

Question			Answer	Marks	Guidance
1	(a)	(<p>1 <i>idea of</i> maintaining (relatively) stable internal , environment / state ;</p> <p>2 within (narrow) limits / within (narrow) range / about a set point ;</p> <p>3 even though environment is changing ;</p>	2 max	<p>1 Need the idea of 'constant' or 'steady' and 'regulation' or 'keeping' and in the body</p> <p>2 ACCEPT about the 'norm'</p> <p>IGNORE ref to negative feedback (as mechanism rather than definition) / optimum conditions</p> <p>CREDIT mps 2 & 3 (only) if response is in terms of example(s) e.g. temperature / blood glucose</p> <p>Note 'maintaining a stable body temperature' = 0 'keeping your body temperature at 37°C' = 1 (mp 2) 'even though it is getting cold' = 1 (mp 3)</p>

Question			Answer	Marks	Guidance										
1	(a)	(i)	<p>1 β cells / α cells / receptors , detect , change / increased / decreased , in blood glucose (concentration) ;</p> <p>2 if high(er) glucose (concentration) , beta / β , cells (in pancreas) release insulin ;</p> <p>3 (increased) uptake / absorption , of glucose by , liver / muscle / effector , cells ;</p> <p>4 enters through glucose transport proteins (in cell surface membrane) ;</p> <p>5 glucose converted to glycogen / glycogenesis ;</p> <p>6 increased (use of glucose in) , respiration / ATP production ;</p> <p>7 if low(er) glucose (concentration) , alpha / α , (in pancreas) cells release glucagon ;</p> <p>8 (increased) conversion of glycogen to glucose / glycogenolysis ;</p> <p>9 (increased) conversion of other compounds (amino acids / lipids) to glucose / gluconeogenesis ;</p> <p>10 glucose leaves cells , by facilitated diffusion / through glucose channels ;</p> <p>11 AVP ;</p>	5 max	<p>1 CREDIT correct ref to detection by α/a (low) or β/b (high) IGNORE monitor / stimulate / figures quoted</p> <p>2 CCEPT 'produce' rather than release DO NOT CREDIT B cells</p> <p>3 CREDIT increased permeability of named cell to glucose IGNORE 'use' / target cell</p> <p>4 CREDI GLUT channels</p> <p>5 unambiguous spelling only of <u>glycogen</u> and <u>glycogenesis</u></p> <p>6 DO NOT CREDIT in context of α and β cells ACCEPT 'increased respiration by body'</p> <p>7 unambiguous spelling only of <u>glucagon</u> ACCEPT 'produce' rather than release</p> <p>8 unambiguous spelling only of <u>glycogen</u> and <u>glycogenolysis</u></p> <p>9 unambiguous spelling only of <u>gluconeogenesis</u></p> <p>11 e.g. correct cellular detail for insulin release or in effector cells ... <ul style="list-style-type: none"> • insulin binds to receptor on plasma membrane of hepatocytes • correct ref to secondary messenger (cAMP) e.g. ref to inhibitory effect(s) of hormone ... <ul style="list-style-type: none"> • conversion in cells / secretion of antagonist </p>										
			<p>QWC – technical terms used appropriately and spelt correctly ;</p>		1	<p>Use of three terms from:</p> <table style="width: 100%; border: none;"> <tr> <td style="width: 33%;">receptor,</td> <td style="width: 33%;">beta,</td> <td style="width: 33%;">insulin,</td> </tr> <tr> <td>effector,</td> <td>glycogen,</td> <td>glycogenesis,</td> </tr> <tr> <td>alpha,</td> <td>glucagon,</td> <td>glycogenolysis,</td> </tr> <tr> <td>gluconeogenesis,</td> <td>facilitated diffusion</td> <td></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 (✗) if QWC has not been awarded You should use the green dot to identify the QWC terms that you are crediting.</p>	receptor,	beta,	insulin,	effector,	glycogen,	glycogenesis,	alpha,	glucagon,	glycogenolysis,
receptor,	beta,	insulin,													
effector,	glycogen,	glycogenesis,													
alpha,	glucagon,	glycogenolysis,													
gluconeogenesis,	facilitated diffusion														

Question			Answer	Marks	Guidance
1	(b)	(requires (daily) , insulin / hormone , injections ; is not affected by dietary changes ;	1 max	ACCEPT insulin is not being produced in sufficient quantities
1	(b)	(i	<i>idea that</i> has developed in , an old(er) person / middle age / a 55 year old ;	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 references to diet, as this was ineffective but use NBOD icon to indicate this
			Total	10	

