

# Mark Scheme (Results) Summer 2007

GCE

GCE Biology (6104/03)

## 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 mark

Stage	Part of cell in which it occurs	Two Products
	cytoplasm / cytosol ;	pyruvate / pyruvic acid, NADH / eq and ATP / H <sup>+</sup> ;
		ATP, CO <sub>2</sub> , NADH / eq and FADH <sub>2</sub> / eq /H <sup>+</sup> ;
	cristae / inner membrane of mitochondrion;	

Total 4 marks

**Question 2**

**Maximum mark**

- (a) (i) liver ;  
(ii) ovary / testis;

**2 marks**

- (b) 1. ref to glucagons binding to receptor activating adenylyl cyclase ;  
2. (therefore) {several / many} ATP molecules are converted to cAMP / eq ;  
3. cAMP activates an enzyme ;  
4. (each activated) enzyme (molecule) {hydrolyses / eq} many glycogen (molecules) ;  
5. idea that glycogen is made up of many glucose (molecules) ;  
6. ref to cascade effect / eq ;

**3 marks**

**Total 5 marks**

**Question 3****Maximum mark**

- (a) 1. idea that anabolism builds up molecules and catabolism breaks them down ;  
2. correct example of anabolism e.g. glucose by photosynthesis, proteins from amino acids ;  
3. correct example of catabolism e.g. carbon dioxide from respiration, glucose from glycogen breakdown ;

**3 marks**

- (b) (i) 1. {hydrogen / electrons} transferred from malate to  $\text{NAD}^+$  ;  
2. ref to reduction of  $\text{NAD}^+$  ;  
3. ref to oxidation of malate ;

**2 marks**

- (ii) (enzyme) 1 ;

**1 mark**

- (iii) 1. less fumarate produced ;  
2. (therefore) less malate produced ;  
3. (therefore) concentration of oxaloacetate decreases / eq ;  
4. (so) {inhibition stops/eq} / enzyme 2 becomes active again ;  
5. ref to negative feedback ;  
6. idea that succinate levels may rise ;  
7. ref to more 2-oxoglutarate / hydroxyglutarate formed ;  
8. ref to decreased {levels / production} of { $\text{NADH}$  /  $\text{FADH}_2$  /  $\text{H}_2\text{O}$ } eq ;

**4 marks****Total 10 marks**

**Question 4****Maximum mark**

- (a) 1. increases ;  
2. (because hydrostatic) pressure increases in {glomerulus / capillaries} ;  
3. idea that volume of blood arriving is greater than that leaving ;

**2 marks**

- (b) 1. deamination / correct description ;  
2. of excess amino acids ;  
3. ref to production of ammonia ;  
4. (followed by) ornithine cycle ;  
5. in the liver ;

**3 marks**

- (c)(i) 1. correct difference i.e.  $15 - 8 (= 7)$  ;  
2. correct division (by 15) ;  
3. conversion to percentage ;  
[correct answer = 46.7]

**3 marks**

- (ii)
1. less protein in diet / eq (on day 2) ;
  2. therefore fewer excess amino acids;
  
  3. more water in diet (on day 2) ;
  4. therefore more water in the urine ;
  
  5. idea of dehydration (on day 1) ;
  6. therefore less water in the urine ;
  
  7. idea of greater demand for amino acids due to {training / growth / repair / pregnancy} (on day 2);
  8. therefore {less / no} excess amino acids ;
  
  9. ref to liver malfunction / eq (on day 2) ;
  10. less urea formed ;
  
  11. urea loss through sweating (on day 2) ;
  12. less urea in urine ;

3 marks

Total 11 marks

**Question 5****Maximum mark**

1. idea of resting potential {at start / returned to at end} (of post-synaptic membrane) ;
2. more  $\text{Na}^+$  outside axon and more  $\text{K}^+$  inside / eq ;
3. (imbalance maintained by)  $\text{Na}^+$  /  $\text{K}^+$  pump ;
4. ref to acetylcholine ;
5. diffuses across synaptic cleft ;
6. binds to receptors ;
7. on post-synaptic membrane ;
8. membrane becomes permeable to  $\text{Na}^+$  /  $\text{Na}^+$  gates open ;
9.  $\text{Na}^+$  enter (by diffusion) ;
10. causes more {  $\text{Na}^+$  channels / voltage gated channels} to open ;
11. result in depolarization (of membrane) / figures quoted;
12. idea of depolarization reaching threshold level;
- 13 (resulting in an) action potential / excitatory post-synaptic potential ;
14. propagation by local currents / eq ;
15. ref to {wave of depolarization / saltatory conduction / eq} ;

