Question			Expected Answer	Mark	Additional Guidance
1	(a)	(i)	vein / venule ;	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** further qualification (e.g. central / hepatic) **but** **DO NOT CREDIT** inappropriate name (e.g. renal vein / hepatic portal vein)
1	(a)	(ii)	hepatocyte(s) / hepatic cells ;	1	**IGNORE** 'liver cells' (as given in Q) and 'sinusoid cells' A list must include 'hepatocytes' or 'hepatic cells' and not include an incorrect cell e.g. hepatocytes and Kupffer cells = 1 hepatocytes and α cells = 0 liver cells and Kupffer cells = 0
1	(b)		deamination ; carbon dioxide / CO_2 ; urea / $CO(NH_2)_2$; water / H_2O ;	4	**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** If a formula is given for compounds D, E and F then the formula given must be correct in order to be awarded the mark e.g. **E** 'urea ($CONH_2$)' = 0 as the formula is incorrect

Question			Expected Answer	Mark	Additional Guidance
1	(c)	(i)	***This is a QWC question***		**Max 2 (instead of 3) for content if use the term , receptor / antigen / enzyme , *throughout* instead of antibody**
			1 (testing for) **human chorionic gonadotrophin** / hCG ;		*1* **ACCEPT** HCG This mark can be awarded for hCG but the name must be given in full for QWC
			2 hormone small so can pass from blood into **filtrate** (at Bowman's capsule) ;		
			3 **monoclonal** / **immobilised** , **antibodies** / immunoglobulin , on stick ;		*3* **ALLOW** 'strip' instead of stick
			4 antibodies attached to , marker / dye ;		
			5 hormone , binds / **complementary** , to antibody ;		*5* **IGNORE** specificity
			6 (triggers) appearance of colour / line becomes visible ;		
			7 AVP ;		*7* e.g. • reference to the second line to validate test • different antibody for second line • 2 coloured lines = pregnant
				3 max	
			QWC - technical terms used appropriately and spelt correctly ;	**1**	Use of **three** terms from: **human chorionic gonadotrophin, filtrate, monoclonal, immobilised, antibody(ies), complementary**

Question			Expected Answer		Mark	Additional Guidance
1	(c)	(ii)				**IGNORE** enhances performance (as given in Q)
			1	fairness / giving unfair advantage / does not give an 'even playing field' ;		*1* **ACCEPT** comment about cheating **IGNORE** idea of should be available to all
			2	*idea of* health risks / dangerous / unhealthy / fatal / side effects ;		*2* **IGNORE** 'has an effect on health' as must imply negative effect
			3	specified health risk ;		*3* e.g. • depression • aggression • liver , damage / failure • heart attack • masculinisation of female athletes • feminisation of male athletes • infertility
			4	*idea of* distrust of 'outstanding' performances / does not reflect athlete's natural talent / sport should reflect athlete's natural talent ;		
			5	*idea of* pressure to keep up with rival competitors ;		
			6	*idea that* can train for longer (without tiring) / can respire longer (without tiring) / can recover from injury quicker / can build up muscle mass ;		
			7	AVP ;	3 max	*7* e.g. • up to the individual to decide • idea that athletes should be role models
				Total	**[13]**	

Question			Expected Answers				Marks	Additional Guidance
2	(a)				*excretion*	*secretion*		**One mark per row.** **CREDIT** converse statements on either side or unmatched statements for each **IGNORE** name or type of product without qualification **DO NOT CREDIT** any ref to egestion in 'excretion'
			1	*one difference*	(metabolic) waste ***or*** toxin / harmful ***or*** substance is to be removed from body ***or*** does not use vesicles	useful product ***or*** used in cell communication (e.g. to target tissues) ***or*** released from glands (ducts or ductless) ***or*** uses vesicles ***or*** remain in body	;	
			2	*one example of a product*	urea / carbon dioxide / water / bile *pigment* / named example	hormone / enzyme / antibodies / mucus / bile *salts* / neurotransmitter / named example	;	2 **IGNORE** sweat / urine / bile / saliva / salt / (named) digestive juice

Question			Expected Answers			Marks	Additional Guidance
			3	*one similarity*	requires ATP ***or*** (involved in) homeostasis ***or*** (compounds) produced by cell(s) / produced by metabolism / need to cross membrane / need to move through membrane / need to leave cell / (may be) transported in blood ;	3	**CREDIT** method of leaving cell e.g. exocytosis **IGNORE** going into cells (as some excretory products do)

Question			Expected Answers		Marks	Additional Guidance
2	(b)				S & C	**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** **CREDIT one statement and a suitable explanation related to that (first) given statement** (e.g. S3 + E3 but not S4 + E1) **DO NOT AWARD 2 marks for 2 statements or 2 explanations**
			S1 **E1**	glucose is not the only substrate / there are other substrates ; named alternative substrate ; ***or***		**1** 'fats can (also) be respired' = E1 'fats can be respired as well as glucose' = S1 + E1
			S2 **E2**	ATP is produced / energy is released ; (by) substrate level / oxidative, phosphorylation ; **or**		**S2** **DO NOT CREDIT energy** produced / made / created
			S3 **E3**	ATP / energy, required ; (for) phosphorylation / glycolysis ; ***or***		
			S4 **E4**	is not a single step reaction / other steps involved / other products / other intermediates ; named stage(s) / named intermediate compound(s) ; **or**		**4** Krebs cycle / ETC , happens = E4 'other stages such as link reaction are involved' = S4 + **E4** E4 e.g. pyruvate / acetyl CoA / acetate **IGNORE** NAD(H) / FAD(H) / ATP
			S5 **E5**	enzymes are involved ; dehydrogenation / decarboxylation / oxidative phosphorylation / named (respiratory) enzyme ; ***or***		
			S6 **E6**	coenzymes / NAD, involved ; oxidative phosphorylation / link reaction / Krebs cycle / glycolysis ; ***or***		**S6** **DO NOT CREDIT** NADP
			S7 **E7**	glucose does not, combine / react , (directly) with oxygen ; (oxygen) used in oxidative phosphorylation / is final electron acceptor / is final hydrogen acceptor ;	**2**	

