UNIVERSITY OF CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Advanced Subsidiary Level and GCE Advanced Level

MARK SCHEME for the May/June 2010 question paper

for the guidance of teachers

9700 BIOLOGY

9700/43 Paper 4 (A2 Structured Questions), maximum raw mark 100

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UNIVERSITY of CAMBRIDGE
International Examinations

1 **(a)** 1 more nests in, areas of low salinity/less salty areas **;** **ora**

2 comment about result for salinity 16-20 not following trend **;**

3 2 paired figs with units **;** *linked to 1* [3]

(b) **(i)** $\frac{(31 - 8)}{8} \times 100$

287.5/288 **;;**

allow one mark for suitable working if incorrect answer [2]

(ii) *any two from*

1 (ensure) low salinity or more freshwater **;**

2 nest sites protected **;**

3 education/ecotourism **;**

4 assisted breeding **;**

5 ban on hunting **;**

6 preventing pollution **;** [2 max]

[Total: 7]

2 **(a)** 1 receptor or binding site not, complementary/specific, to FSH **;**

2 FSH has shorter β chain than LH **; ora**

3 FSH has different, primary structure/sequence of amino acids **;**

4 FSH has different, tertiary structure/3D shape **;** [3 max]

(b) **(i)** follicle (cells) **;** **A** granulosa (cells) [1]

(ii) corpus luteal (cells) **;** **A** granulosa (cells) [1]

(c) 1 (binding to a receptor), acts as a signal to the cells/stimulates cells **;**

2 to, start/increase, synthesis of hormone **;** **A** cells start to divide

3 oestrogen secreted **;** **A** mature follicle formed (oestrogen),

4 stimulates thickening of endometrium/inhibits FSH (production) **;** [3 max]

[Total: 8]

3 **(a)** 1 penicillin inhibits enzyme **;** *ignore name of enzyme*

2 peptidoglycan chains cannot link up/stops cross-links forming **;**

3 cell wall becomes weaker/AW **;**

4 turgor of cell not resisted (by cell wall)/AW **;**

5 cell/wall, bursts **;** [3 max]

(b) **(i)** **B** has, an outer membrane/channel proteins **;**
B has thinner (peptidoglycan) wall **;** *accept* ***ora*** *for* ***A*** [2]

(ii) 1 penicillin V can reach the, wall/(cell surface) membrane, of **A** **;** **ora**

2 outer membrane of **B** stops penicillin V getting through **;** **ora**

3 penicillin V cannot get through pores of outer membrane of **B** **;** [2 max]

(iii) can penetrate outer membrane **;**
through pores/directly through as non-polar **;** [2]

(c) *batch culture*

1 set up and allowed to proceed **;**

2 nutrients not added or products removed, (during fermentation) **;**

3 air allowed in/waste gas allowed out **;**

4 at end of each process, product harvested/fermenter cleaned out **;** *max 2*

continuous culture

5 nutrients added (all the time) **;**

6 products removed (all the time) **;**

7 no down time/AW **;** *max 2* [3 max]

(d) 1 *(Penicillium*/fungus), does not make penicillin all the time/penicillin is made in the later stages of growth **;**

2 when beginning to run out of nutrients **;**

3 (penicillin) is a secondary metabolite **;**

4 continuous culture has no yield of penicillin **;**

5 continuous culture, never reaches stationary phase of growth/always exponential growth **;**
[3 max]

[Total: 15]

4 **(a)** 1 can be grown in many different environments/AW **;**

2 (grains) contain variety of nutrients **;** **A** list of 3+ nutrients

3 detail of nutrient content **;** e.g. high in calcium/vitamin B/protein

4 (grains) have high, energy/fibre, content **;**

5 (grains) store well **;** [3 max]

(b) **(i)** endosperm **;** [1]

