, diffuse / move, into neurone **or** stay open ; **A** Na^{+} always, diffuse / move, into neurone 2 (axon) membrane, cannot be depolarised **or** (axon) membrane stays depolarised ; 3 no action potentials, generated / transmitted (along motor neurone) **or** continuous action potentials, generated / transmitted (along motor neurone) ; 4 Ca^{2+} does not enter presynaptic knob / vesicles not stimulated to move / no ACh release (at neuromuscular junction) **or** Ca^{2+} always enters presynaptic knob / vesicles always stimulated to move / ACh continually released (at neuromuscular junction) ; 5 consequence e.g. paralysis / described or continued muscle contraction ;	**3**

Q7.

(b)(i)	**1** chloride (ions) / Cl^-, not, sodium ions / Na^+ (enter post-synaptic neurone) ; **2** glycine not choline (re-enters / recycled to, pre-synaptic neurone) **OR** glycine not, broken down / hydrolysed, but acetylcholine is (in synaptic cleft) ;	**2**
(b)(ii)	*any **two** from*: **1** Cl^- decreases, membrane / resting, potential (difference) / voltage ; **2** harder / need more depolarisation, to reach threshold ; **3** glycine is inhibitory ;	**2**
(b)(iii)	*any **four** from*: **1** sodium-potassium pump / active transport ; **2** Na^+, out / leaves **and** K^+, in / enters ; **3** three Na^+ for two K^+ ; **4** some K^+ can diffuse out of neurone **OR** (×20) more K^+ diffuses out than Na^+ diffuses in **OR** membrane is (×20) more permeable to K^+ (than Na^+) ; **5** inside of, axon / neurone, is more negative (than outside) **OR** outside of, axon / neurone, is more positive (than inside) ;	**4**

Q8.

(a)	*any **four** from:* 1 mitochondria produce ATP ; *presynaptic knob* 2 for production of, acetylcholine / ACh ; 3 for, making / moving, vesicles ; **A** exocytosis *sarcomere* 4 active transport of Ca^{2+} into, sarcoplasmic reticulum ; 5 detachment of myosin heads / break cross bridge **or** allows myosin head to move back to original position ; 6 AVP ; e.g. *ref. to* sodium potassium pump / active transport of Ca^{2+} out of synaptic knob	**4**
(b)	**X** – agree, because Na^+ influx leads to depolarisation ; **Y** – disagree, because Cl^- influx leads to hyperpolarisation / description **or** disagree, because no Na^+ influx so no depolarisation ; **X** and **Y** – agree, because Na^+ (influx) is balanced by Cl^- (influx) / AW ;	**3**
(c)	*any **two** from:* 1 decrease in transmission speed ; 2 *ref. to* shorter local circuits ; 3 no / less, saltatory conduction / described ;	**2**

Q9.

(b) *any **four** from:* **4**

		nervous system		endocrine system
1	communication	action potential / impulse	and	hormone ;
2	nature of communication	electrical (and chemical)	and	chemical ;
3	mode of transmission	neurone	and	blood ;
4	response destination	muscle	and	target, organs / tissue / cells ;
5	transmission speed	fast(er)	and	slow(er) ;
6	location of effect	specific / localised	and	(can be) widespread ;
7	response speed	fast(er)	and	slow(er) ;
8	duration of effect	short-lived / temporary	and	can be long-lasting / permanent ;

Q10.

(a)(i) *any **four** from:* **4**

both
1 acetylcholine, in / from, vesicles ;
2 many mitochondria ;
3 have presynaptic and postsynaptic membranes ;
4 (synaptic) cleft / gap ;
5 have receptor(s) (for ACh / neurotransmitter) ;
6 presynaptic, Ca^{2+}, entry / channels
or
postsynaptic Na^{+}, entry / channels ;

(a)(ii) *any **three** from:* **3**

1 few(er) Ca^{2+} ions, leave sarcoplasmic reticulum / enter sarcoplasm ;
2 few(er) Ca^{2+} ions bind to troponin ;
3 few(er) troponin molecules change shape ;
4 few(er) tropomyosin molecules move ;
5 few(er) myosin-binding sites, uncovered / exposed ;
6 few(er), actin-myosin cross bridges form / myosin (heads) bind to actin ;
7 AVP ; e.g. lack of P_i leads to less ATP formed
8 AVP ; e.g. myosin-actin cross-bridges do not break / myosin heads do not reset

Q11.

