RECOGNISING ACHIEVEMENT

JUNE 2002

ADVANCED GCE UNIT

MARKING SCHEME

MAXIMUM MARK: 90

Syllabus / Component: 2805/05

Options in Biology:
Mammalian Physiology and Behaviour

Paper Set Date: 20/06/02

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 R = reject ( ) = 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)	choroid;	1
		(ii)	(circular) ciliary muscle; **A** body **R** ciliated	1
		(iii)	blind spot / optic disc;	1
		(iv)	iris;	1
		(v)	sclera / sclerotic (coat/layer);	1
		(vi)	fovea / yellow spot;	1
	(b)		*place ticks or crosses underneath the figure at appropriate places* parallel light rays from tree; light rays refracted by cornea (drawn or annotated); light rays shown crossing over behind lens; **R** if very close to retina inverted image (drawn or annotated) immediately in front of retina;	**3 max**

(c) *assume that answer refers to rods unless otherwise stated – points for cones are given below*
award only one mark for each of the following alternatives

rods	*cones*
not in (human) fovea;	greatest number in fovea; **R** only in fovea
more sensitive to light / respond to lower light intensities / respond to one photon of light;	less sensitive / need higher light intensity;
rhodopsin / one (visual) pigment / AW; e.g. one type of rod cell	iodopsin / three different / >1, (visual) pigments; **A** alternative wording e.g. more than one type of cone
(photosensitive pigment contained in) discs not connected to cell membrane / layered vesicles / AW;	(pigment in) infoldings of the cell membrane / discs attached to membrane / AW;
do not detect colour;	detect colour; **A** reference to absorption of specific wavelengths
several connected to one bipolar neurone / convergence;	(in the fovea) connected individually to bipolar neurones;
narrower (50μm diameter);	wider (60μm diameter);
> 1 neurotransmitter in rods;	one / glutamate;
rods not sensitive to flicker rates above 12 Hz;	cones sensitive to flicker rates up to 55 Hz;

R 'rod shape / not cone shape', relative numbers of rods and cones **4**

treat visual acuity as a neutral point

[Total: 13]

Question			Expected Answers	Marks
2	(a)	(i)	*any two of the following* calcium / Ca^{2+}, phosphate / PO_4^{3-}, **R** phosphorus magnesium / Mg^{2+}, sodium (Na^+) / potassium (K^+) / chloride (Cl^-) / fluoride (F^-) / nitrate (NO_3^-) hydrogencarbonate (HCO_3^- / carbonate (CO_3^{2-}); **A** citrate;	**1**
		(ii)	(tropo) collagen;	**1**
	(b)		**X** (Haversian) canal; **R** Haversian system **Y** osteocyte / osteoblast / lacuna / osteoclast;	**2**
	(c)		blood supply / blood vessels / arteries / veins / capillaries; supply, nutrients / oxygen; remove waste / AW; lymphatic system / lymph vessel / drainage by lymph; **R** lymph node / gland ref nerve;	**3 max**
	(d)		*assume candidate is writing about hyaline cartilage unless otherwise stated* not as hard / softer / more flexible / resists shock / compressible / elastic; semi-transparent / transparent / translucent; **A** glass-like / clear slippery / smooth; (matrix is) chondrin / not mineral matter / no calcium (salts) / no phosphate / AW; **A** ref to 75% water, 25% collagen / matrix has more water chondroblasts / chondrocytes; ora no osteoblasts /osteocytes no processes from, lacunae / cells, into matrix; less collagen; no Haversian, / canals / system; no blood vessels; receives nutrients by diffusion; AVP;	**2 max**

(e) bone loses mass / bone density decreases;
figure to illustrate; e.g. < 648 mg cm^{-3} or loss is >7% per year
ref to osteoclasts and, osteocytes / osteoblasts;
bone broken down faster than replaced / more resorption;
parathormone / PTH / parathyroid hormone, stimulates resorption;

calcium / phosphate, is lost; **A** demineralisation
loss of, collagen / elastin / connective tissue fibres;
bone becomes, more porous / hollow;

max 2 for the following - label ticks with 'C'
ref having children / pregnancy;
menopause / no HRT / reduction in (named) sex hormone levels;
reduced physical exercise;
high intakes of caffeine / protein / salt;
smoking / alcohol;
steroids used in treatments / steroid therapy;
deficiency of, vitamin D / calcium;
anorexia / malnutrition / delayed puberty;
genetic factors;
AVP; e.g. liver / kidney disease

