RECOGNISING ACHIEVEMENT

2805/05 Mammalian Physiology and Behaviour

June 2003

Mark Scheme

ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

1. Please ensure that you use the **final** version of the Mark Scheme.
   You are advised to destroy all draft versions.

2. Please mark all post-standardisation scripts in red ink. A tick (✓) should be used for each answer judged worthy of a mark. Ticks should be placed as close as possible to the point in the answer where the mark has been awarded. The number of ticks should be the same as the number of marks awarded. If two (or more) responses are required for one mark, use only one tick. Half marks (½) should never be used.

3. The following annotations may be used when marking. No comments should be written on scripts unless they relate directly to the mark scheme. Remember that scripts may be returned to Centres.

   x = incorrect response (errors may also be underlined)
   ^ = omission mark
   bod = benefit of the doubt (where professional judgement has been used)
   ecf = error carried forward (in consequential marking)
   con = contradiction (in cases where candidates contradict themselves in the same response)
   sf = error in the number of significant figures

4. The marks awarded for each part question should be indicated in the margin provided on the right hand side of the page. The mark total for each question should be ringed at the end of the question, on the right hand side. These totals should be added up to give the final total on the front of the paper.

5. In cases where candidates are required to give a specific number of answers, (e.g. 'give three reasons'), mark the first answer(s) given up to the total number required. Strike through the remainder. In specific cases where this rule cannot be applied, the exact procedure to be used is given in the mark scheme.

6. Correct answers to calculations should gain full credit even if no working is shown, unless otherwise indicated in the mark scheme. (An instruction on the paper to 'Show your working' is to help candidates, who may then gain partial credit even if their final answer is not correct.)

7. Strike through all blank spaces and/or pages in order to give a clear indication that the whole of the script has been considered.

8. An element of professional judgement is required in the marking of any written paper, and candidates may not use the exact words that appear in the mark scheme. If the science is correct and answers the question, then the mark(s) should normally be credited. If you are in doubt about the validity of any answer, contact your Team Leader/Principal Examiner for guidance.

Abbreviations, annotations and conventions used in the Mark Scheme	/ = alternative and acceptable answers for the same marking point ; = separates marking points NOT = answers which are not worthy of credit ( ) = words which are not essential to gain credit ____ = (underlining) key words which **must** be used to gain credit ecf = error carried forward A = accept R = reject AW = alternative wording ora = or reverse argument

Question			Expected Answers	Marks
1	(a)	(i)	**A** = sinusoid ; **B** = canaliculus ; **A** 'caniculi' **C** = (branch of) hepatic vein / central vein ;	**3**
		(ii)	arrow (in sinusoid) pointing towards central vein ;	**1**
		(iii)	bile ;	**1**
	(b)	(i)	3 ; *accept* one gene codes for one polypeptide chain	**1**
		(ii)	hydrogen bonding ; secondary structure / α helix / β pleated sheet ; folding ; **A** 'coils' tertiary structure ; *in context of 3^{o} or 4^{o}structure* hydrophobic / ionic / disulphide, bonds ; **A** van der Waals ref role of chaperones ; polypeptides transported in rough ER ; to Golgi (body / apparatus) ; carbohydrate molecule added (to form glycoprotein) ; 3 polypeptide chains assembled, to form one unit ; association of two units ;	**max 4**

(iii) *one mark for a named protein and one for correct function*

albumin ;
transport molecule / transports fatty acids / carries drugs or e.g. ;
maintains water potential of blood ; **A** solute / osmotic, potential

prothrombin ;
clotting factor / important in clotting process ;

globulin ;
transport molecule / transports hormones or example (such as thyroxine, testosterone) ;

accept other named plasma proteins that are produced by the liver

R immunoglobulins / antibodies
R lipoproteins **max 4**

[Total: 14]