(ii) 1 both rise and then fall **;**

2 sorghum (enzyme) has higher activity (at all temperatures) **;**

3 sorghum (enzyme) has higher maximum activity **;**

4 sorghum (enzyme) has higher optimum temperature **;** **A** 70° and 60°

5 comparative figures to illustrate points 2 or 3 **;** [3 max]

(iii) 1 (rice) tertiary structure/active site, of amylase is altered more by high temperature **;**

2 (therefore) fewer ES/enzyme-substrate complexes formed/AW **;**

3 high temperatures affect H bonds (more than other bonds) **;**

4 amylase in rice may have more H bonds **;** **ora**

5 correct ref. to other named bond **;** [3 max]

(c) **(i)** 1 higher CO_2 uptake at higher light intensity **;** **ora**

2 comparative figures **;** *using columns 1 and 2*

3 CO_2 used in, Calvin cycle/light independent reaction **;**

4 photophosphorylation/light dependent stage provides, ATP/reduced NADP **;**

5 for use in, Calvin cycle/light independent reaction **;**

6 light is a limiting factor **;** [3 max]

(ii) 1 survive better at low light intensities **;**

2 comparative figures **;** *using columns 1 and 6* [2]

[Total: 15]

5 **(a)** divergence values less for *persimilis* than for *pseudoobscura* (at all DNA regions) **;** **ora** use of figures **;** [2]

(b) 1 some regions of DNA more prone to mutation than others **;**

2 mutation in some regions likely to be fatal (so not seen in populations) **;**

3 there tends to be less divergence if DNA is part of an important gene/**ora** **;**

4 detail **;** e.g. causes change in essential protein [2 max]

(c) 1 allopatric speciation **;**

2 geographical/physical, barrier **;**

3 no, breeding/gene flow, between populations **;**

4 mutations occur **;**

5 different selection pressures/different (environmental) conditions **;**

6 genetic change **;** e.g. different alleles selected for/change in allele frequency/change in gene pool/advantageous alleles passed on **;**

7 genetic drift **;**

8 (ultimately) cannot interbreed/reproductively isolated **;** [4 max]

[Total: 8]

6 (a) 1 allele/gene, found on **X** chromosome **;**

2 females have two copies of, allele/gene **;**

3 males have only one copy of, allele/gene **;** [2 max]

(b) *key to symbols*

recessive allele **X^a** (= allele for CI)

dominant allele **X^A** (= allele for normal iris) ;

cross 1
parental phenotypes male with CI/cleft iris **and** normal female **;**

gametes **X^a or Y** **all X^A ;**

offspring genotypes **X^AX^a** **X^AY ;**

offspring phenotypes **normal female** **normal male ;**

.....
or
……..……..

cross 2
parental phenotypes male with CI/cleft iris **and** normal female **;**

gametes **X^a or Y** **X^A or X^a ;**

offspring genotypes **X^AX^a** **X^AY** **X^aX^a** **X^aY ;**

offspring phenotypes **normal female** **normal male** **cleft iris/CI female** **cleft iris/CI male ;** [5]

offspring phenotypes must be linked to genotypes

(c) 1 in 4/25%/0.25 **; R** ratios [1]

[Total: 8]

7 (a) (i) removal of, carbon dioxide/carboxyl group ;
removal of hydrogen ; [2]

(ii) **P** and **Q** ; [1]

(b) (i) 3 ; [1]

(ii) 1 inner mitochondrial membrane/cristae ;

2 dehydrogenase enzymes ;

3 release hydrogen ;

4 hydrogen splits into protons and electrons ;

5 electrons flow down, ETC/Electron Transfer Chain/AW ;

6 energy released ;

7 protons pumped across (inner membrane) ;

8 into intermembrane space ;

9 proton gradient ;

10 protons pass through, ATP synthase/stalked particles ;

11 ATP formed ; *linked to 10*

12 oxygen (final), hydrogen/proton and electron, acceptor ; *max 4* [5 max]

(c) 1 pyruvate converted to ethanal ;

