

GCE

Biology

Unit F214: Communication, Homeostasis & Energy

Advanced GCE

Mark Scheme for June 2014

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All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Annotations

Annotation	Meaning
BP	Blank Page – this annotation must be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
	Correct answer
×	Incorrect response
BOD	Benefit of Doubt
NBOD	Not Benefit of Doubt
ECF	Error Carried Forward
GM	Given mark
~~~	Underline (for ambiguous/contradictory wording)
^	Omission mark
I	Ignore
	Correct response (for a QWC question)
QWC+	QWC* mark awarded
V	Verbal Construction

^{*}Quality of Written Communication

C	Questi	ion	Answer	Mark	Guidance
1	(a)	(i)	chlorophyll , $\underline{a}$ / $\underline{A}$ ;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks  ACCEPT chlorophyll 680 and chlorophyll 700  (Note that both are required for this
					option)  IGNORE P680 / P700
					DO NOT CREDIT chlorophyll a
1	(a)	(ii)		1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks
			chlorophyll b / xanthophyll(s) / carotenoid(s) / (b / beta-) carotene ;		DO NOT CREDIT karatine (as could be confused with keratin)
1	(a)	(iii)	able to, absorb / use, a range of / different / more / other, (light) wavelengths / L;	1	e.g. absorb wavelength(s) not absorbed by primary pigment  IGNORE frequency IGNORE absorb all wavelengths IGNORE ref to chlorophyll b  DO NOT CREDIT ref to reflection where a pigment absorbs and reflects the same wavelength
1	(a)	(iv)		1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks
			ATP;		DO NOT CREDIT O ₂ / oxygen / red NADP / NADPH DO NOT CREDIT inaccurate name for ATP e.g. 'ATP (adenine triphosphate)' = 0 marks

C	Questi	on	Answer	Mark	Guidance
1	(b)	(i)	rubisco / RuBP carboxylase / ribulose bisphosphate carboxylase ;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks  ACCEPT ribulose biphosphate carboxylase  IGNORE oxygenase
1	(b)	(ii)	GP / glycerate(3-)phosphate;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks  ALLOW PGA / phosphoglyceric acid / phosphoglycerate  DO NOT CREDIT PGAL / GALP / phosphoglyceraldehyde  DO NOT CREDIT inaccurate name for GP  e.g. 'GP (glycerol phosphate)' = 0 marks
1	(b)	(iii)	RuBP / ribulose bisphosphate ;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks  ACCEPT ribulose biphosphate
1	(b)	(iv)	starch / amylose / amylopectin and cellulose;	1	Mark the first two answers. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks
			Total	8	

C	uesti	ion	Answer	Mark	Guidance
2	(a)	(i)	it converts energy (mechanical) into ,	1	If type of energy is specified, it must be as indicated in the brackets  ACCEPT 'converts one form of energy into another' IGNORE pressure
2	(a)	(ii)	<ul> <li>idea that deformation of membrane will allow more Na⁺ through because</li> <li>1 (the increased pressure) causes sodium (ion) channels to open;</li> <li>2 (temporary) gaps / holes / spaces, appear, between the phospholipids / in the bilayer;</li> </ul>	1 max	<ul> <li>CREDIT Na⁺ channels         DO NOT CREDIT Na channels         DO NOT CREDIT ref to voltage(-gated) channels</li> <li>IGNORE weakened         DO NOT CREDIT 'breaks in the bilayer'         DO NOT CREDIT 'pores' for 'gaps'         DO NOT CREDIT idea of additional,</li></ul>
2	(a)	(iii)	if the , stimulus is not strong enough / threshold (value) is not reached / depolarisation (of membrane) is insufficient , then , it / an action potential , is not , generated / AW; ora	1	ACCEPT 'impulses' for 'action potentials'  DO NOT CREDIT ref to 'strength' of an action potential IGNORE ref to numerical value for threshold potential IGNORE ref to 'it' or 'action potential' reaching threshold DO NOT CREDIT ref to action potentials of different sizes/values

Q	uesti	ion	Answer	Mark	Guidance
2	(a)	(iv)		2	Note: max 1 if term 'frequent' or derived term NOT used in answer
					ACCEPT 'impulses' for 'action potentials'
			1 idea that it is represented by the frequency of the action potentials;		CREDIT represented by how , frequently / often,     the action potentials are ,     transmitted / generated
			high, frequency / rate (of generation), of action potentials shows, a strong / an intense, stimulus; ora		2 DO NOT CREDIT ref to speed of , action potentials / impulses
					<b>Note:</b> e.g. 'a high <u>er</u> frequency of impulses represents a strong stimulus' <b>= 2 marks</b>
