

Mark Scheme for June 2011

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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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Any enquiries about publications should be addressed to:

OCR Publications
PO Box 5050
Annesley
NOTTINGHAM
NG15 0DL

Telephone: 0870 770 6622
Facsimile: 01223 552610
E-mail: publications@ocr.org.uk

Question	Expected Answer	Mark	Additional Guidance
In ALL questions			<p>CREDIT AW throughout i.e. credit any alternatively worded statement that conveys the same sense as the whole mark point. If a particular word is essential and no other will do it is <u>underlined</u>.</p> <p>ACCEPT incorrect spellings if they are recognisable and sound the same when pronounced, even for underlined terms. If correct spelling is essential, this will be indicated in the Additional Guidance. For QWC marks, correct spelling and context are necessary.</p> <p>IGNORE wrong or vague statements unless Additional Guidance states DO NOT CREDIT, in which case the mark point is not awarded.</p>

Question		Expected Answer		Mark	Additional Guidance																												
1	(a)		<table border="1"> <thead> <tr> <th><i>motor neurone</i></th> <th><i>sensory neurone</i></th> </tr> </thead> <tbody> <tr> <td>1</td> <td>cell body in CNS</td> <td>cell body , not in CNS / in PNS</td> <td>;</td> </tr> <tr> <td>2</td> <td>cell body at end (of neurone)</td> <td>cell body , not at end / in middle (of neurone)</td> <td>;</td> </tr> <tr> <td>3</td> <td>dendrites connect directly to cell body</td> <td>dendrites do not connect directly to cell body or dendrites at the end(s) of , dendron / axon</td> <td>;</td> </tr> <tr> <td>4</td> <td>long(er) axon</td> <td>short(er) axon</td> <td>;</td> </tr> <tr> <td>5</td> <td>dendron absent / no dendron</td> <td>dendron present</td> <td>;</td> </tr> <tr> <td>6</td> <td>ends at motor end plate</td> <td>starts at / connects to , (sensory) receptor</td> <td>;</td> </tr> </tbody> </table>	<i>motor neurone</i>	<i>sensory neurone</i>	1	cell body in CNS	cell body , not in CNS / in PNS	;	2	cell body at end (of neurone)	cell body , not at end / in middle (of neurone)	;	3	dendrites connect directly to cell body	dendrites do not connect directly to cell body or dendrites at the end(s) of , dendron / axon	;	4	long(er) axon	short(er) axon	;	5	dendron absent / no dendron	dendron present	;	6	ends at motor end plate	starts at / connects to , (sensory) receptor	;	3	<p>Award 1 mark for each correct side by side comparison. Comparative statements must be made on the same row.</p> <p>ALLOW two valid comparisons in the same pair of boxes, e.g</p> <table border="1"> <tr> <td>Cell body at end of neurone in the CNS</td> <td>Cell body in middle and in the PNS</td> </tr> </table> <p>= 2 marks</p> <p>mps 2, 3 and 4 can be taken from a labelled diagram All mps can be taken from annotated diagrams</p>	Cell body at end of neurone in the CNS	Cell body in middle and in the PNS
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1	(b)	<p>1 - 60 to -70 ;</p> <p>2 depolarisation ;</p> <p>3 <u>threshold potential</u> / <u>threshold value</u> ;</p> <p>4 all or nothing ;</p> <p>5 size / magnitude ;</p> <p>6 <u>frequency</u> ;</p>	6	<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>1 ACCEPT any single figure or range (within this range) Must be a negative number</p> <p>4 ALLOW all or none</p> <p>5 ALLOW amplitude DO NOT CREDIT intensity / strength / value / potential difference / voltage</p>
Total			9	

Question			Expected Answer	Mark	Additional Guidance
2	(a)	(i)	0.0017 ; ;		<ul style="list-style-type: none"> • Correct answer, given to 4 dp = 2 marks • If answer not shown on answer line, CREDIT correct answer written in the appropriate space in the table. • If answer is incorrectly rounded or rounded to the wrong number of dp or written in standard form (1.7×10^{-3}) then award 1 working mark • If answer is incorrect then award 1 working mark for seeing $1 \div 576$ or $1 \div 24^2$
2	(a)	(ii)	<p>1 (internal) radius / diameter , of capillary tube ;</p> <p>2 cross-sectional area (of capillary tube) ;</p> <p>3 (use) $\pi r^2 h$;</p>	2	<p>1 ACCEPT radius / diameter , of bubble ACCEPT width of tube</p> <p>2 ACCEPT cross-sectional area of bubble</p>
2	(a)	(iii)	<p>1 (sodium) hydrogen carbonate ;</p> <p>2 bubble in , CO_2 / exhaled air ;</p> <p>3 dry ice ;</p>	1 max	<p>1 ACCEPT bicarbonate DO NOT CREDIT carbonate</p>

