

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
	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
	Benefit of Doubt
	Not Benefit of Doubt
	Error Carried Forward
	Given mark
	Underline (for ambiguous/contradictory wording)
	Omission mark
	Ignore
	Correct response (for a QWC question)
	QWC* mark awarded
	Verbal Construction

* Quality of Written Communication

Question			Answer	Mark	Guidance
1	(a)	(i)	chlorophyll , <u>a</u> / <u>A</u> ;	1	<p>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</p> <p>ACCEPT chlorophyll 680 and chlorophyll 700 (Note that both are required for this option)</p> <p>IGNORE P680 / P700</p> <p>DO NOT CREDIT chlorophyll α</p>
1	(a)	(ii)	chlorophyll b / xanthophyll(s) / carotenoid(s) / (β / beta-) carotene ;	1	<p>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</p> <p>DO NOT CREDIT karatine (as could be confused with keratin)</p>
1	(a)	(iii)	able to , absorb / use , a range of / different / more / other , (light) <u>wavelengths</u> / λ ;	1	<p>e.g. absorb wavelength(s) not absorbed by primary pigment</p> <p>IGNORE frequency IGNORE absorb all wavelengths IGNORE ref to chlorophyll b</p> <p>DO NOT CREDIT ref to reflection where a pigment absorbs and reflects the same wavelength</p>
1	(a)	(iv)	ATP ;	1	<p>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</p> <p>DO NOT CREDIT O₂ / oxygen / red NADP / NADPH DO NOT CREDIT inaccurate name for ATP e.g. 'ATP (adenine triphosphate)' = 0 marks</p>

Question			Answer	Mark	Guidance
1	(b)	(i)	rubisco / RuBP carboxylase / ribulose biphosphate 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	

Question			Answer	Mark	Guidance
2	(a)	(i)	it converts energy (mechanical) into , another / different , form of energy (electrical) ;	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)	<i>idea that deformation of membrane will allow more Na⁺ through because</i> 1 (the increased pressure) causes sodium (ion) channels to open ; 2 (temporary) gaps / holes / spaces , appear , between the <u>phospholipids</u> / in the <u>bilayer</u> ;	1 max	1 CREDIT Na ⁺ channels DO NOT CREDIT Na channels DO NOT CREDIT ref to voltage(-gated) channels 2 IGNORE weakened DO NOT CREDIT 'breaks in the bilayer' DO NOT CREDIT 'pores' for 'gaps' DO NOT CREDIT idea of additional , channels / carriers , inserted
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

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

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

Question			Answer	Mark	Guidance
3	(a)	(i)	diabetes (mellitus) ;	1	<p>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</p> <p>ACCEPT hyperglycaemia IGNORE Type 1 or Type 2 DO NOT CREDIT hypoglycaemia</p>
3	(a)	(ii)	<i>idea that</i> time needed , to restore normal (blood) glucose concentration / for insulin to act (fully) ;	1	
3	(a)	(iii)	18.6 ; ;	2	<p>Correct answer = 2 marks, even if no working shown.</p> <p>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</p> <p>If the answer is not correctly rounded to 1dp, then ALLOW 1 mark for seeing a correct unrounded answer e.g. 18.64</p>
3	(b)		<p>1 HbA1C / glycosylated Hb , contained within , red blood cell(s) / erythrocyte(s) ;</p> <p>2 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 ;</p> <p>3 HbA1C / glycosylated Hb , broken down , in liver / by hepatocytes / by Kupffer cells ;</p>	2 max	<p>CREDIT RBC / rbc for 'red blood cell' throughout</p> <p>3 IGNORE ref to recycling</p>

Question		Answer	Mark	Guidance
3	(c)	<p>patient might have had a drink containing sugar ;</p> <p>AVP ;</p>	1 max	<p>DO NOT CREDIT ref to having eaten (as patient had confirmed that he had not eaten)</p> <p>CREDIT ref to a specific sugar-containing drink</p> <p>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)</p>
3	(d) (i)	<p>1 if blood glucose falls , extremely / dangerously / too / very , low ;</p> <p>2 if patient , cannot produce (enough) glucagon / produces little glucagon ;</p> <p>3 <i>idea that</i> glucose source cannot be taken by mouth ;</p>	1 max	<p>1 CREDIT hypoglycaemic / hypoglycaemia IGNORE 'below normal' alone</p> <p>2 CREDIT ref to dysfunctional , α cells / glucagon receptors</p> <p>3 CREDIT a suitable reason (e.g. fitting or in a coma)</p>

