

## Biology – BY4

- Q.1** Integrated control / integrated pest management [1]
- (b) facultative anaerobes [1]
- (c) osmoreceptors (not: osmoregulators) (not: if ref to pituitary) [1]
- (d) nerve net [1]
- (e) photoperiodism [1]
- [Total 5 marks]**
- Q.2** (a) (i) day 10 [1]
- (ii) day 2 to day 14 [1]
- (b) (i) interspecific [1]
- (ii) 240 (unit needed) [1]
- (iii) adding more nutrients /food / *B. pyocyaneus* / more food for *B. pyocyaneus* / remove waste / adding bacteria  
increasing amount of culture  
(not: more space) [1]
- (iv) increase; [1]  
Less competition for food / more food available [1]
- (c) (i) dependent – effect on population depends on population size  
independent – effect on population is the same whatever the size of  
the population [2]  
[not: population affecting factors]
- (ii) temperature / pH (not: O<sub>2</sub> concentration) (not: fire / flood) [1]
- [Total 10 marks]**
- Q.3** (a) (i) glomerulus [1]
- (ii) urea or amino acids, fatty acids / glycerol / small proteins /  
inorganic ions or Na + or minerals or salts (not: vitamins / salt)  
(name two for 1 mark) [1]
- (iii) ultrafiltration [1]
- (iv) Hydrostatic/ blood pressure decreased; [1]  
less filtrate formed / less rate of filtration [1]
- (b) (i) loop of Henle (not: ascending limb) [1]
- (ii) increased length / longer [1]  
(not: larger)

- (c) (i) fish – ammonia  
bird – uric acid  
mammal – urea [3]
- (ii) uric acid (allow: e.c.f) [1]
- (iii) little mass (for storage) / reduces body mass / light for flight / less storage space for eggs (not: less toxic/ less water unqual) [1]

**[Total 12 marks]**

- Q.4** (a) absorbs light energy / of specific wavelength / wavelengths of light / light at red and blue end of spectrum / photons [1]
- (b) (i) 440 nm (435 – 440) [1]
- (ii) any pigment / chlorophyll absorbs or uses a limited part of the spectrum / light wavelength;  
additional pigments increase range of wavelengths;  
from which energy can be obtained / or increase efficiency of photosynthesis (any two) [2]
- (c) all wavelengths except green are absorbed / green wavelength is reflected or transmitted. (not: ref to light; allow: ref to spectrum / frequency) [1]
- (d) since they follow a similar trend / pattern / shape / close correlation / peaks correspond (not: similar unqual) [1]  
it suggests that the pigments / wavelengths responsible are used in light absorption are then used in photosynthesis. [1]
- (e) (i) R – light harvesting unit / complex / centre / antenna complex [1]  
S – reaction centre [1]
- (ii) cross in circle of reaction centre [1]
- (iii) thylakoid membrane / granal membrane / intergranal membrane [1]

**[Total 11 marks]**

- Q.5** (a) carbon dioxide / CO<sub>2</sub> [1]
- (b) ATP;  
Reduced NADP / NADPH / NADPH<sub>2</sub> [2]
- (c) D;  
G (any order) [2]
- (d) energy source / cellulose / lipids / food store / starch /  
amino acids / proteins / pentose sugar / disaccharide / release energy in  
respiration (accept: named sugars; not: carbohydrates / respiration  
unqual) [1]

[Total 6 marks]

- Q.6** (a) pyruvic acid / pyruvate is converted to (two carbon) acetyl / acetate;  
(two molecules) of reduced NAD formed (by dehydrogenation)  
(allow: NADH etc)  
loss of (two molecules) of carbon dioxide / decarboxylated  
acetate combines with coenzyme A (to form acetyl coenzyme A) [3]  
(pyruvate converted to acetyl Co A = 0)
- (b) (i) cytoplasm;
- (ii) matrix of mitochondrion [2]
- (c) (i) (Decarboxylation) is the removal of carbon dioxide / carboxyl group;  
(Dehydrogenation) is the removal of hydrogen [2]
- (ii) P and Q [1]
- (d) (i) one [1]
- (ii)

	In the link reaction using NADH	In the Krebs Cycle using NADH	In the Krebs Cycle using FADH
Number of Molecules of ATP Formed	3	9	2

All 3 = 2 marks any 2 = 1 mark. 1=0 [2]

