OCR
Oxford Cambridge and RSA

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.

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

Annotation	Meaning
BOD	Benefit of Doubt
CON	Contradiction
	Cross
ECF	Error Carried Forward
GM	Given Mark
	Extendable horizontal wavy line
I	Ignore
	Large dot (Key point attempted)
NBOD	Benefit of the doubt not given
QWC+	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.

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Marks</th><th>Additional Guidance</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td>
<table>
<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>
<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>
</table>
;
;
;
;</td><td>4</td><td>Award one mark per correct row.
DO NOT CREDIT more than one tick on a row
(even if this is in row 3).
DO NOT CREDIT hybrid ticks
IGNORE crosses if in <u>all</u> the ‘blank’ cells

Row 3 ACCEPT tick in ‘both’ column instead of ‘type 1’ column</td></tr>
<tr><td>1</td><td>(b)</td><td>(i)</td><td>1 idea that the insulin is human insulin ;

2 will not , produce an allergic reaction / trigger an immune response ;

3 no animals are harmed / no animal welfare issues / no ethical concerns / no religious concerns ;
4 AVP ;

5 supply can be adjusted to meet demand ;

6 can be , mass produced / produced in large quantities / produced quickly ;

7 AVP ;</td><td>3 max</td><td>IGNORE ref to rejection

1 e.g. the protein made is human

3 e.g. more ethical / fewer ethical concerns

4 e.g. no risk of animal virus transfer
human insulin is more effective

7 e.g. (as it uses a fermenter) frees up land (for other uses)</td></tr>
</table>

Question			Expected Answers	Marks	Additional Guidance
1	(b)	(ii)	would be **,** permanent / a cure / allows them to produce insulin themselves **;** stem cells will **,** produce / (divide and) differentiate into **,** beta / insulin-producing **,** cells **;** (no need for insulin injections because new) <u>beta</u> cells produce insulin **;** AVP **;**	**2 max**	**ACCEPT** long term solution **DO NOT CREDIT** B / b **,** cells **Note;** 'stem cells will differentiate into beta cells which make insulin' = 2 marks 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
			Total	**9**	

<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Marks</th><th>Additional Guidance</th></tr>
<tr><td>2</td><td>(a)</td><td></td><td>removal of waste products of metabolism (from the body) ;</td><td>1</td><td>Must refer to or imply metabolism
‘unwanted by-products’ = ‘waste’
IGNORE ref to faeces (as they do contain some excretory substances)</td></tr>
<tr><td>2</td><td>(b)</td><td></td><td>
<table>
<tr><th>Component</th><th>Explanation</th><th></th></tr>
<tr><td>urea</td><td>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.</td><td></td></tr>
<tr><td>ions -
slightly less</td><td>idea that more are filtered out than reabsorbed
or
idea that some are excreted</td><td>;</td></tr>
<tr><td>glucose -
slightly less</td><td>idea that reabsorbed / described
and
some used by (kidney cells) for ,
respiration / ATP production /
active processes</td><td>;</td></tr>
<tr><td>oxyhaemoglobin - less</td><td>oxygen used (by kidney cells) for
<u>aerobic</u> respiration</td><td>;</td></tr>
<tr><td>red blood cells - the same</td><td>too large to be (ultra)filtered out of the blood (at glomerulus / into nephron)</td><td>;</td></tr>
</table>
</td><td>4</td><td>One mark for each correct row

DO NOT CREDIT if glucose is excreted

CREDIT too big to pass through ,
basement membrane / capillary wall</td></tr>
</table>

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)		*idea that* 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) **;** *idea that* 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)	**1** (most of the ATP is produced by) <u>oxidative</u> <u>phosphorylation</u> / <u>chemiosmosis</u> ; **2** hydrogen ions travel through ATP synth(et)ase ; **3** (more hydrogen ions moving results in) greater amount of energy released (for ADP + P to form ATP) ; **4** hydrogen / H^+ / H , can be , attached to / carried by , NAD / FAD **or** hydrogen / H^+ / H , can form reduced NAD / reduced FAD ;	2 max	**DO NOT CREDIT** if answered in the context of grana and/or thylakoids "they" = hydrogen (ions) **2 ACCEPT** ref to facilitated diffusion using ATP synth(et)ase **3 ACCEPT** greater proton motive force (to provide energy) more rotation of ATP synthase (for conversion of ADP to ATP)