(a)(ii)	*any **four** from:* 1 *ref. to* receptor / generator, potential ; 2 vesicles of (named) neurotransmitter, move towards / fuse with, (presynaptic) membrane ; 3 (named) neurotransmitter, release / exocytosis ; 4 neurotransmitter binds to receptors on sensory neurone ; 5 Na^+ / sodium, ions enter (sensory neurone) ; 6 depolarisation (of membrane of sensory neurone) ; 7 *ref. to* threshold potential / all-or-nothing response ;	**4**

Q12.

(a)	*any **four** from:* *motor / neurone* 1 resting potential higher ; 2 –70 mV (motor) versus –90 mV (muscle) ; 3 smaller change in membrane potential / smaller depolarisation ; 4 110 mV (motor) versus 130 mV (muscle) ; 5 action potential / depolarisation, takes less time / is faster ; 6 (action potential) 2.7 ms (motor) versus 4 ms (muscle) **or** (depolarisation) 1 ms (motor) versus 2 ms (muscle) ; 7 hyperpolarisation / <u>relative</u> refractory period, occurs ;	**4**
(b)(i)	*any **three** from:* 1 transverse / T- , tubules depolarised ; 2 Ca^{2+} <u>diffuse</u> out of sarcoplasmic reticulum ; 3 Ca^{2+} bind to troponin ; 4 tropomyosin, moves from / exposes, binding sites ; 5 for myosin on actin ; 6 cross-bridges form / myosin (head) binds to actin ;	**3**

(b)(ii)	*any **one** from:* 1 cross bridges break / myosin heads detach, at different times ; 2 AVP ;	**1**

Q13.

(b)	*any **three** from:* **1** Ca^{2+} (stays) in, cytoplasm / sarcoplasm ; **2** Ca^{2+}, binds / bound, to troponin ; **3** tropomyosin, shifted / does not cover (myosin) binding sites (on actin) ; **4** myosin-actin, cross bridges / bonds, exist / remain ; **5** sarcomere(s) / muscle, contracted / shortened / paralysed ;	**3**
(c)	*any **three** from:* **1** Ca^{2+}, enters / diffuses into, synaptic knob ; **2** through (voltage-gated) calcium (ion) channels ; **3** vesicles containing acetylcholine ; **4** move to / fuse with, presynaptic membrane ; **5** exocytosis of acetylcholine ;	**3**

Q14.

(a)	<table><tr><th>motor</th><th></th><th>sensory</th></tr><tr><td>**1** transmits impulses from CNS to effector</td><td>**and**</td><td>transmits impulses from, receptors / (named) sense organs, to CNS ;</td></tr></table> *plus **two** from:* <table><tr><th>motor</th><th></th><th>sensory</th></tr><tr><td>**2** cell body at end of, neurone / axon</td><td>**and**</td><td>cell body, in middle of / part-way along, neurone **OR** cell body not at end of, neurone / axon ;</td></tr><tr><td>**3** cell body in, CNS / brain / spinal cord</td><td>**and**</td><td>cell body in (dorsal root) ganglion ;</td></tr><tr><td>**4** long axon **OR** axon</td><td>**and**</td><td>short axon **OR** axon and dendron ;</td></tr><tr><td>**5** dendrites attached to cell body</td><td>**and**</td><td>dendrites attached to dendron ;</td></tr></table>	**3**
(b)	*any **three** from:* **1** no myelin slow and myelin fast(er) / myelin increases speed ; **2** no myelin = 0.5–2 m s^{-1} and with myelin > 5 / up to 120 m s^{-1} ; **3** as axon diameter increases speed increases ; **4** diameter (+ units once) and speed (+ units once) for two neurones ;	**3**

