

GCE

Biology

Unit **F214**: Communication, Homeostasis & Energy

Advanced GCE

Mark Scheme for June 2017

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.















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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

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These are the annotations, (including abbreviations), including those used in scoris, which are used when marking

Annotation	Meaning
	Benefit of Doubt
	Contradiction
	Cross
	Error Carried Forward
	Given Mark
	Extendable horizontal wavy line
	Ignore
	Large dot (Key point attempted)
	Benefit of the doubt not given
	additional QWC credit given
	Tick
	Tick 1
	Tick 2
	Omission Mark

Subject specific instructions for this question paper

Unless otherwise stated, accept phonetic spelling throughout unless there is clear ambiguity with another term.

For each correct mark point awarded the tick annotation should be used.

Ensure that the answers to all part questions are acknowledged with a suitable annotation – e.g.

an omission mark or NBOD if the answer is incomplete or not good enough

a wavy line if some information is inaccurate

CON if a potential mark point is contradicted

a cross if the answer is completely wrong.

Use BOD with care and only if you are certain that the answer is close enough to the required information for the mark.

Question		Expected Answers	Marks	Additional Guidance																				
1	(a)	<table border="1"> <thead> <tr> <th>Fact</th> <th>Type 1 diabetes only</th> <th>Type 2 diabetes only</th> <th>Both Type 1 and Type 2 diabetes</th> </tr> </thead> <tbody> <tr> <td>body cells no longer respond to insulin</td> <td></td> <td>✓</td> <td></td> </tr> <tr> <td>blood glucose concentration cannot be controlled</td> <td></td> <td></td> <td>✓</td> </tr> <tr> <td>insulin injections are required</td> <td>✓</td> <td></td> <td>(or ✓)</td> </tr> <tr> <td>linked to obesity</td> <td></td> <td>✓</td> <td></td> </tr> </tbody> </table>	Fact	Type 1 diabetes only	Type 2 diabetes only	Both Type 1 and Type 2 diabetes	body cells no longer respond to insulin		✓		blood glucose concentration cannot be controlled			✓	insulin injections are required	✓		(or ✓)	linked to obesity		✓		4	<p>Award one mark per correct row. DO NOT CREDIT more than one tick on a row (even if this is in row 3).</p> <p>DO NOT CREDIT hybrid ticks</p> <p>IGNORE crosses if in <u>all</u> the 'blank' cells</p> <p>Row 3 ACCEPT tick in 'both' column instead of 'type 1' column</p>
Fact	Type 1 diabetes only	Type 2 diabetes only	Both Type 1 and Type 2 diabetes																					
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1	(b)	(i)		<p>IGNORE ref to rejection</p> <p>1 e.g. the protein made is human</p> <p>3 e.g. more ethical / fewer ethical concerns</p> <p>4 e.g. no risk of animal virus transfer human insulin is more effective</p> <p>7 e.g. (as it uses a fermenter) frees up land (for other uses)</p>																				
			3 max																					

Question			Expected Answers	Marks	Additional Guidance
1	(b)	(ii)	<p>would be , permanent / a cure / allows them to produce insulin themselves ;</p> <p>stem cells will , produce / (divide and) differentiate into , beta / insulin-producing , cells ;</p> <p>(no need for insulin injections because new) <u>beta</u> cells produce insulin ;</p> <p>AVP ;</p>	2 max	<p>ACCEPT long term solution</p> <p>DO NOT CREDIT B / b , cells</p> <p>Note; ‘stem cells will differentiate into beta cells which make insulin’ = 2 marks</p> <p>e.g. avoids use of injections for those with phobias less disruption to lifestyle injection sites can be difficult to use as skin becomes hardened there (could) reduce risk of infection from repeated injections specific ref to less , restricted diet / dietary practice</p>
			Total	9	

