

# Mark Scheme (Results) January 2007

GCE

GCE Biology (8040/9040)

# General Principles

## Symbols used in the mark scheme

Symbol	Meaning of symbol
; semi colon	Indicates the end of a marking point.
eq	Indicates that credit should be given for other correct alternatives to a word or statement, as discussed in the Standardisation meeting. It is used because it is not always possible to list every alternative answer that a candidate may write that is worthy of credit.
/ oblique	Words or phrases separated by an oblique are alternatives to each other.
{ } curly brackets	Indicate the beginning and end of a list of alternatives (separated by obliques) where necessary to avoid confusion.
() round brackets	Words inside round brackets are to aid understanding of the marking point but are not required to award the point.
[] square brackets	Words inside square brackets are instructions or guidance for examiners.

## Crossed out work

If a candidate has crossed out an answer and written new text, the crossed out work can be ignored. If the candidate has crossed out work but written no new text, the crossed out work for that question or part question should be marked, as far as it is possible to do so.

## Spelling and clarity

In general, an error made in an early part of a question is penalised when it occurs but not subsequently. The candidate is penalised once only and can gain credit in later parts of the question by correct reasoning from the earlier incorrect answer.

No marks are awarded specifically for quality of language in the written papers, except for the essays in the synoptic paper. Use of English is however taken into account as follows:

- the spelling of technical terms must be sufficiently correct for the answer to be unambiguous  
e.g. for amylase, 'ammalase' is acceptable whereas 'amylose' is not  
e.g. for glycogen, 'glicojen' is acceptable whereas 'glucagen' is not  
e.g. for ileum, 'illeum' is acceptable whereas 'ilium' is not  
e.g. for mitosis, 'mytosis' is acceptable whereas 'meitosis' is not
- candidates must make their meaning clear to the examiner to gain the mark.
- a correct statement that is contradicted by an incorrect statement in the same part of an answer gains no mark - irrelevant material should be ignored.

Question 1

Maximum Marks

- (a) position of hypothalamus correctly identified ; 1 mark
- (b) forebrain ; 1 mark
- (c)
- 1 homeostasis ;
  - 2 reference to osmoregulation /eq ;
  - 3 reference to maintaining body temperature ;
  - 4 acts as an endocrine gland / produces {hormones / ADH / oxytocin} ;
  - 5 controls pituitary gland ;
  - 6 controls autonomic nervous system/eq ;
  - 7 controls behaviour (patterns) /named behaviour e.g. feeding/sleeping/aggression ;

2 marks

Total 4 marks

Question 2

Maximum Marks

- (a) (i) B ; 1 mark
- (ii) one ; 1 mark
- (b)
- 1 rhodopsin consists of retinal and opsin ;
  - 2 light (energy) absorbed by {rhodopsin / pigment / visual purple} ;
  - 3 retinal changes shape / cis to trans ;
  - 4 rhodopsin {splits / eq / bleaches} ;
  - 5 (rod cell) sodium gates close / reduced permeability to sodium ions / less sodium diffuses in / hyperpolarisation / becomes more negative inside ;
  - 6 bipolar cell becomes depolarised / action potential formed in ganglion (cell) ;
- 4 marks
- Total 6 marks

Question 3

Maximum Marks

(a) A - B

- 1 sodium(ions) are reabsorbed / eq (from the proximal convoluted tubule) ;
- 2 by active transport/reference to cotransport with glucose or amino acids ;

B - C

- 3 sodium ions pumped out / chloride ions pumped out and sodium ions follow (into medulla) ;
- 4 of ascending limb (of loop of Henle) ;

3 marks

- (b)
- 1 idea of water leaving (from proximal convoluted tubule) ;
  - 2 in similar proportions to Na<sup>+</sup>/eq ;

2 marks

- (c)
- 1 distal convoluted tubule/collecting ducts ;
  - 2 become more permeable to water ;
  - 3 therefore more water is reabsorbed / eq ;
  - 4 by osmosis ;
  - 5 ref to aquaporins ;
  - 6 {decreases/eq} concentration (of Na<sup>+</sup> / NaCl in the blood) ;

3 marks

Total 8 marks

Question 4

Maximum Marks

- (a) (i)
- 1 bolus insulin only present for 5 hours, basal insulin present for 24 hours;
  - 2 concentration of bolus insulin increases faster / eq ;
  - 3 bolus decreases faster / eq ;
  - 4 concentration of bolus insulin has a peak value at 2 hours, concentration of basal insulin{has peak at 6 hours / remains at maximum value for 6-12 hours} ;
  - 5 peak concentration of bolus is higher ;
  - 6 comparative manipulation of data ;

3 marks

- (ii)
- 1 idea that bolus insulin lowers blood glucose {immediately / after meals} ;
  - 2 idea that (very) high blood glucose levels can be controlled by bolus insulin ;
  - 3 but only lasts for short time ;
  - 4 basal insulin works between meals/during night / eq ;
  - 5 when blood glucose concentration is lower / eq ;