(c)	*any **three** from:* **A –** *any one reason from:* **1** Na^+ / sodium, channels already open **OR** Na^+ has already entered neurone **OR** no more Na^+ channels to open **OR** less Na^+ outside to diffuse in **OR** less steep Na^+ concentration gradient ; **B –** *any one reason from:* **2** sodium channels are, inactive / unresponsive **OR** potassium channels are open **OR** membrane is, impermeable / less permeable, to Na^+ **OR** membrane is more permeable to K^+ ; **C –** *any one reason from:* **3** harder to reach threshold **OR** potassium channels are (still) open **OR** sodium-potassium pumps need to restore the resting potential ; **4** hyperpolarisation at **C** ;	**3**

Q15.

(a)	microvilli ; **A** brush border	**1**
(b)	no movement of, chemicals / substances / ions, between the, chemoreceptor / cells / (cells) **A** ; **Ignore** food **A** named dissolved substance	**1**

(c)	*any **seven** from:* 1. Na^+ ions enter, (chemo)receptor cell / **A**, through, microvilli / **Y** / channel (proteins) ; 2 cell **surface** membrane depolarised ; 3 receptor potential ; 4 *ref. to* threshold ; 5 (voltage-gated) Ca^{2+} / calcium, channels open ; 6 Ca^{2+} ions enter, cytoplasm / cell / **A** ; **A** presynaptic knob 7 vesicles (of neurotransmitter), move towards / fuse with, cell **surface** membrane / presynaptic membrane ; 8 exocytosis (described) / secretion, of (named) neurotransmitter ; 9 neurotransmitter binds to receptor on, postsynaptic / (sensory) neurone / **B**, membrane ; 10 Na^+ / sodium, channels open **or** Na^+ enter (sensory) neurone / **B** ; 11 postsynaptic membrane / (sensory) neurone membrane, depolarised ; 12 *ref. to* threshold ; *allow either mp4 or mp12*	**7**

Q16.

(a)(i)	**A** – sodium potassium pump ; CON if channel mentioned **B** – potassium ions ; **A** K^+ **D** – sodium ions ; **A** Na^+ *max 2 if no ref. to ions*	**3**
(a)(ii)	ATP ;	**1**
(b)	*any **five** from:* *drugs could be in any order* *curare* **1** less / no, ACh binds to receptors ; **I** neurotransmitter **2** fewer / no, (ligand gated) Na^+ channels open **or** fewer / no, Na^+ can enter sarcomere / sarcoplasm **or** no / less, depolarisation of, sarcolemma / muscle cell membrane ; *nerve gas* **3** no / less, ACh broken down **or** ACh remains bound to receptor ; **4** (ligand gated) Na^+ channels remain open / Na^+ continue to enter post synaptic neurone **or** permanent / AW, depolarisation (of post synaptic membrane) ; **A** sarcolemma *alcohol* **5** no / less, binding of, neurotransmitter / ACh, to receptors ;	**5**

(b)	**6** fewer / no, (ligand gated) Na^+ channels open **or** fewer / no, Na^+ can enter post synaptic neurone **or** no / less, depolarisation (of post synaptic membrane) ; **A** sarcolemma	

Q17.

(c)	to reduce ingestion of food **or** binds to receptor(s) in brain ;	**1**

Q18.

