RECOGNISING ACHIEVEMENT

JUNE 2002

ADVANCED GCE UNIT

MARKING SCHEME

MAXIMUM MARK: 90

Syllabus / component: 2805/01

Options in Biology:
Growth, Development and Reproduction

Paper Set Date: 20/6/02

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 ® = 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 AW = alternative wording ora = or reverse argument

Question	Expected Answers	Marks
1 (a)	1. cross pollination / bee goes to another flower / AW; 2. by long tongued; 3. insect / bee etc; 4. (attracted by) colourful / conspicuous flower / scent; 5. ring of hairs prevent small insects reaching nectar; 6. landing platform; 7. stigma below anthers (so bee touches stigma first); 8. stigma picks up pollen from, back / body / bee; 9. nectar / y; 10. collect pollen / nectar for food; 11. brushes pollen from anthers onto, back / body / bee; 12. anthers mature before the stigma / protandry; 13. may self pollinate; 14. and 15. AVP;; e.g. anthers elongate, curl over to deposit pollen on own stigma, sticky pollen, hooks / sculptured pollen.	**5 max**
(b)	*advantages* increases variation / more variation in the <u>population</u> / larger variety of gametes; outbreeding; widens / more variety in, gene pool; more variants for natural selection / evolution / development new species; more heterozygotes; less homozygous recessive / disease genes expressed; more vigour / more resistant / less susceptible, to disease; survive / adapt better, in harsh environment / if environment changes;	**3 max**
	disadvantages need another plant / not good if plants rare / widely scattered; need pollinating agent / wind / insect; waste of, energy / gametes / pollen / resources / named resource; pollination may not occur / less reliable; takes longer / fewer offspring; may lose advantageous phenotype / less uniformity / genetic variation as may be well adapted to constant environment / AW; disease transmission / transmission poor characteristics; ® expression mutants	**3 max**
		[Total: 11]

Question	Expected Answers	Marks
2 (a)	1. break dormancy;	
	water 2. softens testa; 3. mobilises / transports / utilises, food reserves / named; 4. hydrolysis reactions / solvent for biochemical reactions; 5. mobilises / activates enzymes / named; 6. transport to meristem / growing point; 7. washes out, germination / growth inhibitors; 8. e.g. ABA; 9. allows gibberellin to promote germination; 10. swells, cells / seed / embryo / named part of embryo / cell elongation / keeps tissue turgid; 11. ruptures testa; 12. osmosis; 3 max	
	oxygen 13. respiration; ® respiration starts 14. oxidises glucose / lipids / oils / named substrate; 15, to release energy; ® produces, creates 16. (produce / create) ATP; 17. for growth / AW / named synthetic product; 18. during oxidative phosphorylation; 19. terminal hydrogen / electron acceptor; 3 max	
	a suitable temperature 20. increases metabolic rate; ® metabolism starts 21. optimum for enzymes / enzymes work faster / properly; ® inhibition or denaturation 22. to digest / break down, food reserves / named / named alternative processes; 23. for respiration / growth; 24. ref' to prechilling / fire; 3 max	
	25. AVP;	**7 max**
	Q – legible text with accurate spelling punctuation and grammar;	**1** **8 max**

Q 2 continued

(b) (i) a large sample / 80+; ® if wrong type of seed
soak in water 24 hours;
grow under identical conditions / control variables / at least two named eg same variety / same source/vermiculite etc./temp/presence of light / water;
record at 2 week intervals;
first sample after one week;
at least 10, at each harvest / sample;
randomly selected;
weigh / find mass;
detail of method ;; e.g. desiccator, constant mass, temperature A 60-110 ^{0} C, remove soil from roots; ® warm area,
find mean / average; **4 max**

(ii) respiration;
loss of CO_2 / loss of testa; ® all refs to photosynthesis **2**

(iii) (20g – 7.5 - 8g =) 12 / 12.5 / 4 / any valid method; *check for working on graph*
3 / 3.125 / 3.13 g (week^{-1}) ; ; if correct answer **2**

(iv) photosynthesis stops and respiration continues / respiration greater than photosynthesis;
dies / named structure falls off / AW; **1 max**

[Total: 17]

