

Question			Answer	Marks	Guidance
1	(a)	(i)	<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>	<p>2 max</p>	<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>

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Question			Answer	Marks	Guidance	
1	(a)	(ii)	<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 ACCEPT '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 CREDIT 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%; vertical-align: top;"> receptor, effector, alpha, gluconeogenesis, </td> <td style="width: 33%; vertical-align: top;"> beta, glycogen, glucagon, facilitated diffusion </td> <td style="width: 33%; vertical-align: top;"> insulin, glycogenesis, glycogenolysis, </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, effector, alpha, gluconeogenesis,	beta, glycogen, glucagon, facilitated diffusion	insulin, glycogenesis, glycogenolysis,				

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Question			Answer	Marks	Guidance
1	(b)	(i)	requires (daily) , insulin / hormone , injections ; is not affected by dietary changes ;	1 max	ACCEPT insulin is not being produced in sufficient quantities
1	(b)	(ii)	<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	

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2	(a)	(i)	liver ;	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
2	(a)	(ii)	<p>1 (high intake of protein) leads to a large amount of amino acids ;</p> <p>2 (excess) amino acids cannot be stored ;</p> <p>3 <u>amino acids</u> deaminated or <u>amine</u> group / <u>NH₂</u> , removed / converted to ammonia ;</p> <p>4 (large amount of) ammonia enters ornithine cycle (for conversion to urea) ;</p> <p>5 increased , <u>blood</u> / <u>plasma</u> , concentration of urea (leads to more urea in , filtrate / urine) ;</p> <p>6 high concentration of , amino acids / urea , in blood increases water absorption from urine ;</p>	3 max	<p>1 Must emphasise the idea of <i>leading to</i> , more / too many / lots of , amino acids</p> <p>3 DO NOT CREDIT deamination of protein IGNORE amino group</p> <p>4 ACCEPT ref to urea cycle instead of ornithine cycle correct diagram of the cycle</p>
2	(b)		diabetes (mellitus) ;	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 kidney disease / nephritis / kidney failure / pregnancy IGNORE type 1 or 2</p>

Question			Answer	Marks	Guidance
2	(c)	(i)	(human) chorionic gonadotrop(h)in / hCG;	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 phonetic spelling (a vowel between the ch and r) DO NOT CREDIT chronic ACCEPT combinations of lower and upper case letters DO NOT CREDIT letters in the incorrect order (eg hGC)

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Question			Answer	Marks	Guidance
2	(c)	(ii)	<p>1 LH binds to , anti-LH / its complementary (free / mobile / with dye) , antibodies ;</p> <p>2 this (LH-anti-LH) antibody complex moves along (test stick together with urine) ;</p> <p>3 this (LH-anti-LH) antibody complex binds (only) with , immobilised antibodies specific to them / lower band of immobilised antibodies ;</p> <p>4 (only) control antibodies bind with , immobilised antibodies specific to them / upper band of immobilised antibodies ;</p> <p>5 <i>idea that</i> binding of antibody (with dye to its immobilised anti-antibody) produces coloured line ;</p> <p>6 2 lines indicates , positive result / presence of LH or darker line = more LH or 'control' / top , line indicates the strip is working (correctly) or 'control' / top , line alone indicates no LH ;</p>	<p>3 max</p>	<p>ACCEPT joins / attaches , for 'bind' throughout IGNORE 'reacts with' DO NOT CREDIT active site / enzyme references instead of antibodies If a candidate's <u>whole</u> answer is in terms of pregnancy testing, DO NOT CREDIT mps 1, 2 & 3</p> <p>1 ACCEPT hormone for LH 'specific' for 'complementary'</p> <p>2 IGNORE urine moving along the stick on its own</p> <p>5 Award in context of either LH or control line</p> <p>6 DO NOT CREDIT this alternative in context of positive pregnancy result</p>
			Total	9	

