



RECOGNISING ACHIEVEMENT

JANUARY 2003

ADVANCED GCE UNIT

# MARK SCHEME

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MAXIMUM MARK: 90

**Syllabus / Component: 2804**

**Biology: Central Concepts**

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Paper Set Date: 28/01/03

## 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 ( $\frac{1}{2}$ ) 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.

<b>Abbreviations, annotations and conventions used in the Mark Scheme</b>	/	= 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 <b>must</b> 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)	blue and red light used in photosynthesis; (light of) wavelength 420 – 450 <u>nm</u> , gives high rate / AW; (light of) wavelength 650 – 690 <u>nm</u> , gives high rate / AW; (light of) wavelength of 500 – 650 <u>nm</u> / green light, less effective / reflected; sharp / AW, drop after 680 – 690 <u>nm</u> ;	<b>max 3</b>
(b) (i)	chlorophyll a; chlorophyll b; carotenoids / carotene; xanthophylls; phaeophytin;  <b>A</b> - chlorophyll 1 mark	<b>2</b>
(ii)	absorb/ trap/ capture / harvest, light / transfer energy / transfer electrons; <b>R</b> gather	<b>1</b>
(iii)	granum/ thylakoid (membrane) / lamella / quantasome;	<b>1</b>
(c) (i)	<b>cyclic</b> <b>non cyclic</b> 1 / P700;                      1/P700 and 2 / P680; ATP;                              ATP, oxygen, NADP <sup>red</sup> ;	<b>4</b>
(ii)	energy from ATP; used to change GP to GALP / TP; phosphate from ATP / phosphorylation by ATP; used in formation of RuBP;	<b>max 3</b>

**Question 1 continued**

- (d) only cyclic photophosphorylation / no non cyclic;  
no photolysis of water;  
no reduced NADP formed / no hydrogen available;  
unable to form GALP / TP (from GP);  
GP accumulates;  
Calvin cycle / light independent stage, stops;  
no carbon dioxide fixed;

**max 3**

**[Total: 17]**

Question	Expected Answers	Marks
2 (a)	36; 46; 12; 8;  R refs to haploid and diploid	4
(b) (i)	3 5 2 4 1 6 ;	1
(ii)	A – nuclear envelope / membrane; B – centromere / kinetochore; C - bivalent / homologous pair chromosomes; D - centriole(s);	4
(c)	crossing over / chiasmata formation / AW; prophase1; R prophase on own  <i>(prophase 1 must be linked to crossing over)</i>  independent assortment; metaphase 1; R metaphase on own metaphase 2 (following crossing over);  <i>(metaphase 1 and 2 must be linked to independent assortment)</i>  gametes (genetically) unique / AW; random fusion of gametes / fertilisation; random mating; correct ref to mutation;	max 4
		[Total: 13]

Question	Expected Answers	Marks
3 (a)	1- lag (phase); 2- log( phase) / exponential; 3- stationary / plateau / steady (phase) / carrying capacity;	3
(b)	maximum size of population; can be supported by, habitat / environment; reached carrying capacity; food supply limiting / competition for food / AW; nesting sites limiting / competition for nesting sites / AW; correct reference to, predators / disease / parasites; death rate equals birth rate / AW;	max 3
(c)	1 rise in temperature / warmer; 2 increased rate of metabolism / enzymes work more efficiently; 3 greater light <u>intensity</u> ; 4 increased day length / more light; 5 increased photosynthesis; 6 more minerals / named mineral in water / eutrophication; 7 from increased rate of decomposition; 8 from, agricultural run off / sewage / AW; 9 increased, growth / cell division / reproduction; 10 increased number of algae / algal bloom; 11 overshoots carrying capacity; 12 decreased photosynthesis; 13 shading / lack of light / colder; 14 minerals exhausted; 15 eaten by consumers; 16 algae population falls; 17 rises from 400 – 500 dm <sup>-3</sup> to 5200 to 5600 (dm <sup>-3</sup> ); 18 falls from 900 to 1200 (dm <sup>-3</sup> ) ; 19 AVP; e.g. increased carbon dioxide from respiration, build up of toxins	max 7
	<b>QWC – legible text with accurate spelling, punctuation and grammar;</b>	1

