

**MARK SCHEME for the May/June 2010 question paper  
for the guidance of teachers**

**9700 BIOLOGY**

**9700/42**

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

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- 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  $\beta$  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]**

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- 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]

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- 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<sub>2</sub> uptake at higher light intensity ; **ora**
- 2 comparative figures ; *using columns 1 and 2*
- 3 CO<sub>2</sub> 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]**

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- 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]**

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- 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<sup>a</sup>** (= allele for CI)

*dominant allele* **X<sup>A</sup>** (= allele for normal iris) ;

*cross 1*

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

*gametes* **X<sup>a</sup> or Y** **all X<sup>A</sup> ;**

*offspring genotypes* **X<sup>A</sup>X<sup>a</sup>** **X<sup>A</sup>Y ;**

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

.....  
**or**  
 .....

*cross 2*

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

*gametes* **X<sup>a</sup> or Y** **X<sup>A</sup> or X<sup>a</sup> ;**

*offspring genotypes* **X<sup>A</sup>X<sup>a</sup>** **X<sup>A</sup>Y** **X<sup>a</sup>X<sup>a</sup>** **X<sup>a</sup>Y ;**

*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]

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- 7 (a) (i) removal of, carbon dioxide/carboxyl group ; [2]  
removal of hydrogen ;
- (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<sup>+</sup> from lowering pH ; [4 max]

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- (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]**



Page 9	Mark Scheme: Teachers' version	Syllabus	Paper
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- 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 energy to, primary pigment/reaction centre/chlorophyll a ;
- 8 P700 / P1, 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 photolysis (of water) ;
- 15 releases H<sup>+</sup> ; *R H/hydrogen atoms*
- 16 by, P680/P11 ;
- 17 e<sup>-</sup> released ;
- 18 by, P700/P1 ;
- 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]

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- 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  $\text{Na}^+$  channels open ; **A** sodium channels
  - 13  $\text{Na}^+$  enter cell ; **R** enter membrane
  - 14 inside becomes, less negative/positive/+40mV **or** membrane depolarised ;
  - 15  $\text{Na}^+$  channels close ; **A** sodium channels
  - 16  $\text{K}^+$  channels open ; **A** potassium channels
  - 17  $\text{K}^+$  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]**