R brittle / fractures easily **5 max**

(f) women have, lower bone density / less calcium than men to start with / smaller bone mass; **A** ora
lack of / low levels of, oestrogen / progesterone;
after menopause;
AVP; e.g. ref to pregnancy or dieting **2 max**

[Total: 16]

Question			Expected Answers	Marks
3	(a)	(i)	incisors, small / for removing flesh from bones; canines, large; canines, sharp / pointed / for piercing / AW; **A** killing, tearing premolars / molars, pointed / sharp / AW; carnassial teeth; large area for (insertion of) temporal(is) muscle / AW; **R** muscle unqualified AVP; e.g. no diastema / small gaps between teeth / different shapes	**3 max**
		(ii)	*three max for teeth or jaw – label ticks 'T' and 'J'* *teeth* T1 cheek teeth / premolars / molars, flattened / large surface area, for grinding (cellulose / vegetation) / chewing; T2 (cheek teeth) ridged surface for grinding / hard enamel making ridges; **R** rigid / cusps without mention of troughs T3 dentine exposed / enamel worn away, to make troughs; T4 self-sharpening; T5 (peg-shaped) incisors, for cropping grass / work against horny pad; *jaw* J1 (loose joint) flexibility / wide movement / lateral movement; J2 <u>diastema</u>, to manipulate food / store food / mix food with saliva; J3 freshly cropped grass kept separate from grass being chewed; J4 large process on lower jaw, for (insertion of) masseter muscle;	**4 max**
	(b)		*either* carnivore food, not abrasive / not ground up; **A** carnivores do not chew carnivore teeth, do not need to grow (throughout life) / are not worn away; *or* herbivore, teeth / enamel, constantly worn away; must grow (throughout life);	**2**

(c) **1** suitable name of cud-chewing animal; (e.g. cow, sheep, goat, camel)

2 four chambered 'stomach'; **A** 'multi-chambered' but **R** 2 or 3 or > 4
R four stomachs
3 large, for storage of food / AW;
4 rumen, reticulum, omasum, abomasum; ***i.e. chambers in correct sequence***
5 (rumen full of) bacteria / microorganisms;
6 mutualism / mutual relationship; **A** symbiosis
7 anaerobic (conditions) / fermentation;
8 microbes produce, cellulase / enzyme for breaking down cellulose (to cellobiose or glucose)
9 hydrolysis of / breaks, β glycosidic links;
10 converted (by bacteria) to, fatty acids / carboxylic acids / ethanoic acid / propanoic acid / lactic acid;
11 regurgitation / AW; **R** chewing the cud
12 omasum squeezes out water;
13 very muscular walls;
14 epithelium of, rumen / reticulum / omasum, is rough / tough / thick / stratified / like oesophagus;
15 folded into ridges;
16 helps mechanical breakdown of food;
17 (abomasum) digestion of bacteria provides protein;

18 much saliva secreted;
19 urea secreted in saliva;
20 AVP; e.g. microbes as a source of vitamins
protoctists feed on bacteria, become a source of protein;
urea used (with NH_3) by microbes for making, amino acids / proteins; **7 max**

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

[Total: 17]

Question			Expected Answers	Marks
4	(a)	(i)	*look for the examples anywhere in the answers to (i) and (ii)* *accept non-mammalian examples* *reflex action* suitable (mammalian) example; e.g. coughing due to irritation of pharynx lining / withdrawal of hand from hot object / pupil size / blinking / eardrum tightening to loud noise / knee jerk	**1**
			involuntary / no thought needed / (*if spinal reflex as example*) does not involve the brain / ref to nerve pathway (sensory + motor = minimum); innate / instinctive / genetic / non learned; short-lived response to a specific stimulus; stimulus always produces same response / **A** 'stereotyped'; protective / fast / rapid / quick;	**2 max**
		(ii)	*conditioned reflex* suitable (mammalian) example; e.g. Pavlov's dogs / described	**1**
			learning; ref to association of two stimuli / bell stimulates salivation / correct ref to conditioned stimulus and conditioned response; temporary / needs reinforcement; involuntary;	**2 max**
	(b)	(i)	medulla (oblongata); **A** brain stem	**1**
		(ii)	sino-atrial / sino-auricular, node; **R** sino-atrial nerve **A** SAN **A** pacemaker sends impulses across heart muscle / initiates heart beat / acts as the heart's pacemaker (but **R** last point if pacemaker named) / AW; ***R*** *makes sure that all heart muscle contracts at the same time*	**2**

