OCR
RECOGNISING ACHIEVEMENT

GCE

Biology

Advanced GCE

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

Mark Scheme for January 2013

Oxford Cambridge and RSA Examinations

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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
	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

**Quality of Written Communication*

Question			Answer	Marks	Guidance
1	(a)	(i)	**A** dendrite(s) **;** **B** dendron (membrane) **;** **C** cell body (of neurone) **;** **D** axon (membrane) **;**	4	**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** **A DO NOT CREDIT** sensory receptor **B DO NOT CREDIT** dendr**i**on (as inclusion of the 'i' means that it can be confused with dendrite)
1	(a)	(ii)	direction of (conduction / travel / transmission) **,** impulse / action potential **;**	1	**DO NOT CREDIT** signal / message **DO NOT CREDIT** 'action potential' alone

Question			Answer	Marks	Guidance
1	(b)		*pumping / active* **1** **sodium-potassium pump** , uses ATP / uses energy / by active transport / (pumps) actively ; **2** pumps / actively moves , sodium **ions** / Na^+ , out of , cell / axon / neurone , and , potassium ions / K^+ , in ; *passive / diffusing* **3** K^+ , **diffuse** / move / flow / leak , (freely) back out (of cell) ; **4** membrane less **permeable** to Na^+ / fewer Na^+ channels open , so fewer Na^+ , diffuse / move / flow / leak , back in ; **ora** **5** **voltage-gate**d (Na^+) , channels closed ; **6** AVP ; **QWC** – technical terms used appropriately and spelled correctly ;	3 max 1	**If symbol for ion not used, must refer to <u>ion</u>** **IGNORE** ref to value of resting potential **1** **DO NOT CREDIT** if referring to 2 separate pumps **2** **IGNORE** numbers / ratio for this mark **DO NOT CREDIT** in context of (diffusion) channels **4** Looking for a comparative statement referring to permeability **<u>and</u>** its consequence **ACCEPT** 'K^+ move out (20x) faster than Na^+ move in' for idea of more K^+ moving out **IGNORE** ref to impermeable to Na^+ / all Na^+ channels closed **5** **IGNORE** ref. ligand-gated channels **6** e.g. • 3 Na^+ out and 2 K^+ in • build up of +ve ions outside • large (numbers of) , anions / -ve ions , inside • ref to negatively charged proteins **Note** 'pumps 3 Na^+ out and 2 K^+ into cell' = **2 marks** (mp 2 and mp 6) 'the Na/K pump actively moves 3 Na^+ out of and 2 K^+ into axon' **= 3 marks** (mps 1, 2 and 6) Use of **three** terms from: **sodium-potassium pump**, **ion**(s), **diffuse** (or derived term), **permeable**, **voltage-gate**d **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			Answer	Marks	Guidance
1	(c)	(i)	**X** depolarisation **;** **Y** repolarisation **;** **Z** hyperpolarisation **;**	3	**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** As the term is asked for, **IGNORE** descriptions **X** **ACCEPT** depolarise(d) / depolarising **Y** **ACCEPT** repolarise(d) / repolarising **Z** **ACCEPT** hyperpolarise(d) / hyperpolarising **IGNORE** refractory period
1	(c)	(ii)	threshold (potential / value / voltage) **;**	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** threshold frequency
1	(c)	(iii)	**1** *idea that* only stimuli **,** that reach / are greater than **,** threshold value / -50mV **,** produce an action potential **;** **ora** **2** (when stimulated) action potential either occurs or does not / all-or-nothing (law) **;** **3** *idea that* the action potential is the same (magnitude / size) **,** no matter how strong the stimulus / even if strength of stimulus increases **;** **4** *idea that* a strong stimulus produces many action potentials (in rapid succession) **;**	2 max	**IGNORE** ref to refractory period as Figs do not indicate this **Note** 'strong stimulus increases frequency but not magnitude of action potential' = **2 marks** (mps 3 & 4)
			Total	15	