2	(b)		action potentials not generated because	1 max	<b>IGNORE</b> lack of (named) neurotransmitter as the Q refers to generation of the action potential in the receptor and not its onward transmission
			sodium (ion) channels (remain) open / resting potential not re-established;		1 CREDIT Na ⁺ channels IGNORE 'voltage-gated' DO NOT CREDIT Na channels
			2 idea of ions being in the wrong place for correct ion movement (across membrane);		

Question	Answer	Mark	Guidance
2 (c)		3 max	ACCEPT 'action potentials' for 'impulses' IGNORE 'messages' and 'signals' throughout
	1 allows, neurones to communicate / cell signalling;		e.g. • passes impulse on to next neurone     passes neurotransmitter on to next neurone
	ensure transmission (between neurones)     in one direction (only);		2 Must be transmission between neurones IGNORE description unless for clarification
	allows, convergence / impulses from more than one neurone to be passed to a single neurone;		3 IGNORE 'summation' ACCEPT 'neurotranmsitter' instead of 'impulse'
	4 allows, divergence / impulses from a single neurone to be passed to more than one neurone;		4 ACCEPT 'neurotranmsitter' instead of 'impulse'
	5 idea that filters (out), 'background' / low level, stimuli or ensures that only stimulation that is strong enough will be passed on;		
	6 prevents fatigue / prevents over-stimulation;		
	7 allows many low level <u>stimuli</u> to be amplified;		7 IGNORE 'summation'
	8 idea that presence of inhibitory and stimulatory synapses allows impulses to follow specific path;		
	9 permits, memory / learning / decision making;		
			Note: 'impulses from more than one neurone can pass to a single neurone' = 2 marks (mps 1 & 3)  Note: 'impulses from a single neurone can pass to many neurones' = 2 marks (mps 1 & 4)
	Total	9	

C	uesti	on	Answer	Mark	Guidance
3	(a)	(i)	diabetes (mellitus);	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks  ACCEPT hyperglycaemia IGNORE Type 1 or Type 2 DO NOT CREDIT hypoglycaemia
3	(a)	(ii)	idea that time needed, to restore normal (blood) glucose concentration / for insulin to act (fully);	1	
3	(a)	(iii)	18.6;;	2	Correct answer = 2 marks, even if no working shown.  If answer is incorrect, then ALLOW 1 mark for seeing: $1.1 \div 5.9$ or $(7.0 - 5.9) \div 5.9$ or $118.6$ or $118.64$ If the answer is not correctly rounded to 1dp, then ALLOW 1 mark for seeing a correct unrounded answer e.g. $18.64$
3	(b)		<ul> <li>HbA1C / glycosylated Hb , contained within , red blood cell(s) / erythrocyte(s) ;</li> <li>red blood cells / erythrocyte(s) , have limited life span / live for 8 to 12 weeks or red blood cells / erythrocyte(s) , break down after , 12 weeks / 3 months ;</li> <li>HbA1C / glycosylated Hb , broken down , in liver / by hepatocytes / by Kupffer cells ;</li> </ul>	2 max	CREDIT RBC / rbc for 'red blood cell' throughout  3 IGNORE ref to recycling

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G	Questi	ion	Answer	Mark	Guidance
3	(c)			1 max	DO NOT CREDIT ref to having eaten (as patient had confirmed that he had not eaten)
			patient might have had a drink containing sugar;		CREDIT ref to a specific sugar-containing drink
			AVP;		e.g. • patient was nervous and secreted adrenaline • other medication interferes with glucose levels • patient's haemoglobin does not bind effectively with glucose (e.g. anaemia / sickle cell)
3	(d)	(i)	1 if blood glucose falls, extremely / dangerously / too / very, low;	1 max	CREDIT hypoglycaemic / hypoglycaemia     IGNORE 'below normal' alone
			2 if patient, cannot produce (enough) glucagon / produces little glucagon;		CREDIT ref to dysfunctional, a cells / glucagon receptors
			3 idea that glucose source cannot be taken by mouth;		3 CREDIT a suitable reason (e.g. fitting or in a coma)

Q	uesti	on	Answer	Mark	Guidance
3	(d)	(ii)	<ul> <li>when blood glucose concentration decreases</li> <li>1 (glucagon) released by the , <u>alpha</u> / <u>a</u> , cells in , islets of Langerhans / pancreas ;</li> </ul>		IGNORE ref to insulin or events following an increase in blood glucose concentration  1 DO NOT CREDIT 'alpha cells are produced'
			<pre>promotes / AW ,</pre>		Any description must correspond correctly to term     DO NOT CREDIT if glucagon converts glycogen directly
			3 ref gluconeogenesis / described;		3 Any description must correspond correctly to term IGNORE imprecise ref to glucagon doing the conversion
