

Biology BY4

- 1 (a) (i) X ATP
 Y ADP 1 mark for both (1)
- (ii) Active transport; Nerve impulse;
 Muscle contraction; Light independent stage of p/s;
 Glycolysis;
 Protein synthesis / cell division; (Any 2)
- (iii) ATP synthetase / ATPase (1)
- (b) (i) Electron transport (chain) (1)
- (ii) A Proton pumps (1)
 B stalked particle / ATP synthetase / ATP ase (1)
- (iii) High energy electrons/eq;
 Fuel (eq) the proton pumps;
 Which pumps protons into the inter-membrane space;
 This creates an electrochemical gradient/eq;
 Which causes H⁺ to flow through a stalked particle;
 Synthesising ATP;
 Correct reference to chemiosmosis;
- Any 4 but in THE CORRECT SEQUENCE* (4)

Total: 11 MARKS

- 2 (a) 1 Obligate aerobes; (1)
 at the top of the test tube in order to absorb maximal oxygen/eq; (1)
- 2 Obligate anaerobes; (1)
 gather at the bottom to avoid oxygen/eq. (1)
- 3 Facultative anaerobes; (1)
 gather mostly at the top, since aerobic respiration is the most
 beneficial/but as lack of oxygen does not inhibit them, they can
 be found all along the test tubes. (1)
- (b) *C. perfringens* is an obligate anaerobe;
 More/high pressure oxygen (is forced) into the wound;
C. perfringens/bacteria cannot metabolise / is inhibited in the presence
 of O₂; (not: respire)
 Bacteria stop dividing / producing toxin;
 Allows antibiotics/immune system time to destroy bacteria. (Any 2)
- (c) Suitable temperature (not heat);
 Suitable pH;
 Carbon source/glucose*;
 Nitrogen source/eq*;
 Vitamins*;
 Mineral salts*; (1)
 [or nutrients instead of *]
 Water; *Any 3 for 1 mark*

Total: 9 MARKS

- 3 (a) Ribosomes are not involved in respiration/eq; (1)

Mitochondria cannot metabolise glucose/have no enzymes for glucose breakdown / have no carrier for glucose in the membrane;

Pyruvate is broken down in the/Link reaction/Krebs cycle producing CO₂;

No lactate with either substrate as mitochondria are not involved in anaerobic respiration; (Any 2)

CR breaks down glucose anaerobically to lactate;

Enzymes for pyruvate breakdown are in mitochondria/Link or Krebs occurs in mitochondrial matrix;

Cytoplasmic residue cannot metabolise pyruvate (Any 2)
(No source of reduced NAD)

- (b) Cyanide must stop Krebs cycle/Link reaction (since no CO₂ is produced);

Non competitive inhibitor;

Of the ETC/(last) proton pump;

Cyanide is a respiratory inhibitor / inhibits respiration; (Any 2)

Total: 7 MARKS

- 4 (a) Ultrafiltration;
 High hydrostatic pressure/high pressure in glomerular capillary/glomerulus;
 Forces small molecules through the capillary (walls) into capsule;
 through basement /dialysing membrane; (Any 3)

- (b) (i) podocytes, (1)
 (ii) Capillary shows pores/fenestrations/small gaps; (1)
- (c) (i) Selective reabsorption (1)
 (ii)

Transport mechanism

Molecule	Facilitated Diffusion	Active Transport	Osmosis
Glucose	✓	(✓)	
Amino Acids	✓	(✓)	
Water			✓
Sodium Ions		✓	

One mark per column (3)

- (d) Short length (in fresh water mammals)
 Because water is readily available so low Ψ not needed; (1)
 Medium length (in terrestrial mammals)
 Water reasonably available; (1)
 Long length (in desert mammals)
 Water needs to be conserved so medulla with low Ψ required; (1)

- (e) ADH is not being secreted;
 Collecting duct cells are not responsive to ADH;
 So reduced water uptake into the medulla; (Any 1)
 Collecting duct cells less permeable.

Total: 13 MARKS

- 5 (a) Decay/putrefaction/decomposition/ammonification; (1)
- (b) *Nitrosomonas/nitrococcus* (1)
Nitrobacter (1)
- (c) Denitrification (1)
 Anaerobic/eq (1)
- (d) (i) *Rhizobium* (1)
- (ii) Hb absorbs/has an affinity for O₂ (1)
- (e) Respiration would demand high use of O₂;
 O₂ is the final electron acceptor in the ETC;
 (And so rapidly) converts O₂ to water (Any 2)
- (f) Waterlogged soil/bogs are anaerobic;
 Have low nitrate content/denitrification occurring;
 Insect's protein is digested;
 Releasing *amino acids/ammonium* ions;
 Which can be used for plant protein/nucleic acid synthesis; (Any 2)
 (not: nitrates or growth)

Total: 11 MARKS

- 6 (a) Sunlight/Red light is absorbed during daylight;
 Pr/ P660 is converted to Pfr/ P730;
 Pfr is active and inhibits flowering (in short day plants);
 In Exp1 lots of light/high Pfr so no flowering (inhibited);
 In Exp2 not enough Pfr/low Pfr (no inhibition) so flowering;
 In Exp3 the Pr is (rapidly) converted back to Pfr; so inhibition of
 flowering; (Any 3)
 (allow: converse points)
- (b) Short day plant (1)
- (c) Allows plant breeders to cross pollinate flowers which would not
 usually flower at the same time
 Preparation of flowering plants for known dates – Christmas/Easter/
 Mothers' Day/eq (1)

Total: 5 MARKS

- 7 (a) Large/intense/dark spot of G3P indicating a lot has been synthesised;
 First product after $^{14}\text{CO}_2$ added is G3P;
 Smaller quantity of sugar phosphates produced later; (Any 2)
- (b) More sugar phosphates produced;
 More triose phosphate produced;
 Presence of amino acids indicate other compounds being synthesised;
 Presence of citric acid;
 Any comment on Krebs cycle intermediates being used to synthesise
 amino acids; (Any 3)
 Sucrose present.