Question			Answer	Marks	Guidance
2	(a)	(i)	*product* urea ; *organ transported to* kidney ;	2	**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** bladder
2	(a)	(ii)	**1** hepatocytes can tolerate , lactate / low pH (which would otherwise be toxic) ; **2** hepatocytes have / (other) cells do not have , enzymes to , metabolise lactate / catalyse this reaction ; **3** (conversion of lactate) requires oxygen and , muscle cells do not have enough oxygen / O_2 is not available during anaerobic respiration / O_2 is sufficient in hepatocytes ;	1 max	**2** **ACCEPT** ref to hepatocytes having the , correct / necessary , enzyme(s)

Question			Answer	Mark	Guidance
2	(b)		**1** blood glucose (concentration) would fall **,** too low / below normal level **;** **2** *idea that* glucose would continue to be taken up by **,** cells / liver / muscle (results in low blood glucose) **or** *idea that* glucose is continually converted into glycogen / would store too much glucose as glycogen **;** **3** (mitochondria eventually) cannot **,** release enough energy / generate enough ATP (as less available glucose in blood) **;** **4** coma / death **;** **5** AVP **;**	**2 max**	**1** **CREDIT** causes <u>hypoglyc</u>aemia **2** Needs to convey the idea of ***continued / too much*** uptake rather than 'more'. **IGNORE** 'glucose taken up by cells' / 'glucose converted to glycogen' unless suitably qualified **ACCEPT** 'too much glucose is taken up by cells' **3** **CREDIT** ref to use of alternative respiratory substrate **4** **IGNORE** fatigue / tiredness / fainting **5** e.g. ● receptor (on hepatocyte) becomes desensitised ● triggering of glucagon release

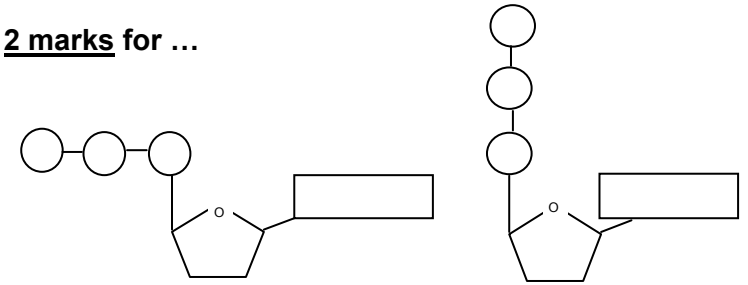
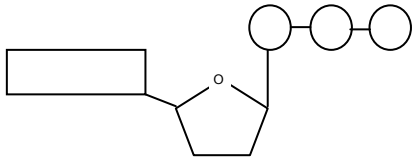
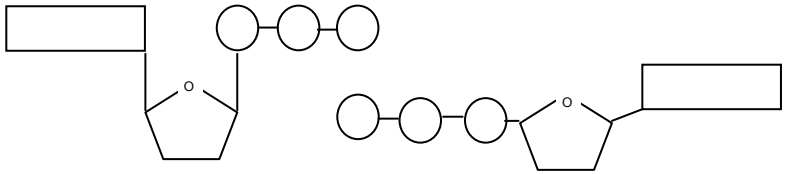
Question			Answer	Mark	Guidance
2	(c)	(i)	**1** build-up of lactate / prevention of pathway S **,** poisons / kills **,** (liver) cells **;** **2** disruption of enzymes as a result of low pH **;** **3** *idea that* lack of substrate / fatty acids not available **,** for respiration **;** **4** lack of (oxidised) NAD for (metabolic) reactions **;** **5** (some) deamination / ornithine cycle / pathway P / breakdown of (named) hormones / pathway R **,** cannot occur **;** **6** build-up of fatty acids / more fatty acids present **,** resulting in **,** fat deposits in (liver) cells / fatty liver / cirrhosis **;**	**2 max**	**1** **IGNORE** ref to ethanal **2** **IGNORE** 'affects enzymes' without qualification **4** e.g. ● 'less NAD is available for oxidation of fatty acids' ● 'lack of NAD for respiration' when referring to conversion of lactate to pyruvate the emphasis must be on the lack of available NAD to accept hydrogen from the lactate (and so inhibiting the conversion of lactate to pyruvate) **6** **IGNORE** 'fatty acids build up in liver' without qualification **IGNORE** repetition of bulleted statements without ref to build up **IGNORE** ref to fat deposited around the liver
2	(c)	(ii)	crista(e) / inner mitochondrial membrane **;**	**1**	**Mark the first answer.** if the answer if correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **ACCEPT** (at) electron transport chain **DO NOT CREDIT** inter mitochondrial membrane
			Total	**8**	