Question	Expected Answers	Marks	Additional Guidance												
2 (a)	removal of waste products of metabolism (from the body) ;	1	Must refer to or imply metabolism 'unwanted by-products' = 'waste' IGNORE ref to faeces (as they do contain some excretory substances)												
2 (b)	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 25%;"><i>Component</i></th> <th><i>Explanation</i></th> </tr> </thead> <tbody> <tr> <td style="text-align: center;"><i>urea</i></td> <td><i>When the blood enters the glomerulus, all the urea gets filtered out of the blood. But some of it is reabsorbed as it goes through the tubule, so there is still a small amount in the renal vein.</i></td> </tr> <tr> <td style="text-align: center;"><i>ions - slightly less</i></td> <td><i>idea that more are filtered out than reabsorbed or idea that some are excreted</i> ;</td> </tr> <tr> <td style="text-align: center;"><i>glucose - slightly less</i></td> <td><i>idea that reabsorbed / described and some used by (kidney cells) for , respiration / ATP production / active processes</i> ;</td> </tr> <tr> <td style="text-align: center;"><i>oxyhaemoglobin - less</i></td> <td><i>oxygen used (by kidney cells) for <u>aerobic</u> respiration</i> ;</td> </tr> <tr> <td style="text-align: center;"><i>red blood cells - the same</i></td> <td><i>too large to be (ultra)filtered out of the blood (at glomerulus / into nephron)</i> ;</td> </tr> </tbody> </table>	<i>Component</i>	<i>Explanation</i>	<i>urea</i>	<i>When the blood enters the glomerulus, all the urea gets filtered out of the blood. But some of it is reabsorbed as it goes through the tubule, so there is still a small amount in the renal vein.</i>	<i>ions - slightly less</i>	<i>idea that more are filtered out than reabsorbed or idea that some are excreted</i> ;	<i>glucose - slightly less</i>	<i>idea that reabsorbed / described and some used by (kidney cells) for , respiration / ATP production / active processes</i> ;	<i>oxyhaemoglobin - less</i>	<i>oxygen used (by kidney cells) for <u>aerobic</u> respiration</i> ;	<i>red blood cells - the same</i>	<i>too large to be (ultra)filtered out of the blood (at glomerulus / into nephron)</i> ;	4	<p>One mark for each correct row</p> <p>DO NOT CREDIT if glucose is excreted</p> <p>CREDIT too big to pass through , basement membrane / capillary wall</p>
<i>Component</i>	<i>Explanation</i>														
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Question			Expected Answers	Marks	Additional Guidance
2	(c)	(i)	hypothalamus or (cell bodies of) osmoreceptors / neurosecretory cells ;	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 DO NOT CREDIT produced in pituitary (as ADH secreted from there but not produced there) IGNORE stored in pituitary
2	(c)	(ii)	(walls of) collecting duct / distal convoluted tubule / dct ;	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 medulla / cortex
2	(d)		<i>idea that</i> they reduce the amount of water reabsorbed (in collecting duct / from filtrate) or they reduce the amount of ions reabsorbed (in tubule / from filtrate) or (could) reduce amount of ADH released or blocks ADH receptors (in wall of collecting duct) ; <i>idea that</i> reduced blood volume will decrease pressure ;	2	ACCEPT ref to decreased permeability to water as long as ref is also made to the absorption DO NOT CREDIT ref to , preventing / stopping , water reabsorption ACCEPT the idea that reduction in Na ⁺ and water relaxes the walls of the blood vessels and so reduces pressure
Total				9	

Question			Expected Answers	Marks	Additional Guidance
3	(a)		2.5 ;	1	Correct answer to 1 dp only
3	(b)	(i)	glycerol ;	1	CREDIT propan(e)-1,2,3-(tri)ol
3	(b)	(ii)	<p>1 (most of the ATP is produced by) <u>oxidative phosphorylation</u> / <u>chemiosmosis</u> ;</p> <p>2 hydrogen ions travel through ATP synth(et)ase ;</p> <p>3 (more hydrogen ions moving results in) greater amount of energy released (for ADP + P to form ATP) ;</p> <p>4 hydrogen / H⁺ / H , can be , attached to / carried by , NAD / FAD</p> <p>or hydrogen / H⁺ / H , can form reduced NAD / reduced FAD ;</p>	2 max	<p>DO NOT CREDIT if answered in the context of grana and/or thylakoids</p> <p>“they” = hydrogen (ions)</p> <p>2 ACCEPT ref to facilitated diffusion using ATP synth(et)ase</p> <p>3 ACCEPT greater proton motive force (to provide energy) more rotation of ATP synthase (for conversion of ADP to ATP)</p>