			4 ref conversion of triglycerides to (free) fatty acids / lipolysis / increased use of fatty acids in respiration;		4 Any description must correspond correctly to term IGNORE imprecise ref to glucagon doing the conversion
			5 negative feedback, reduces / inhibits, the secretion of glucagon;		5 DO NOT CREDIT stopping glucagon secretion
			6 glucagon, reduces / inhibits, insulin secretion;	4 max	6 DO NOT CREDIT stopping insulin secretion
			QWC – technical terms used appropriately and spelled correctly;	1	Use of three terms from: alpha, islet, pancreas, glycogen, glycogenolysis, effector, gluconeogenesis, negative feedback  Please insert a QWC symbol next to the pencil icon, followed by a tick (P) if QWC has been awarded or a cross (0) if QWC has not been awarded You should use the green dot to identify the QWC terms that you are crediting.
			Total	13	,

C	uesti	on	Answer	Mark	Guidance
4	(a)	(i)	acetylcholine;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks  CREDIT other correct examples e.g. dopamine / noradrenaline / norepinephrine ACCEPT ACh
4	(a)	(ii)	either	2	Explanation must match correct location for 2 marks.  If no location stated then explanation can be awarded independently for 1 mark.  Incorrect location = 0 marks.  IGNORE 'interferes' (as in Q)  IGNORE ref to dendrites / cell bodies /neurone(s) / synapse(s)
			post-synaptic membrane; (TRPA1) prevents attachment of (named) neurotransmitter to its receptor;  or  pre-synaptic membrane / (pre)synaptic knob /		CREDIT causes hyperpolarisation  DO NOT CREDIT idea that TRPA1 is a free protein that will enter the ACh receptor and block it (rather like a competitive inhibitor occupying the active site of an enzyme)  ACCEPT Ca ²⁺

(	Questi	ion	Answer	Mark	Guidance
4	(b)	(ii)	<ul> <li>A sinusoid;</li> <li>B (branch of) bile duct;</li> <li>C (branch of) hepatic portal vein;</li> <li>D (branch of) hepatic artery / arteriole;</li> <li>E (branch of) hepatic / central, vein;</li> <li>1 because there is not enough glutathione /</li> </ul>	Mark 5	Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks  B DO NOT CREDIT canaliculus  C IGNORE inter lobular
4	(b)	(iii)	glutathione has run out ;  2 enzyme catalysing glutathione reaction is ,	1	2 DO NOT CREDIT in context of P450 system 3 IGNORE ref to excretion  CREDIT (liver) stem cells / hepatic cells IGNORE liver cells unqualified DO NOT CREDIT Kupffer cells  ONLY CREDIT correct spelling for mitosis / mitotic
			Total	10	

Q	uesti	ion		Answer	Mark	Guidance
5	(a)	(i)	1	(as the temperature increases) the respiration <u>rate</u> increases;	2 max	Only credit answers that refer to an increase in temperature – no ora  1 Clear statement required – cannot be inferred from figures quoted.  ACCEPT positive correlation between temperature and respiration rate IGNORE ref to directly proportional
			2	respiration <u>rate</u> doubles with a 10°C temperature increase;		<ul> <li>Clear statement required – cannot be inferred from figures quoted.</li> <li>CREDIT Q₁₀ = 2</li> </ul>
			3	comparative figures with correct units  (units once for respiration and once for temperature)  in the context of either mp;		3 e.g. • between 0 and 20°C the respiration goes from 17 to 69 mg CO ₂ kg ⁻¹ h ⁻¹ • between 5 and 10°C the rate changes by 13 mg CO ₂ kg ⁻¹ h ⁻¹ e.g. • between 0 and 10°C the rate goes from 17 to 34 mg CO ₂ kg ⁻¹ h ⁻¹ • between 10 and 20°C the respiration goes from 34 to 69 mg CO ₂ kg ⁻¹ h ⁻¹ 0 °C 5 °C 10 °C 15 °C 20 °C 17 21 34 44 69   Note: 'between 0 and 20°C the respiration rate increased
						from 17 to 69 mg $CO_2$ kg ⁻¹ h ⁻¹ ' = <b>2 marks</b> (mps 1 & 3) <b>But</b> 'at 0 °C the respiration is 17 mg $CO_2$ kg ⁻¹ h ⁻¹ ' and at 20°C it is 69' = <b>1 mark</b> (mp 3)

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C	Question			Answer	Mark		Guidance
5	(a)	(ii)	1	best conditions are low(er) temperatures because respiration rate low;	2 max	1	5°C or below IGNORE statements that simply describe a trend
			2	0 °C / freezing , could be / is , best ;			
			3	idea that 0°C might be too low as (the food cells) might be damaged at 0°C;		3	<b>ACCEPT</b> ref to freezing instead of 0 °C
			4	idea that for some (named) food(s) (storage) temperature doesn't seem to matter;		4	NOT asparagus, blackberry or cauliflower
			5	<pre>idea that data is incomplete for , potato / parsnip ,     so , only limited / no , conclusions can be made ;</pre>			