3 marks

- (iii)
- 1 bolus insulin acts very rapidly ;
  - 2 therefore insulin may cause hypoglycaemia/eq ;
  - 3 it takes time for digestion ;
  - 4 and for glucose to be absorbed into blood /eq ;

2 marks

(b)  $\frac{120}{10} = 12$  (CP) ;

$12 \times 1.5 = 18$  (units of insulin) ; [allow CE]

2 marks

- (c)
- 1 stimulates conversion of {glucose to glycogen/glycogenesis} ;
  - 2 inhibits gluconeogenesis /eq ;
  - 3 increases uptake of glucose {into cells / by liver} ;
  - 4 increases respiration of glucose ;

2 marks

Total 12 marks

Question 5

Maximum Marks

- 1 (anaerobic respiration) occurs in cytoplasm / sacroplasm ;
- 2 reference to glycolysis ;
- 3 as {breakdown / conversion} of glucose to {pyruvate / pyruvic acid} ;
- 4 phosphorylation of glucose / glucose converted to glucose (6) phosphate ;
- 5 reference to use of ATP (for phosphorylation) ;
- 6 prevents glucose leaving cell / reference to activation energy / increased reactivity of glucose ;
- 7 ref. to {glycerate-3-phosphate / GP / G3P / phosphoglycerate / phosphoglyceric acid / PGA} as an intermediate ;
- 8 ref. to {NAD<sup>+</sup> to NADH / reduction of NAD<sup>+</sup>} ;
- 9 phosphorylation of ADP to form ATP ;
- 10 reference to net yield = 2 ATP (per glucose molecule) ;
- 11 pyruvate converted to lactic acid/lactate ;
- 12 reference to NAD being regenerated / NADH is oxidized ;
- 13 idea that this is necessary for glycolysis to continue ;
- 14 reference to involvement of {oxidoreductase / dehydrogenase} enzymes ;
- 15 results in an oxygen debt / can only occur for short period of time / produces less ATP / build up of lactic acid causes cramps ;

Total 10 marks



Question 6

Maximum marks

- (a) 1 {produce/secrete} {antibodies / anti toxins} ;  
2 {destroy pathogens/eq } / involved in immune response ;

2 marks

- (b) 1 receptors respond to stretching / proprioceptors ;  
2 (can) cause muscle to contract / help to maintain posture ;

2 marks

- (c) 1 source of phosphate / production of ATP ;  
2 in muscles ;

2 marks

Total 6 marks

Question 7

Maximum marks

(a) A : cartilage ;

B : synovial fluid ;

2 marks

(b) 1 thinner / worn cartilage ;

2 {swollen / inflamed / misshapen} joint / bone destruction / fused bones ;

3 {no / reduced} synovial {membrane / fluid} ;

2 marks

Total 4 marks

Question 8

Maximum Marks

(a) Breathing rate : number of breaths in unit time / one minute ;

Tidal volume : volume of air breathed {in / out} ;

2 marks

- (b) (i)
- 1 both the breathing rate and tidal volume increase ;
  - 2 breathing rate gradually increases up to 125 a.u. and then increases more sharply ;
  - 3 tidal volume increases steeply up to 75 a.u. and then increases less steeply ;
  - 4 idea that the point at which the gradient changes for the breathing rate is not the same as the tidal volume ;

3 marks

(ii) Breathing rate graph

- 1 lower at rest ;
- 2 lower breathing rate at each intensity ;

Tidal volume graph

- 3 higher at rest ;
- 4 lower tidal volume at intensities above 75 a.u. ;

3 marks

- (c)
- 1 minute volume calculated by multiplying breathing rate by the tidal volume ;
  - 2 (expressed in) litres or  $\text{dm}^3$  ;
  - 3 read pairs of values from both graphs / eq ;
  - 4 idea that critical points for reading values are at exercise intensities of 0, 75, 125 and 250 arbitrary units / eq ;
  - 5 plot graph of minute volume against increase in exercise intensity ;

3 marks

Question 9

Maximum Marks

(a) 1  $1.4 - (0.62 - 0.6) / = (0.78 - 0.8) ;$

2  $\frac{(0.78 - 0.8) \times 100 (\%)}{\div 0.6} ;$

3  $= (125.8 - 133.3 (\%)) ;$

3 marks

- (b) (i) A - actin (filament)  
B - sarcomere ;

1 mark

(c) Myoglobin

1 high affinity for oxygen

2 oxygen store ;

3 immediately available ;

4 released when (partial pressure of oxygen / eq) is very low ;

3 marks

Calcium ions

1 bind to actin / eq ;

2 (cause) change in shape ;

3 exposes myosin binding site / eq ;

4 allows myosin (head) to bind to actin ;

2 marks

Total 9 marks