Question		Expected Answers	Marks
2	(a)	**A** ; **D** ; **E** ;	**3**
	(b)	connects <u>middle</u> ear, to throat / pharynx ; **A** back of mouth equalises pressure on either side of ear drum ; opens when, swallowing / yawning ; so eardrum, is not stretched / is not damaged / bulges in or out / is able to vibrate ;	**max 2**
	(c)	***R** to signals / messages* **1** vibrations, passed / transmitted to , oval window ; **2** causes vibration of / transmitted to , fluid (in cochlea) ; **3** (causes) movement of , basilar membrane / membrane in organ of Corti ; **4** (stimulates) (sensory) hair cells / sensory hairs ; **5** stereocilia ; **6** (by) displacement / movement / ref to 'shearing' ; **A** vibrations **7** <u>depolarisation</u> of sensory cells ; **R** action potential **8** release of, (neuro)transmitter / named neurotransmitter ; **9** <u>diffuses</u> across synapse ; **10** <u>depolarisation</u> of / <u>action potential</u> in, cochlear / auditory, nerve ; **R** impulses **11** (impulses transmitted) to brain ; **12** frequency / pitch (of sound) , detected by groups of sensory cells ; e.g. hair cells nearest oval window detect high frequency **13** loudness / amplitude, influences , frequency, of action potentials ; *or* detected by special groups of cells **14** AVP : e.g. ref Reissner's membrane **15** AVP ; ref tectorial membrane ref endolymph / perilymph	**max 8**
		QWC – legible text with accurate spelling, punctuation and grammar;	**1**
			[Total: 14]

Question		Expected Answers	Marks
3	(a)	**P** – dorsal root / ganglion ; **Q** – spinal nerve ; **A** peripheral nerve	**2**
	(b)	***R** signals / messages* ref to reflex arc ; transmits impulses from, receptors / sensory neurones, to brain ; transmits impulses from brain to, effectors / muscles / glands / motor neurones ; AVP ; e.g. ref to autonomic nervous system / sympathetic / parasympathetic, centres / cell bodies ; ref to cerebrospinal fluid synapses between neurones	**max 2**
	(c)	*thoracic vertebra has* larger / longer, transverse process ; **R** ref to size of the whole vertebra thinner / longer, neural spine ; spine sloping, downwards / backwards ; thinner / smaller, centrum ; (articulating) surfaces for ribs ;	**max 2**
	(d)	articulating surfaces / facets / AW ; for articulation with other vertebrae ; intervertebral notch / AW ; allows exit of nerves ; larger / thick, centrum ; for resisting compression ; **A** ref to weight / load large / wide, centrum ; large surface area for, strength / AW ; **A** articulation with intervertebral disc thick neural arch ; protects spinal cord ; broad neural spine ; for muscle / ligament, attachment ; large / broad, transverse processes ; for muscle / tendon, attachment ;	**max 6**
			[Total: 12]

Question			Expected Answers	Marks
4	(a)	(i)	**T** - mitochondrion ; **U** - Z, disc / line / band ; **V** – myofibril / muscle fibril ;	**3**
		(ii)	sarcomere; **A** 'sacromere'	**1**
		(iii)	energy store ; supplies glucose, for respiration ; for generation of ATP ;	**max 1**
		(iv)	*two marks for the correct answer, one mark for measuring correctly divided by the magnification* 60 000 / 42 000 ; 1.4 (μm) ;;	**2**
	(b)		**A** – stays the same length ; **H** – decreases / shortens ; **I** – decreases / shortens ;	**3**

(c) **1** depolarisation of, sarcolemma / (muscle) cell membrane ;
2 (depolarisation spreads down) transverse (system) tubules ; **A** 'T tubules'
3 calcium channels , in sarcoplasmic reticulum , open ;
4 calcium ions / Ca^{2+} , released / diffuse out ; **R** 'calcium' or Ca^{+} etc
5 calcium (ions) bind to troponin ;
6 (troponin) moves tropomyosin ; **R** calcium moves tropomyosin
7 exposes (myosin) binding sites , on actin (molecules) / thin filaments;
8 myosin head binds to (binding site on) actin / cross bridges formed ;
9 swiveling / tilting / ref to 45^{o} , of myosin (head); **A** 'rowing' action of myosin / power stroke
10 ref (myosin) ATPase / release of ADP + Pi ;
11 actin / thin filaments , drawn closer together ; **A** more overlap between thick and thin filaments
12 cross bridges break and reform / described ; **A** ratchet mechanism
13 ATP (hydrolysed) for release of myosin (heads) / AW ;

max 2 for synoptic points about energy
14 glycogenolysis / glycogen hydrolysed to glucose / AW ;
15 ref to glycolysis / Krebs cycle / oxidative phosphorylation ;
16 production of ATP , by mitochondria ;