			6	idea that if product needs to ripen during storage then a higher temperature (not above 20 °C) will be ideal;		6	IGNORE ref to ethene
						No	te: '0 °C is best as the respiration rate is low' = 2 marks (mps 1 & 2)
5	(a)	(iii)	1	onion;	3	1	DO NOT CREDIT if an additional suggestion is made
			2	has low(est) respiration rate;			
			3	across all temperatures (in the investigation / up to 20 °C) or			
				temperature has, the least / little, effect on respiration rate;		3	<b>DO NOT CREDIT</b> 'temperature has <b>no</b> effect on respiration rate'
			4	can be , stored / kept , at , higher temperatures / room temperature / at 20°C;		4	CREDIT idea that no need to store in fridge

C	Question		Answer	Mark	Guidance
5	(a)	(iv)		1	Both parts of the mark point required for the mark to be awarded
			asparagus		DO NOT CREDIT 'asparagus' without a supporting reason
			<u>and</u>		
			has a high respiration <u>rate</u> across all temperatures / has the highest respiration <u>rate</u> (of the foods);		ACCEPT 'has a high respiration rate even at low temperature(s)'
5	(b)	(i)	<ul> <li>idea that parasites have little access to oxygen;</li> <li>(inaccessible because)         <ul> <li>little oxygen dissolved in plasma / oxygen not very soluble (in plasma);</li> </ul> </li> <li>(inaccessible because) idea that oxygen is, combined with haemoglobin / contained in red blood cells;</li> <li>idea that haemoglobin has greater affinity for oxygen</li> </ul>	2 max	DO NOT CREDIT 'no oxygen accessible' clearly stated DO NOT CREDIT in the context of , the mammal respiring anaerobically / deoxygenated blood / temporary lack of oxygen  ACCEPT in context of saturation
			than parasite (pigment);		Note: 'because the oxygen is bound to haemoglobin, the parasite is unable to use it' = 2 marks (mps 3 & 1)

Question	Answer	Mark	Guidance
5 (b) (ii)	<ul> <li>in animals         A1 pyruvate is , converted / reduced , to , lactate / lactic acid ;         A2 can be reversed as no , atoms lost / other product formed ;     </li> <li>A3 lactate dehydrogenase available to reverse the reaction ;</li> <li>in yeast</li> </ul>	3 max	Only award 3 content marks if A mark(s) plus Y mark(s)  awarded A1 Cannot be inferred from awarding of A2 or A3  A2 e.g. pyruvate and lactate are both 3C compounds so reaction can be reversed
	Y1 pyruvate converted to ethanol (in 2 steps) and carbon dioxide / CO ₂ ;  Y2 cannot be reversed as, carbon dioxide is / atoms are, lost;  Y3 (de)carboxylase enzyme cannot reverse the reaction;		Y1 CREDIT pyruvate decarboxylated to ethanol  Y2 e.g. pyruvate is 3C and , ethanol / ethanal , is 2C so reaction cannot be reversed
	QWC – technical terms used appropriately and spelled correctly;	1	Use of three terms from:  pyruvate, lactate, lactate dehydrogenase carbon dioxide, ethanol (de)carboxylase / (de)carboxylation (or derived term)  Please insert a QWC symbol next to the pencil icon, followed by a tick (P) if QWC has been awarded or a cross (0) if QWC has not been awarded You should use the green dot to identify the QWC terms that you are crediting.
	Total	14	

C	Question		Answer	Mark	Guidance
6	(a)	(i)	Q;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks  IGNORE named region as question requires candidates to identify the relevant regions from the diagram.
6	(a)	(ii)	Q and J and K and L;	1	All 4 letters required for the mark. If additional letters given, = 0 marks  IGNORE named region as question requires candidates to identify the relevant regions from the diagram.
6	(a)	(iii)	J;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks  IGNORE named region as question requires candidates to identify the relevant regions from the diagram.
6	(b)		<ul> <li>1 more (sodium and chloride) ions pumped, out of ascending limb / into medulla;</li> <li>2 builds up greater water potential gradient;</li> <li>3 allows, reabsorption / removal, of more water from, collecting duct / M;</li> </ul>	2	<ul> <li>CREDIT active transport / AW , for 'pumped' IGNORE salts / diffusion</li> <li>ACCEPT even more negative water potential in medulla (than other mammals)</li> </ul>

C	Question		Answer	Mark	Guidance
6	(c)		anabolic steroids;	1	Mark the first answer. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks  ACCEPT androgenic steroids  IGNORE named steroids as type of drug asked for
			Tota	6	

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