14. Coordination and response

14.1 Coordination and response

Paper 3 and 4

Marking Scheme

Q1.

(a)(i)	**X –** spinal cord ; **Y –** motor neurone ;	**2**	
(a)(ii)	(leg) muscle ;	**1**	
(a)(iii)	hammer tapping (knee / leg) / AW ;	**1**	
(a)(iv)	it is rapid / immediate / AW ; it doesn't require conscious thought / is automatic / AW ; AVP ; e.g. protective / may not involve the brain	**2**	
(b)	3750000 (times) / 3.75×10^6 ;;	**2**	MP1 conversion of **both** values to the same unit e.g. 1.5 m = 1500 mm or 0.0004 mm = 0.0000004 m MP2 correct calculation e.g. 1500 ÷ 0.0004 or 1.5÷0.0000004 = 3 750 000 ecf MP2 no conversion (MP1) i.e. 3750 = 1 mark
(c)	synapse / synaptic gap / synaptic cleft ;	**1**	

Q2.

(a)(i)	(change in) temperature / heat / hot pan ;	**1**	
(a)(ii)	muscles ;	**1**	
(a)(iii)	brain ; spinal cord ;	**2**	either order
(b)	motor (neurone) ; relay (neurone) ; sensory (neurone) ;	**3**	
(c)	synapse ;	**1**	

Q3.

(b)	The brain and spinal cord are part of the peripheral nervous system. coordinates body functions. contains receptors that detect the temperature of the blood. produces insulin. receives impulses from motor neurones. receives impulses from the optic nerve. ;;;	**3**	one mark for each correct line **R** each additional line

Q4.

(a)	*in this order vertically from the top:* receptor ; relay neurone ; effector / muscle / gland ;	**3**
(b)	Reflex actions are automatic. ; Reflex actions coordinate stimuli with responses. ; Reflex actions involve the central nervous system. ;	**3**

Q5.

(a)	motor / effector, (neurone) ; impulse ; synapse ;	**3**	
(b)	light ; sound ; temperature ; touch ; chemicals ; AVP ; e.g. gravity / movement / stretch	**3**	
(c)	(stimulus detected by) receptor ; receptor passes (impulse) to sensory neurone ; sensory neurone passes (impulse) to, relay / intermediate, neurone ; relay neurone passes (impulse) to motor neurone ; motor neurone passes to muscle / gland / effector ; automatic / involuntary / AW ; AVP ;	**4**	

Q6.

	nervous ; motor ; impulses ; synapses ; fast ;	**5**	

Q7.

(b)(i)	label line and the letter X that touches the neurone coming from the brain to the eye ;	**1**	
(b)(ii)	*any three from:* 1 correct ref to neurotransmitter (molecules) ; 2 (neurotransmitters) released from vesicles (from first or presynaptic neurone / into synaptic gap) ; 3 (neurotransmitters) diffuse across (gap / cleft) ; 4 (neurotransmitters) bind / fit / attach / receive to, receptor (proteins / molecules) / membrane proteins (on the next neurone) ;	**3**	
(b)(iii)	*total of four from:* 1 identify **E** as ciliary muscle and **K** as suspensory ligaments and **F** as lens ; *max three from:* 2 ciliary muscle / **E**, contracts; 3 suspensory ligaments / **K**, slacken / loosen / AW ; 4 lens / **F**, becomes more convex / AW ; 5 more refraction ; 6 light / image (of object), is focussed onto the, retina / fovea / **A** or **B** ;	**4**	

Q8.

(a)	*first gap:* central **and** *second gap:* peripheral ;	**1**	both needed for the mark
(b)(i)	**T** **P** **S** **Q** **N** **M** **R** ;;	**2**	MP1 for **P** first and **M** at the end MP2 for **S**, **Q**, **N** in that order but in *any* position in relation to **P** and **M**
(b)(ii)	*any two from:* touch ; temperature ; AVP ;	**2**	e.g. pressure / pain
(b)(iii)	circular / radial, muscle ;	**1**	**A** iris
(c)	*total of five from:* **1** only the first neurone releases neurotransmitters ; **2** only the second neurone has (complementary) receptors ; *max four from:* **3** *ref. to* neurotransmitter (molecules) ; **4** (neurotransmitter is released) from vesicles ; **5** into the synaptic gap ; **6** the junction between the neurones is the synapse ; **7** (neurotransmitter molecules) diffuse (across the gap) ; **8** *ref. to* receptors are complementary in shape (to neurotransmitter) ; **9** (neurotransmitter molecules) bind with receptors (on the next neurone) ; **10** impulse is then stimulated (in the next neurone) ;	**5**	

Q9.

