GCE MARKING SCHEME

SUMMER 2016

BIOLOGY – BY4
1074/01

INTRODUCTION

This marking scheme was used by WJEC for the 2016 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

GCE BIOLOGY - BY4

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Question			Marking details	Marks Available
1	*(a)*		{lipopolysaccharide/ lipoprotein} present in Gram-negative; There is an extra physical barrier / it is impermeable/ OWTTE; Accept protects cell	2
	(b)		*amino acids* protein / polypeptide / peptide / enzymes; Nucleic acids = neutral *purines and pyrimidines* nucleic acid synthesis / nucleotides/ DNA/ RNA; Accept ATP	2
	(c)		(only) {reproduce/ replicate} inside (living) cells;	1
	(d)		Any two from: • put (unopened) culture plates {plastic /autoclave /biohazard} bags; • use of autoclave; • {121^{o}C/ 100kPa/ 15psi} for 15-30 mins; tolerance ± 2^{o}C	2
			Question 1 total	**[7]**

Question			Marking details	Marks Available
2	*(a)*		Line clearly drawn to palisade mesophyll; Must be in layer above the vascular bundles	1
	(b)		Absorption spectrum – is (the quantity of) light absorbed at each wavelength; Action spectrum – is the rate of photosynthesis at each wavelength;	2
	(c)		Any 4 from: • Carbon dioxide {combines with/ is fixed with} {ribulose bisphosphate/RuBP}; • To produce <u>two</u> molecules of {glycerate 3-phosphate/G3P}; • <u>Reduced to</u> {triose phosphate/ GALP/ glyceraldehyde phosphate}; • Use of {reduced NADP/NADPH/$NADPH_2$/NADPH + H^+}; • and ATP; Award marks for annotated diagrams	4
	(d)		More acidic/lower pH (in the thylakoid cavity); Because of the high H^+ concentration (in the thylakoid cavity); ORA	2
			Question 2 total	**[9]**

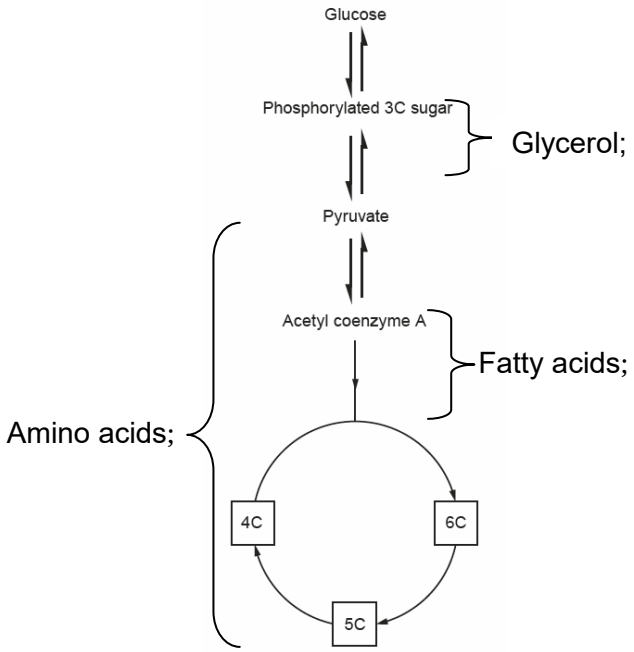
Question			Marking details	Marks Available
3	*(a)*	(i)	length of loop of Henle increases from beaver to Kangaroo rat/ OWTTE	1
		(ii)	• The kangaroo rat {lives in {dry/desert/ arid} conditions/ lives in conditions with little water/ OWTTE}; Neutral = hot/ drought • The beaver lives {with ready access to water/unlimited water supply/ where little water needs to be conserved}; Neutral = lives in water/ aquatic environment • The pig {can produce concentrated urine (if necessary)/has more access to water than the kangaroo rat/ has less access to water than the beaver/ lives in a mesic environment};	3
	(b)		{Dry conditions/ mountainous environment} <u>because</u> the urine is concentrated; Neutral = hot/ warm	1
			Question 3 Total	**[5]**

Question			Marking details	Marks Available
4	*(a)*		Stain purple/violet (with Grams stain); Rod shaped bacteria;	2
	(b)		{Lives/reproduces/grow} inside cells; NOT organisms Requires oxygen {to reproduce/ for respiration/ for growth/ for metabolism};	2
	(c)		Can only live inside cells/ ORA;	1
	(d)		Any three from: • Damage to {Schwann cells/ myelin sheath}/ reduces the electrical insulation of the axon/ demyelination; • Which {prevents/ slows} saltatory conduction/ OWTTE; • So {action potential/ impulse} travels more slowly; • May not reach CNS;	3
			Question 4 Total	**[8]**

Question			Marking details	Marks Available
5	*(a)*	(i)	Biological (control)/ biocontrol	1
		(ii)	Bt insecticides {are specific/ only kill target species/ Owtte}; Bt is {non-toxic/ does no harm} to {people/wildlife/beneficial insects/natural predators};	2
		(iii)	Only effective for {a short time/ less than a week}/ May need to be re-applied; Does not eradicate pest totally; More labour intensive;	2
	(b)		Not leaf eating (so do not eat bacteria)/ BT cannot penetrate the fruit;	1
			Question 5 Total	**[6]**