**Total 10 marks**



**Question 6****Maximum mark**

- (a)
1. by inhalation of bacteria in (droplets/dust) ;
  2. called *Mycobacterium tuberculosis* ;
  3. formation of {tubercles / plaques / lesions} ;
  4. in the lungs ;
  5. ref to invasion of other tissues / organs ;

**3 marks**

- (b)
1. formation of atheroma / plaque ;
  2. in artery walls ;
  3. due to {lipid / eq} {deposits / eq} ;
  4. narrowing the lumen (of the artery) / idea of restricting blood flow ;
  5. ref to high (blood) cholesterol / high blood pressure / smoking / lack of exercise ;

**3 marks****Total 6 marks**

**Question 7****Maximum mark**

- (a)
1. reading 22 and 15 ;
  2. correct numerator :  $\{7 / 22-15\} \times 100\%$  ;
  3. correct denominator: 22 = correct answer ;  
[correct answer 28.57: - 36.36%]

**3 marks**

- (b)
1. ref to  $\text{Ca}^{2+}$  binding to muscle protein (troponin) ;
  2. (this) results in {change in shape of muscle protein (troponin) / movement of muscle protein (tropomyosin) / exposure of (myosin) binding site on actin} ;
  3. ATP binds to myosin (head) ;
  4. myosin attaches to actin (binding site) ;
  5. ATP broken down to ADP and  $\text{P}_i$  / energy released from ATP / release of ADP and  $\text{P}_i$  ;
  6. head swivels / changes angle / idea of actin moving (over myosin) ;

**4 marks****Total 7 marks**

**Question 8****Maximum mark**

(a) medulla / medulla oblongata ; 1 mark

(b) before diving / singing / sniffing / playing a musical instrument / peak flow measurement / breathalyser / eq ; 1 mark

(c) 1. ref to baroreceptors / stretch receptors ;  
2. detect degree of stretch in diaphragm and/or intercostals muscles ;  
3. (and) feedback this to the {medulla /respiratory control centres} along (sensory) neurones ;  
4. idea of nervous link from {medulla / respiratory control centres}to muscles to {alter / change} {ventilation (rate) / breathing rate / (depth of) breathing} ; 3 marks

(d) 1. idea that exercise {increases the {CO<sub>2</sub> / H<sup>+</sup>} concentration / {decreases the pH / O<sub>2</sub> concentration} ;  
2. (this increase is) detected by chemoreceptors ;  
3. (chemoreceptors) send impulse to medulla ;  
4. (resulting in) increased {rate of ventilation / breathing rate / depth of breathing / contraction of {respiratory / intercostals / diaphragm muscles} } ; 2 marks

**Total 7 marks**

## Question 9

Maximum mark

- (a)
1. calcified connective tissue ;
  2. {bone cells / osteocytes / eq} in {cavities in a matrix / lacunae} ;
  3. cavities called lacunae ;
  4. matrix consists of collagen fibres and {inorganic / eq} salts ;
  5. salt called hydroxyapatite ;
  6. ref to Haversian canals / description e.g. concentric rings idea ;
  7. canals contain {blood vessels / nerves / lymphatic vessels} ;
  8. ref to canaliculi ;
  9. (canaliculi) contain cytoplasm ;

4 marks

- (b) (i)
1. (overall) average bone mass density increases with length of exercise ;
  2. ref to anomaly at 90 minutes of exercise ;
  3. greatest increase in bone mass density seen between 0 and 30 mins of exercise ;
  4. (only) 120 minutes of exercise reduces range of bone mass densities measured ;
  5. manipulation of figures to compare two groups / bone densities or ranges ;

3 marks

- (ii)
1. idea that many other factors influence bone mass density ;
  2. idea that factors were not controlled ;
  3. any two factors named e.g. body weight / cigarette smoke / alcohol intake / intake of other drugs / genetics / contraceptive pill / gender / additional exercise taken / low calcium diet ;;

2 marks

- (iii)
- exercise of this length is most significant contributing factor / eq / maximum bone density reached which cannot be exceeded ;

1 mark

Total 10 marks