- (iii) carrier system involving NAD has three pumps FAD has two pumps.[1]  
(not: ref carriers)

[Total 12 marks]

- Q.7** (a) (rapid) reaction/ response to a stimulus; [1]  
 automatic / involuntary / not under conscious control /  
 brain not involved (not: cannot be controlled / automated without thinking) [1]
- (b) A – motor;  
 B – relay / intermediate / connector;  
 C – sensory  
 (all three) [1]
- (c) (i) X – myelin sheath / Schwann cell  
 Y – node of Ranvier [2]
- (d) (i) Na<sup>+</sup> or sodium ions are actively removed / pumped out /  
 faster than K<sup>+</sup> ions are moved in; [1]  
 K<sup>+</sup> or potassium ions diffuse out more rapidly than Na<sup>+</sup> /  
 membrane has a higher permeability to K<sup>+</sup> than Na<sup>+</sup>. [1]  
 or Na / K pumps 3Na<sup>+</sup> out and 2K<sup>+</sup> in = 2 marks  
 (Ref. to ions needed at least once; 1 mark if no number)
- (ii) Sudden change /increase in the permeability of the membrane to Na<sup>+</sup>/  
 sodium gates / channels open;  
 sodium ions diffuse in or ref. concentration gradient  
 (not: move in) [2]
- (e) (i) As the axon diameter increases the speed of conduction increases  
 (ref. linear/proportional needs direction allow: positive correlation) [1]
- (ii) Speed of transmission (of the action potential) depends on [1]  
 resistance (of axoplasm)  
 (This resistance is related to the diameter of the axon). The greater /  
 larger the diameter of the axon the less the resistance. [1]  
**Or** increased diameter means increased surface area (of axon)  
 over which exchange of ions can take place.
- (iii) ATP is required for active transport / ref Na/ K pumps;  
 Na<sup>+</sup> ions (actively) moved out only at nodes in myelinated;  
 Na<sup>+</sup> ions (actively) moved out along whole length of  
 axon in non-myelinated. (Any 2) [2]

**[Total 14 marks]**

- Q.8 (a)**
- A. Glucose is phosphorylated / ATP is added. [1]
  - B. to form hexose (di) phosphate. [1]
  - C. this is split into (two) 3C triose phosphate molecules.  
(not: abbreviations) [1]
  - D. which are converted to pyruvate. [1]
  - E. and (2) reduced NAD or eq e.g. NADH [1]
  - F. takes place in the cytoplasm / glycolysis [1]
  - G. in the absence of oxygen, (the Krebs cycle and) ETC cannot occur / no oxygen to act as the final electron acceptor at the end of the ETC. [1]
  - H. Pyruvate is converted to lactate / lactic acid in animal cells / humans. [1]
  - I. using the reduced NAD to reduce the pyruvate / transferring the hydrogen to pyruvate (in the process) [1]
  - J. in plants / fungi there is a loss of carbon dioxide / decarboxylation [1]
  - K. ethanal / acetaldehyde is produced [1]
  - L. ethanal is reduced by NADH to ethanol [1]
  - M. anaerobic respiration yields a total of 2 ATP [1]
  - N. (because) a lot of energy is still tied up / contained in the lactate / ethanol (i.e. ethanol high in calories) [1]

**[Total 10 marks]**

- (b)**
- A. All materials are added at start / not during the process [1]
  - B. Sterile apparatus. [1]
  - C. (Pure (culture) of) ref *Penicillium (notatum)*. [1]
  - D. Sterile nutrient medium. [1]
  - E. Aeration method as oxygen is required for respiration / for aerobic conditions [1]
  - F. pH adjustment / buffer. [1]
  - G. introduction of sterile air / oxygen. to prevent contamination (by airborne organisms) [1]
  - H. Method of mixing (qualified). (eg paddle) to mix nutrients (and culture / oxygen) [1]

- I. Water jacket to prevent overheating to remove excess heat produced during respiration / metabolism or maintain optimum temperature qual / prevent enzyme denaturation [1]
- J. nutrients / glucose is depleted during growth phase. [1]
- K. Penicillin is secondary metabolite. [1]
- L. Penicillin is produced / harvest after growth phase / during stationary phase / after nutrient depletion. [1]
- M. Filter / purify culture fluid / separate fungus. [1]
- N. AVP e.g. penicillin production in nature possibly to reduce competition / comparison with continuous culture. [1]

**[Total 10 marks]**