

Mark Scheme for January 2013

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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.

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

Question	Answer	Marks	Guidance
1 (b)	<p><i>pumping / active</i></p> <p>1 sodium-potassium pump , uses ATP / uses energy / by active transport / (pumps) actively ;</p> <p>2 pumps / actively moves , sodium ions / Na⁺ , out of , cell / axon / neurone , <u>and</u> , potassium ions / K⁺ , in ;</p> <p><i>passive / diffusing</i></p> <p>3 K⁺ , diffuse / move / flow / leak , (freely) back out (of cell) ;</p> <p>4 membrane less permeable to Na⁺ / fewer Na⁺ channels open , so fewer Na⁺ , diffuse / move / flow / leak , back in ; ora</p> <p>5 voltage-gated (Na⁺) , channels closed ;</p> <p>6 AVP ;</p> <p>QWC – technical terms used appropriately and spelled correctly ;</p>	<p>3 max</p> <p>1</p> <p>2</p> <p>4</p> <p>5</p> <p>6</p> <p>1</p>	<p>If symbol for ion not used, must refer to <u>ion</u> IGNORE ref to value of resting potential</p> <p>1 DO NOT CREDIT if referring to 2 separate pumps</p> <p>2 IGNORE numbers / ratio for this mark DO NOT CREDIT in context of (diffusion) channels</p> <p>4 Looking for a comparative statement referring to permeability and 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</p> <p>5 IGNORE ref. ligand-gated channels</p> <p>6 e.g. <ul style="list-style-type: none"> • 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 </p> <p>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)</p> <p>1 Use of three terms from: sodium-potassium pump, ion(s), diffuse (or derived term), permeable, voltage-gated</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>

Question			Answer	Marks	Guidance
1	(c)	(i)	<p>X depolarisation ; Y repolarisation ; Z hyperpolarisation ;</p>	3	<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>As the term is asked for, IGNORE descriptions</p> <p>X ACCEPT depolarise(d) / depolarising Y ACCEPT repolarise(d) / repolarising Z ACCEPT hyperpolarise(d) / hyperpolarising IGNORE refractory period</p>
1	(c)	(ii)	<p><u>threshold</u> (potential / value / voltage) ;</p>	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 threshold frequency</p>
1	(c)	(iii)	<p>1 <i>idea that</i> only stimuli , that reach / are greater than , threshold value / -50mV , produce an action potential ; ora</p> <p>2 (when stimulated) action potential either occurs or does not / all-or-nothing (law) ;</p> <p>3 <i>idea that</i> the action potential is the same (magnitude / size) , no matter how strong the stimulus / even if strength of stimulus increases ;</p> <p>4 <i>idea that</i> a strong stimulus produces many action potentials (in rapid succession) ;</p>	2 max	<p>IGNORE ref to refractory period as Figs do not indicate this</p> <p>Note 'strong stimulus increases frequency but not magnitude of action potential' = 2 marks (mps 3 & 4)</p>
			Total	15	

Question			Answer	Marks	Guidance
2	(a)	(i)	<p><i>product</i> urea ;</p> <p><i>organ transported to</i> kidney ;</p>	2	<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 bladder</p>
2	(a)	(ii)	<p>1 hepatocytes can tolerate , lactate / low pH (which would otherwise be toxic) ;</p> <p>2 hepatocytes have / (other) cells do not have , enzymes to , metabolise lactate / catalyse this reaction ;</p> <p>3 (conversion of lactate) requires oxygen and , muscle cells do not have enough oxygen / O₂ is not available during anaerobic respiration / O₂ is sufficient in hepatocytes ;</p>	1 max	<p>2 ACCEPT ref to hepatocytes having the , correct / necessary , enzyme(s)</p>

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

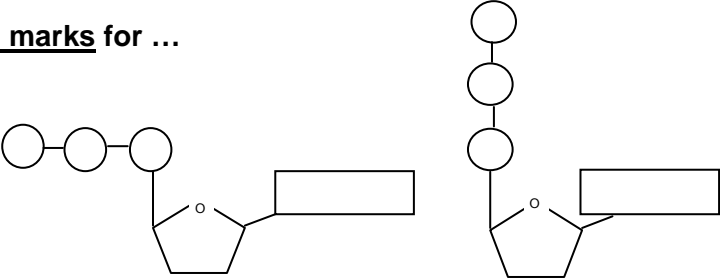
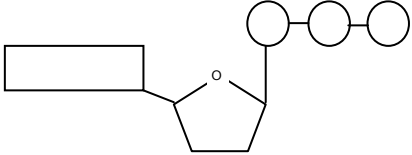
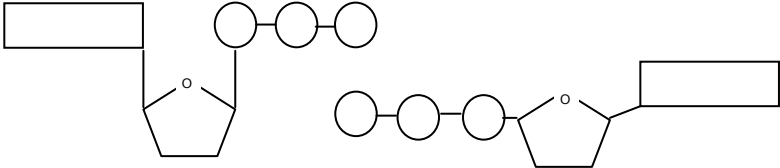
Question			Answer	Mark	Guidance
2	(c)	(i)	<p>1 build-up of lactate / prevention of pathway S , poisons / kills , (liver) cells ;</p> <p>2 disruption of enzymes as a result of low pH ;</p> <p>3 <i>idea that</i> lack of substrate / fatty acids not available , for respiration ;</p> <p>4 lack of (oxidised) NAD for (metabolic) reactions ;</p> <p>5 (some) deamination / ornithine cycle / pathway P / breakdown of (named) hormones / pathway R , cannot occur ;</p> <p>6 build-up of fatty acids / more fatty acids present , resulting in , fat deposits in (liver) cells / fatty liver / cirrhosis ;</p>	2 max	<p>1 IGNORE ref to ethanal</p> <p>2 IGNORE 'affects enzymes' without qualification</p> <p>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)</p> <p>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</p>
2	(c)	(ii)	<p>crista(e) / inner mitochondrial membrane ;</p>	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 (at) electron transport chain DO NOT CREDIT inter mitochondrial membrane</p>
			Total	8	

