RECOGNISING ACHIEVEMENT

2805/05 Mammalian Physiology and Behaviour

January 2004

Mark Scheme

ADVICE TO EXAMINERS ON THE ANNOTATION OF SCRIPTS

7

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)	peripheral (ns); autonomic (ns); spinal cord; cerebrum; cerebellum;	5
(b)	(electrically) insulated / described; **R** idea of mechanical protection speeds up conduction of, impulses / action potentials; **R** signals / messages / information / 'more efficient' idea saltatory conduction / ref. to nodes (of Ranvier);	max 2
(c) (i)	*idea* of heat transfer / conduction / absorption; **R** diffusion high (specific) heat capacity of water; *idea* of circulation / movement (of CSF);	max 2
(ii)	proteins / named protein, in blood; low(er) the water potential of blood (plasma); ora osmosis / diffusion (in correct direction); down water potential gradient / from high to low water potential; AVP; e.g. ref. to meninges	max 3
	[Total:	**12]**

Question	Expected Answers	Marks
2 (a)	*any **two** of* hepatic artery hepatic vein hepatic <u>portal</u> vein ;	**1**
(b)	drainage of / removal of excess, bile (into, bile duct / small intestine); **A** collection of bile for testing / AW	**1**
(c)	<u>antigens</u> (on liver cells); recognised as, foreign / non self; ref to antibodies; produced by, B lymphocytes / plasma cells; **A** cells ref to T lymphocytes; **A** cells AVP; e.g. ref to complementary / specific	**max 3**
(d)	no bile to emulsify fats; no bile to neutralise stomach acid; ref to incorrect pH for, pancreatic / intestinal enzyme(s); less digestion of fat by lipase; less digestion of protein by protease; less absorption of, fatty acids / amino acids; use of fat stores; AVP; e.g. breakdown of muscle protein	**max 3**

(e) *marking point 6 may be accepted as part of protein metabolism*
accept 'interferes', 'disrupts', 'damages', but reject 'affect' / 'effect'

carbohydrate metabolism

1 less glucose absorbed (by liver cells);
2 (less) glycogen stored / glycogen synthesis / glycogenesis;
3 (because) cells do not respond to insulin;
4 (less) release of glucose from stored glycogen / glycogenolysis;
5 (if) cells do not respond to glucagon;
6 (less) production of glucose from, amino acids / glycerol;
A gluconeogenesis max 5

protein metabolism

7 (less) breakdown of (named) protein / hormone;
8 (less) conversion of amino acids to ammonia / (less) deamination;
9 (less) urea production / disruption of ornithine cycle;
10 ref to disruption of transamination;
11 (reduced) synthesis of protein;
12 ref to named protein; max 5

allow the following general points once but in either section

13 disruption of cell surface receptors / cell membranes;
14 reduced synthesis / activity of enzymes;
15 AVP; e.g. consequences of any of the above, such as
16 AVP;
blood clotting
transport role of proteins
antibodies / immunoglobulins
water potential / solute potential/ oedema
less substrate for Krebs cycle
blood glucose concentration is high /
inability to regulate blood glucose /
diabetic – like symptoms
need for amino acid supplements **max 8**

QWC – legible text with accurate spelling, punctuation and grammar; 1

[Total: 17]

Question			Expected Answers	Marks
3	(a)		several / different, tissues; **A** more than one named tissue working together to, perform a function / detect light; **A** functional unit **R** 'to see' / 'to be aware of surroundings'	**2**
	(b)	(i)	nucleus;	**1**
		(ii)	line to one of the outer segments;	**1**
	(c)		produce ATP; *for* sodium potassium pump / pumping Na^+ out, K^+ in; in inner segment / resting potential / hyperpolarised when light hits rods; synthesis of, neurotransmitter / glutamate; movement of synaptic vesicles / for exocytosis; synthesis of, visual pigment / rhodopsin; **A** *trans* to *cis* **R** 'for pigments to function' AVP; e.g. production of named protein / protein for named function	**max 3**
	(d)		(dark) adaptation; **R** light adaptation	**1**
	(e)	**1**	ref to **9** minutes; **A** +/- 1 minute / 2 small squares	
		2	cone cells detect light of high intensity / rods detect light of low intensity;	
		3	rhodopsin present in rods;	
		4	(rhodopsin) bleached / broken down, by (5 minutes of white) light;	
		5	detail of breakdown products;	
		6	takes time to resynthesise (during dark);	
		7	*idea* of more synthesis of pigment / lower threshold; ora	**max 4**
	(f)		curve levelling off at 9 minutes; line straight across (to at least 25 minutes), no lower than 30 arbitrary units;	**2**
				[Total: 14]