Question			Expected Answer	Mark	Additional Guidance
2	(b)	(i)	<p><i>idea that some of the oxygen</i></p> <p>1 would dissolve in the water ;</p> <p>2 used in , respiration / oxidative phosphorylation ;</p> <p>3 may escape the collection apparatus ;</p> <p>4 trapped in , a bubble attached to / air spaces in , the leaf ;</p>	2 max	<p>1 IGNORE 'oxygen is in the water'</p> <p>2 IGNORE produces energy</p>
2	(b)	(ii)	<p>1 (nitrogen) was present in the air (spaces) in the , leaf / plant ;</p> <p>2 (nitrogen) leaves the plant with the oxygen ;</p> <p>3 <i>idea that</i> (nitrogen) comes out of solution / 'undissolved' (as less soluble in warm water) ;</p>	1 max	
2	(b)	(iii)	<p>1 higher than , expected / normal / in atmosphere ;</p> <p>2 (plant is) respiring / produces CO₂ during respiration ;</p> <p>3 CO₂ , has been added to water / is present in excess ;</p> <p>4 (CO₂) comes out of solution / 'undissolved' (as less soluble in warm water) ;</p> <p>5 less / low(er) , as some CO₂ will dissolve in , water / solution ;</p> <p>6 less / low(er) , as CO₂ used in photosynthesis ;</p>	3 max	<p>2 IGNORE produces energy</p> <p>5 DO NOT CREDIT if in context of lower than O₂ and N₂</p> <p>6 DO NOT CREDIT if in context of lower than O₂ and N₂</p>

Question		Expected Answer	Mark	Additional Guidance
2	(c)	<p><i>intensity</i></p> <p>1 in deeper water there is , less / lower , light <u>intensity</u> ;</p> <p>2 (these pigments) can absorb what (little) light there is ;</p> <p><i>wavelength</i></p> <p>3 not all wavelengths of light can penetrate or mainly shorter wavelengths can penetrate or (mostly) blue light (450 – 520 nm) penetrates ;</p> <p>4 (these pigments) can absorb wavelengths of light that can penetrate (deeper water) ;</p>	<p>2 max</p>	<p>IGNORE ref to photosynthesis (as 'photosynthetic' stated in Q)</p> <p>2 ACCEPT trap / harvest / capture IGNORE use / collect</p> <p>3 idea of restricted range of wavelengths able to penetrate (rather than wavelengths are different) ACCEPT 'higher frequency' instead of 'shorter wavelength'</p> <p>4 ACCEPT trap / harvest / capture IGNORE use / collect</p>
Total			12	

Question		Expected Answer	Mark	Additional Guidance
3	(a)	<p>1 less ventilation / <i>Idea of difficulty in exhaling due to less recoil / small surface area for gaseous exchange / less oxygen entering capillaries / less oxygen entering blood ;</i></p> <p>2 less oxygen (reaching cells) for , (aerobic) respiration / oxidative phosphorylation ;</p> <p>3 (so) less ATP produced ;</p> <p>4 <i>idea of increased acidity (as CO₂ / lactate builds up) interfering with / affects , enzymes / respiratory metabolism ;</i></p>	2 max	<p>IGNORE 'produces' energy in any mark point</p> <p>1 DO NOT CREDIT no oxygen</p> <p>2 DO NOT CREDIT no respiration</p> <p>3 DO NOT CREDIT no ATP</p>
3	(b)	<p>1 not enough / less , glucose uptake into <u>cells</u> ;</p> <p>2 not enough / less , glucose / substrate , for , respiration / ATP production ;</p> <p>3 glucose not , stored as / converted to , glycogen ;</p>	2 max	<p>ACCEPT 'sugar' for glucose</p> <p>IGNORE (excess) glucose lost in urine (as does not answer the Q)</p> <p>Only CREDIT ora if candidate clearly states that the sequence of events does not happen in this case</p> <p>1 DO NOT CREDIT no glucose uptake</p> <p>2 IGNORE produces energy DO NOT CREDIT no respiration / no ATP / no glucose</p>