Question			Answer	Mark	Guidance
3	(d)	(ii)	<p><i>when blood glucose concentration decreases</i></p> <p>1 (glucagon) released by the , alpha / α , cells in , islets of Langerhans / pancreas ;</p> <p>2 promotes / AW , conversion of glycogen to glucose / glycogenolysis , in , liver / muscle / effector , cells ;</p> <p>3 ref gluconeogenesis / described ;</p> <p>4 ref conversion of triglycerides to (free) fatty acids / lipolysis / increased use of fatty acids in respiration ;</p> <p>5 negative feedback , reduces / inhibits , the secretion of glucagon ;</p> <p>6 glucagon , reduces / inhibits , insulin secretion ;</p>	4 max	<p>IGNORE ref to insulin or events following an increase in blood glucose concentration</p> <p>1 DO NOT CREDIT 'alpha cells are produced'</p> <p>2 Any description must correspond correctly to term DO NOT CREDIT if glucagon <i>converts</i> glycogen directly</p> <p>3 Any description must correspond correctly to term IGNORE imprecise ref to glucagon <i>doing the conversion</i></p> <p>4 Any description must correspond correctly to term IGNORE imprecise ref to glucagon <i>doing the conversion</i></p> <p>5 DO NOT CREDIT stopping glucagon secretion</p> <p>6 DO NOT CREDIT stopping insulin secretion</p>
			QWC – technical terms used appropriately and spelled correctly ;	1	<p>Use of three terms from: alpha, islet, pancreas , glycogen, glycogenolysis, effector, gluconeogenesis, negative feedback</p> <p>Please insert a QWC symbol next to the pencil icon, followed by a tick (✓) if QWC has been awarded or a cross (×) if QWC has not been awarded You should use the green dot to identify the QWC terms that you are crediting.</p>
			Total	13	

Question			Answer	Mark	Guidance
4	(a)	(i)	acetylcholine ;	1	<p>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</p> <p>CREDIT other correct examples e.g. dopamine / noradrenaline / norepinephrine</p> <p>ACCEPT ACh</p>
4	(a)	(ii)	<p>either</p> <p>post-synaptic membrane ; (TRPA1) prevents attachment of (named) neurotransmitter to its receptor ;</p> <p>or</p> <p>pre-synaptic membrane / (pre)synaptic knob / axon terminal / bouton / synaptic bulb ; (TRPA1) prevents , release of (named) neurotransmitter / influx of calcium ions ;</p>	2	<p>Explanation must match correct location for 2 marks. If no location stated then explanation can be awarded independently for 1 mark.</p> <p>Incorrect location = 0 marks.</p> <p>IGNORE 'interferes' (as in Q)</p> <p>IGNORE ref to dendrites / cell bodies /neurone(s) / synapse(s)</p> <p>CREDIT causes hyperpolarisation</p> <p>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)</p> <p>ACCEPT Ca²⁺</p>

Question			Answer	Mark	Guidance
4	(b)	(i)	<p>A sinusoid ;</p> <p>B (branch of) bile duct ;</p> <p>C (branch of) hepatic portal <u>vein</u> ;</p> <p>D (branch of) hepatic artery / arteriole ;</p> <p>E (branch of) hepatic / central , <u>vein</u> ;</p>	5	<p>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</p> <p>B DO NOT CREDIT canaliculus</p> <p>C IGNORE inter lobular but DO NOT CREDIT intra lobular</p> <p>D IGNORE inter lobular but DO NOT CREDIT intra lobular</p> <p>E IGNORE intra lobular but DO NOT CREDIT inter lobular</p>
4	(b)	(ii)	<p>1 because there is not enough <u>glutathione</u> / <u>glutathione</u> has run out ;</p> <p>2 enzyme catalysing glutathione reaction is , working at V_{max} / inhibited / in short supply ;</p> <p>3 the NAPQI cannot , cross the cell (surface) membrane / leave the cell / leave (named) organelle ;</p>	1 max	<p>2 DO NOT CREDIT in context of P450 system</p> <p>3 IGNORE ref to excretion</p>
4	(b)	(iii)	<p>hepatocytes</p> <p>and</p> <p><u>mitosis</u> / <u>mitotic</u> (division) ;</p>	1	<p>CREDIT (liver) stem cells / hepatic cells</p> <p>IGNORE liver cells unqualified</p> <p>DO NOT CREDIT Kupffer cells</p> <p>ONLY CREDIT correct spelling for mitosis / mitotic</p>
			Total	10	

