

5(a)	feature	ADH	glucagon	insulin	
	binds to receptors on cell surface membranes	✓	✓	✓	;
	results in molecules moving from cells into the blood	✓	✓	×	;
	is secreted as a result of detection by osmoreceptors	✓	×	×	;
5(b)	<i>any four from:</i> 1 impulses / action potentials / neurotransmitters, in nervous system <u>and</u> hormones in endocrine system ; 2 electrical in nervous system <u>and</u> chemical in endocrine system ; 3 neurones / nerve cells, in nervous system <u>and</u> blood in endocrine system ; 4 effects are / target is, specific / localised, in nervous system <u>and</u> (can be) widespread in endocrine system ; 5 effect / response, happens quickly in nervous system and slowly in endocrine system ; 6 effect / response, lasts a short time in nervous system <u>and</u> long time in endocrine system ; 7 AVP ;				
5(c)(i)	C ;				
5(c)(ii)	B ;				
5(c)(iii)	1 (D / it), shortens / contracts / decreases ; <i>and any three from:</i> 2 calcium ions / Ca ²⁺ , bind to troponin ; 3 tropomyosin, moves / shifts position / exposes binding sites on actin ; 4 myosin (head) binds to actin / myosin-actin cross-bridges form ; 5 power stroke / myosin head, pulls actin ; 6 more actin, enters / overlaps with, A band / B or more overlap between actin and myosin ;				
9(a)	(X =) (renal) pelvis ; (Y =) medulla ;				
9(b)	<i>any four from:</i> 1 glucose oxidase (present / immobilised, in sensor / on strip) ; 2 glucose → hydrogen peroxide ; 3 hydrogen peroxide (oxidised) → oxygen / electrons ; 4 (magnitude of) e– flow / current / voltage, (generated) is proportional to, hydrogen peroxide / glucose, concentration ; 5 digital / numerical / quantitative, reading / result / value (on screen) ; 6 AVP ;				

6(a)	<i>any four from :</i> 1 less / no, PKB, activated / stimulated ; 2 fewer / no, vesicles, move to / fuse with, cell surface membrane ; 3 fewer / no, GLUT4 (transport proteins) added to (cell surface) membrane or (cell surface) membrane, less / not, permeable to glucose ; 4 less / no, glucose taken up by facilitated diffusion (into muscle cells) ; 5 blood glucose concentration, (remains) high(er) / does not decrease ;
6(b)	<i>any seven from :</i> 1 (biosensor has) glucose oxidase (immobilised on recognition layer) ; 2 blood sample added ; 3 glucose (in blood) passes through, partially / selectively, permeable membrane ; 4 glucose oxidase, oxidises glucose / converts glucose / catalyses glucose reaction ; 5 gluconic acid and hydrogen peroxide formed ; 6 reaction converted to a current (by transducer) ; 7 current is amplified ; 8 digital / numerical / quantitative, reading ; 9 size of current is proportional to glucose concentration ; 10 instant result / accurate ;

6(a)(i)	1 <u>blood glucose concentration</u> increases until 30 minutes ; 2 decreases to original value / returns to 5 mmol dm ⁻³ , by 90 minutes ;
6(a)(ii)	83.3 ; ;
6(a)(iii)	<i>any two from:</i> 1 reduce intake of (named) carbohydrate ; 2 physical exercise ; 3 inject insulin ; 4 AVP ;
6(b)	<i>any seven from :</i> 1 glucagon is, cell-signalling molecule / ligand / first messenger ; 2 binds to receptor on liver cell (surface) membrane ; 3 G-protein activated ; 4 aden(yl)yl cyclase activated / formation of cAMP ; 5 <i>ref. to</i> second messenger ; 6 enzyme cascade / signal amplified ; 7 glycogenolysis / glycogen hydrolysed to glucose ; 8 gluconeogenesis / amino acids → glucose / triglycerides → glucose ; 9 glucose released into blood ; 10 AVP ;

6(a)(i)	P: <u>selective reabsorption</u> ; Q: osmoregulation ; R: ultrafiltration ;
6(a)(ii)	P: proximal convoluted tubule ; Q: collecting duct / distal convoluted tubule ; R: Bowman's capsule ;
6(b)	1 B / interstitial fluid / tissue fluid / medulla, has more, salt / sodium chloride / Na^+ / Cl^- ; <i>plus one from:</i> 2 salt gradient helps reabsorb water from collecting duct ; 3 AVP ;
7(a)	<i>any four from:</i> 1 insulin / it, is a <u>hormone</u> ; 2 (described) stimulus causes insulin to be secreted from (named) endocrine, gland / tissue / cells ; 3 insulin travels in blood ; 4 binds to receptors on (named) target <u>cells</u> ; 5 to cause (described) response ; 6 AVP ;
7(b)(i)	<i>any four from:</i> 1 at 21 min, blood glucose concentration / it, rises to $110 \text{ mg } 100 \text{ cm}^{-3}$; 2 (high / increase in, blood glucose concentration) detected by pancreas / causes response in pancreas ; 3 insulin rises to 500 pmol dm^{-3} ; 4 (insulin) increase GLUT proteins in membrane / increases glucose uptake into cells / increases cell permeability to glucose or (insulin) increases rate of respiration of glucose ; 5 (insulin) causes / stimulates, glycogenesis / lipogenesis ; 6 (mean) blood glucose concentration / it, falls, to normal / within normal range / below starting point / to set point ;
7(b)(ii)	<i>any three from:</i> 1 blood glucose concentration falls as glucose is respired ; 2 blood glucose concentration falls below, set point / normal ; 3 insulin, secretion / release, stops ; 4 <u>glucagon</u> (secreted / released / rises) ; 5 glycogen, (in cells) converted to glucose or glycogenolysis ; 6 (stored) protein / fat, converted to glucose or gluconeogenesis or (stored) protein / fat, used for respiration ;