UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Level

MARK SCHEME for the October/November question paper

9700 BIOLOGY

9700/04 **Paper 4**
maximum raw mark 60

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. This shows the basis on which Examiners were initially instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began. Any substantial changes to the mark scheme that arose from these discussions will be recorded in the published *Report on the Examination*.

All Examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes must be read in conjunction with the question papers and the *Report on the Examination*.

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Question 1

(a) matrix of mitochondria ; **[1]**

(b)(i) 3 sites labeled ;; *deduct one mark for each additional or missing label*

(ii) 5 sites labeled ;; **[3 max]**

(c) reduced NAD ;
ref. to ETC ;
oxidized / give up hydrogen ; **[3]**

(d) ref. to substrate level phosphorylation;
no proton gradient involved ;
no ATP synthase ;
no ETC ; **[1 max]**

Total [8]

Question 2

(a) correct parental genotypes ;
correct gametes ;
correct genotypes of offspring ;
correct phenotypes linked to genotypes ; **[4]**

(b) yellow shrunken homozygous ;
double recessive ; **[2]**

(c) (381 x 3/16) = 71 (36/71) = 0.507;
(381 x 1/16) = 24 (9/24) = 0.375 ;
1.80 ; **[3]**

(d) greater than 0.5 ; allow ecf **[1]**

(e) difference from expected not significant ; allow ecf
because greater than 0.5 ;
ratio phenotype is 9:3:3:1 ;
(the small) observed differences are due to chance ; **[2 max]**

Total [12]

Question 3

(a) RQ = $\frac{\text{volume of carbon dioxide given off}}{\text{volume of oxygen taken up}}$; **[1]**

(b)(i) 18 H_2O ;
18CO_2 ; **[2]**

(ii) 18/26 ;
= 0.7 ; 2 marks for correct answer **[2]**

(iii) fatty acid A lipids / triglycerides / fat / oil ; **[1]**

(c) less C-C bonds ;
less C-H bonds ;
more oxygen ; **A** O **R** O_2 **[2 max]**

Total [8]

Question 4

(a) most birds that survive drought years have larger beaks ;
because they have been able to feed on larger seeds ;
these characteristics are inherited ;
after drought years mainly birds with large beaks remain to breed ; **[3 max]**

(b) abundance of smaller seeds in drought free years ;
large beaks and bodies no longer at an advantage ;
smaller bodies and beaks selected / survive to reproduce ;
ref. smaller birds produce more offspring / require less food ;
ref. to competition in normal years ;
ref. to overproduction of offspring ;
extreme phenotypes unfit ;
ref. to very small birds unable to open any seeds ;
avp ; **[3 max]**

(c) ref. isolation of islands ;
ref. different environmental conditions / selection pressures on different islands ;
ref. adaptive radiation ;
ref. stabilizing selection ; **[2 max]**

Total [8]

Question 5

(a) restriction (endonuclease) enzyme ;
named example e.g. EcoR1 ;
specific sequence of bases ;
ref. to sticky ends / exposed bases ; **[3 max]**

(b) ref. to complimentary base pairing ;
of sticky ends ;
ligase ;
formation of phosphodiester bond ; **[3 max]**

(c) identical to human insulin (ref. to bovine / porcine insulin used previously) ;
ref. to possible immune response ;
easier to extract ;
pure / uncontaminated ;
regular production not dependent on livestock ; **[2 max]**

Total [8]

Question 6

(a) *Describe how the structure of a dicotyledonous leaf is related to its functions in photosynthesis.* *[8]*

(b) *Discuss the effects that variations in carbon dioxide concentration and light intensity have on the rate of photosynthesis.* *[7]*

(a) thin / flat to give large surface area to volume ratio ;
held at right angles to sun to allow max. light absorption ;
ref. to arrangement of cells in palisade mesophyll ;
ref. to spongy mesophyll large surface area for CO_2 uptake / gaseous exchange ;
ref. to stomata / guard cells and entry of CO_2 ;
ref. to moist surfaces ;
ref. to xylem and supply of water / mineral ions ;
and support ;
ref. to phloem and translocation of products of photosynthesis ;
ref. to cuticle on upper surface ;
avp ; **[8 max]**

(b) *carbon dioxide* 0.03% ;
most likely limits / major limiting / implied low in atmosphere ;
increase in carbon dioxide concentration and increase in rate ;
during day when light and warm ;
ref. to variations in conc. e.g., within canopy / at soil surface ;
avp ;

light intensity
ref. to wavelengths of light ;
light saturated below full sun ;
idea of limiting and saturation, with other key factor limiting ;
light and stomatal aperture ;
and temperature of leaf ;
day length and season / morning and evening ;
high light and damage to pigments ;
ref. to light exciting electrons in chlorophyll ;
avp ; **[7 max]**

Total [15]

Question 7

(a) *Explain the source and importance of removing nitrogenous waste products from the body.* *[6]*

(b) *Describe how the kidney removes metabolic wastes from the body.* *[9]*

(a)
deamination;
ref. to ornithine cycle ;
ref. to not all urea / produced each day / always some present ;
ref. to urea ;
ref. to creatinine and uric acid ;
and ammonium ions ;
produced in liver ;
continuously / from excess amino acids ;
toxic ;
if allowed to accumulate ;
ref. to potential damage to tissues ;
ref. to not all urea / that produced each day ; **[6 max]**

(b)
ultrafiltration ;
of blood in glomerulus ;
forming filtrate in Bowman's capsule ;
of kidney tubule ;
soluble molecules ;
including urea ;
and ammonium ions pass into filtrate ;
concentrated by removal of water (in collecting ducts) ;
ref. to formation of ammonium ions in distal convoluted tubule ;
from ammonia and protons ;
ref. to removal of metabolic water (as a waste product) ;
and osmoregulation ;
by collecting ducts ;
ref. formation of urine ;
ref. to distal convoluted tubule excrete excess acid ; **[9 max]**

Total [15]