Question			Answer	Marks	Guidance
3	(a)	(i)	<p>W (chloroplast outer) membrane / envelope ;</p> <p>X granum / grana ;</p> <p>Y <u>stroma</u> ;</p> <p>Z thylakoid(s) / (intergranal) lamella(e) ;</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>W DO NOT CREDIT cell / plasma , membrane DO NOT CREDIT inner membrane alone but IGNORE if stated together with outer</p> <p>X ACCEPT granal stack / thylakoid stack</p> <p>Y DO NOT CREDIT stoma / matrix / cytoplasm</p>
3	(a)	(ii)	<p>1 (DNA) coding for , gene(s) / protein / enzyme or (ribosome) protein / enzyme , synthesis ;</p> <p>2 (enzymes for production of / proteins for) chlorophyll synthesis / pigment synthesis / photosystem ;</p> <p>3 (protein for) electron , acceptor(s) / carrier(s) ;</p> <p>4 ATP synth(et)ase ;</p> <p>5 (enzyme / PSII) for , photolysis / splitting of water ;</p> <p>6 (enzymes for) Calvin cycle / light independent reaction ;</p>	2 max	<p>DO NOT CREDIT any mps in context of respiration</p> <p>1 IGNORE 'information' / ref to replication DO NOT CREDIT making amino acids</p> <p>3 CREDIT named acceptor / carrier (e.g. NADP / cytochrome)</p> <p>6 CREDIT Rubisco</p>

Question		Answer	Marks	Guidance														
3	(b)	<table border="1"> <thead> <tr> <th>statement</th> <th>letter</th> </tr> </thead> <tbody> <tr> <td>ATP is produced</td> <td>B</td> </tr> <tr> <td>an electron leaves photosystem I</td> <td>B ;</td> </tr> <tr> <td>electrons are passed along an electron carrier chain</td> <td>B ;</td> </tr> <tr> <td>electrons leave both photosystem I and photosystem II</td> <td>N ;</td> </tr> <tr> <td>an electron from a water molecule replaces the electron lost from the photosystem</td> <td>N ;</td> </tr> <tr> <td>the same electron returns to the photosystem</td> <td>C ;</td> </tr> </tbody> </table>	statement	letter	ATP is produced	B	an electron leaves photosystem I	B ;	electrons are passed along an electron carrier chain	B ;	electrons leave both photosystem I and photosystem II	N ;	an electron from a water molecule replaces the electron lost from the photosystem	N ;	the same electron returns to the photosystem	C ;	5	<p>Mark the first answer in each box. 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 lower case letters</p> <p>DO NOT CREDIT 'N and C' <i>instead of</i> B, as they have been asked to use B</p> <p>IGNORE 'N and C' if stated <i>in addition to</i> B in rows 1 and 2</p> <p>ACCEPT B for this row</p>
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		Total	11															

Question			Answer	Marks	Guidance
4	(a)	(i)	link reaction and Krebs cycle ;	1	Mark the first 2 answers. If they are correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks
4	(a)	(ii)	oxidative phosphorylation ;	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 electron transport chain / electron transport system / electron carrier chain IGNORE chemiosmosis DO NOT CREDIT photorespiration
4	(b)	(i)	<p>1 to make the <u>volume</u> of , contents / 'peas' , the same (in the respirometers) ;</p> <p>2 <i>idea that because</i> the <u>volume</u> of peas in A is greater than the volume of peas in B</p> <p>or the peas in A , are bigger / take up more space or the peas in A have absorbed water or the peas in B , are smaller / take up less space ;</p> <p>3 as without the beads there would be more , air / gas / oxygen , in B than in A ;</p>	2 max	<p>1 IGNORE ref to mass / weight</p> <p>2 IGNORE ref to mass / weight must refer to A / soaked / germinating and/or B / dry / dormant</p> <p>3 CREDIT idea that with the presence of beads the volume of gas would be the same</p>