Question		Answer	Marks	Guidance
3	(a)	<p><i>autotroph</i> can make , organic molecule(s) / named organic molecule(s) , from , inorganic molecule(s) / carbon dioxide ;</p> <p><i>heterotroph</i> relies on / needs to use / has to obtain / feeds on and digests , (named) organic molecules (that have been made by another organism) ;</p>	2	<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>IGNORE ref to biological molecules</p> <p>ACCEPT fixes carbon dioxide to produce (named) carbohydrates / protein / lipid</p> <p>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</p>
3	(b) (i)	<p>E granum / grana ;</p> <p>F stroma ;</p>	2	<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>E IGNORE ref to stacks of , lamellae / thylakoids</p> <p>F DO NOT CREDIT stoma / stroma</p>
3	(b) (ii)	<p>for membrane formation or phospholipid / cholesterol / glycolipid , for membrane ;</p> <p>fatty acid / (named) pigment , synthesis ;</p>	1 max	<p>IGNORE ref to ATP production (as primarily generated by photophosphorylation in a chloroplast)</p> <p>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)</p>

Question		Answer	Marks	Guidance		
3	(c)	<p>1 (primary & accessory) pigments , are in / form a(n) , photosystem / complex / antenna complex ;</p> <p>2 photon / light energy , absorbed by <u>pigment</u> (molecule(s)) ;</p> <p>3 electron , excited / moves to higher energy level / delocalised , and returned to pigment ;</p> <p>4 (energy / photon) passed from one pigment to another ;</p> <p>5 (energy / photon) passed to , reaction centre / chlorophyll a / P680 / P700 / PSI / PSII / primary pigment ;</p> <p>6 range of / accessory , pigments allow range of wavelengths to be absorbed ;</p> <p>QWC – technical terms used appropriately and spelt correctly ;</p>	4 max	<p>IGNORE ref to photophosphorylation, as irrelevant to Q</p> <p>1 if pigments are named, state that chlorophyll a and at least 1 named accessory pigment are in a photosystem</p> <p>2 <i>idea of absorption</i> required in the context of this Q IGNORE falls on / hits / strikes</p> <p>3 DO NOT CREDIT if <i>this</i> electron is passed to , electron acceptor / ETC DO NOT CREDIT in context of chlorophyll a</p> <p>4 DO NOT CREDIT ref to electron being passed</p> <p>5 DO NOT CREDIT ref to electron being passed But apply ecf from mp 4</p> <p>6 CREDIT ‘photon energy’ for ‘wavelengths’ IGNORE in context of P680 and P700</p> <p>1 Use of three terms from:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; vertical-align: top;"> pigment photon chlorophyll , a / A accessory </td> <td style="width: 50%; vertical-align: top;"> antenna complex reaction centre primary wavelength(s) </td> </tr> </table> <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>	pigment photon chlorophyll , a / A accessory	antenna complex reaction centre primary wavelength(s)
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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)	<i>idea that</i> the number of , plots / samples , was , too / very , small ;	1	Just ref to a smaller number of plots is not quite enough CREDIT <i>idea that</i> the number of plots was not large enough IGNORE ref to the idea that the difference is very large
3	(d)	(iii)	1 prevents <u>non-cyclic photophosphorylation</u> ; 2 no electron(s) available to form reduced NADP ; 3 <i>idea that</i> ATP production by <u>cyclic photophosphorylation</u> is not prevented ; 4 no / less , ATP <u>and</u> 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)	<i>idea that</i> <u>energy</u> given off from , high energy / excited , electron (emitted by , chlorophyll / reaction centre) ;	1	
Total				16	

Question		Answer	Marks	Guidance
4				<p>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...'</p> <p>If a candidate has labelled each term with a number or letter and has then answered using these labels, credit appropriately.</p> <p>Also credit as appropriate if candidate has used arrows back to the original list.</p>
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)	<p>row of 3 phosphates joined to ribose and ribose joined to adenine ;</p> <p>phosphates and adenine shown joined to correct place on ribose</p> <p>or stated that phosphate(s) joined to carbon 5 and adenine joined to carbon 1 ;</p>	2	<p>CREDIT a written description that meets the requirements of the mark point</p> <p>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</p> <p>2 marks for ...</p>  <p>ALLOW 2 for reverse of above (as long as C atoms not numbered incorrectly) eg</p>  <p>1 mark for ... (as implies that adenine is attached to carbon 5)</p>  <p>(as implies that phosphates are attached to carbon 4)</p>

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

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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