(a)(i)	*any **three** from:* **1** wider / thicker / larger diameter → increases / higher, speed ; **2** large(r) membrane surface area so more ion movement ; **3** myelin → increases / faster / higher, speed ; **4** saltatory conduction (in myelinated) ; **5** pairwise data comparison ;	**3**
(a)(ii)	*any **one** from:* **1** impulses, for touch / in **A^{β}** neurones, travel faster ; **2** (**A^{β}** neurones) inhibit, spinal cord / relay / projection, neurones ; **3** AVP ;	**1**
(b)(i)	*any **four** from:* **1** endorphins bind to (endorphin) receptors ; **2** stop, calcium ions / Ca^{2+}, entering presynaptic knob ; **3** no / fewer, vesicles, move towards / fuse with, (presynaptic) membrane ; **4** no / less, acetylcholine / ACh, released ; **5** no / less, binding of ACh to postsynaptic receptors ; **6** no / less, depolarisation of postsynaptic, neurone / membrane ; **7** no / fewer, action potentials / impulses, to, pain centre / brain ;	**4**
(b)(ii)	*any **one** from:* **1** (drug) dependency / addiction / tolerance ; **2** (drug) side-effects ; **3** expensive ; **4** work more slowly ;	**1**

Q19.

(a)	*any **five** from:* **1** opiod binds to receptor ; **2** activates G protein ; **3** blocks Ca^{2+} channels **or** no / less, Ca^{2+} enter presynaptic, knob / neurone ; **4** vesicles do not, move towards / fuse with, presynaptic membrane **or** fewer vesicles, move towards / fuse with, presynaptic membrane ; **A** cell surface / plasma, membrane **5** no / less, Ach / acetylcholinesterase, released into (synaptic) cleft **or** no / less, exocytosis of ACh ; **6** no / less, Ach / acetylcholinesterase, binds to receptors on postsynaptic membrane ; **7** no / smaller, depolarisation of postsynaptic membrane ;	**5**
(b)(i)	automatic / involuntary / no conscious thought / brain not involved ; response always the same / stereotypic ;	**2**
(b)(ii)	(sensory) dorsal root ganglion **or** (sensory) part way along (neurone) / AW ; **and** (motor) CNS / spinal cord **or** (motor) at end (of neurone) ;	**2**

(b)(iii)	*sensory* **1** transmit, impulses / action potentials, from receptor ; **2** to, relay / intermediate, neurone **or** CNS / spinal cord **or** motor neurone ; *motor* **3** transmit, impulses / action potentials, from, CNS / spinal cord **or** relay / intermediate, neurone **or** sensory neurone ; **4** to effector / muscle / gland ;	**4**

Q20.

(a)(i)	(cytoplasm of) presynaptic / terminal, knob ; presynaptic membrane ; presynaptic membrane ; postsynaptic membrane ;	**4**
(a)(ii)	*any **two** from:* one-way / unidirectional (transmission of impulses) ; communication between (many) neurones ; AVP ;	**2**
(b)	*any **four** from:* **1** binds to / inhibits, acetylcholinesterase ; **2** active site, blocked / shape changes ; **3** Ach / acetylcholinesterase, not broken down / stays bound to receptors ; **4** Na^+ channels stay open ; **5** sarcolemma, (stays) depolarised / has constant action potentials ; **6** muscles stay contracted ;	**4**
(c)	*any **two** from:* **1** Ca^{2+} channels open ; **2** Ca^{2+}, diffuses / released, into sarcoplasm ; **3** Ca^{2+} binds to troponin ; **4** tropomyosin, moves / changes position ; **5** cross-bridges form / myosin binds to actin ;	**2**

Q21.

(c)	*any **three** from:* *Venus fly trap* 1 smaller change in membrane potential / smaller depolarisation ; **ora** 2 longer duration of action potential / shorter duration of depolarisation ; **ora** 3 shorter duration of repolarisation / longer duration of hyperpolarisation ; **ora** 4 longer refractory period ; **ora** 5 data quote to **support** either mp1, mp2, mp3 or mp4 ; 6 membrane / resting, potential 0mV compared with -70mV for human ;	**3**

Q22.