Question		Expected Answer	Mark	Additional Guidance
3	(c)	<p>1 <i>idea of</i> slow rate of / sluggish , blood flow or low(er) blood pressure ;</p> <p>2 less / irregular amount of , oxygen (reaching cells) for , (aerobic) respiration / oxidative phosphorylation ;</p> <p>3 less glucose (reaching cells) for respiration ;</p> <p>4 (so) less ATP produced ;</p> <p>5 <i>idea of</i> increased acidity (as CO₂ / lactate builds up) interfering with / affects , enzymes / respiratory metabolism ;</p>	2 max	<p>IGNORE 'produces' energy in any mark point</p> <p>1 IGNORE 'heart doesn't beat strongly enough' or 'heart beat is inefficient' IGNORE ref to volume of blood without time/rate</p> <p>2 DO NOT CREDIT no oxygen / no respiration</p> <p>3 IGNORE sugar DO NOT CREDIT no glucose / no respiration</p> <p>4 DO NOT CREDIT no ATP</p>

Question			Expected Answer	Mark	Additional Guidance
3	(d)	(i)	<p>1 less pyruvate for , link reaction / Krebs cycle or link reaction / Krebs cycle , cannot take place / reduced or only / mainly , glycolysis takes place ;</p> <p>2 no / little , oxidative phosphorylation ;</p> <p>3 less , energy / ATP , for muscle contraction / resulting in muscle weakness / for mental processes ;</p> <p>4 <u>anaerobic</u> respiration takes place ;</p> <p>5 lactate / decrease in pH , causing aching muscles ;</p>	3 max	<p>2 IGNORE produces energy</p> <p>3 DO NOT CREDIT no ATP IGNORE produces energy IGNORE muscle fatigue</p> <p>5 CREDIT 'lactic acid' instead of 'lactate' ACCEPT muscle cramps</p>
3	(d)	(ii)	<p>1 <i>idea that</i> B lymphocytes do not respond to cytokines (that have been produced) ;</p> <p>2 little , energy / ATP , for B cell , mitosis / clonal expansion ;</p> <p>3 little , energy / ATP , for , production / release , of antibodies ;</p>	1 max	
Total				10	

Question			Expected Answer	Mark	Additional Guidance
4	(a)	(i)	islet(s) of Langerhans ;	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 α and β cells in islets of Langerhans DO NOT CREDIT α cells in islets of Langerhans DO NOT CREDIT β cells in islets of Langerhans

Question		Expected Answer	Mark	Additional Guidance
4	(a) (ii)	<p>use ✓¹</p> <p><i>endocrine</i></p> <p>H1 hormone(s) released directly into blood ;</p> <p>H2 beta / β , cells , secrete / produce / release , insulin ;</p> <p>H3 alpha / α , cells , secrete / produce / release , glucagon ;</p> <p>H4 islet / α and β , cells , detect / monitor , blood glucose concentration ; 3 max</p>	4 max	<p>If endocrine and exocrine terms are muddled, then ignore endocrine and exocrine refs but only award max 2 for both sections and do not award the QWC mark.</p> <p>H1 DO NOT CREDIT carried / transported , in</p> <p>H2 ACCEPT b cells</p> <p>H3 ACCEPT a cells DO NOT CREDIT incorrect spelling of glucagon</p> <p>H4 ACCEPT a and b cells α cells and β cells secrete glucagon and insulin = 2 marks α cells and β cells secrete insulin and glucagon = 0 marks</p> <p>E1 IGNORE substances DO NOT CREDIT carried / transported , in</p> <p>E5 CREDIT 2 enzymes but no more than 1 enzyme from each bullet point</p> <ul style="list-style-type: none"> • lipase • amylase / carbohydrase • trypsin / chymotrypsin / protease / trypsinogen / chymotrypsinogen
		<p>use ✓²</p> <p><i>exocrine</i></p> <p>E1 fluid / juice / secretion / enzymes , released into <u>duct</u> ;</p> <p>E2 (release triggered by) nervous / hormonal , stimulation ;</p> <p>E3 pancreatic secretions into , gut / small intestine / duodenum ;</p> <p>E4 alkaline / pH 8 / (sodium) hydrogen carbonate ;</p> <p>E5 containing 2 <u>named enzyme(s)</u> ; 3 max</p>		
		<p>QWC – technical terms used appropriately with correct spelling ;</p>	1	<p>Do not award if endocrine & exocrine are muddled.</p> <p>Use of 3 terms from:</p> <p>hormone(s), beta, alpha, glucagon, islet(s), pancreatic, duodenum, enzyme(s), amylase, trypsin(ogen) / chymotrypsin(ogen)</p> <p>You should use the GREEN DOT to identify the QWC terms that you are crediting.</p> <p>Please insert a QWC symbol next to the PENCIL ICON, followed by</p> <p>a tick (✓) if QWC has been awarded or a cross (×) if QWC has not been awarded</p>