2 ethanal reduced ;

3 by reduced NAD ;

4 NAD, oxidised/regenerated ;

5 allows glycolysis to continue ;

6 ethanal dehydrogenase ;

7 ethanol formed ;

8 prevents H^+ from lowering pH ; [4 max]

(d) 1 no, decarboxylation/carbon dioxide removed ; **A** ora

2 single step ;

3 lactate dehydrogenase ;

4 reversible ; [3 max]

[Total: 16]

8 **(a)** **(i)** 1 change in, genetic material/DNA, (in cell) ;

2 (therefore) change product of cell ;

3 during protein synthesis ; [2 max]

(ii) 1 identification of transformed, cells/organisms ;

2 avoid use of antibiotics ;

3 easy to detect ;

4 no known ill effect on GM organism ; [2 max]

(b) **(i)** 1 reduces deficiency disease/AW ;

2 better quality food ;

3 assistance to developing nations/AW ;

4 cheap seed ; e.g. for golden rice [2 max]

(ii) 1 high cost of GM seed ;

2 too much power held by multinational companies ;

3 change to ecosystem ; e.g. hybridisation

4 GM crops may be difficult to sell ;

5 GM plant varieties may be genetically unstable ;

6 no long term studies done on effects on human health ;

7 reduction in biodiversity/outcompetes natural variety or species ; [2 max]

[Total: 8]

9 **(a)** 1 arranged in light harvesting, clusters/system **;**

2 primary pigments/chlorophyll a **;**

3 at reaction centre **;**

4 P700/P1, absorbs at 700(nm) **;**

5 P680/P11, absorbs at 680(nm) **;**

6 accessory pigments/chlorophyll b/carotenoids, surround, primary pigment/reaction centre/ chlorophyll a **;**

7 pass <u>energy</u> to, primary pigment/reaction centre/chlorophyll a **;**

8 P700 / PI, involved in cyclic photophosphorylation **;**

9 (light absorbed results in) electron excited/AW **;**

10 emitted from, chlorophyll/photosystem **;**

11 flows along, chain of electron carriers/ETC **;**

12 ATP synthesis **;**

13 electron returns to, P700/P1 **;** [8 max]

(b) 14 <u>photolysis</u> (of water) **;**

15 releases H^+ **;** ***R*** *H/hydrogen atoms*

16 by, P680/PII **;**

17 e^- released **;**

18 by, P700/PI **;**

19 both combine with NADP **;**

(reduced NADP)

20 reduces, GP **;** **A** PGA

21 to TP **;** **A** PGAL / GALP

22 ATP used **;**

23 NADP, regenerated/oxidised **;** [7 max]

[Total: 15]

10 (a) 1 nucleus in cell body ;

2 (long) dendron ; **R** plural

3 (shorter) axon ;

4 many mitochondria (in cell body) ;

5 many RER/nissl's granules, (in cell body) ;

6 synaptic knobs ;

7 detail of synaptic knob ;

8 (terminal) dendrites ;

9 Schwann cells ;

10 detail of myelin sheath ;

11 nodes of Ranvier ;

accept points on labelled diagram [7 max]

(b) 12 Na^+ channels open ; **A** sodium channels

13 Na^+ enter cell ; **R** enter membrane

14 inside becomes, less negative/positive/+40mV **or** membrane depolarised ;

15 Na^+ channels close ; **A** sodium channels

16 K^+ channels open ; **A** potassium channels

17 K^+ move out (of cell) ; **R** of membrane

18 inside becomes negative **or** membrane repolarised ; **A** negative figure
max 5

19 local circuits/description ;

20 (myelin sheath/Schwann cells) insulate axon/does not allow movement of ions ;

21 action potential/depolarisation, only at nodes (of Ranvier)/gaps ;

22 saltatory conduction/AW ;

23 one-way transmission ;

24 AVP ; e.g. hyperpolarisation/refractory period [8 max]

[Total: 15]