

GCE Biology BY4

Mark Scheme – January 2013

Question	Marking details	Marks Available
1	(a) (i) Photoperiod(ism)	1
	(ii) <u>Phytochrome NOT PR/ PFR</u>	1
	(iii) Leaves	1
	(b) (i) Ammonium/ NH_4^+ + nitrate (ions)/ NO_3^- [both needed for 1 mark] NOT ammonia	1
	(ii) Denitrification	1
	(iii) <u>Azotobacter</u>	1
	Question 1 total	6

Question	Marking details	Marks Available
2 (a)	Gram positive: purple/ violet NOT crystal violet Gram negative: red / pink [both needed for 1 mark];	1
(b)	<u>Gram +ve:</u> (thick) {murein / peptidoglycan} cell wall (only)/ no lipopolysaccharide layer; {retains/ binds/ absorbs} crystal violet stain / purple colour; <u>Gram –ve:</u> {lipoprotein / lipopolysaccharide}{ layer / wall} (external to murein cell wall); Does not retain {crystal violet stain / purple colour}; Stains {red/pink} with {counter stain / safranin / carbol fuchsin};	3 max 2 if only discuss one type of bacteria
(c) (i)	Ignore references to Gram +ve / Gram –ve. A bacillus/ bacilli; NOT rod B spirillum/ spirilli; NOT spiral C coccus/ cocci; NOT round / staphylococcus	1 1 1
(ii)	(lipoprotein / lipopolysaccharide layer) protects against (some) {antibiotics} / penicillin / antibodies / makes them less susceptible to attack by lysozyme/ (lipid component) acts as an (endo)toxin;	1

Question	Marking details	Marks Available
(d) (i)	<p><i>Plate U</i> - enough colonies for reliable results/ - colonies easily countable; NOT the right number/ we can see them</p> <p><i>Plate R/S</i> - cannot distinguish individual colonies;</p> <p><i>Plate T</i> - too many colonies to count reliably;</p> <p><i>Plate V</i> - not enough colonies for reliable estimate</p>	max 2
(ii)	<p>69 colonies x 10 000 (dilution factor) x 2 (or 1/0.5);</p> <p>1 380 000/ 1.38 x 10⁶ colonies per cm³;</p>	2
(iii)	<p>does not include {dead / non-viable bacteria}/ cannot be sure that {each colony has grown from a single bacterium/ colonies are not clumped}/ ORA;</p>	1
(iv)	<p>need to count pathogenic bacteria / pathogenic bacteria more likely to grow at temperature close to body temperature/ want bacteria to grow quickly to identify to treat infection as quickly as possible;</p> <p>NOT want to grow them as quickly as possible without qualification</p>	1
Question 2 total		[14]

Question	Marking details	Marks Available
3	(a) (i) {maximum number / density/ size} of a population; Sustained/ maintained (indefinitely) by a particular environment/ OWTTE;	2
	(ii) 24 to 26;	1
	(iii) I. Density Dependent nutrient / food / yeast levels; oxygen level / concentration; disease/ infection/ contamination; toxins / waste products; accept pH NOT mates	max 2
	II. Density Independent temperature; size of container; accept pH if not awarded in I	max 1
	(b) (i) competition for (same) food source/ niche; reject nutrients <i>P.aurelia</i> {more successful than/ outcompetes} <i>P.caudatum</i> ;	2
(ii) Live in different locations in same habitat/ <i>P. caudatum</i> swims freely while <i>P. bursaria</i> lives at bottom of ponds/ <i>P. caudatum</i> feeds (on yeast suspended) in water while <i>P. bursaria</i> feeds (on yeast that have settled) at the bottom; Less interspecific competition;	2	
Question 3 Total		[10]

Question
4 (a)

Marking details

Marks Available

Chloroplasts	Mitochondria
D;	H;
A;	F;
B;	J;
E;	G;

8

- (b) (i) Reference to a suitable function of ATP e.g. protein synthesis/
active transport/ muscle contraction etc NOT movement
Different types of energy can be transferred into a common
form;
Only 1 molecule needed to transfer energy to chemical
reactions;
Energy can be supplied in {small amounts/ packages/ approx
30.6kJ} /less {energy/ heat} wasted;
Easily transported (across membranes);
{Single enzyme/ only ATPase} needed to release energy from
ATP;
{Single bond needed to be broken/ one step reaction} to
release energy;


max 3

- (ii) used by all organisms/ species; NOT cells
To provide {energy/ fuel} for (nearly all biochemical) reactions;
NOT provide energy unqualified

2

Question 4 Total

[13]