Question			Answer	Mark	Guidance										
5	(a)	(i)	<p>1 (as the temperature increases) the respiration <u>rate</u> increases ;</p> <p>2 respiration <u>rate</u> doubles with a 10°C temperature increase ;</p> <p>3 comparative figures with correct units (units once for respiration and once for temperature) in the context of either mp ;</p>	2 max	<p>Only credit answers that refer to an increase in temperature – no ora</p> <p>1 Clear statement required – cannot be inferred from figures quoted.</p> <p>ACCEPT positive correlation between temperature and respiration rate</p> <p>IGNORE ref to directly proportional</p> <p>2 Clear statement required – cannot be inferred from figures quoted.</p> <p>CREDIT $Q_{10} = 2$</p> <p>3 e.g. • between 0 and 20°C the respiration goes from 17 to 69 mg CO₂ kg⁻¹ h⁻¹</p> <p>• between 5 and 10°C the rate changes by 13 mg CO₂ kg⁻¹ h⁻¹</p> <p>e.g. • between 0 and 10°C the rate goes from 17 to 34 mg CO₂ kg⁻¹ h⁻¹</p> <p>• between 10 and 20°C the respiration goes from 34 to 69 mg CO₂ kg⁻¹ h⁻¹</p> <table border="1" style="width: 100%; text-align: center;"> <thead> <tr> <th>0 °C</th> <th>5 °C</th> <th>10 °C</th> <th>15 °C</th> <th>20 °C</th> </tr> </thead> <tbody> <tr> <td>17</td> <td>21</td> <td>34</td> <td>44</td> <td>69</td> </tr> </tbody> </table> <p>Note: ‘between 0 and 20°C the respiration rate increased from 17 to 69 mg CO₂ kg⁻¹ h⁻¹’ = 2 marks (mps 1 & 3)</p> <p>But ‘at 0°C the respiration is 17 mg CO₂ kg⁻¹ h⁻¹’ and at 20°C it is 69’ = 1 mark (mp 3)</p>	0 °C	5 °C	10 °C	15 °C	20 °C	17	21	34	44	69
0 °C	5 °C	10 °C	15 °C	20 °C											
17	21	34	44	69											

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

Question			Answer	Mark	Guidance
5	(a)	(iv)	<p>asparagus</p> <p>and</p> <p>has a high respiration <u>rate</u> across all temperatures / has the highest respiration <u>rate</u> (of the foods) ;</p>	1	<p>Both parts of the mark point required for the mark to be awarded</p> <p>DO NOT CREDIT 'asparagus' without a supporting reason</p> <p>ACCEPT 'has a high respiration rate even at low temperature(s)'</p>
5	(b)	(i)	<p>1 <i>idea that</i> parasites have little access to oxygen ;</p> <p>2 (inaccessible because) little oxygen dissolved in plasma / oxygen not very soluble (in plasma) ;</p> <p>3 (inaccessible because) <i>idea that</i> oxygen is , combined with haemoglobin / contained in red blood cells ;</p> <p>4 <i>idea that</i> haemoglobin has greater affinity for oxygen than parasite (pigment) ;</p>	2 max	<p>1 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</p> <p>3 ACCEPT in context of saturation</p> <p>Note: 'because the oxygen is bound to haemoglobin, the parasite is unable to use it' = 2 marks (mps 3 & 1)</p>

Question			Answer	Mark	Guidance
5	(b)	(ii)	<p><i>in animals</i></p> <p>A1 pyruvate is , converted / reduced , to , lactate / lactic acid ;</p> <p>A2 can be reversed as no , atoms lost / other product formed ;</p> <p>A3 lactate dehydrogenase available to reverse the reaction ;</p> <p><i>in yeast</i></p> <p>Y1 pyruvate converted to ethanol (in 2 steps) and carbon dioxide / CO₂ ;</p> <p>Y2 cannot be reversed as , carbon dioxide is / atoms are , lost ;</p> <p>Y3 (de)carboxylase enzyme cannot reverse the reaction ;</p>	3 max	<p>Only award 3 content marks if A mark(s) <u>plus</u> Y mark(s) awarded</p> <p>A1 Cannot be inferred from awarding of A2 or A3</p> <p>A2 e.g. pyruvate and lactate are both 3C compounds so reaction can be reversed</p> <p>Y1 CREDIT pyruvate decarboxylated to ethanol</p> <p>Y2 e.g. pyruvate is 3C and , ethanol / ethanal , is 2C so reaction cannot be reversed</p>
			<p>QWC – technical terms used appropriately and spelled correctly ;</p>	1	<p>Use of three terms from: pyruvate, lactate, lactate dehydrogenase carbon dioxide, ethanol (de)carboxylase / (de)carboxylation (or derived term)</p> <p>Please insert a QWC symbol next to the pencil icon, followed by a tick (✓) if QWC has been awarded or a cross (×) if QWC has not been awarded You should use the green dot to identify the QWC terms that you are crediting.</p>
			Total	14	

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

Question			Answer	Mark	Guidance
6	(c)		<u>anabolic</u> 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 <u>androgenic</u> steroids IGNORE named steroids as <i>type</i> of drug asked for
			Total	6	

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