Question			Expected Answers	Marks
4	(a)	(i)	*for leopard, two of the following for one mark* fewer pre-molars / different number of pre-molars in upper and lower jaw less premolars in its lower jaw fewer molars ;	1
		(ii)	no need to, immobilise prey / tear off flesh / kill prey; ref to diastema / gap between teeth / more space to mix food; allows separation of cud from (freshly cropped) grass; efficient chewing of plant food; horny pad to crop of grass;	max 3
	(b)		carnassial; sharp, edges *or* cusps *or* crowns *or* points, for piercing / tearing; stop bones (of prey) moving; high pressure on a small point; ref to shearing / scissors action / slicing past each other; **R** grinding / sawing / chewing cracking / crunching bones; **R** grinding or chewing cut meat in (small) pieces (for swallowing); (completely) covered in enamel, therefore hard; **R** refs. to roots of teeth	max 3
	(c)		*assume statements refer to ileum unless stated otherwise* villi; lack of (gastric) pits; no crypts (of Lieberkuhn); microvilli / brush border; no, oxyntic / parietal / chief / HCl-secreting cells; **R** mucus secreting cells / goblet cells	max 2
	(d)		*award two marks if correct answer (25) is given* $\frac{55}{100}$ (mm) = 0.55 (mm) ; $\frac{0.55}{0.022}$ = 25 (hours) ;	2

(e) **1** folded surface membrane / microvilli / brush border; **R** villi
2 (gives) large surface area;
3 (allows) high rate of;
4 facilitated diffusion;
5 (protein) channels / pores / carriers / pumps;
6 for, polar molecules / glucose / amino acids;
7 non-polar molecules / fat soluble molecules / fatty acids / monoglycerides / glycerol;
8 diffuse / pass through, phospholipid (bilayer) of surface membrane;
9 many mitochondria;
10 supply ATP;
11 active uptake;
12 ref. to co-transport of, glucose / amino acids, with sodium ions;
13 pinocytosis / endocytosis / described;
14 fatty acids + glycerol to triglycerides in smooth ER;
15 Golgi body, produces chylomicrons / coated by proteins;
16 AVP; e.g. hydrolysis in brush border / glycocalyx
17 AVP; **max 7**

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

[Total: 19]

Question		Expected Answers	Marks
5	(a)	inherited / genetic / inborn; no, learning / practice needed; instinctive; (often) stereotyped / shown by all members of same species; **R** hard wired / pre-set / 'not taught'	**max 2**
	(b)	trial and error; a chance (correct) response becomes more common / AW; rat learns to carry out a, behaviour / response; associated with a, reward / food;	**max 2**
	(c)	rats learn at faster rate if given more food; by day, 12 /13, all rats respond equally successfully (despite amount of food given); rats given one pellet learn more slowly; use of data for number of pellets; no difference between 0 and 5 second delay in receiving food; delaying food, by 30 seconds / 'long' time, slows learning; use of data for delay in receiving pellets;	**max 5**
	(d)	controlled diet (outside of test runs); fasting of rats, before each trial / between trials; **A** 'hungry rats' type of food (as reward); age of rats; variety of rats; gender of rats; (environmental) temperature; (environmental) light intensity; environmental noise; random allocation of each rat to one of the groups; AVP; e.g. only use rats not previously tested in 'T –maze' use of a clean maze for each trial	**max 2**
	(e)	idea of a random / chance correct response / 50% probability / chance of correct response; variation about mean; measure of significance;	**max 2**
			[Total: 13]

Question			Expected Answers	Marks
6	(a)	(i)	*two of* actin tropomyosin troponin ; **R** myosin	**1**
		(ii)	from Z line to Z line;	**1**
		(iii)	wide **H** zone; wide **I** band; little overlap of filaments / AW; ref to length of sarcomere (may be annotated on Fig. 6.1);	**max 2**
	(b)		calcium ions (normally) bind to troponin; in presence of hydrogen ions, less binding (of calcium ions); less / no, change in shape / movement, of tropomyosin; binding sites (on actin) not exposed; **R** active sites no binding of myosin head / fewer cross bridges / no ratchet action; effect of hydrogen ions on tertiary structure of (named) protein; effect on named bond; **R** peptide	**max 5**
	(c)	(i)	**E** – hyaline / articular;	**1**
		(ii)	**F** - compact;	**1**
	(d)		calcium phosphate; **A** $CaPO_4$	**1**
	(e)		osteoclast; **R** osteocyte	**1**
	(f)		increased fractures / brittle bones; reduced mobility; increased pain; Dowager's hump; AVP; e.g. take named supplements AVP; advised to take, oestrogen / HRT	**max 2**
				[Total: 15]