

Question			Answer	Marks	Guidance
1	(a)	(i)	(thermoregulatory centre 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 ACCEPT hyperthalamus
1	(a)	(ii)	<u>thermoreceptor</u> / <u>peripheral</u> temperature receptor ;	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 'heat' / 'sensory cell'
1	(a)	(iii)	<u>negative feedback</u> / <u>thermoregulation</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 homeostasis
1	(b)	(i)	M <u>and</u> N <u>and</u> P ;	1	If the answer is correct and an additional letter is given that is incorrect then = 0 marks All 3 correct letters required for one mark IGNORE J
1	(b)	(ii)	K <u>and</u> O ;	1	If the answer is correct and an additional letter is given then = 0 marks Both correct letters required for one mark
1	(b)	(iii)	L ;	1	Mark the first answer. If the answer is correct and an additional letter is given that is incorrect then = 0 marks ACCEPT J

Question			Answer	Marks	Guidance
1	(b)	(iv)	N ;	1	Mark the first answer. If the answer is correct and an additional letter is given then = 0 marks
1	(c)	(i)	<p>Look for ref to , heat loss / cooling , at any point in the answer before awarding any marks</p> <p>large surface area (to lose heat) ; (thin) so , blood flows / (named) blood vessel are , close to the (skin) surface (to lose heat) ; (movement) increases air movement over , skin / surface (to lose heat) ;</p>	2 max	<p>DO NOT CREDIT evaporation of heat IGNORE ref to sweating</p> <p>ACCEPT SA:Vol</p>
1	(c)	(ii)	<p>Needs to be in the context of reducing heat loss from the blood</p> <p>blood loses less heat because , less <u>blood</u> flows to feet / warm <u>blood</u> diverted from arterioles to veins</p> <p>or less <u>blood</u> flows to feet so core body temperature maintained ;</p>	1	<p>DO NOT CREDIT prevents / stops , blood flowing to feet ACCEPT 'extremities' for 'feet' IGNORE ref to vasoconstriction of peripheral arterioles DO NOT CREDIT vasoconstriction of shunt vessels IGNORE ref to countercurrent (as not answering Q)</p>
			Total	10	

Question			Answer	Mark	Guidance
2	(a)	(i)	mitosis ;	1	CREDIT correct spelling only ACCEPT binary fission
		(ii)	in the grex / 3 ;	1	
	(b)	(i)	<u>cell signalling</u> ;	1	
		(ii)	1 attraction of <u>cell(s)</u> to folic acid from bacteria ; 2 attraction of <u>cells</u> to each other by cAMP ; 3 coordinated movement in grex ; 4 differentiation / described, of (grex / slime mould) <u>cells</u> in response to DIF ;	2 max	NOTE must name the chemical involved for description (except mp 3 coordinated movement) ACCEPT attraction of cells to bacteria by folic acid IGNORE makes cells stick together
		(iii)	contains , receptors / glycoproteins / glycolipids / glycocalyx ; for , folic acid / cAMP / DIF ;	2	DO NOT CREDIT <i>consists</i> of receptors
	(c)		17 (hours) ;	1	
Total				8	

Question			Answer	Marks	Guidance
3	(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									
3	(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,
receptor,	beta,	insulin,												
effector,	glycogen,	glycogenesis,												
alpha,	glucagon,	glycogenolysis,												
gluconeogenesis,	facilitated diffusion													

Question			answer	Marks	Guidance
3	(b)	(requires (daily) , insulin / hormone , injections ; is not affected by dietary changes ;	1 max	ACCEPT insulin is not being produced in sufficient quantities
3	(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
4	(a)	(i)	<p>X adenine ;</p> <p>Y ribose ;</p> <p>Z (tri / 3) phosphate(s) ;</p>	3	<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>X IGNORE nitrogenous base / base / A DO NOT CREDIT adenosine</p> <p>Y IGNORE pentose / sugar DO NOT CREDIT ribulose / hexose</p> <p>Z IGNORE chemical formulae (as Q asks for name) DO NOT CREDIT phosphorus / phosphoryl (PO)</p>