Question			Expected Answers	Marks	Additional Guidance
3	(c)		***Two from mps 1 - 3*** **1** (protein is) **hydrolysed** / acted upon by **enzyme**s / acted upon by **protease**s / **peptide** bonds broken **,** to produce **amino acid**s **;** **2** (amino acids) are **deaminated** **;** **3** can enter **Krebs cycle** **;** **AND** **4** *idea that* deamination does not release hydrogen (as is the case with lipids) / ratio of hydrogen to carbon is less (than lipids) **;**	**3 max**	**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)** **1** **ACCEPT** broken down / digested / converted **,** to amino acids **2** **ACCEPT** a description (e.g. amino acid converted into pyruvate) **3** **DO NOT CREDIT** if urea enters directly **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)
			QWC – technical terms used appropriately and spelled correctly **;**	**1**	Use of **three** terms from: **hydrolysed** (or derived term), **enzyme**s / **protease**s, **peptide**, **amino acid**s, **deaminated** (or derived term) **Krebs cycle** **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.**
			Total	**8**	

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	**Mark the first 3 answers.** **All 3 correct = 1 mark** **Any missing or incorrect = 0 marks** If the first 3 answers are correct and an additional answer is given then = **0 marks** [*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.*]

Question	Expected Answers	Marks	Additional Guidance
4 (b)	**1** adrenaline attaches to **,** J / **receptor ;** **2** adrenaline **complementary** (shape) to (binding site on) J **;** **3** J / receptor **,** changes shape **;** **either** **4a** causes **,** K / **G protein ,** to **,** change shape / be activated / be released from J **;** **4b** this **,** activates / binds with **,** L / enzyme / **adenyl**(yl) **cyclase** / **adenylate cyclase** / **effector ;** **or** **5** **adenyl**(yl) **cyclase** / **adenylate cyclase** / **effector ,** is activated **;** **6** adenyl(yl) / adenylate **,** cyclase **,** converts ATP into **,** cAMP / **cyclic AMP ;**	**4 max**	**1** **ACCEPT** 'first messenger' for 'adrenaline' **IGNORE** ref to active site **2** **DO NOT CREDIT** ref to active site **5** **IGNORE** ref to K and L **6** **ACCEPT** 'second messenger' for 'cyclic AMP' **IGNORE** ref to K and L **IGNORE** ref to action of cAMP once formed
	QWC – technical terms used appropriately and spelled correctly **;**	**1**	Use of **three** terms from: **receptor**, **complementary**, **G protein**, **adenyl**yl **cyclase** or **adenylate cyclase,** **effector**, **cyclic AMP** **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.**

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)		*purple sulfur bacteria* do not have chloroplasts / photosynthesis is carried out on an infolded membrane **;**	1	**No ORA** **ACCEPT** do not have (enclosed) grana **IGNORE** unqualified ref to membrane bound organelles
5	(b)	(i)	*reactant* water / H_2O **and** *evidence* sulfur bacteria supplied with H_2S produce S (assuming H_2S to be equivalent to H_2O) **or** sulfur bacteria do not use water as a reactant and so don't produce O_2 **;**	1	Needs to be evidence from Q so **IGNORE** a description of H_2O being used and O_2 being produced in plants

Question			Expected Answers	Marks	Additional Guidance
5	(b)	(ii)	*not appropriate because* **1** organism used **,** is not eukaryote / is prokaryote **;** **2** a specific way in which the processes may not be (directly) comparable **;** **3** pigment used is different / absorbs different wavelengths of light **;** *appropriate because* **4** but as H_2S is equivalent to H_2O in the reaction we can clearly see that the S is produced from H_2S **;** **5** both use carbon dioxide to produce carbohydrate **;** **6** AVP **;**	**2 max**	Award mark only if context stated or clearly implied. **1 ACCEPT** bacteria do not have chloroplasts **IGNORE** bacteria have no organelles **2** e.g. • (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) • H_2S is a reactant in bacteria (and not in green plants) / S is a product in bacteria (and not in green plants) **6** e.g. • 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 / $NADPH_{(2)}$ **,** is required **;** **3** no **,** ATP / reduced NADP / $NADPH_{(2)}$ **,** 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)	*initial increase* **1** RuBP is (still) being converted to GP **;** *then remains constant* **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)	**1** no glucose being formed and some being **,** used / respired (by cells) **;** **2** no glucose being formed and some being converted into another (named) compound **;** **3** AVP **;**	**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)		respond ; organs / tissues ; cell signalling ; negative feedback ; homeostasis ;	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** **ACCEPT** react / adapt **ACCEPT** cells
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	**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** Only credit correct spelling

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

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