Question			Answer	Marks	Guidance
3	(a)		*autotroph* can make **,** organic molecule(s) / named organic molecule(s) **,** from **,** inorganic molecule(s) / carbon dioxide **;** *heterotroph* relies on / needs to use / has to obtain / feeds on and digests **,** (named) organic molecules (that have been made by another organism) **;**	**2**	**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** **IGNORE** ref to biological molecules **ACCEPT** fixes carbon dioxide to produce (named) carbohydrates / protein / lipid idea of ***need*** or ***taking in and breaking down*** is important 'gets its organic molecules from another organism' **= 0 marks** 'has to get its organic molecules from another organism' **= 1 mark**
3	(b)	(i)	**E** granum / grana **;** **F** stroma **;**	**2**	**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** **E** **IGNORE** ref to stacks of **,** lamellae / thylakoids **F** **DO NOT CREDIT** stoma / storma
3	(b)	(ii)	for membrane formation **or** phospholipid / cholesterol / glycolipid **,** for membrane **;** fatty acid / (named) pigment **,** synthesis **;**	**1 max**	**IGNORE** ref to ATP production (as primarily generated by photophosphorylation in a chloroplast) **ACCEPT** ref to repair of membrane **ACCEPT** ref to (chloroplast) envelope instead of membrane **DO NOT CREDIT** ref to cell surface membrane (as this is not in the chloroplast)

Question			Answer	Marks	Guidance
3	(c)			4 max	**IGNORE** ref to photophosphorylation, as irrelevant to Q
			1 (primary & accessory) **pigment**s **,** are in / form a(n) **,** photosystem / complex / **antenna complex ;**		**1** if pigments are named, state that chlorophyll a **and** at least 1 named accessory pigment are **in a photosystem**
			2 **photon** / light energy **,** absorbed by pigment (molecule(s)) **;**		**2** *idea of* absorption required in the context of this Q **IGNORE** falls on / hits / strikes
			3 electron **,** excited / moves to higher energy level / delocalised **,** and returned to pigment **;**		**3** **DO NOT CREDIT** if ***this*** electron is passed to **,** electron acceptor / ETC **DO NOT CREDIT** in context of chlorophyll a
			4 (energy / photon) passed from one pigment to another **;**		**4** **DO NOT CREDIT** ref to electron being passed
			5 (energy / photon) passed to **,** **reaction centre / chlorophyll a** / P680 / P700 / PSI / PSII / **primary** pigment **;**		**5** **DO NOT CREDIT** ref to electron being passed **But** apply ecf from mp 4
			6 range of / **accessory ,** pigments allow range of **wavelengths** to be absorbed **;**		**6** **CREDIT** 'photon energy' for 'wavelengths' **IGNORE** in context of P680 and P700
			QWC – technical terms used appropriately and spelt correctly **;**	**1**	Use of **three** terms from: **pigment** **antenna complex** **photon** **reaction centre** **chlorophyll** , **a / A** **primary** **accessory** **wavelength**(s) **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			Answer	Marks	Guidance
3	(d)	(i)	- 864.3 (kg ha^{-1}) ; - 7.4 (%) ;	2	**DO NOT CREDIT** answer that is not given to 1 dp **DO NOT CREDIT** correct numerical answer without minus sign If no answers on the answer lines, then look in the appropriate boxes in the table for the answers. **ALLOW** ecf from candidate's value for kg ha^{-1}
3	(d)	(ii)	*idea that* the number of **,** plots / samples **,** was **,** too / very **,** small ;	1	Just ref to a smaller number of plots is not quite enough **CREDIT** *idea that* the number of plots was not large enough **IGNORE** ref to the idea that the difference is very large
3	(d)	(iii)	**1** prevents non-cyclic photophosphorylation ; **2** no electron(s) available to form reduced NADP ; **3** *idea that* ATP production by cyclic photophosphorylation is not prevented ; **4** no / less **,** ATP and no reduced NADP available for **,** Calvin cycle / light independent reaction / conversion of GP to TP ;	2 max	**1** **IGNORE** ref to cyclic photophosphorylation **2** **CREDIT** red NADP / NADPH / NADPH + H^+ / $NADPH_2$ for 'reduced NADP'
3	(d)	(iv)	*idea that* energy given off from **,** high energy / excited **,** electron (emitted by **,** chlorophyll / reaction centre) ;	1	
			Total	16	