Question			Expected Answer		Mark	Additional Guidance
4	(a)	(ii)	1	transfers energy / energy 'currency' / releases energy / universal energy molecule / energy intermediate / (immediate) source of energy ;		1 IGNORE contains energy DO NOT CREDIT produce energy
			2	phosphate(s) can be removed by <u>hydrolysis</u> ;		2 ATP → ADP + P _(i) by <u>hydrolysis</u> or ATP + H ₂ O → ADP + P _(i) (must include water)
			3	to , release / provide , 30 <u>k</u> J (mol ⁻¹) energy ;		3 ACCEPT 28 – 32 <u>k</u> J DO NOT CREDIT produce energy
			4	(energy released for) metabolism / appropriate named reaction / appropriate reaction described ;		4 e.g. • muscle contraction • active transport • phosphorylation • glycolysis • during movement binding to proteins to change their shape IGNORE respiration / photosynthesis unqualified
			5	ADP can attach a phosphate (forming ATP) during , respiration / photosynthesis ;		5 CREDIT during, oxidative phosphorylation / chemiosmosis / substrate level phosphorylation / photophosphorylation
			6	energy released in , small 'packets' (to prevent cell damage) / suitable quantity ;		NOTE 'it releases 30kJ of energy when a phosphate is removed by hydrolysis' = 3 marks (mps 3, 1 and 2)
					3 max	

Question			Expected Answer	Mark	Additional Guidance
4	(b)	(i)	crista ;	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 'cristae' / 'inner mitochondrial membrane' IGNORE 'stalked particles'</p>
4	(b)	(ii)	chemiosmosis / oxidative phosphorylation ;	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 description of chemiosmosis [e.g. • 'ATP synthesis' • 'electron flow along electron carriers'] IGNORE 'aerobic respiration' IGNORE 'electron transport chain' alone (as this is not a process)</p>
4	(c)	(i)	<p>1 <u>substrate</u> respired changes over time ;</p> <p>2 initially respire (mostly) , glucose / carbohydrate ;</p> <p>3 lower / decrease in / 0.75 , RQ indicates (more) , fat / lipid , as substrate</p> <p>or as time goes by (more) lipid is respired ;</p> <p>4 glucose / carbohydrate , used up / decreases (over time) ;</p> <p>5 protein not likely to be used as substrate / protein only used as a last resort ;</p>	3 max	<p>1 Needs to be a clear statement and not just names and not inferred from candidate's complete answer</p> <p>2 IGNORE respiring protein</p> <p>3 IGNORE respiring protein</p> <p>5 'Less protein respired' isn't quite enough for this mp</p>

Question			Expected Answer	Mark	Additional Guidance
4	(c)	(ii)	<p><i>This is a QWC question</i></p> <p>1 peripheral / skin , thermoreceptors / (heat) receptors , stimulated (by decrease in external temp) ;</p> <p>2 (impulses sent to / blood temperature monitored in) hypothalamus / sensory cortex ;</p> <p>3 vasoconstriction of , arterioles / small arteries , to reduce heat loss ;</p> <p>4 (prevents heat loss by) radiation / conduction / convection ;</p> <p>5 increased , metabolic rate / metabolism / respiration , to generate heat (energy) ;</p> <p>6 (release of) adrenaline / thyroxine ;</p> <p>7 shivering / (involuntary) muscle spasms , to generate heat (energy) ;</p> <p>8 erector / hair , muscles raise , (skin) hair / fur , to trap , air / heat ;</p> <p>9 AVP ;</p>	4 max	<p>Only CREDIT answers that refer to preventing a decrease in body temperature – no ora</p> <p>IGNORE negative feedback (Q only about preventing decrease)</p> <p>3 ACCEPT ‘pre-capillary sphincter’ instead of ‘arterioles’ DO NOT CREDIT other blood vessels but allow QWC</p> <p>5 Emphasis needs to be on increase / higher rate / more</p> <p>7 Needs the idea of generating heat not just ‘to keep warm’</p> <p>9 e.g. • specific behavioural response (such as huddling / increased exercise / move to find sun) • involvement of sympathetic nervous system • reduce sweating / reduce panting / stop panting DO NOT CREDIT ‘stop sweating’</p>
		<p>QWC - technical terms used appropriately and spelt correctly ;</p>	<p>Use of three terms from: peripheral, thermoreceptor(s), hypothalamus, cortex, vasoconstriction, metabolic rate / metabolism, adrenaline, thyroxine, erector radiation / conduction / convection</p> <p>Please insert a QWC symbol next to the mark total bracket, 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>		
			Total	[16]	