Question			Expected Answer	Mark	Additional Guidance
4	(b)		D A G H C F ; ; ; ;	4	All letters in correct sequence = 4 marks If letters are not all in the correct sequence, then mark as follows: D at the beginning and F at the end = 1 mark A somewhere before G = 1 mark G somewhere before H = 1 mark H somewhere before C = 1 mark
4	(c)	(i)	<p>1 <i>idea of plentiful / dependable , supply ;</i></p> <p>2 cheap ;</p> <p>3 not cruel to pigs / more ethical ;</p> <p>4 no religious objections / can be used by vegetarians ;</p> <p>5 reliable , quality / standard ;</p> <p>6 (exact match to) human insulin / no allergic reaction ;</p>	2	<p>Mark the first <u>two</u> advantages</p> <p>1 e.g. can meet demand / can be mass produced IGNORE ref to speed</p> <p>6 ACCEPT ref to not spreading prions IGNORE spread of disease from pigs / no rejection DO NOT CREDIT genetically identical insulin</p>
4	(c)	(ii)	<p>1 (has the potential to) cure / do more than manage , the condition ;</p> <p>2 long term effect / permanent / no need for repeated treatments ;</p>	1 max	<p>1 e.g. no need to restrict diet</p> <p>2 e.g. no need to inject insulin (regularly)</p>
Total				13	

Question		Expected Answer	Mark	Additional Guidance
5	(a)	<p>P cortex ;</p> <p>Q ureter ;</p>		<p>Mark the first answer for each letter. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</p> <p>Q Correct spelling only DO NOT CREDIT incorrect spelling of ureter</p>

Question			Expected Answer	Mark	Additional Guidance
5	(b)	(i)	1 ultrafiltration ;	3 max	<p>4 e.g. fenestrations in capillary wall don't allow red blood cells to leave DO NOT CREDIT cell walls of capillaries</p> <p>5 e.g. basement membrane (only) allows small molecules to pass through</p>
			2 afferent arteriole is wider than efferent arteriole ;		
3 high blood pressure in glomerulus / high(er) hydrostatic pressure in glomerulus (than in Bowman's capsule) ;					
4 <i>idea that</i> endothelium / wall of capillary , has gaps to , allow / prevent , passage (of substances / cells) ;					
5 <i>idea that</i> basement membrane stops removal of , large molecules / cells ;					
6 podocytes / epithelial cells of Bowman's capsule , have (finger-like) projections / processes ;					
7 (projections) ensure gaps to allow passage (of substances) ;					
			QWC – technical terms used appropriately and spelt correctly ;	1	<p>Use of 3 terms in the correct context from: afferent, efferent, blood pressure / hydrostatic pressure, endothelium / endothelial, basement membrane, podocyte(s), epithelial / epithelium, ultrafiltration</p> <p>You should use the GREEN DOT to identify the QWC terms that you are crediting. 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</p>

Question			Expected Answer	Mark	Additional Guidance
5	(b)	(ii)	<p>1 (large) protein / amino acids , present ;</p> <p>2 blood (cells) present ;</p> <p>3 glucose present ;</p> <p>4 more water present / more dilute ;</p> <p>5 more , ions / salts / electrolytes , present ;</p> <p>6 (more) vitamins present ;</p>	2 max	<p>Mark as prose - award marks wherever they occur</p> <p>1 ACCEPT more , protein / amino acids ACCEPT appropriately named protein e.g. albumin / antibodies / immunoglobulins</p> <p>3 DO NOT CREDIT more glucose</p>
5	(c)	(i)	protein / polypeptide ;	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 alpha helix / intrinsic / transmembrane DO NOT CREDIT glycoprotein</p>
5	(c)	(ii)	<p>1 the ions (in solution) are too large to pass through the channel or the channel is too narrow for the ions (in solution) to pass through ;</p> <p>2 shapes not compatible ;</p> <p>3 <i>idea that</i> positive charge (in the channel) repels the (positively charged) ions ;</p>	2 max	<p>Mark the first <u>two</u> suggestions</p> <p>1 ACCEPT gap / hole for channel</p> <p>3 DO NOT CREDIT repels and/or attracts</p>
Total				11	

Question			Expected Answer	Mark	Additional Guidance
6	(a)	(i)	<u>adrenal cortex</u> ;	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 endocrine gland(s)
6	(a)	(ii)	inner mitochondrial membrane / crista / location described ;	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 e.g. between the inter-membrane space and the matrix IGNORE stalked particles / ATP synthetase
6	(b)	(i)	<u>positive feedback</u> ;	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 respiratory acidosis / hyperventilation
6	(b)	(ii)	<u>cyclic photophosphorylation</u> ;	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 cyclic phosphorylation
6	(b)	(iii)	cell signalling ;	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 homeostasis
Total				5	

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

14 – 19 Qualifications (General)

Telephone: 01223 553998

Facsimile: 01223 552627

Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

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OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553

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