[Total: 14]

Question	Expected Answers	Marks
4 (a)	reference to initial rise; associated with abscission (of immature fruits); then falls to low level; stays very low as fruit develops; (steep) rise after 32 – 33 days; as fruit matures;	max 3
(b)	diffuses to nucleus; acts on genetic material / AW; production of enzymes; effect on cell wall / middle lamella; ref. ethene;  binds to receptor on guard cell (membrane); inhibits proton pump; potassium ions do not enter (guard cell);  <i>allow these three points in part (c) if not in (b)</i>	max 2
(c)	<i>mark parts (i) and (ii) together</i>	
(i)	less water in soil;	
(ii)	increased, transpiration / evaporation; plant under water stress / dehydrated / AW; leads to stomatal closure; transpiration rate decreases; prevents wilting;	max 4
		[Total: 9]

Question	Expected Answers	Marks
5 (a)	0.8 / 9.4 x 100; 8.5 / 8.51;  <i>2 marks for correct answer even if no working shown</i>	2
(b)	1 many birds die / population decreases; 2 figures which show decline from 5.1A;  3 change in mean beak size; 4 state 1976 and 1978 mean value figures / increased by 0.8mm / increased by 8.5%;  5 drought reduced available food; 6 figures which show decrease from 5.1B;  7 increased competition; 8 for seeds / food; 9 more of the seeds are larger; 10 birds with bigger beaks at an advantage / survival of fittest idea; <i>ora</i> 11 these survive in greater numbers; <i>ora</i> 12 able to reproduce; <i>ora</i>  13 beak size is, heritable / genetically controlled / AW; 14 <u>allele</u> for big beak passed to offspring; 15 change in <u>allele</u> frequency; 16 reference to natural selection;  17 AVP; e.g. directional selection	max 9
	<b>QWC – clear, well organised and using specialist terms;</b>	1

[Total: 12]



Question	Expected Answers	Marks
6 (a)	islets of Langerhans;	1
(b)	protein / polypeptide;	1
(c)	<u>glucagon</u> ; insulin;	2
(d)	measurement 4.3 – 4.5cm or other correct units; 1.4 – 1.5 ( $\mu\text{m}$ );	2
(e)	fall detected by, pancreas / islets of Langerhans / alpha cells / beta cells; fall inhibits insulin, secretion / production; secretion / production, of glucagon (by alpha cells); into blood; binds to <u>receptor</u> ; on liver cell / hepatocyte; glycogen to glucose / glycogenolysis; gluconeogenesis; detail of gluconeogenesis; fats (broken down) and respired; glucose into bloodstream;	max 6
(f)	more rapid response; shorter duration of response; less chance of immune response to insulin / AW; ideal for people who do not respond to / develop tolerance to, animal insulin; sensitive issue to kill cattle / pigs; insulin from cattle / pigs slightly different ; <i>ora</i> cheaper / easier to produce (large amounts); <b>R</b> cheaper unqualified less chance of, infection / disease;	max 3
		[Total: 15]

Question	Expected Answers	Marks
7 (a)	ratio of, volume / amount, of carbon dioxide given out to, volume / amount, of oxygen taken in ;  <b>or</b> $\frac{\text{volume / amount of carbon dioxide given out}}{\text{volume/ amount of oxygen taken in}} ;$	1
(b)	55 CO <sub>2</sub> ; 50 H <sub>2</sub> O;	2
(c)	55 / 77; 0.7 / 0.71;  <i>2 marks for correct value if no working present ecf if correctly use wrong figures from (b)</i>	2
(d)	lipid / oil / fat / triglyceride; <b>R</b> fatty acid <i>ecf</i>	1
(e)	<i>overall</i>  RQ decreases as oxygen availability increases;  <i>immediately</i> soaking prevents oxygen entering; anaerobic respiration; therefore high RQ value;  <i>12 hours</i> becoming, more aerobic / less anaerobic; absorbtion of oxygen;  <i>36 hours</i> aerobic after 36 hours; radicle splits, testa / AW, to allow oxygen in; mainly carbohydrate; value close to 1.0;	max 4
		[Total: 10]