Question	Expected Answers	Marks	Additional Guidance
<p>3 (c)</p>	<p>Two from mps 1 - 3</p> <p>1 (protein is) hydrolysed / acted upon by enzymes / acted upon by proteases / peptide bonds broken , to produce amino acids ;</p> <p>2 (amino acids) are deaminated ;</p> <p>3 can enter Krebs cycle ;</p> <p>AND</p> <p>4 <i>idea that</i> deamination does not release hydrogen (as is the case with lipids) / ratio of hydrogen to carbon is less (than lipids) ;</p> <hr/> <p>QWC – technical terms used appropriately and spelled correctly ;</p>	<p>3 max</p> <p>1</p>	<p>For 3 marks, the answer must have been awarded mp 4 If all 3 marks awarded from mps 1-3, indicate the 3rd as GM (given max)</p> <p>1 ACCEPT broken down / digested / converted , to amino acids</p> <p>2 ACCEPT a description (e.g. amino acid converted into pyruvate)</p> <p>3 DO NOT CREDIT if urea enters directly</p> <p>4 e.g. lipids , have more H / provide more H⁺ , per gram than protein proteins provide fewer, H / H⁺ , for chemiosmosis proteins provide fewer acetyl groups (than lipids)</p> <p>Use of three terms from: hydrolysed (or derived term), enzymes / proteases, peptide, amino acids, deaminated (or derived term) Krebs cycle</p> <p>Please insert a QWC symbol next to the pencil icon, followed by a tick (✓) if QWC has been awarded or a cross (x) if QWC has not been awarded You should use the green dot to identify the QWC terms that you are crediting.</p>
	<p>Total</p>	<p>8</p>	

Question			Expected Answers	Marks	Additional Guidance
4	(a)	(i)	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
4	(a)	(ii)	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
4	(a)	(iii)	B ;	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
4	(a)	(iv)	A, C and D ;	1	<p>Mark the first 3 answers. All 3 correct = 1 mark Any missing or incorrect = 0 marks</p> <p>If the first 3 answers are correct and an additional answer is given then = 0 marks</p> <p>[With reference to C: C is a simple Na^+ channel. During the establishment of the resting potential, the Na/K pump will pump K^+ into the cell and Na^+ out of the cell (as, indeed, it does constantly). Na^+ will diffuse back in slowly through C and K^+ will diffuse back out slowly through B. The movement of Na^+ back in is much less than the movement of K^+ back out. As B and C are not voltage-gated they will remain open at all times, even during depolarisation. The diffusion of the ions through B and C depends on both the relative concentration of the ions and the electrochemical gradient and will be small or, at times, negligible.]</p>

Question	Expected Answers	Marks	Additional Guidance
4 (b)	<p>1 adrenaline attaches to , J / receptor ;</p> <p>2 adrenaline complementary (shape) to (binding site on) J ;</p> <p>3 J / receptor , changes shape ;</p> <p>either</p> <p>4a causes , K / G protein , to , change shape / be activated / be released from J ;</p> <p>4b this , activates / binds with , L / enzyme / adenyl(y) cyclase / adenylate cyclase / effector ;</p> <p>or</p> <p>5 adenyl(y) cyclase / adenylate cyclase / effector , is activated ;</p> <p>6 adeny(l) / adenylate , cyclase , converts ATP into , cAMP / cyclic AMP ;</p>	<p>4 max</p>	<p>1 ACCEPT 'first messenger' for 'adrenaline' IGNORE ref to active site</p> <p>2 DO NOT CREDIT ref to active site</p> <p>5 IGNORE ref to K and L</p> <p>6 ACCEPT 'second messenger' for 'cyclic AMP' IGNORE ref to K and L IGNORE ref to action of cAMP once formed</p>
	<p>QWC – technical terms used appropriately and spelled correctly ;</p>	<p>1</p>	<p>Use of three terms from: receptor, complementary, G protein, adenyl(y) cyclase or adenylate cyclase, effector, cyclic AMP</p> <p>Please insert a QWC symbol next to the pencil icon, followed by a tick (✓) if QWC has been awarded or a cross (x) if QWC has not been awarded You should use the green dot to identify the QWC terms that you are crediting.</p>

Question			Expected Answers	Marks	Additional Guidance
4	(c)	(i)	mitochondrion ;	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 mitochondria
4	(c)	(ii)	ATP synth(et)ase ;	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 DO NOT CREDIT ATPase as it doesn't have that function in the mitochondrion DO NOT CREDIT pump
4	(c)	(iii)	hydrogen ion(s) / H ⁺ / proton(s) ;	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
4	(c)	(iv)	P / R ;	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
4	(c)	(v)	N ;	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
Total				14	