Question		Expected Answers		Marks
3	(a)	(FSH) stimulates development of primary follicle; ® refs to structures preceding this stage follicle, grows / cells, multiply / divide; theca develops / secretes oestrogen; fluid filled spaces develop / form antrum; primary oocyte completes <u>meiosis 1</u>; ® miosis or spelt with t in word into (first) polar body and secondary oocyte; polar body disintegrates; forms Graafian / ovarian follicle; zona pellucida / corona radiata; lysosomes / lipid droplets / cortical granules; microvilli; (Graafian / ovarian) follicle moves to surface ovary; <u>ovulation</u>; forms corpus luteum / yellow body; secretes progesterone; degenerates if, no implantation / no fertilisation / AW; AVP; eg GnRH triggers puberty;		**5 max**
	(b) (i)	<u>hypothalamus</u>; 1 max through the blood vessels / in blood; must be in correct context between the hypothalamus and the <u>anterior</u> lobe of the pituitary gland; 1 max		**2 max**

Q 3 continued

(ii) 1. GnRH stimulates, the secretion of FSH and, LH / ICSH;
2. from the anterior lobe of the pituitary gland;
3. LH / ICSH, stimulates, the interstitial cells / cells of Leydig;
4. to produce testosterone;
5. to stimulate spermatogenesis / production; *must be related to production of testosterone*

6 and 7. accurate detail on sperm development
mitosis to produce spermatogonia;
growth to form primary spermatocyte;
meiosis I to produce secondary spermatocyte;
meiosis II to produce spermatids; max 2

8. in the seminiferous tubules;
9. FSH stimulates the Sertoli cells;
10. which stimulate sperm maturation / maturity / described;
11. secrete fluid into the lumen;
12. increase in testosterone inhibits GnRH;
13. testosterone inhibits, LH / ICSH;
14. inhibin which suppresses FSH;
15. negative feedback;
16. AVP; eg continuous, starts at puberty, specific receptors on membranes Sertoli cells, testosterone made from cholesterol. **6 max**

Q – clear, well organised answer, using specialist terms; **1**

7 max

Q3 continued

(c)

FSH injected / given;
stimulates <u>super-ovulation</u>;
for IVF;
oestrogen and progesterone;
combined pill;
prevents ovulation;
inhibits FSH;
progesterone <u>only</u>;
mini pill;
thickens cervical mucus preventing entry of sperm;
morning after pill prevents implantation;
RU 486 / prostaglandin aborts embryo;

FSH stimulates / AW, development of the primary follicle;
oestrogen;
repairs / thickens <u>lining of</u> uterus / endometrium; 'maintains' is neutral
inhibits FSH / LH;
high level oestrogen increases FSH / LH;
LH, causes ovulation / described;
LH controls development of, corpus luteum / yellow body;
this produces progesterone;
maintains / thickens uterine <u>lining</u> / endometrium / increases glandular activity;
inhibits, oestrogen / FSH / LH;
ovulation inhibited;

hormones must be named and effects assigned to them

in menopause follicles less sensitive to FSH;
fewer follicles therefore less oestrogen;
FSH is normally inhibited by oestrogen / AW;
therefore FSH increases; **4 max**

[Total: 18]

Question			Expected Answers	Marks
4	(a)	(i)	**A** *more than one on line but only two attempts at answer. do not pick from a list* glucose / sucrose; amino acids; nutrients / mineral salts / saline / Na^+ / Cl^- / K^+ / PO_4^{3-} NO_3^-; trace amounts of, iron / copper; vitamins; sterile water; blood plasma / tissue fluid; agar; oxygen; AVP; eg (P)GRs /auxin / cytokinins / hormones/ chemicals to prevent bacteria growing;	**2 max**
		(ii)	identical / uniform cells / clone; rapid / bulk production / many produced; disease free; production any time of year; can be grown in small space / lab / cost effective; produce plants hard to grow from seeds / exotic plants; used for genetic engineering / specific eg / AW, organs / cells; AVP; used for replacement of damaged skin / tissue / used for drug testing, less likely to reject if culture own cells.	**2 max**
	(b)	(i)	production / AW, of TGFα itself increases production of TGFα / increase in a hormone produces increase in same hormone / AW; ® increase in one produces increase in another	**1**
		(ii)	gene switched on / gene promoter activated; transcribed; mRNA codes for TGFα; positive feedback; increases / causes division; mitosis; grows / more cells; and specialisation / become specialised / differentiation; epithelial cells formed / cells become flat / keratinised / hard / collagen forms / AW;	**4 max**
		(iii)	they would cause uncontrolled cell division; cancer; therefore need an inhibitor / AW; problem of positive feedback; AVP; eg named alternative growth regulator	**2 max**