Question		Expected Answer	Mark	Additional Guidance
2	(a)	<p>1 less ventilation / <i>Idea of</i> difficulty in exhaling due to less recoil / small surface area for gaseous exchange / less oxygen entering capillaries / less oxygen entering blood ;</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</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 DO NOT CREDIT no oxygen</p> <p>2 DO NOT CREDIT no respiration</p> <p>3 DO NOT CREDIT no ATP</p>
2	(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
2	(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
2	(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>
2	(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
3	(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
3	(a)	(ii)		
		<p>use ✓¹</p> <p><i>endocrine</i></p> <p>H1 <u>hormone</u>(s) released directly into blood ; H2 beta / β , cells , secrete / produce / release , insulin ; H3 alpha / α , cells , secrete / produce / release , glucagon ;</p> <p>H4 islet / α and β , cells , detect / monitor , blood glucose concentration ; 3 max</p> <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 ; E3 pancreatic secretions into , gut / small intestine / duodenum ; E4 alkaline / pH 8 / (sodium) hydrogen carbonate ; E5 containing 2 named <u>enzyme</u>(s) ; 3 max</p>	<p>4 max</p>	<p>If endocrine and exocrine terms are muddled, then ignore endocrine and exocrine refs but only award max 2 for <u>both sections</u> and do not award the QWC mark.</p> <p>H1 DO NOT CREDIT carried / transported , in H2 ACCEPT b cells H3 ACCEPT a cells DO NOT CREDIT incorrect spelling of glucagon 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>QWC – technical terms used appropriately with correct spelling ;</p>	<p>1</p>	<p>Do not award if endocrine & exocrine are muddled. Use of 3 terms from: 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. 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
3	(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
3	(c)	(i)	<p>1 <i>idea of</i> plentiful / dependable , supply ;</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>
3	(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 Answers	Marks	Additional Guidance
4	(a)	(i)	<p><i>2nd messenger</i> cAMP / cyclic AMP / cyclic adenosine monophosphate ;</p> <p><i>1st messenger</i> adrenaline / adrenalin ;</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 CAMP / camp DO NOT CREDIT adenine monophosphate</p> <p>IGNORE chemicals not named in Fig. 5.1</p>
	(a)	(ii)	<p>1 <u>glycogen</u> → <u>glucose</u> / <u>glycogenolysis</u> ;</p> <p>2 by <u>hydrolysis</u> ;</p> <p>3 <i>correct ref to</i> protein kinase / glycogen phosphorylase kinase (activates glycogen phosphorylase)</p> <p>or glycogen phosphorylase (stimulates conversion of glycogen)</p> <p>or inhibition of glycogen synthase (preventing glucose conversion to glycogen) ;</p>	1 max	<p>1 DO NOT CREDIT gluconeogenesis / glycogenesis</p> <p>2 This term must be used, or a derived term.</p> <p>3</p>

Question		Expected Answers		Marks	Additional Guidance
(a)	(iii)	1	different tissues have different (types of adrenaline) receptors ;	2 max	<p>IGNORE reasons not related to adrenaline (as Q specifies 'how the adrenaline molecule can cause ...')</p> <p>IGNORE descriptions of stated effects in different tissues as Q asks <i>how</i> adrenaline causes these different effects</p> <p>1</p> <p>2 ACCEPT adenylyl cyclase / cAMP , inhibited</p> <p>3</p> <p>4</p>
		2	(causing) cAMP concentration to increase or decrease ;		
		3	second messenger (may be) different ;		
		4	cAMP / second messenger , activates , different / other , enzymes / enzyme reactions (in different target cells) ;		

