RECOGNISING ACHIEVEMENT

JANUARY 2003

ADVANCED GCE UNIT

MARK SCHEME

MAXIMUM MARK 90

Syllabus / Component 2805/01

Options in Biology:
Growth, Development
and Reproduction

Paper Set Date: 30/01/03

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**

(a)

feature	*oogenesis*	*spermatogenesis*
time of cycle when process starts	pre-birth / AW,	puberty;
time of cycle when process stops	menopause / 50-60,	end of life / death;
number of gametes produced from each germ cell	one,	four;
number of polar bodies produced from each germ cell	two,	none;
precise site of production within the ovary or testis	follicle / germinal epithelium of ovary,	germinal epithelium of seminiferous tubule;
name of accessory cell involved	follicle (cells),	Sertoli cell;

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continued on next page

Q 1 continued **Expected answers** **Marks**

(b) (i) independent / random, orientation;
at metaphase, I / II;
independent / random, assortment;
at anaphase, I / II;
crossing over; **R** chiasma formation
at prophase I;
mutation;
random fertilisation / AW; **4 max**

(ii) some may have a selective advantage / adapt better to / survive, changing environment / AW;
selection occurs, during gametogenesis in female / fertilisation / any appropriate stage in male;
advantageous alleles may occur / may be added / retained in gene pool / AW;
may be hidden in heterozygote / avoids harmful homozygous recessives / AW;
high evolutionary potential / AW; **2 max**

(iii) fertilisation involves fusion of two sets chromosomes / avoids doubling chromosome number;
need to be haploid (to avoid doubling) / haploid to diploid / AW;
AVP; **R** variation **2 max**

(c) removal of, the glycoprotein / plasma protein;
from the outer surface / head of the sperm;
enzymes / proteases / named;
specific to / active site matches, glycoprotein / plasma protein;
break peptide bonds;
to produce, polypeptides / peptides / amino acids;
(makes plasma membrane) more permeable / more sensitive;
to Ca^{2+} / chemical signals from oocyte / other function; **4 max**

[Total: 18]

Question			Expected Answers	Marks
2	(a)	(i)	B ;	1
		(ii)	C ;	1
		(iii)	F ;	1
	(b)	(i)	**1** explant; **2** cut from meristem / dividing tissue; **3** placed in culture medium / Murashige and Skoog medium; **4** e.g. of named nutrient; **5** sterile, conditions / medium; **6** growth of callus (tissue); **7** mitosis; **8** subculture of callus / described; **9** genetically identical; **10** totipotent / described; **11** addition of PGR's / plant hormones / named; **12** to form / differentiate, roots and shoots; **13** ref to embryoid; **14** plantlets, grown on in suitable medium; **15** AVP; e.g. constant conditions	max 6
			QWC - clear, well organised, using specialist terms;	1
		(ii)	cell mass; totipotent; **A** pluripotent gene may be introduced into single cell; divide by mitosis / genetically identical; therefore in whole plant; ease of technique qualified; AVP;	max 2
				[Total: 12]

Question	Expected Answers	Marks

3 (a) *mark hormone independently of function*

A FSH;

stimulates, maturation / development of primary follicle;
into, secondary follicle / Graafian follicle;
secondary oocyte;
indirectly oestrogen production;
inhibited by oestrogen;
surge at ovulation;
positive feedback from high oestrogen level; 3 max

B LH;

stimulates ovulation / described;
surge, times from graph / at ovulation / AW;
stimulates / causes, the development of corpus luteum;
stimulates / causes, the secretion of progesterone; 2 max

C progesterone;

maintains endometrium; **R** thickens **R** wall
stimulates glandular activity;
thickens cervical mucus;
inhibits, FSH / LH;
inhibits GnRH;
inhibits ovulation; 3 max

6 max

(b) (i) *two marks for the correct answer*

$\frac{85}{182}$ (x 100);

47%; **2**

(ii) asthma attacks, are highest between day 26 and day 4 / rise from days 5-18;
falls / lowest, between day 19 and day 25 of the cycle;
AVP; **2 max**

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Q3 continued **Expected answers**

(iii) asthma attacks, are less frequent when oestrogen concentrations, remain / are high;
asthma attacks, increase when oestrogen concentrations drop;
figures in support; *must include day and number of cases*
AVP; e.g. ref to alternative hormone **2 max**

(iv) the probability of getting these results by chance is less than 1 in 100 / 0.01;
therefore these results are significant;
at the 0.05 / 5% / usual, level;
reject null hypothesis / accept hypothesis; **2 max**

[Total: 14]