Question			Marking details	Marks Available
6	*(a)*	(i)	• {Gaps/fenestrations} in {capillary walls/endothelium} which are too small to allow (large) proteins to pass through; Accept pores • Basement membrane {has pores/ reference to molecular sieve} which are too small to allow large proteins to pass through; *'which are too small to allow large proteins to pass through'* only needs to be mentioned once	2
		(ii)	In the proximal convoluted tubule; Glucose is {selectively transported/ actively transported / selectively reabsorbed } into the {bloodstream/ capillaries};	2
		(iii)	Any three from: • High glucose levels lower water potential of the fluid in the collecting duct; • Less of a water potential gradient; • Less water moves from the collecting duct into the medulla by osmosis; • Some mention of {increased thirst/ greater intake of water};	3
	(b)	(i)	Any two from: Three polypeptide chains/**α** helices; Linked by cross bridges/ hydrogen bonds; rope-like /fibrous; IGNORE reference to level of protein structure	2
		(ii)	Glomerular membrane structure is damaged; Accept pores damaged Damage to endothelial cells/capillary wall; Allows proteins and red blood cells to be forced through gaps in the membrane; Accept ultrafiltration	3
			Question 6 Total	**[12]**

Question			Marking details	Marks Available
7	*(a)*		Higher temp: • Depolarisation takes longer to {start/ reach threshold}; • {lower the action potential/ reduces the action potential to half/ max depolarisation}; • quicker action potential returns to resting potential; • less hyperpolarisation/ shorter refractory period; NOT no hyperpolarisation • Action potential takes less time;	3
	(b)		K^+ channels open more rapidly at higher temperature therefore repolarisation is faster; K^+ channels close more rapidly at higher temperature therefore there is less hyperpolarisation;	2
	(c)	(i)	Acetyl Choline binds to <u>post synaptic membrane</u>; Accept neurotransmitter Causing opening of Na^+ channels which causes Na^+ to flood into post synaptic neurone;	2
		(ii)	Inhibitor prevents the (rapid) breakdown of Acetyl Choline, **and** {remains in synaptic cleft for longer/ remains bound to receptors for longer}; Allows {more (sodium) channels to be opened/ (sodium) channels open for longer} so allows depolarisation to occur (even with little Acetyl Choline present);	2
	(d)		{Blocks/stops} the dopamine transporter from {pumping/allowing/the flow of} dopamine back through the presynaptic membrane; flooding the {synapse/synaptic cleft} with dopamine/ increased concentration of dopamine in synapse/ (dopamine) remains bound to the receptors/ stays in synaptic cleft; {intensifies/prolongs} the stimulation of {receiving neurons/post synaptic neurone};	3
			Question 7 Total	**[12]**

Question			Marking details	Marks Available
8	*(a)*			3
	(b)		Is the final electron acceptor/accepts electrons and protons from the final proton pump; in the electron transport chain;	2
	(c)	(i)	0.70	1
		(ii)	All three needed for one mark Amino acids + Glucose + Triglycerides	1
	(d)	(i)	lactate/ lactic acid;	1
		(ii)	cytoplasm	1
		(iii)	(provides the energy) for muscle **contraction**	1
	(e)		It would {be higher/rise} **because** there would be a high CO_2 levels **and** {little/no} O_2 uptake;	1
			Question 8 Total	**[11]**

Question			Marking details	Marks Available
9	*(a)*		**Cyclic photophosphorylation**	[10]
		A	Photons/light energy absorbed by photosystem 1;	
		B	{High energy/ excited} electrons emitted from {reaction centre/chlorophyll **a**};	
		C	Used to power proton pumps (in the thylakoid membrane/ grana);	
		D	Return of electrons to PS 1;	
		E	Build up of H+ causes {electrochemical/ proton} gradient;	
		F	Allowing synthesis of ATP;	
			Non cyclic photophosphorylation	
		G	Photons/light energy absorbed by both photosystem 1 and 2;	
		H	Electrons from PS 2 pass through ETC, generating ATP;	
		I	Then pass to PS1 (to replace the electrons lost);	
		J	Electrons from PS 1 pass to NADP forming reduced NADP;	
		K	Which decreases the {proton/ H^+} concentration in the stroma/ protons are combined with NADP;	
		L	Loss of electrons from PS2 causes the photolysis of water;	
		M	Water splits to release O_2 as a {by-product/ waste};	
		N	Electrons to replace those lost from PS2;	
		O	Photophosphorylation occurs in the thylakoid membrane;	
			Question 9 a Total	**[10]**

Question			Marking details	Marks Available
9	*(b)*			[10]
		A	Nitrogen fixation by *Rhizobium* in legume root nodules;	
		B	Nitrogen fixation by *Azotobacter* free living in soil;	
		C	Atmospheric nitrogen is converted to ammonium ions;	
		D	Plants take up nitrates via roots;	
		E	nitrates are used to synthesise amino acids/proteins;	
		F	{Decay/putrefaction/ammonification} of nitrogen containing compounds;	
		G	Example of nitrogen containing compound - {urea/uric acid/ protein/ amino acids/nucleic acid};	
		H	Releasing {ammonia/ammonium ions} from F or G;	
		I	Converted to nitrites by *Nitrosomonas*;	
		J	And then nitrates by *Nitrobacter*;	
		K	Release of nitrogen back into the atmosphere by the action of denitrifying bacteria;	
		L	Ploughing/drainage;	
		M	{aerates/ increases oxygen levels of} the soil/ encourage aerobic conditions;	
		N	Favouring the aerobic nitrifying bacteria/ *Nitrosomonas* and *Nitrobacter* /Reducing the activity of denitrifying bacteria*;*	
		O	{Ploughing in/ planting of} leguminous crops/ manure spreading/ fertiliser;	
			Question 9 b Total	**[10]**