

# Control and co-ordination in mammals

## Mark Scheme 7

<b>Level</b>	International A Level
<b>Subject</b>	Biology
<b>Exam Board</b>	CIE
<b>Topic</b>	Control and co-ordination
<b>Sub Topic</b>	Control and co-ordination in mammals
<b>Booklet</b>	Theory
<b>Paper Type</b>	Mark Scheme 7

**Time Allowed :** 65 minutes

**Score :** / 54

**Percentage :** /100

**Grade Boundaries:**

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1	(a)	<p>1 action potential / depolarisation, reaches presynaptic membrane ;</p> <p>2 (<math>\text{Ca}^{2+}</math>) channels open in presynaptic membrane / presynaptic membrane becomes more permeable to (<math>\text{Ca}^{2+}</math>) ; R calcium / Ca / <math>\text{Ca}^+</math></p> <p>3 <math>\text{Ca}^{2+}</math> (flood) into presynaptic, neurone / knob ; R membrane</p> <p>4 (this causes) vesicles of, acetylcholine / ACh ;</p> <p>5 (to) move towards presynaptic membrane / (to) fuse with presynaptic membrane;</p> <p>6 ACh released into synaptic cleft / exocytosis of ACh ;</p> <p>7 ACh <u>diffuses</u> across (cleft) ;</p> <p>8 ACh binds to receptor (proteins) / AW ;</p> <p>9 on <u>postsynaptic membrane</u> ;</p> <p>10 proteins change shape / channels open ;</p> <p>11 sodium ions (rush) into postsynaptic neurone ; R membrane</p> <p>12 postsynaptic <u>membrane</u> depolarised ;</p> <p>13 action potential / nerve impulse ;</p> <p>14 action of <u>acetylcholinesterase</u> ;</p>	[9 max]
	(b)	<p>15 ensure one-way transmission;</p> <p>16 receptor (proteins) <u>only</u> in postsynaptic, membrane / neurone ; ora</p> <p>17 vesicles <u>only</u> in presynaptic neurone ; ora</p> <p>18 adaptation / ACh amount reduces due to overuse of synapse ;</p> <p>19 wide range of responses ;</p> <p>20 due to interconnection of many nerve pathways ;</p> <p>21 inhibitory synapses affect other synapses ;</p> <p>22 involved in memory / learning ;</p> <p>23 due to new synapses being formed ;</p> <p>24 summation / discrimination ;</p>	[6 max]
			<b>[Total: 15]</b>

- 2 (a) *FSH:*  
1 anterior pituitary gland ;  
2 follicle ;  
3 stimulates, growth of follicle / follicle to secrete oestrogen ;  
  
*progesterone:*  
4 corpus luteum ;      **A** some from follicle cells      **A** yellow body  
5 endometrium (uterine epithelium) / anterior pituitary ;    **A** lining **R** wall  
6 stimulates glandular activity in endometrium **or** maintains / increases, thickness of endometrium **or** inhibits FSH secretion **or** inhibits LH secretion ;      [6]
- (b) 1 (effect on) hypothalamus / anterior pituitary ;  
2 (both) inhibit secretion of, FSH / LH ;  
3 (hence) no ovulation ;    **R** ref. to eggs  
4 ref. negative feedback ;  
5 makes cervical mucus hostile to sperm / thickens mucus therefore stops sperm ;  
6 prevents implantation ;      [3 max]

[Total: 9]

- 3 (a) *most of these points can be taken from an annotated diagram*
- 1 nucleus in cell body ;
  - 2 (short), dendrites / dendrons ;
  - 3 axon ;
  - 4 (axon) much longer than, dendrite / dendrons ;  
*must be stated / not on diagram*
  - 5 cell body contains, mitochondria / RER / golgi / groups of ribosomes ;
  - 6 many mitochondria at, synaptic knob / terminal branch ;
  - 7 synaptic vesicles ;
  - 8 neurotransmitter / named neurotransmitter ;    *linked to 7*
  - 9 Schwann cells / myelin sheath ;
  - 10 nucleus in Schwann cell ;    **R** nucleus in myelin sheath
  - 11 node of Ranvier ;
  - 12 AVP ; e.g. motor end plate / (dendrites) have receptors (for neurotransmitters) [7 max]
- (b)
- 13  $\text{Na}^+$  channels open ;    **A** sodium channels
  - 14  $\text{Na}^+$  enter cell ;    **R** enter membrane
  - 15 inside becomes, less negative / positive / +40mV / depolarised ;
  - 16  $\text{Na}^+$  channels close ;    **A** sodium channels
  - 17  $\text{K}^+$  channels open ;    **A** potassium channels
  - 18  $\text{K}^+$  move out (of cell) ;    **R** of membrane
  - 19 inside becomes, negative / repolarised ;    **A** negative figure [5 max]
  - 20 local circuits / description ;
  - 21 (myelin sheath / Schwann cells) insulate axon / does not allow movement of ions ;
  - 22 action potential / depolarisation, only at nodes (of Ranvier) / gaps ;
  - 23 saltatory conduction / AW ;
  - 24 one-way transmission ;
  - 25 AVP ; e.g. hyperpolarisation / refractory period    *related to 24* [3 max]

- 4 (a) Describe how the structure of neurones speeds up the transmission of action potentials. [6]
- (b) Explain, using a named example, how sensory receptors in mammals convert energy into action potentials. [9]

[Total: 15]

- (a) 1 myelin sheath / schwann cell ;  
2 insulates, axon / dendron ;  
3 impermeable to  $\text{Na}^+$  /  $\text{K}^+$  ;  
4 depolarisation only at nodes of Ranvier ;  
5 ref. local circuits ;  
6 action potentials 'jump' from node to node ;  
7 saltatory conduction ;  
8 speed increased by 50 times /  $0.5 \text{ ms}^{-1}$  to  $100 \text{ ms}^{-1}$  ;  
9 axons with large diameter / giant axon ;  
10 reduce resistance ;  
11 elongated, axon / dendron / neurone ;

**6 max**

- (b) 12 ref. specific example ; e.g. pacinian corpuscle / rod / cone / hair cell  
13 correct stimulus ; e.g. touch / pressure light / sound  
14 detail of receptor response ; e.g. deformation of pacinian corpuscle membrane  
15 stimulus causes  $\text{Na}^+$  channels to open ;  
16  $\text{Na}^+$  enters cell ;  
17  $\text{K}^+$  channels open ;  
18  $\text{K}^+$  leaves cell ;  
19 depolarisation ;  
20 receptor / generator potential ;  
21 greater than threshold leads to, action potential / impulses ;  
22 less than threshold only localised depolarisation ;  
23 increased stimulus leads to increased frequency of action potentials ;  
24 AVP ;  
*apply max 8 for points 15 - 24*

**9 max**

**Total 15**