

**June 2004**

**GCE A LEVEL**

**MARK SCHEME**

**MAXIMUM MARK: 60**

**SYLLABUS/COMPONENT: 9700/04**

**BIOLOGY  
Paper 4 (Theory 2 (A2 Core))**

<b>Page 1</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>BIOLOGY – JUNE 2004</b>	<b>9700</b>	<b>4</b>

### Question 1

- (a) peptide bonds between amino acids ;  
 primary structure / amino acid sequence determines folding sites ;  
 hydrogen bonds maintain (secondary structure) ;  
 ref. beta pleated sheet / alpha helix ;  
 ref. folding to form tertiary structure / globular shape ;  
 sulphur bridges / ionic bonds / Van de Waals forces / hydrophobic interactions ;
- 3 max**

- (b) reverse transcriptase / synthesise DNA from mRNA ;  
 restriction endonuclease / enzyme ;  
 produces sticky ends ;  
 plasmid cut by restriction enzyme ;  
 recombinant DNA formed ;  
 DNA ligase (correct ref) ;  
 DNA inserted into host e.g. Hamster kidney / ovary cells ;  
 Detail of insertion e.g. electric shock / calcium ions.
- 4 max**

- (c) no contamination / ref. named infection HIV / reduced rate of infection /  
 greater production rate ;
- 1**

- (d) ref. to introns and exons / only mammalian cells have Golgi / enzymes (for  
 post translational modification) ;
- 1**

**Total: 9**

Page 2	Mark Scheme	Syllabus	Paper
	BIOLOGY – JUNE 2004	9700	4

### Question 2

- (a) (i) correctly indicated on inner membrane ;  
(ii) correctly indicated in matrix ;

2

- (b) folded inner membrane / cristae ;  
increases surface area available ;

intermembrane space ;  
allows accumulation of H<sup>+</sup> ;

impermeability of inner membrane to H<sup>+</sup> ;  
maintains H<sup>+</sup> gradient / H<sup>+</sup> only go through channels ;

stalked particles / ATPase ;  
channel for H<sup>+</sup> / ATP synthesis ;

linear arrangement of ETC on inner membrane ;  
greater efficiency ;

4 max

- (c) (no) oxygen to combine with e<sup>-</sup> / H<sup>+</sup> / H / 2H / proton ;  
at the end of the ETC ;  
no H<sup>+</sup> gradient produced ;  
no ATP synthesized / oxidative phosphorylation does not occur ;  
no NAD regenerated / NADH not oxidized ;  
stops Krebs cycle ;

3 max

**Total: 9**

Page 3	Mark Scheme	Syllabus	Paper
	BIOLOGY – JUNE 2004	9700	4

### Question 3

- (a) **A** microvilli / brush border ;  
**B** invagination / infolding of membrane / basal channels ;
- 2**
- (b) basal channels / microvilli / brush border – increase surface area ;  
many mitochondria – provide ATP for active transport ;  
carrier proteins / cation pumps in csm – active uptake / facilitated diffusion / co-transport ;  
tight junctions – prevent migration of membrane proteins / separate tubule fluid ;  
ref. to pinocytosis – protein uptake ;
- 3 max**
- (c)  $\text{Na}^+$  actively transported (out of cell) into blood ;  
creates concentration gradient ;  
 $\text{Na}^+$  enters cell by diffusion ;  
through cotransporter / symporter proteins ;  
glucose cotransported / facilitated diffusion (from lumen to cells) ;  
glucose diffuses into blood capillaries ;
- 3 max**
- (d) proximal convoluted tubule cells have a low / more negative water / solute potential ;  
due to high concentration of salts / ions / glucose /  $\text{Na}^+$  ;  
water enters by osmosis ;  
down water potential gradient (idea) ;
- 2 max**

**Total: 10**

Page 4	Mark Scheme	Syllabus	Paper
	BIOLOGY – JUNE 2004	9700	4

#### Question 4

(a) Use **one** of the following schemes **1, 2 or 3**.

**1** named example e.g. sickle cell anaemia / PKU  
change base ;  
may change amino acid ;  
change folding / shape of protein ;  
detail of affect of protein changes ;

**2** named example e.g. PKU ; **R** sickle cell anaemia  
lack of enzyme / non functioning enzyme ;  
2 x phenotype changes / symptoms ;;

**3** chromosome mutation ;  
detail of mutation ;  
named example e.g. Down's syndrome ;  
2 x symptoms ;;

**4 max**

(b) homozygotes for sickle cell allele die from sickle cell anaemia ;  
sickle cell allele frequent in malarial areas ;  
heterozygotes are resistant to malaria / have selective advantage ;  
therefore pass on sickle cell allele ;  
homozygous normal suffer / die from malaria ;

**4 max**

**Total : 8**



<b>Page 6</b>	<b>Mark Scheme</b>	<b>Syllabus</b>	<b>Paper</b>
	<b>BIOLOGY – JUNE 2004</b>	<b>9700</b>	<b>4</b>

### Question 6

#### (a)

- 1 depolarisation/action potential ;
- 2 of presynaptic membran,/synaptic knob ;
- 3 opening calcium ion channels ;
- 4 calcium ions in ;
- 5 vesicles containing transmitter / acetylcholine ;
- 6 fuse with membrane ;
- 7 contents emptied into synaptic cleft / exocytosis ;
- 8 transmitter / acetylcholine diffuses across synaptic cleft ;
- 9 transmitter / acetylcholine binds to receptor ; **R** protein channel
- 10 on post synaptic membrane ;
- 11 Na<sup>+</sup> channels open / Na<sup>+</sup> enters ;
- 12 depolarises post synaptic membrane ;
- 13 action potential set up / impulse transmitted ;
- 14 breakdown / hydrolysis of transmitter / acetylcholine by enzyme /  
cholinesterase ;

**9 max**

#### (b)

- 15 when blood glucose levels low ;
- 16 glucagon released from alpha cells (in pancreas) ;
- 17 (acts on) liver (cells) ;
- 18 breakdown of glycogen to glucose ;
- 19 use of fatty acids in respiration ; **R** fats
- 20 production of glucose from other compounds / fats / amino acids /  
gluconeogenesis ;
- 21 liver releases glucose into blood ;
- 22 glucose levels rise / return to normal ;
- 23 switching off glucagon secretion ;
- 24 antagonistic to insulin ;

**6 max**

**Total : 15**

Page 7	Mark Scheme	Syllabus	Paper
	BIOLOGY – JUNE 2004	9700	4

### Question 7

#### (a)

- 1 RuBP 5C ;
- 2 combines with carbon dioxide ;
- 3 rubisco ;
- 4 to form an unstable 6C compound ;
- 5 which forms 2 X GP (PGA) ;
- 6 ATP;
- 7 energy source
- 8 and reduced NADP ;
- 9 forms TP (GALP) ;
- 10 TP used to form glucose / carbohydrates 1 lipids / amino acids ;
- 11 TP used in regeneration of RuBP
- 12 requires ATP ;
- 13 as source of phosphate ;
- 14 light independent ;

**9 max**

#### (b)

- 15 coenzyme ;
- 16 reduced ;
- 17 carries protons ;
- 18 and (high energy) electrons ;
- 19 from photosystem 7light stage ;                      R photosystem II
- 20 on thylakoid membrane grans ;
- 21 to stroma / Calvin cycl~
- 22 ref. regeneration of NADP ;

**6 max**

**Total : 15**