Question			Answer	Marks	Guidance
4					**The spelling must be unambiguous and there must be no implication that another or 'hybrid' term is being given as the answer. In particular, look for** **'gly….' 'glu…'** **'…agon' '…ogen'** **'…genes…' '…genoly…'** **If a candidate has labelled each term with a number or letter and has then answered using these labels, credit appropriately.** **Also credit as appropriate if candidate has used arrows back to the original list.**
4	**(a)**		glycolysis **;**	**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	**(b)**		glucagon **and** insulin **;**	**1**	**Mark the first 2 answers.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then **= 0 marks**
4	**(c)**		gluconeogenesis **and** glycogenolysis **;**	**1**	**Mark the first 2 answers.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then **= 0 marks**
4	**(d)**		glycolysis **and** glycogenesis **;**	**1**	**Mark the first 2 answers.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then **= 0 marks**
			Total	**4**	

Question			Answer	Marks	Guidance
5	(a)	(i)	row of 3 phosphates joined to ribose **and** ribose joined to adenine **;** phosphates and adenine shown joined to correct place on ribose **or** stated that phosphate(s) joined to carbon 5 **and** adenine joined to carbon 1 **;**	2	**CREDIT** a written description that meets the requirements of the mark point **IGNORE** ribose drawn without an 'O' Phosphates must be attached to a vertical line from ribose Adenine must not be attached to a vertical line from ribose **2 marks for …**  **ALLOW 2** for reverse of above (as long as C atoms not numbered incorrectly) eg  **1 mark for …** (as implies that adenine is attached to carbon 5)  (as implies that phosphates are attached to carbon 4)

Question			Answer	Marks	Guidance
5	(a)	(ii)	hydrolysis ;	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** dephosphorylation **IGNORE** ref to phosphorylation in glycolysis (as, even if addition of phosphate to glucose is explained, this is not the type of reaction)
5	(b)	(i)	1 ;	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**
5	(b)	(ii)	none ;	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**
5	(b)	(iii)	2 / 3 ;	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	6	

Addendum to F214 January 2013 Question Paper

Chemiosmotic theory is a learning outcome of Module 4 of the F214 specification.

The chemiosmotic theory, as presented in the examination paper for F214, January 2013, and the OCR endorsed A2 Heinemann textbook, has been the subject of debate by a group of Academics working in the area of bioenergetics. This group of scientists has stated that the outer mitochondrial membrane does not play a role in oxidative phosphorylation and, hence, in ATP synthesis.

An account of the chemiosmotic theory has been produced by this group to assist with the teaching and learning of this important topic and has been placed on the OCR website http://www.ocr.org.uk/qualifications/as-a-level-gce-biology-h021-h421/

Question			Answer	Marks	Guidance
6	(a)		hydrostatic ; water / urea / amino acids / vitamins / small proteins ; ultrafiltration ; water ; capillaries / vessels ;	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** **IGNORE** blood **DO NOT CREDIT** osmotic / hydrostolic **ALLOW** ADH / hCG / LH **DO NOT CREDIT** ions / salts / minerals (because sentence refers to molecules) **CREDIT** urea **IGNORE** ref to vitamins **DO NOT CREDIT** amino acids (as these are completely reabsorbed) **DO NOT CREDIT** plasma / arteries / arterioles / tissue fluid
6	(b)	(i)	((walls of) blood vessels in) hypothalamus ;	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** brain
6	(b)	(ii)	osmoreceptor(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** **ACCEPT** neurosecretory (cell body) **DO NOT CREDIT** osmoregulatory

Question			Answer	Marks	Guidance
6	(c)	(i)	cortex ;	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	(c)	(ii)	water potential of , plasma / blood , will , decrease / become more negative ; (ADH secretion) will increase ;	2	**CREDIT** concentration of Na^+ in , plasma / blood , will increase **IGNORE** ref to increased uptake of Na^+ into blood **DO NOT CREDIT** ADH starts to be released / produced
6	(c)	(iii)	negative feedback ;	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** cell signaling

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