17 AVP; e.g. shortening of sarcomere(s) / distance between Z discs decreases
18 AVP; reduction in length / shortening , of myofibrils / muscle fibres
one reference to A / I / H bands

R references to events at neuromuscular junction and during muscle relaxation **max 8**

QWC – clear, well organised using specialist terms ; **1**

[Total: 19]

Question	Expected Answers	Marks
5 (a)	genetic ; **A** inherited / 'born with' **R** 'pre-set' / 'in built' not learnt ; instinctive ; reflex occurs when, lips are touched / milk is tasted or smelt ;	**max 2**
(b)	*each of these to max 3, max 4 for the whole question* increase, heart rate / frequency of contraction ; increase, stroke volume / strength of contraction ; increase cardiac output ; ref to action of SAN in correct context ; AVP ; reduces (smooth) muscle action / slows peristalsis ; **A** reduce gut movements sphincter muscles, close / constrict / contract ; **A** for pyloric sphincter etc and for idea of precapillary sphincters decrease blood flow / diverts blood away ; causes arterioles to contract / vasoconstriction ; decreases digestive secretions / has little or no effect ; AVP ;	**max 4**

(c) (i) *insulin concentration*

decreases, during conditioning / time ref ;
accept ref to lowest concentration at 2 days
increases above normal, after conditioning / time ref ;
accept 'reaches a peak at 6 days'
decreases to, normal / original concentration ;

adrenaline concentration

increases, during conditioning / time ref ;
accept 'reaches a peak at 2 days'
decreases to, normal / original concentration, after conditioning / time ref ;
stays at constant concentration / does not fall below normal ;

peak of adrenaline is at same point as the trough for insulin ;
both hormones return to, normal / pre-conditioning levels, by 10 days ;
ref to figures (with units) for any one time and concentration (either hormone) ;
A 'au' for arbitrary units **max 5**

(ii) **1** operant conditioning

during conditioning
2 cold / stress, causes release of adrenaline ;
3 ref to sympathetic nervous system ;
4 (stimulates) glycogenolysis / glycogen breakdown, in liver cells ;
5 release of glucose / raises glucose concentration ; **A** blood sugar for glucose
6 antagonises insulin ;
7 insulin secretion, inhibited / suppressed ; **R** 'insulin not needed'

after conditioning
8 (adrenaline levels fall as) animal learns to control, environment / temperature ;
9 no reason to secrete adrenaline / increase in parasympathetic activity ;
10 insulin stimulates uptake of glucose by cells ;
11 (stimulates) glycogenesis / glycogen storage / glucose to glycogen ; ora

12 ref to negative feedback ;

13 AVP ; e.g. ref to changes in eating behaviour
14 AVP ; increased thermogenesis during conditioning
effects of eating on insulin concentration **max 4**

[Total: 15]

Question **Expected Answers** **Marks**

6 (a)

hormone	site of production	sites of action	effect
	stomach / mucosa / gastric glands / gastric pits ;		
		pancreas ;	
			contraction / release of bile ; **R** secretion of bile
	duodenum ;		stimulates, release / secretion, of alkaline fluid/ HCO_3^- ;
		liver / hepatocytes ;	

6

(b) (i) **A** protease once in the answer
1 – pepsin / endopeptidase ;
2 – trypsin / chymotrypsin / endopeptidase ;
3 – exopeptidase / aminopeptidase / carboxypeptidase ; **3**

(ii) hydrolyses ;
peptide, bond / link ;
detail / description, of hydrolysis ; **A** 'addition of water'
release of, terminal amino acid / dipeptide ;
at, C terminal / at N terminal, of peptide ; **max 3**

(iii) active transport / energy requiring process ;
carrier protein / transport protein ; **R** channels
in, cell (surface) membrane / microvilli / brush border ;
(facilitated) diffusion ; *linked with amino acids*
symport / co-transport / AW ;
with sodium ion ;
number of different carrier proteins for different types of amino acids ;
carrier protein at, base / side of, cell ;
AVP ; e.g. some amino acids enter as dipeptides / tripeptides
uptake of amino acids by active transport is indirect **max 4**

[Total: 16]