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Question			Answer	Marks	Guidance
4	(b)	(ii)	<p>1 (determined by) finding difference in volume between (30) soaked , seeds / peas and (30) dry , seeds / peas ;</p> <p>2 the difference represents the volume of glass beads required</p> <p>or add the quantity of glass beads necessary to make the volumes (of respirometer contents) equal ;</p> <p>3 calculate / knowing , volume of 1 bead to determine number of beads equivalent to volume required ;</p>	2 max	<p>ACCEPT ref to mass/weight instead of volume throughout (ii) as an error carried forward (ecf)</p> <p>3 CREDIT any suitable <i>method</i> of determining the volume of beads required</p> <p>e.g. <ul style="list-style-type: none"> • displacement • put soaked peas in tube and measure volume; mark; then put dry peas in and add glass beads into tube and top up to mark </p>
4	(c)	(i)	0.014 ; ;	2	<p>Correct answer = 2 marks, even if no working</p> <p>If answer incorrect , not rounded correctly or given to more than 3 dp then ALLOW 1 mark for seeing</p> <ul style="list-style-type: none"> • $\frac{0.27}{20}$ <p>or</p> <ul style="list-style-type: none"> • 0.0135 <p>Only if there is no answer on the dotted answer line, should you look for the answer in the working or in the appropriate place in the table.</p>

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Question			Answer	Marks	Guidance
4	(c)	(ii)	<p><i>at, higher temperature / 25°C</i> increased <u>kinetic</u> energy ;</p> <p>(named respiratory) enzymes / decarboxylases / dehydrogenases , involved ;</p>	2	<p>CREDIT ora for lower temperature</p> <p>IGNORE more collisions / ESCs</p> <p>Needs a clear statement that they are involved in <u>respiration</u></p> <p>IGNORE (named) co-enzymes</p>
4	(c)	(iii)	<p>1 reactions require aqueous medium / reactions need to take place in water / reactions need to take place in solution ;</p> <p>2 enzymes and substrates can move (to collide) in soaked seeds or movement (of reactants) , prevented / limited , in dry seeds ;</p> <p>3 soaked seeds need more , ATP / energy or dry seeds need less , ATP / energy ;</p> <p>4 for , protein synthesis / mitosis / other (named) metabolic reaction ;</p>	2 max	<p>ACCEPT 'germinating' for 'soaked', 'peas' for 'seeds', 'dormant' for 'dry' throughout</p> <p>1 IGNORE ref to reactants dissolving</p> <p>2 IGNORE ref to ESC as the mp is for the idea of mobility</p> <p>3 DO NOT CREDIT 'no' ATP / energy</p> <p>4 CREDIT soaked peas have increased metabolism IGNORE growth / respiration DO NOT CREDIT ref to photosynthesis</p>
			Total	12	

Question		Answer	Marks	Guidance
5	(a)	<p>E (proximal / first / distal / second) convoluted tubule / PCT / DCT ;</p> <p>F (lumen of) Bowman's / renal , capsule ;</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 ACCEPT collecting duct DO NOT CREDIT loop of Henle (as not in cortex) DO NOT CREDIT 'cells of ...' / tube IGNORE 'nephron tubule' / nephron</p>

Question			Answer	Marks	Guidance
5	(b)	(i)	<p>1 afferent arteriole , has diameter greater than that of / is wider than , efferent arteriole ;</p> <p>2 build up of / high , hydrostatic / blood , pressure ;</p> <p>3 endothelium / wall , of , <u>capillary</u> / <u>glomerulus</u> , has , (small) pores / fenestrations ;</p> <p>4 (these allow) ultrafiltration ;</p>	2 max	<p>1 IGNORE different / larger / smaller, without suitable qualification</p> <p>IGNORE thicker / thinner</p> <p>3 ACCEPT holes / gaps instead of pores</p> <p>IGNORE epithelium</p> <p>DO NOT CREDIT cell wall</p> <p>DO NOT CREDIT podocytes / basement membrane if linked to capillary structure</p> <p>IGNORE podocytes / basement membrane if linked to the Bowmans capsule</p>
			<p>QWC – technical terms used appropriately and spelt correctly ;</p>		<p>1</p> <p>Use of three terms from: afferent, efferent, arteriole, hydrostatic, endothelium, fenestrations, ultrafiltration (or derived term)</p> <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>
5	(b)	(ii)	podocyte(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