Question		Expected Answers	Marks	Additional Guidance
5	(a)	<p><i>purple sulfur bacteria</i> do not have chloroplasts / photosynthesis is carried out on an infolded membrane ;</p>	1	<p>No ORA</p> <p>ACCEPT do not have (enclosed) grana IGNORE unqualified ref to membrane bound organelles</p>
5	(b)	(i) <p><i>reactant</i> water / H₂O</p> <p>and</p> <p><i>evidence</i> sulfur bacteria supplied with H₂S produce S (assuming H₂S to be equivalent to H₂O)</p> <p>or sulfur bacteria do not use water as a reactant and so don't produce O₂ ;</p>	1	<p>Needs to be evidence from Q so IGNORE a description of H₂O being used and O₂ being produced in plants</p>

Question	Expected Answers	Marks	Additional Guidance
5 (b) (ii)	<p><i>not appropriate because</i></p> <p>1 organism used , is not eukaryote / is prokaryote ;</p> <p>2 a specific way in which the processes may not be (directly) comparable ;</p> <p>3 pigment used is different / absorbs different wavelengths of light ;</p> <p><i>appropriate because</i></p> <p>4 but as H₂S is equivalent to H₂O in the reaction we can clearly see that the S is produced from H₂S ;</p> <p>5 both use carbon dioxide to produce carbohydrate ;</p> <p>6 AVP ;</p>	2 max	<p>Award mark only if context stated or clearly implied.</p> <p>1 ACCEPT bacteria do not have chloroplasts IGNORE bacteria have no organelles</p> <p>2 e.g.</p> <ul style="list-style-type: none"> • (bacteria) only use photosystem 1 (cyclic) • (bacteria) do not use , photosystem 2 / non-cyclic photophosphorylation • (bacteria) do not produce oxygen • green plants use photosystem 2 (non-cyclic) • H₂S is a reactant in bacteria (and not in green plants) / S is a product in bacteria (and not in green plants) <p>6 e.g.</p> <ul style="list-style-type: none"> • bacterial enzymes may work at different , pH / temperature • both use photosystem 1

Question			Expected Answers	Marks	Additional Guidance
5	(c)	(i)	(radioactive) carbon dioxide / CO_2 , is combining with RuBP ; RuBP / fixation , with radioactive carbon forms GP ;	1 max	ACCEPT carboxylation of RuBP
5	(c)	(ii)	1 RuBP is (still) being converted into GP ; 2 RuBP not regenerated as , ATP / reduced NADP / $\text{NADPH}_{(2)}$, is required ; 3 no , ATP / reduced NADP / $\text{NADPH}_{(2)}$, is produced , in the dark / by the light-dependent reaction / by photophosphorylation ;	2 max	2 ACCEPT convert GP (eventually) into RuBP instead of 'regenerate RuBP'
5	(c)	(iii)	<i>initial increase</i> 1 RuBP is (still) being converted to GP ; <i>then remains constant</i> 2 no RuBP , available / left (to convert to GP) OR no , ATP / reduced NADP , available to , regenerate RuBP / convert GP to TP ;	2	'increase' and 'constant' must be stated unless described in sequence 2 DO NOT CREDIT 'less' ACCEPT 'depleted' 2 ACCEPT convert GP (eventually) into RuBP instead of 'regenerate RuBP'

Question			Expected Answers	Marks	Additional Guidance
5	(c)	(iv)	<p>1 no glucose being formed and some being , used / respired (by cells) ;</p> <p>2 no glucose being formed and some being converted into another (named) compound ;</p> <p>3 AVP ;</p>	1 max	3 e.g. any glucose being formed from (stored) starch will not be radioactive and so will not be detected
Total				10	

Question			Expected Answers	Marks	Additional Guidance
6	(a)		<p>respond ; organs / tissues ; cell signalling ;</p> <p>negative feedback ; homeostasis ;</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>ACCEPT react / adapt ACCEPT cells</p>
6	(b)	(i)	pancreas ;	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
6	(b)	(ii)	Schwann (cell) ;	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
6	(b)	(iii)	glucagon ;	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>Only credit correct spelling</p>

Question			Expected Answers	Marks	Additional Guidance
6	(b)	(iv)	vagus ;	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 phonetic spelling IGNORE parasympathetic</p>
6	(b)	(v)	smooth muscle in arteriole (wall) ; erector muscle ; sweat gland ;	1 max	<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 sphincter muscle in arteriole ACCEPT hair muscle</p>
Total				10	

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