- (c) Presence of nucleic acids/ATP/ADP/eq.;
- Starch;
- Proteins;
- Lipids/glycerol/fatty acids; (Any 2)
- Cellulose.
- (not: RUBP/ glucose/fructose/ethanol)
- (d) Reduced NADP/NADPH/NADPH₂
- ATP 1 mark for both (1)
- (e) *Cyclic*
- Light absorbed/harvested by PS 1/P700;
- High energy electrons used to fuel proton pump;
- Creating EC gradient/eq.;
- Allowing ATP synthesis/ATP as a product;
- Electrons return to PS1/P700/same PS (I); (Any 2)
- Non Cyclic*
- Light harvested/absorbed by both PS;
- High energy electrons passed to carriers;
- Replaced in PS2/P680 by photolysis of water/eq.;
- Electrons replaced in PS1/P700 from PS2/P680;
- Electrons from PS 1/P700 passed to NADP;
- Products are reduced NADP and ATP (Any 4)

Total: 14 MARKS

8 (a) Chemical control*Advantages*

- A. Very effective/quick/cheap means of control
- B. Chemicals can be applied on a small area (e.g. Market gardening) /
Application does not require a high level of skill/knowledge

Disadvantages

- C. Chemicals are not specific/may eradicate useful insects
- D. Resistance may occur (not: immunity)
- E. Killing of fish/birds/mammals/bioaccumulation;
- F. Risk to human health/contamination of rivers.

Biological control*Advantages*

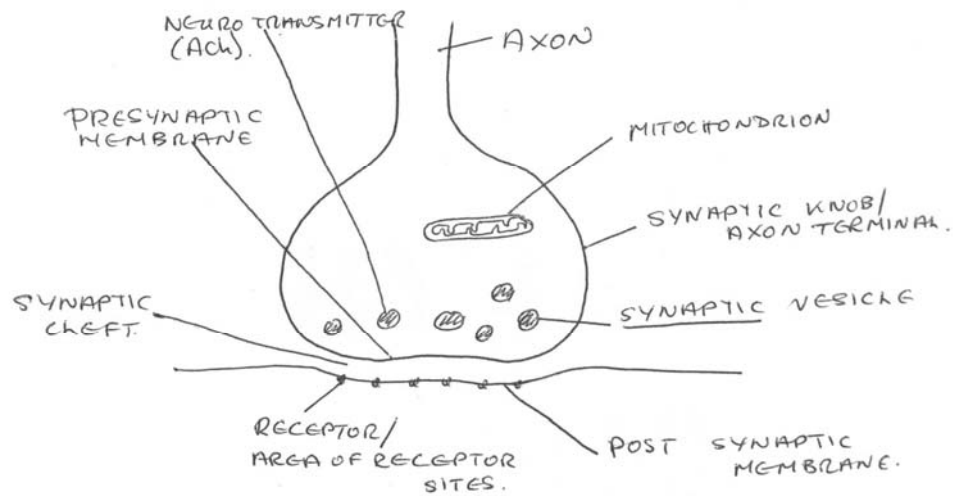
- G. Highly specific to one pest
- H. Long term control if predator: prey balance / Use in glasshouses
- I. May be inexpensive in long term
- J. No environmental contamination

Disadvantages

- K. Slow build up/have to accept some damage to crop/'not perfect'/pest
not totally eradicated;
- L. Few successful examples
- M. Skill and research is expensive/detailed life cycle knowledge is
needed
- N. Frequent input of predator needed / may only be of use in closed
systems (greenhouses)
- O. Predator may become a pest itself/suitable e.g. (cane
toads/hedgehogs on Uist)

Any 10 from the 15 marks available

- (b) A. Decent drawing of a synapse.



/Na channels

- B.C.D. With 6 labels (2 correct labels per mark)
- E. When action potential arrives at axon terminal Ca^{2+} moves into synaptic knob
- F. Synaptic vesicles fuse with presynaptic membrane
- G. Neurotransmitter/ACh/eq released by exocytosis
- H. Diffuses over synaptic cleft
- I. ACh binds to receptors on post synaptic membrane
- J. Causing the protein channels to open/Na gates open
- K. Na^+ flows in through channels
- L. So depolarising the post synaptic membrane
- M. With sufficient depolarisation, an impulse/action potential is generated in the post synaptic neurone
- N. Some comment on the breakdown of ACh by (A)Ch-esterase
- O. Diffusion back into axon terminal through presynaptic membrane/Use of ATP for re-synthesis and packaging

Any 10 from the 15 marks available