Question			Answer	Marks	Guidance
5	(c)	(i)	<p><i>if kidney cannot filter so substances remain in blood</i></p> <p>1 increase / high , in urea ; 2 increase / high , in , (named) ions / (named) salts ; 3 increase / high , in water ; 4 AVP ;</p> <p>OR</p> <p><i>if problems cause substances to be lost indiscriminately</i></p> <p>5 decrease / low , in , protein / blood cells ; 6 decrease / low , in , (named) ions / (named) salts ; 7 decrease / low , in , glucose / amino acids / vitamins ; 8 decrease / low , in water ;</p>		<p>Candidate's answer can only come from one section of the mark scheme if type of failure not specified. However, all marks are available if clearly linked to the type of failure.</p> <p>3 IGNORE ref to water potential 4 e.g. • high(er) levels of , creatinine / (named) hormone • high(er) levels of , metabolite / toxin , breakdown</p> <p>for mps 5-8 DO NOT CREDIT 'no' / 'none' / 'zero'</p> <p>7 IGNORE sugar 8 IGNORE ref to water potential</p> <p>Note 'increase in urea' = 1 (mp 1) 'increase in salt and water' = 2 (mps 2 & 3) 'low in protein but high in urea' = 1 (mp 5, but not mp 1 as different type of failure and has not been specified)</p>
				2 max	

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Question			Answer	Marks	Guidance
5	(c)	(ii)	<p><i>if not closely matched</i></p> <p>1 donated kidney will be recognised as , foreign / non-self ;</p> <p>2 antigens / glycoproteins , (on donated kidney) will be different ;</p> <p>3 causing rejection ;</p> <p>4 (response) by immune system ;</p> <p>5 use of immuno-suppressant drugs ;</p> <p>6 ref to need for suitable size in specific case (e.g. if recipient is a small child) ;</p>	<p>3 max</p>	<p>CREDIT ora for all mark points</p> <p>1 Needs the idea of the body <i>recognising</i> the foreign nature</p> <p>4 CREDIT a description of immune response DO NOT CREDIT ref to <u>autoimmunity</u></p>
			Total	11	

Question		Answer	Marks	Guidance
6	(a)	<p>1 receptors ;</p> <p>2 intensity ;</p> <p>3 chemical ;</p> <p>4 potential / value ;</p> <p>5 impulse ;</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>1 ACCEPT receptor cells DO NOT CREDIT neurones / organs</p> <p>2 IGNORE brightness DO NOT CREDIT frequency</p> <p>3 IGNORE volatile / soluble</p> <p>4 ACCEPT 'level' / '(needed) for depolarisation' IGNORE numerical value quoted / 'receptor' DO NOT CREDIT action potential</p> <p>5 ACCEPT action potential DO NOT CREDIT message / signal / information / stimulus</p>

Question			Answer	Marks	Guidance
6	(b)	(i)	<p><i>the motor neurone - structure</i></p> <p>the cell body is at (one) end of the , neurone / cell or the cell body is in , brain / spinal cord / CNS or dendrites connected (directly) to cell body or long(er) axon or no dendron or axon , connects to / ends at , effector / motor end plate ;</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>IGNORE ref to cell size / myelin(ation)</p> <p>DO NOT CREDIT at end of axon / nerve</p> <p>IGNORE reference to dendrite length</p> <p>CREDIT ora for sensory i.e. cell body is at centre of cell or cell body is in PNS or dendrites at the end(s) of , axon / dendron or short(er) axon or dendron present or connects to / starts at , receptor</p>

Question			Answer	Marks	Guidance
6	(b)	(ii)	<p><i>the motor neurone - function</i> carries , impulse(s) / action potential(s) , from , brain / spinal cord / CNS / relay neurone or carries , impulse(s) / action potential(s) , to , effector / muscle / gland ;</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 IGNORE refs to 'connects ...' DO NOT CREDIT message / signal / information / stimulus DO NOT CREDIT message / signal / information / stimulus</p> <p>CREDIT ora for sensory i.e. carries , impulse(s) / action potential(s) , to , brain / spinal cord / CNS / relay neurone or carries , impulse(s) / action potential(s) , from receptor</p>
			Total	7	