(c) *max 4 for increase or decrease*

increase

(nerve) impulses to (cardiac) accelerator centre;
(nerve) impulses to heart via (cardiac) accelerator nerve;
ref noradrenaline;
sympathetic (pathway / outflow / nervous system / nerve);
increases heart rate;
impulses to adrenal gland;
adrenaline secreted;

decrease

(nerve) impulses to (cardiac) inhibitor centre;
(nerve) impulses to heart via, (cardiac) decelerator nerve / vagus;
ref acetylcholine / ACh;
parasympathetic (pathway / outflow / nervous system / nerve);
decreases heart rate;

synoptic points from HH&D
oxygen deficit / oxygen debt / increase in [CO_2] / increase in O_2 demand;
supply of oxygen / oxygenated blood, to muscles;

AVP; e.g. ref to chemoreceptors
preganglionic / postganglionic, neurones **7**

(d) heart continues to beat; **1**
A anything that implies that heart continues to beat

[Total: 17]

Question			Expected Answers	Marks
5	(a)	(i)	**X** urea / $CO(NH_2)_2$; **Y** ornithine;	**2**
		(ii)	converts, NH_3 / NH_4^+, to urea; less toxic / detoxify;	**2**
		(iii)	ornithine cycle / (Krebs) urea cycle;	**1**
	(b)		*max 6 for metabolism*	
		M1	ethanol → ethanal / CH_3CHO / acetaldehyde;	
		M2	ALD / alcohol dehydrogenase;	
		M3	in cytosol;	
		M4	**A** ref to microsomal ethanol oxidising system/ MEOS (in smooth E.R.);	
		M5	ethanal → ethanoate / ethanoic acid / acetate / CH_3COO^- / ketone / acetic acid;	
		M6	acetaldehyde / ethanal, dehydrogenase;	
		M7	in mitochondria;	
		M8	acetyl CoA involved in synthesis of fatty acids;	
		M9	acetate into Krebs cycle / respired to CO_2 and H_2O;	
		M10	NAD → NADH / reduced NAD builds up;	
		M11	interrupts normal metabolic reactions / AW;	
		M12	used to produce more ATP;	
		M13	causing unused fatty acids to build up;	
		E1	fat droplets / triglycerides, inside cells; **A** fatty liver / fat stored in liver;	
		E2	inflammation / hepatitis;	
		E3	cirrhosis; **A** serrosis **R** sclerosis	
		E4	hepatocytes / liver cells, destroyed / die;	
		E5	liver cells replaced by, collagen / fibrous tissue / connective tissue / scar tissue;	
		E6	AVP; e.g. ref to named liver functions that do not function normally	
		E7	AVP;	**9 max**
			QWC – clear, well organised, using specialist terms;	**1**

[Total: 15]

Question	Expected Answers	Marks
6 (a)	**P** myelin sheath / Schwann cell; **Q** vesicle; **R** post-synaptic membrane / sarcolemma;	3
(b)	entry of <u>calcium ions</u> or <u>Ca^{2+}</u> / calcium channels open; **A** gates for channels vesicles fuse with membrane / exocytosis; neurotransmitter / ACh, released (into gap) / diffuses (across gap); binds to receptor site **(**on sarcolemma / post-synaptic membrane); ref to large surface area; depolarisation / end plate potential / open sodium channels; depolarisation / action potential / impulse in, T / transverse (system) tubules; sarcoplasmic reticulum releases, <u>calcium ions</u> / <u>Ca^{2+}</u>; <u>calcium ions</u> / <u>Ca^{2+}</u> , bind to troponin; tropomyosin moves; reveals myosin binding sites on, actin / thin filaments; **A** myosin binding sites exposed movement of myosin heads / sliding filaments described / AW; mitochondria produce ATP; ref to ATP (either in neurone or muscle);	7
(c)	*question says 'a way' – mark first answer with further detail for maximum of two marks or treat first part of answer as neutral to allow the award of one mark* same shape as / mimics, ACh; **A** A/W causes sodium channels to open; binds / attaches, to receptor sites; ref to complementary shapes of nicotine and receptor; post-synaptic membrane / sarcolemma; stimulates release of ACh; inhibits, destruction of ACh / uptake of ACh by motor neurone; AVP; e.g. further detail of other alternative method ref acetycholinesterase	2
		[Total: 12]