CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the October/November 2013 series

9700 BIOLOGY

9700/41 Paper 4 (A2 Structured Questions), maximum raw mark 100

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Mark scheme abbreviations

;	separates marking points
/	alternative answers for the same point
R	reject
A	accept (for answers correctly cued by the question, or by extra guidance)
AW	alternative wording (where responses vary more than usual)
underline	actual word given must be used by candidate (grammatical variants excepted)
max	indicates the maximum number of marks that can be given
ora	or reverse argument
mp	marking point (with relevant number)
ecf	error carried forward
I	ignore
AVP	Alternative valid point (examples given as guidance)

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1 **(a)** allele – variation / different form, of a gene **;**

dominant – (allele) always expresses itself (in the phenotype when present) **;** [2]

(b) the greater the number of (CAG) repeats the earlier the symptoms first appear / inversely proportional / negative correlation **;**

paired figures **;** [2]

(c) 1. fear of needles **;**

2. fear of positive result **;**

3. fear of effect of result on other members of family **;**

4. no desire to have children **;**

5. financial / insurance, concerns / AW **;**

6. possibility of false results **;**

7. cost of test **;**

8. not worth having test because of no treatment **;** [max 3]

[Total: 7]

2 **(a)** *in context of woolly mammoth*

1. individuals varied (in their phenotypes) **;**

2. (phenotypic variation) caused by, genetic variation / mutation **;**

3. change in, selection pressure / environmental conditions **;**

4. *idea that* variation increases the chance of some individuals surviving / AW **;**

5. named adaptation explained **;** e.g. better insulation / smaller surface area to volume

6. survivors breed **;**

7. passed on <u>alleles</u> to offspring **;**

8. changed <u>allele</u> frequency (in population) **;** [max 5]

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(b) 1. differences in, primary structure / sequence of amino acids / polypeptide **;**

2. provides different, side chains / R groups **;**

3. change in, tertiary structure / 3D shape **;**

4. effect on quaternary structure **;**

5. greater effect on β chain **;**

6. change in properties **;** **A** function [max 3]

(c) **(i)** 1. still able to offload oxygen (in cold temperatures) **;**

2. surface tissues colder than, core / body, temperature **;**

3. so can maintain oxygen supply to surface tissues **;** [max 2]

(ii) 1. no / tiny, difference in effect of temperature on haemoglobin alone **;**

2. so no evidence (woolly mammoth haemoglobin) better adapted **;**

3. greater reduction in effect of temperature on haemoglobin with red cell effector in woolly mammoth **; ora**

4. (so) woolly mammoth haemoglobin (with red cell effector) better adapted to cold **;**

5. ref. change to oxygen binding sites **;**

6. so can offload oxygen at low temperatures **;** [max 4]

[Total: 14]

3 **(a)** adenine / nitrogen(ous) base / purine **; R** adenosine

ribose / pentose **;** [2]

(b) 1. (cell uses) ATP as source of energy **;**

2. ATP broken down **;**

3. (so) cell must regenerate ATP **;**

4. from ADP and Pi **;**

5. ref. ADP / AMP, must be synthesised in the cell **;** [max 2]

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(c) (i) 1. palmitic acid has **more**, hydrogens / C-H bonds **;**

2. per mole **;**

3. hydrogens needed for, ATP production / chemiosmosis / oxidative phosphorylation **;**
[max 2]

(ii) *alanine* – starvation / lack of fat or carbohydrate **;**

lactate – after anaerobic respiration **;** [2]

[Total: 8]

4 (a) (i) working **;** e.g. 1st oestrogen peak at day 13, 2nd peak at day 41 / looked at two peaks and calculated number of days in between

28 **;** [2]

(ii) began: day 13 or14 **;**

ended: day 29 or 30 **;** [2]

(iii) (anterior) pituitary (gland) **; R** posterior pituitary [1]

(iv) 1. stimulates follicle **;**

2. to secrete oestrogen **;**

3. surge in LH secretion**;**

4. stimulates ovulation **;**

5. ref. development of corpus luteum / stimulates corpus luteum **;**

6. to secrete progesterone **;** [max 3]

(b) (i) 1. ref. reliability **;**

2. ref. to irregularity of cycles **;**

3. *idea that* cannot be sure about menstrual phase on day 22 **;**

4. *idea that* using hormones alone might not identify day of cycle precisely enough **;**
[max 2]

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(ii) 1. (yes because) oestrogen concentration high on day 22 and low on day 2 ;

2. (but) shows correlation but not necessarily, linked / causal effect ;

3. concentration of progesterone could be affecting performance ;

4. (progesterone concentration) high at 22 days and low on day 2 ;

5. not LH as concentration low on both days ;

6. ref. to small numbers in investigation / more evidence needed ;

7. ref. to use of statistics to determine if difference in results is significant ; [max 4]

[Total: 14]

5 **(a)** 1. no change between 1860 and 1930 ;

2. ref. to increases from 1930 to 2010 ;

3. use of figures including <u>units</u> ; [3]

(b) 1. single-cross hybrids have homozygous parents ;

2. each has inherited the same alleles ;