Question	Expected Answers	Marks	Additional Guidance
(b)	<p>1 adrenalin(e) increases , heart rate / stroke volume / cardiac output ;</p> <p>2 cardiovascular centre in medulla oblongata ;</p> <p>3 <i>idea of</i> nervous connection to , SAN / sino-atrial node ;</p> <p>4 (which) controls frequency of waves of , excitation / depolarisation ;</p> <p>5 vagus / parasympathetic , nerve decreases heart rate ;</p> <p>6 accelerator / sympathetic , nerve increases heart rate ;</p> <p>7 high blood pressure detected by , stretch receptors / baroreceptors ;</p> <p>8 low blood pH / increased levels of blood CO₂ , detected by chemoreceptors ;</p> <p>9 (receptors) in , aorta / carotid sinus / carotid arteries ;</p>	<p>4 max</p>	<p>1</p> <p>2 ACCEPT 'cardiac' instead of cardiovascular but not for QWC</p> <p>3 ACCEPT SAN for mp 3 but not for QWC</p> <p>4 CREDIT in relation to mp 2 or mp 3</p> <p>5 ONLY CREDIT vagus or parasympathetic for QWC</p> <p>6 ONLY CREDIT accelerator or sympathetic for QWC ACCEPT phrenic nerve</p> <p>7 DO NOT CREDIT proprioceptor</p> <p>8</p> <p>9</p>
	<p>QWC – technical terms used appropriately with correct spelling ;</p>	<p>1</p>	<p>Correct use of adrenalin(e) (Identify using the tick 1 <input checked="" type="checkbox"/> 1 AND MUST BE INCLUDED FOR QWC TO BE AWARDED) plus use of 2 terms from: cardiovascular centre, medulla oblongata, sino-atrial node, vagus or parasympathetic, carotid, accelerator or sympathetic, chemoreceptor</p> <p>You should use the GREEN DOT to identify the remaining QWC terms that you are crediting.</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</p>
	<p>TOTAL</p>	<p>10</p>	

Question			Expected Answer	Mark	Additional Guidance
5	(a)	(i)	<p>starch contains (only) glucose and sucrose contains , 50% glucose or glucose and fructose ;</p> <p>by <u>hydrolysis</u> , starch releases more glucose / sucrose releases less glucose ;</p>	2	
	(a)	(ii)	<p>both starch and cellulose are (only) made of glucose ;</p> <p>starch , is digestible / can be broken down and cellulose , is indigestible / cannot be broken down ;</p> <p>(named) enzyme present for starch digestion / no (named) enzyme present for cellulose digestion ;</p>	2 max	
	(b)		<p>1 low / decrease , starch ;</p> <p>2 as starch has the <u>greatest</u> effect on blood glucose conc. ;</p> <p>3 increase / include , cellulose / fibre / roughage / fat / protein / meat , as no effect on blood glucose ;</p> <p>4 some / medium amount of , sugars / sucrose / lactose ;</p> <p>5 <i>idea of limiting</i> , sucrose / lactose / fat / protein , as causes an increase in insulin and will make cells less responsive (to insulin) ;</p>	3 max	<p>1 ACCEPT 'no starch'</p> <p>2 'substantial' or 'high' or 'big' is not quite enough</p> <p>3 IGNORE the idea that , fat / protein , increases insulin and could indirectly lower blood glucose (as this is not relevant to Type 2 diabetes) DO NOT CREDIT little effect / less effect (as table shows no effect)</p>

Question		Expected Answer		Mark	Additional Guidance												
(c)			<table border="1"> <thead> <tr> <th></th> <th>glycogen</th> <th>glucagon</th> </tr> </thead> <tbody> <tr> <td>type of compound</td> <td>carbohydrate OR polysaccharide</td> <td>hormone OR polypeptide OR protein</td> </tr> <tr> <td>role of compound</td> <td>storage OR to provide glucose (when blood glucose conc. falls) OR can undergo glycogenolysis</td> <td>binds to cell receptor OR causes conversion of glycogen to glucose OR stimulates glycogenolysis OR increases (blood) glucose concentration</td> </tr> <tr> <td>site of production</td> <td>liver OR hepatocytes</td> <td>pancreas OR islets of Langerhans OR alpha / α , cells</td> </tr> </tbody> </table>		glycogen	glucagon	type of compound	carbohydrate OR polysaccharide	hormone OR polypeptide OR protein	role of compound	storage OR to provide glucose (when blood glucose conc. falls) OR can undergo glycogenolysis	binds to cell receptor OR causes conversion of glycogen to glucose OR stimulates glycogenolysis OR increases (blood) glucose concentration	site of production	liver OR hepatocytes	pancreas OR islets of Langerhans OR alpha / α , cells		<p>Award one mark per row</p> <p><i>both glycogen and glucagon</i> IGNORE polymer or macromolecule unless qualified</p> <p><i>glycogen</i> DO NOT CREDIT complex sugar / sugar</p> <p><i>both glycogen and glucagon</i> Look for qualification of glycogenolysis</p> <p><i>glycogen</i> ACCEPT muscle / brain</p> <p><i>glucagon</i> ACCEPT 'a cells' IGNORE pancreas DO NOT CREDIT beta / β , cells</p>
		glycogen	glucagon														
	type of compound	carbohydrate OR polysaccharide	hormone OR polypeptide OR protein														
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				3													
			Total	[10]													