Q 4 continued

(c) **(i)** named e.g.; mark first name given whether on line or in rest of answer. If no eg or inappropriate eg but appropriate method max 1

budding / fragmentation / cloning; ® binary fission
mitosis;
cells differentiate / described;
identical offspring;
detach when independent; **3 max**

(ii) no undifferentiated cells / more complex;
dividing cells scattered through body / grows all over body / AW;
AVP; **A** ref' to identical twins **1 max**

[Total: 15]

Question			Expected Answers	Marks
5	(a)	(i)	diffusion eg O_2 / CO_2 / H_2O / Na^+ / K^+ / urea / etc ; facilitated diffusion / described eg glucose; water by osmosis; amino acids / minerals / ions / Na^+ / K^+ / Ca^{2+} / Fe^{2+} / vitamins / etc by active transport; pinocytosis eg lipids / fatty acids / antibodies;	**4 max**
		(ii)	large surface area; villi / microvilli; one cell thick / thin for, diffusion / exchange / short diffusion / exchange distance; networks / many (fine) blood vessels / capillaries; selectively / partially / semi, permeable membrane; chorionic villi bathed in maternal blood / chorionic membrane surrounded by blood / AW; only three membranes / capillary endothelium, connective tissue of villus, trophoblast / villus membrane, for materials to cross; gradient maintained by, circulation / counter-current; protein carriers; cation / $Na^+ + K^+$ pumps, in cell membrane; mitochondria, to release energy / produce ATP for active transport; ref to fetal haemoglobin;	**5 max**
	(b)		IUGR / slow / stunted growth / underweight baby; ® smaller molecules are small enough to cross the placenta; carbon monoxide binds, irreversibly / very strongly / stable; has higher affinity for haemoglobin than oxygen; carboxyhaemoglobin; reduces oxygen transport / AW; nicotine; **A** if in a list constricts / narrows / reduces blood flow in arteries blood vessels; reduces transport nutrients / named; increases fetal heart rate; small placenta; increased risk miscarriage / increased risk perinatal mortality/ stillborn; baby may be premature / have respiratory illness / named illness eg immature lungs / asthma; reduces vitamin C uptake by mother; AVP; eg behavioural problems, increased BP, baby addicted to nicotine, less resistance to disease	**6 max**
				[Total: 15]

Question			Expected Answers	Marks
6	(a)	(i)	less soluble / insoluble / compact / large / inactive / less reactive / osmotically inert / AVP; e.g. rapid precursor	1 max
		(ii)	thyroglobulin + <u>water / H_2O</u> = thyroxine / T_3 / triodothyronine / T_4 / tetraiodothyronine; A water / H_2O on arrow	1
		(iii)	the form which produces a reaction in body / AW / affects basal metabolic rate;	1
	(b)	(i)	shape of thyroxine molecule, complements / matches, that of receptor / lock and key / AW; ® same shape or corresponds to	1
		(ii)	*context and sequence must be correct* locks on to DNA / finds target gene / AW; ref to promoter (gene); transcribed; * into mRNA; * mRNA leaves nucleus; * binds to ribosome; * translated; * ® if tRNA or DNA into polypeptide / peptide chain / protein; ® dipeptide, chain amino acids, protein synthesis processed / packaged in Golgi; secreted by exocytosis;	4 max

Q6 continued

(c) ® refs to 'thyroxine uptake' and concentrations at times other than 6 hours

description max 4 **A** figures in range given on mark scheme

1. X, has less, in thyroid (than in urine) / more in urine (than in thyroid) / 10 - 12% difference / twice as much / ora;
2. Y, has more, in thyroid (than in urine) less, in urine (than in thyroid) / 73 - 75% difference / 15/16 times more / ora;

3. X has 10 - 12% in thyroid compared with 79 - 80% in Y;
4. X has 22 - 24% in urine compared with 5 - 7% in Y;

5. X has 69 - 70% less in thyroid, Y has 69-70% more in thyroid;
6. X has 17 - 19% more in urine, than Y / Y has 17 - 19% less in urine than X;

explanation

7. Y has an overactive thyroid / hyperthyroidism / Y 's thyroid takes up <u>iodine</u> rapidly;
8. X takes up iodine at lower / normal rate / X's thyroid works more slowly;
9. Y makes thyroxine / T3 / T_4 in large quantities / AW / ora;
10. excess iodine / iodine not taken up, excreted in urine;
11. very little excess / most is taken up in Y / AW / ora; **6 max**

[Total: 14]