3. (so) they are uniformly heterozygous ;

4. double-cross hybrids have heterozygous parents ;

5. each has inherited different combinations of alleles
or
(mixture of) homozygous dominant, homozygous recessive and heterozygous hybrids ;
[max 3]

(c) **(i)** 1. the greater the inbreeding coefficient, the lower the yield ;

2. in each site in each year ;

3. use of figures ; [max 2]

(ii) 1. the yield differs, at different sites / in different years ;

2. for the same inbreeding coefficient ;

3. use of figures ;

4. named environmental factor ; e.g. rainfall / temperature / mineral content of soil
[max 2]

[Total: 10]

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6 (a) (i) greater speed (if myelinated) **;**

comparative figures with units **;** [2]

(ii) larger diameter greater speed / ora **;**

comparative figures with units **;** [2]

(b) 1**.** myelin insulates axon **;**

2. no myelin at nodes **;**

3. action potentials / depolarisation, only at nodes (of Ranvier) **;**

4. local circuits set up between nodes **;**

5. action potentials 'jump' from node to node / saltatory conduction **;**

6. myelination prevents leakage of ions **; ora** [max 3]

(c) (i) 1. (sheath) treated as, 'foreign' / non-self **;**

2. ref. role of, antibodies / phagocytes / lymphocytes **;** [2]

(ii) 1. less insulation of axon **;**

2. action potentials, slow down / stop **;** [2]

[Total: 11]

7 (a) (i) 1. (blue) light is absorbed and used for photosynthesis **;**

2. CO_2 , used / concentration decreased **;**

3. leads to, rise in pH / decrease in acidity **;** [max 2]

(ii) 1. respiration **but no** photosynthesis **;**

2. CO_2, produced / released **;**

3. leads to, decrease in pH / increase in acidity **;** [max 2]

(b) (i) absorb light (energy) **;**

pass (light) energy onto, primary pigment / chlorophyll a / reaction centre **;** [2]

(ii) $H_2O \longrightarrow 2H^+ + 2e^- + ½\ O_2$ **;**

A $2H_2O \longrightarrow 4H^+ + 4e^- + O_2$ [1]

(iii) grana / thylakoid, membrane **;** [1]

[Total: 8]

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8 **(a)** any number between 873 – 882 inclusive **;;**

allow one mark for correct working or for number not rounded up [max 2]

(b) *named species (no mark)*

*four **relevant** reasons for a named species* **; ; ; ;**
e.g. animal species
direct human effect e.g. hunting / fishing / collection / skins
habitat destruction
climate change qualified
increase in pollution
spread / increase, in disease or new disease
lack of food
increased predation

e.g. plant species
direct human effect e.g. specimen collection / logging
habitat destruction
climate change qualified
increase in pollution
spread / increase, in disease or new disease
loss of pollinators
increased competition from introduced plants [4]

[Total: 6]

9 dormancy **;**

embryo **;**

aleurone **;**

endosperm **;**

maltose **;**

ATP / energy **;**

transcription / expression **;** [7]

[Total: 7]

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10 (a) 1. chance / random / spontaneous **;**

2. change in, base / nucleotide, sequence (in DNA) **;**

3. during DNA replication **;**

4. base substitution **;**

5. often no effect **/** silent mutation / may code for same amino acid **;**

6. base addition **/** base deletion **;**

7. have great effect on phenotype **;**

8. frame shifts **;**

9. alters whole sequence of bases after mutation **;**

10. may lead to stop codon **;**

11. different / new, allele **;**

12. protein, different shape / different function / not made **;** [max 9]

(b) 1. no / no functional, channels for Cl^- ions **;**

2. Cl^- ions do not move out **;**

3. less water leaves cell **;**

4. mucus (on cell surface membrane) stays, thick / sticky **;**

*5. symptoms – any **4** from:*
mucus not moved effectively by cilia / mucus accumulates **;**

6. reduced gaseous exchange / longer diffusion pathway **;**

7. difficulty in breathing **;**

8. more infections / (mucus) traps bacteria **;**

9. lungs are scarred **;**

10. blocked sperm ducts **;**

11. blocked pancreatic duct **;** [max.6]

[Total: 15]

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11 (a) 1. multicellular ;

2. (cells are) differentiated into tissues ;

3. autotrophic / photosynthetic ;

4. eukaryotic (cells);

5. starch is storage compound ;

6. (some have) chloroplasts / chlorophyll ;

7. cell wall ;

8. made of cellulose ;

9. plasmodesmata ;

10. large (central) vacuole ; [max 7]

(b) 1. 0.5–1.0 μm, diameter / width ;

2. double membrane ;

3. inner membrane folded / cristae ;

4. hold, stalked particles / ATP synthase / ATP synthetase ;

5. site of ETC ;

6. ref. H^+ and intermembrane space ;

7. ATP production ;

8. oxidative phosphorylation / chemiosmosis ;

9. matrix is site of, link reaction / Krebs cycle ;

10. enzymes in matrix ;

11. 70S ribosomes ;

12. (mitochondrial) DNA ; [max 8]

[Total: 15]

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