

# GCE 2005

## *January Series*



# Mark Scheme

## Biology Specification A

### BYA1 Molecules, Cells and Systems

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*Dr Michael Cresswell Director General*

**BYA1****Question 1**

- (a) (Small alveoli with) large surface area;  
For diffusion; 2
- (b) (i) Epithelium / epithelial/squamous/pavement cells;  
*Reject endothelium.* 1
- (ii) 0.11  $\mu\text{m}$ ; 1
- (c) (i) Less oxygen / more carbon dioxide / more water vapour;  
*Two differences required, but only one mark for this part of the question.* 1
- (ii) Gas exchange takes place in alveoli / does not take place in trachea; 1
- (d) (i) Pulmonary artery; 1
- (ii) Concentrations reach equilibrium/become equal;  
Diffusion occurs when there is a concentration gradient (so some will remain in blood);  
OR  
Lung cells/vessel cells respire;  
Add/produce carbon dioxide; 2

Total 9 marks

**Question 2**

- (a) (i) (Grinding) breaks open cells / increases surface area (of liver);  
Releases catalase/enzyme/more catalase /  
allows more hydrogen peroxide into liver; 2
- (ii) Heating causes bonds (maintaining tertiary structure) to break;  
Denatures / changes tertiary structure;  
Active site changed;  
Substrate no longer fits / ES complex not formed; max 3
- (b) (Control) to show that sand did not affect reaction (with ground liver); 1
- (c) (i) Lower activation energy / less energy required to bring about reaction; 1
- (ii) Energy in products/water and oxygen less than energy in substrate/  
reactants/hydrogen peroxide;  
(Difference) given out as heat / exothermic; 2

Total 9 marks

**Question 3**

- (a) (i) (Molecule) made up of many identical/similar molecules/monomers/  
subunits; 1  
*Not necessary to refer to similarity with monomers.*
- (ii) Cellulose / glycogen / nucleic acid / DNA / RNA; 1
- (b) (i) To keep pH constant;  
A change in pH will slow the rate of the reaction / denature the amylase /  
optimum for reaction; 2
- (ii) Purple/lilac/mauve/violet; 1  
*Do not allow blue or pink.*
- (iii) Protein present;  
The enzyme/amylase is a protein;  
Not used up in the reaction / still present at the end of the reaction; max 2

Total 7 marks

**Question 4**

- (a) Any two from:  
Loop of DNA; Non-cellulose cell wall;  
Plasmid; Capsule;  
Flagellum; Mesosome; 2  
*Accept small ribosomes*
- (b) (i) (Granules) turn blue-black/dark blue/black/purple with iodine; 1
- (ii) Cellulose / pectin; 1
- (c) Use principle:  
Feature of starch;  
Consequence in terms of storage;  
  
e.g.  
Insoluble;  
Therefore will not “wash” out of cell / affect water potential / affect osmosis;  
OR  
Molecule coiled/branched;  
Therefore large amount stored in small space / compact  
OR  
Does not affect water potential;  
So no effect on entry of water (into cell); 2

Total 6 marks

**Question 5**

- (a) Does not have the resolution / cannot distinguish between points this close together;  
As light has longer wavelength; 2  
*The key ideas in marking this part of the question are resolution and wavelength.*
- (b) Lipid soluble / small / non-polar / not charged; 1
- (c) (i) Concentration of sodium ions (outside cell);  
As concentration/independent variable increases so does the rate of diffusion; 2
- (ii) Sodium ions are passing through the channels/pores;  
At their maximum rate;  
Rate is limited by the number of sodium channels / another limiting factor; max 2

Total 7 marks

**Question 6**

- (a) (i) Impulse to diaphragm;  
Diaphragm contracts/flattens; 2  
*Ignore references to intercostal muscles.*
- (ii) Muscles (associated with breathing) relax; 1
- (b) Produces lower pressure (and air moves in down pressure gradient); 1
- (c) (i) Rate of diffusion  $\propto \frac{\text{(Surface) area} \times \text{Difference in concentration}}{\text{Thickness (of exchange surface)}}$  / Conc. Gradient 1
- (ii) Rate of diffusion is proportional to concentration gradient / difference in concentration;  
Breathing changes air / maintains gradient; 2

Total 7 marks

**Question 7**

- (a) Lymphocyte has round nucleus;  
Granulocyte has lobed nucleus; 2
- (b) (i) Mitochondria site of respiration;  
Production of ATP / release of energy;  
For contraction; 3  
*Do not award credit for making or producing energy.*
- (ii) Enzymes are proteins;  
Proteins synthesised/made on ribosomes; 2
- (c) Lysosomes produce/contain enzymes;  
Which break down/hydrolyse proteins/substances/cells of tail; 2
- (d) 1. Chop up (accept any reference to crude breaking up);  
2. Cold;  
3. Buffer solution;  
4. Isotonic / same water potential;  
5. Filter and centrifuge filtrate;  
6. Centrifuge supernatant;  
7. At higher speed;  
8. Chloroplasts in (second) pellet; max 6

Total 15 marks

**Question 8**

- (a) 0.1 – 0.6 seconds;  
Volume (in left ventricle) increasing / ventricle filling; 2
- (b) (i) 2 marks for correct answer of 75 (beats) per minute;  
1 mark if heart beat correctly identified as lasting 0.8 seconds; 2
- (ii) 70 cm<sup>3</sup>; 1
- (c) Multiply them; 1
- (d) 750; 1  
*Accept a small increase – up to 800 cm<sup>3</sup>*
- (e) (i) 4 : 1 / 4; 1  
*Ratio must be expressed in simplest terms*
- (ii) 18 cm<sup>3</sup>; 1
- (f) 1. Thick wall of artery;  
2. Allowing it to withstand (higher) pressure;  
OR  
1. Thin wall of vein;  
2. Does not ‘need’ to withstand pressure;
3. Both have endothelium/epithelium;  
4. Consisting of squamous/flat cells;  
5. Reduces friction with blood / allows smooth flow of blood;  
6. Muscle which may contract and alter vessel diameter / divert blood;  
7. Elastin smoothes out pressure / stretches and recoils;  
8. Valves in veins;  
9. Prevent backflow of blood; max 6

Total 15 marks