Question			Expected Answers	Marks
4	(a)	(i)	(serial) dilution; haemocytometer slide; microscope; count cells in 1 mm^3 / known volume, grid / cell; every two days; count cells overlapping edge of two sides as whole cells / ignore cells overlapping edge on two sides / AW; count at least 600 cells / use replicates; multiply, up to 1 cm^3 / for dilution factor;	**4 max**
		(ii)	the slide must be clean / difficult to distinguish bacteria from other particles; culture must be sterile; bacteria may not be evenly distributed throughout the sample; counts live and dead bacteria / AW; technique is difficult, qualified; AVP; e.g. difficult to see whole organism, difficult to see grid lines	**2 max**
		(iii)	competition / ref to limiting factor; for space / named nutrients / named respiratory gas; poisoned by / accumulation of, toxic waste / named; cell division = cell death / death rate; **R** birth rate reached carrying capacity;	**4 max**
		(iv)	*two marks for the correct answer* $\frac{305 - 220}{220}$ / 85 / $\frac{85}{220} \times \frac{100}{2}$; = 19.32% / 0.193 day^{-1} / increases by $\frac{1}{5}$ or 0.21 day^{-1} ;	**2**
	(b)		*answer could be on annotated diagrams* binary fission; DNA replicating; growth of wall / AW constriction / cytokinesis / described / AW; daughter cell; genetically identical; AVP; e.g. ref to mesosome, replication of plasmids	**4 max**
				[Total: 16]

Question		Expected Answers	Marks
5	(a)	*accept first two pairs, method named + detail*	
		male sterilisation / vasectomy; cut, vas deferens / sperm duct; female sterilisation; oviducts / fallopian tube, cut / tied / clipped; condom; over penis, to prevent semen reaching, vagina / cervix / uterus; diaphragm / femidom; over cervix, to prevent sperm reaching uterus; natural / rhythm method; calendar / computer, identifies fertile / infertile phase; fertility thermometer / Billing's method; temperature rises, when ovulation has occurred / mucus, changes in female; withdrawal / coitus interruptus; penis withdrawn, before ejaculation; AVP;;	**4 max**
	(b)	***R*** *trivial questions as answers*	
	1	reduces the number of unwanted pregnancies;	
	2	less children require, care / foster homes / adoption;	
	3	fetus murdered / AW / fetal right to life;	
	4	religious objection qualified; **R** 'playing God'	
	5	doctor / medical staff, have to take life;	
	6	at 24 weeks fetus, fully formed / can survive out of uterus;	
	7	not known when fetus may feel pain / AW;	
	8	mother's right to choose / may need counselling / suffer emotional distress;	
	9	father's rights;	
	10	physical health of mother;	
	11	age of mother / teenage pregnancies;	
	12	victims of, rape / incest;	
	13	selective abortion may increase chance of other fetuses surviving;	
	14	gender selection / eugenics / selection for specific purpose / described;	
	15	may be used as birth control;	
	16	AVP;	
	17	AVP; **R** 'playing God'	**9 max**
		QWC – legible text with accurate spelling punctuation and grammar;	**1**
			[Total: 14]

Question			Expected Answers	Marks
6	(a)	(i)	the hedge is a limiting factor;	
			shoot shoot growth faster; closer to hedge; less mass further away; comparative figures to illustrate;	
			root root growth faster overall; comparative figures to illustrate;	
			plant total mass constant after 90 cm; ref to change in balance / distribution further from the hedge; correct ref to error bars; AVP;	**4 max**
		(ii)	root growth dominates / root gets more resources throughout / AW; food store gets most resources / AW; less light closer to hedge / shading by hedge; therefore shoot grows to increase light; for photosynthesis; competition for water; competes for nutrients / named, with radish plants; when light / nutrients / named, is not a <u>limiting factor</u>; AVP; e.g. alternative cause of change in growth	**3 max**
		(iii)	ref to meristem increasing cell number / causing growth; **R** water producing elongation synthesis (of new material) / e.g. of synthesis; glucose; produced in photosynthesis; translocated; as sucrose; in phloem; stored as, starch / polysaccharide; by condensation; AVP;	**3 max**

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Q6 continued	Expected answers	Marks
(b)	*first five points could be taken from a diagram* two forms *or* PFR / P730, and, PR / P660; red light / 660nm / daylight changes PR to PFR; far red light / 730nm / dark changes PFR to PR; slowly in dark; PFR is the biologically active form; SDP's flower, if day length below / dark above, a critical value; really long night plants; PFR inhibits flowering in SDP's; therefore flower when PFR converted to PR; ref to florigen qualified;	**6 max**
		[Total: 16]