(a)	**X** – vesicle (membrane) ; **Y** – synapse / synaptic gap ;	**2**	
(b)	*any five from:* movement is, impaired / slower / non-existent ; slower reflexes / AW ; fewer vesicles ; fewer neurotransmitters in, vesicles / **X** ; fewer neurotransmitters, released (when an impulse arrives) ; fewer neurotransmitters diffuse across the, synapse / gap / cleft ; fewer neurotransmitters bind to receptor proteins ; fewer / no, impulses (in the, postsynaptic / second / next, neurone) ; AVP ;	**5**	

Q10.

(a)	central and peripheral (nervous system) ;	**1**	

Q11.

(a)	*one mark for each row:* function / name / letter on Fig. 4.1 conducts impulses to CNS / sensory / afferent, neurone / **V** ; conducts impulses to an effector / motor / effector / efferent, neurone / **Y** ; conducts impulses within the CNS / relay / connector / intermediate, neurone / **X** ; detects / senses, stimulus / change in temperature / receptor / **U** ; contracts / causes movement / carry out response / biceps / muscle / effector / **Z** ;	**5**	**A** nerve cell / nerve throughout **A** interneurone **A** receive **A** change in, environment / surroundings **A** heat / hot object **A** carry out an action ***ignore*** triceps
(b)	*any four from:* **1** vesicles move towards end of, pre-synaptic neurone / axon / AW ; **2** vesicles fuse with (pre-synaptic) membrane ; **3** (named) neurotransmitter released ; **4** neurotransmitter diffuses across, synapse / gap / synaptic cleft ; **5** neurotransmitter binds to receptor, on post-synaptic neurone ; **6** impulse (generated) in post-synaptic neurone ; **7** AVP ;	**4**	

Q12.

(f)(i)	**A** sensory neurone ; **B** vesicle ; **C** synapse / synaptic cleft ; **D** receptor molecules ;	**4**
(f)(ii)	*any three from:* drug **X** blocks, **D** / receptor (molecules) ; neurotransmitters are not able to bind to, **D** / receptor (molecules) ; drug **X** is similar in shape to neurotransmitter / complementary to shape of receptor (molecule) ; drug **X** stops, impulse/electrical signal, being transmitted in relay neurone ; (so) less / no, pain felt with drug **X** ;	**3**

Q13.

(c)	*general marking point* neurotransmitters move across, synapse / gap / junction / AW ; *atropine* neurotransmitter cannot, bind to / enter / reach, receptors ; therefore no impulses (along, next / postsynaptic, neurone) / no impulses reach the CNS ; no sensitivity to stimuli / feels no pain / painkiller ; no, contraction of muscle / response ; depressant ; *eserine* neurotransmitter stays in, synapse / synaptic gap ; neurotransmitter can bind to receptor (rather than stay in synapse) ; continuously stimulates the, next / postsynaptic, neurone ; (more) impulses are sent (in, next / postsynaptic, neurone) ; repeated, contraction of muscle / response ; stimulant ;	**6**	**A** reaction time is longer / no reflex

Q14.

(a)	long, to transmit (impulse), over (long) distance / faster / direct connection ; mitochondria to (release energy), for transmission impulse / protein synthesis / active transport / making (neuro)transmitters ; vesicles to, carry / hold / release, chemicals / (neuro)transmitters (into synapse) ; (neuro)transmitters are released, to allow connection to other neurones / across a synapse ; receptors / vesicles, allow unidirectional transmission ; AVP ;;	**3**	
(a)(ii)	brain and spinal cord (only) ;	**1**	
(b)(i)	stimulus / light (detected by) retina / rod / cone / receptor ; *reference to* (electrical) impulse / electrical signal ; sensory neurone → relay / connector, neurone → motor neurone ; *reference to* synapses between neurones ; effector / (circular) muscles (in iris), contract / respond ;	**3**	
(b)(ii)	automatic / involuntary ; receptors / neurones / nerve, still function ;	**1**	
(c)(i)	**E** – vesicle ; **F** – neurotransmitter ; **G** – (neurotransmitter) receptor (molecule / site / protein) ;	**3**	
(c)(ii)	arrow drawn from right to left, pointing left ;	**1**	

Q15.

(d)	hormones are chemicals / hormonal coordination is only chemical ; transported in the, blood / circulatory system ; (effects are) slower (than nerves) ; **ora** (effects are) longer lasting ; **ora** each hormone may have more than one target, organ / tissue / cells ; **ora**	**3**	