

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⁺/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⁺ / 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 / sarcoplasm ;
- 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⁺ to NADH / reduction of NAD⁺} ;
- 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 heat treated to at least 100 °C ;
2 kills all {microorganisms / eq} / denatures enzymes / prevents metabolites spoiling milk;

2 marks

- (b) 1 aerobic bacteria unable to {grow / reproduce} ;
2 prevents entry of more microorganisms / eq ;

2 marks

- (c) 1 prevent rancidity ;
2 prevent deterioration by oxidation ;

2 marks

Total 6 marks

Question 7

Maximum marks

- (a) (i) arrow pointing to a terminal bond ;
- (ii) (α -) 1,4 glycosidic (bond) ;
- (b) 1 converts glucose to fructose ;
2 used in production of high fructose corn syrup ;
3 therefore less can be used / foods with {a lower calorific value / eq} can be made ;

1 mark

1 mark

2 marks

Total 4 marks

Question 8

Maximum Marks

- (a)
- 1 no change in pH in first 30 minutes ;
 - 2 (after 30 minutes) pH falls ;
 - 3 yoghurt starts to thicken at pH 5 ;
 - 4 (lower than pH 5) yoghurt continues to thicken as pH falls ;
- 3 marks

- (b)
- 1 inability to digest lactose ;
 - 2 no lactase / β -galactosidase ;
 - 3 lactose fermented by bacteria ;
 - 4 in (large) intestine / colon ;
 - 5 causing nausea / abdominal pain / vomiting / eq;
- 3 marks

- (c) (i)
- 1 idea that enzyme treatment needs to take place before culture is set up ;
 - 2 need for addition of {microorganisms / eq} to milk ;
 - 3 incubation at appropriate temperature;
 - 4 ref. to use of same volume of milk / mass of micro-organism / same type of microorganism / same volume of starter culture ;
 - 5 ref. to use of pH probe / indicator solution / indicator paper ;
 - 6 calculation of rate in fall of pH / plot results on pH-time graph ;
- 4 marks

- (ii) monosaccharides are sweeter than disaccharides / {glucose or galactose} are sweeter than lactose/ two monosaccharides from each lactose ;

1 mark

Total 11 marks

Question 9

Maximum Marks

- (a) (i) 1 decreases with age ;
2 greatest decrease between 0.5 and 2 years / little difference between 2 and 5 years / manipulation of figures ;
3 ref. to high growth rate in babies ;
4 ref. to growth slowing with age / eq ;

3 marks

- (ii) pregnancy / training / idea of natural variation ;

1 mark

- (b) (i) 1 0.7 multiply by 75 ;
2 divide by 25.4 ;
3 correct answer with units ;

3 marks

- (ii) high {fat / cholesterol} content ;
no fibre ;

2 marks

Total 9 marks