Question	Marking details	Marks Available
5 (a)	<p>(i) A + 40mV C - 70mV [both needed for 1 mark] (accept suitable alternatives eg., -60 / + 30)</p>	1
	<p>(ii) depolarisation Sodium / Na⁺ (ion) channels open; Na⁺ {flood / diffuse rapidly} into axon; (pd) inside axon becomes {positive/ +40};</p> <p>repolarisation Na⁺ (ion) channels close and <u>K⁺</u>(ion) channels open; K⁺ {flood / diffuse rapidly} out of axon ; Must infer <u>sudden</u> movement out (pd) inside axon becomes {negative/ returns to-70};</p>	max 2
	<p>(iii) <u>threshold</u> potential not reached / all sub-<u>threshold</u> stimuli; stimulus / depolarisation not enough to open Na⁺ (ion) channels; ref. to action potential being 'All or Nothing';</p>	max 2
(b)	<p>(i) {2 or more/ a number of/ several} <u>polypeptide</u> chains; NOT group {bonded/ joined} together; NOT held Reject if used 'wrong' bond – i.e. hydrogen (alone)/ glycosidic/ ester/ peptide to form functional protein/ OWTTE;</p>	max 2
	<p>(ii)</p> 	1
	<p>(iii) middle of cell membrane is composed of {lipid / fatty acid side chains / tails}/ non polar;</p>	1

Question	Marking details	Marks Available
(c)	(i) Myelin; Accept phospholipid	1
	(ii) Schwann cell;	1
	(iii) Accept annotation on diagram myelin inhibits {loss of charge/ movement of ions} (from axon) / insulates (axon)/ prevents depolarisation; {gaps/ spaces} (between Schwann cells) called nodes of Ranvier; no myelin present in {nodes/ gaps/ spaces}; depolarisation only possible at Nodes of Ranvier / action potential can only form {at the nodes/ where there is no myelin}/ channels can only {open/close} in the nodes; action potential jumps from one node to the next / saltatory conduction/ lengthens local circuits/ OWTTE; nerve impulse transmission faster;	max 4
Question 5 Total		[17]

Question	Marking details	Marks Available
6 (a)	(i) Glycolysis cytoplasm; Link reaction matrix (of mitochondria); Krebs Cycle matrix (of mitochondria); [1 mark each row]	3
	(ii) Glycolysis;	1
(b)	(i) Carbon dioxide/ CO ₂ ;	1
	(ii) Decarboxylase;	1
(c)	Substrate- level phosphorylation 2; and 6; Glycerol can be converted to a 3C sugar which 3; enters respiration at this point ATP is used in phosphorylation 1;	4
Question 6 Total		[10]

Question	Marking details	Marks Available
7 (a)	<p>Describe how the light-independent stage of photosynthesis (Calvin cycle) leads to the production of triose phosphate. [7]</p> <p>Indicate the origin of the raw materials required for this stage of photosynthesis and the possible uses of the triose phosphate produced. [3]</p> <p>A In stroma (of chloroplast);</p> <p>B 5 carbon compound;</p> <p>C ribulose biphosphate / RuBP;</p> <p>D carbon dioxide <u>fixed/ fixation</u>;</p> <p>E By enzyme RuBisco;</p> <p>F To form hexose biphosphate / 6C compound;</p> <p>G (breaks down into 2 × 3C) glycerate 3 phosphate/PGA/GP;</p> <p>H (converted into 2 × 3C) triose phosphate/TP/GALP;</p> <p>I NADPH H⁺/reduced NADP / NADPH₂;</p> <p>J supplies hydrogen/used for reduction;</p> <p>K ATP broken down into ADP and Pi supplies energy. (not ATP supplies energy).</p> <p>L ATP + NADPH₂ from <u>light dependent stage</u>,</p> <p>M CO₂ from {environment/respiration}</p> <p>N RuBP regenerated from TP.</p> <p>O Phosphate from ATP needed for this.</p> <p>P TP starting point for synthesis of: glucose, lipids, amino acids, chlorophyll, cellulose, starch etc. Any 2 products.</p>	<p>[Max 7]</p> <p>[max 3]</p> <p>[10]</p>
	Question 7(a) Total	

Question	Marking details	Marks Available
7 (b)	Give an account of how the kidney is involved in osmoregulation in mammals. [10]	
	<p>A Antidiuretic hormone; NOT abbreviated</p> <p>B (ADH) is {secreted/ released} by the (posterior lobe of the) pituitary;</p> <p>C (ADH) is carried in the bloodstream to the (distal convoluted tubule and) <u>collecting duct</u>;</p> <p>D When the blood is more concentrated / low Ψ/ more negative/ low blood volume;</p> <p>E Detected by (osmo) receptors in hypothalamus;</p> <p>F (more) ADH released;</p> <p>G ADH levels increases the permeability of the (cells lining the) DCT/CD to water /explanation of water channels opening / aquaporins inserted into DCT membrane.;</p> <p>H Water moves out of the DCT/CD by <u>osmosis</u>;</p> <p>I Into the {interstitial / tissue} fluid where it is rapidly removed by the capillary network/ vasa recta;</p> <p>J This occurs because the {medulla of the kidney/ tissue fluid} has a high {solute/ salt/ ion} concentration/low Ψ;</p> <p>K Due to the countercurrent multiplier system operating in the Loop of Henle/ correct reference of how counter current produced;</p> <p>L This (conserves water and) produces {small volumes/ concentrated urine};</p> <p>M Most water absorbed in the PCT;</p> <p>N Length of loop of Henle effects the volume of urine produced</p> <p>O Short loop of Hemle results in less water reabsorbed/ ORA</p> <p>P Correct ref to adaptation to their environment</p>	
	Question 7b Total	[max 10] [10]