(a)	**A** – Schwann cell / myelin sheath ; **B** – axon / axoplasm / cytoplasm ;	**2**
(b)	1 action potential / impulse, 'jumps' from node to node ; 2 local circuits, set up between nodes / longer ; **A** local currents 3 fast / increases speed (of transmission of impulse) ;	**3**
(c)	*any **five** from:* 1 no calcium ions enter (the presynaptic knob) ; 2 (so) vesicles do not, move towards / fuse with, presynaptic membrane ; 3 no, exocytosis / release, of ACh ; **R** exocytosis of vesicles 4 ACh does not diffuse across (synaptic) cleft ; 5 no binding with receptor (protein) on postsynaptic membrane ; 6 sodium (ion) channels do not open ; 7 sodium ions do not enter (postsynaptic) neurone ; 8 no depolarisation (of postsynaptic membrane) ;	**5**

Q23.

(a)	*any 4 of:* 1 (presynaptic) membrane depolarised ; 2 calcium (ion) channels open / (presynaptic membrane becomes) more permeable to Ca^{2+} ; 3 Ca^{2+} move in (to presynaptic, neurone / knob) ; **R** membrane 4 causes vesicles (of ACh) to move towards (presynaptic) membrane ; 5 vesicle fuses with (presynaptic) membrane / exocytosis ;	**4**
(b)	*any 2 of:* 1 no Na^+ enter (postsynaptic neurone) ; 2 no depolarisation of (postsynaptic) membrane ; 3 no, action potentials / impulses (transmitted) ;	**2**
(c)(i)	**A** – myelin sheath / Schwann cell ; **B** – sarcolemma ; **C** – mitochondria ;	**3**
(c)(ii)	*any 2 of:* 1 insulates axon / prevents movement of ions / AW ; 2 increases speed (of impulses) ; 3 saltatory conduction / described ;	**2**

(c)(iii)	1 produces / releases, ATP ; *any 3 of mp2-5:* 2 (for) production / recycling, of ACh ; 3 (for) production / movement, of vesicles **or** exocytosis ; 4 (for) contraction of sarcomere ; 5 (for) sodium potassium pumps / active transport ;	**4**

Q24.

(a)

feature	nervous system	endocrine system	
method of communication	electrical / impulses / action potentials / wave of depolarisation	hormones / chemical(s) (messengers)	;
method of transmission	neurones / nerve fibres / nerve cells / axons	blood (stream / plasma) / circulation	;
transmission speed	fast(er) / quick(er) / rapid	slow(er)	;
duration of effect	short(er) / temporary / seconds	long(er) / permanent / minutes – years	;

4

Q25.

(a)	*any three from* **1** detect / respond to, (change in) stimulus / stimuli ; **2** *two examples from* – light / heat / sound / touch / pressure / pain / chemicals / taste / smell / tension ;; **3** (act as) transducers / convert stimulus energy to electrical energy ; **4** produce, generator / receptor / action, potential ; **5** passes impulse, to / along, sensory neurone ;	**3**
(b)(i)	*Na+/K+ pump:* **C** or **D** and **E** ; *Na+ channels open:* **C** ; *K+ channels open:* **D** ;	**3**
(b)(ii)	*for A (**ora** for B)* **1** generator / receptor, potential ; **2** threshold not, reached / exceeded / crossed ;	**2**
(b)(iii)	*any two from* **1** limits / controls, (maximum) frequency of action potentials ; **2** (action potentials / impulses) travel in one direction ;	**2**
(b)(iv)	*any four from* **1** local circuit / movement of ions from positive to negative region ; **2** (causes) opening of Na^+ channels ; **3** at next, node (of Ranvier) / gap in myelin sheath ; **4** causing next / new, action potential / depolarisation ; **5** saltatory conduction ; **6** one-way transmission ; **7** AVP ; e.g. myelin (sheath) / Schwann cells, insulate axon / prevent (named) ion movement / impermeable to (named) ions / speed up transmission / lengthens local circuits	**4**