Question			Expected Answers		Marks	Additional Guidance
2	(c)	(i)				**Max 1 if referring to insulin receptors**
			1	unable to produce (enough) insulin / do not secrete insulin / produces ineffective insulin ;		1 **DO NOT CREDIT** 'excrete' as incorrect
			2	insulin-producing cells / beta cells / islets of Langerhans, not functioning (correctly) / damaged / destroyed / attacked ;		2 **ALLOW** lack of beta cells / ref to b cells **DO NOT CREDIT** alpha cells / B cells (if lymphocytes implied)
			3	by (body's own) immune system / by (body's own) antibodies / auto-immune disease ;		3 **CREDIT** description
			4	(idea of) family history / genetic / hereditary ;		
			5	(condition can be) triggered by , virus / environmental factor ;	2 max	5 e.g. • shock • drugs side effect • (pancreatic) cancer • infection / disease
2	(c)	(ii)				**Mark the first 3 responses only**
			1	increasing age / older / ageing / more prevalent over 40 ;		1 **DO NOT CREDIT** age without 'older' implication
			2	(idea of) family history / genetic / hereditary ;		
			3	(more common in) males ;		
			4	(more common in) some ethnic groups / African / Afro-Caribbean / Asian / Hispanic / Oceanic ;		
			5	obese / overweight / fat around abdomen ;		5 **CREDIT** 'apple shaped'
			6	high / frequent, intake of , sugar / highly processed food / high GI food ;		6 **IGNORE** 'poor diet' / 'bad diet' / 'unhealthy diet' **IGNORE** fat / carbohydrate , in diet
			7	lack of physical activity / sedentary lifestyle ;		
			8	high blood pressure ;		8 **CREDIT** history of , heart attack / stroke
			9	excessive alcohol intake ;	3 max	9 idea of *too much* is needed
				Total	**10**	

Question			Expected Answers	Marks	Additional Guidance
3	(a)		ultrafiltration ;	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** This term required but **ACCEPT** phonetic spelling
3	(a)		17.9 ; ;	2	**Correct answer = 2 marks** If answer incorrect, not rounded or incorrectly rounded then allow 1 mark for working 125 ÷ 700 **or** an unrounded answer e.g. 17.857412
3	(b)	(i)	(cuboidal) epithelium / epithelial ;	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** 'epithelium **cells'** / 'ciliated epithelium' / 'squamous epithelium' / endothelium **ALLOW** columnar epithelium
3	(b)	(ii)	microvilli / microvillus ;	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** 'brush border' **DO NOT CREDIT** cilia

Question			Expected Answers	Marks	Additional Guidance
3	(b)	(iii)	***This is a QWC question***		
			1 selective **reabsorption** ; **2** of glucose and amino acids ; **3** **co-transport** / ***facilitated*** **diffusion** / uptake described ; **4** water follows by **osmosis** so concentration of, ions / nitrogenous waste / urea / remaining substances , increases ; **5** AVP ;	**S & C** **3 max**	**2** **DO NOT CREDIT** if glucose & amino acids **& proteins** **3** **ACCEPT** direct uptake , of glucose / amino acids, by active transport **5** e.g. • microvilli provide large surface area for uptake • many mitochondria provide energy for uptake • many brush border enzymes (ATPase) for active uptake • active secretion of nitrogenous waste into lumen
			QWC - technical terms used appropriately and spelt correctly ;	**1**	Use of **three** terms from: **reabsorption** (or derived term), **co-transport** (or derived term), **facilitated diffusion**, **osmosis**

Question			Expected Answers	Marks	Additional Guidance
3	(c)	(i)	**L** artery / shunt / vein (at arterial end of shunt) **AND** **M** vein ;	1	**IGNORE** names of artery / vein (e.g. renal) **DO NOT CREDIT** aorta and vena cava
3	(c)	(ii)	so that clots don't form, while in the (dialysis) machine / during dialysis ;	1	**ALLOW** congeal instead of clot **IGNORE** prevents clotting in the body **IGNORE** clumping
3	(c)	(iii)	*idea of* allowing blood to clot normally after treatment ;	1	**CREDIT** preventing low blood pressure (as low viscosity)
3	(c)	(iv)	(simple) <u>diffusion</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** dialysis **DO NOT CREDIT** facilitated diffusion
3	(c)	(v)	*idea that* it, maintains diffusion gradient / maintains concentration gradient / maximises diffusion gradient / maximises concentration gradient / allows maximum removal of waste / allows maximum rate of diffusion / AW ;	1	**IGNORE** unqualified ref to countercurrent e.g. • solutions in contact over greater distance • provides maximum contact for exchange • allows exchange over longer distance **IGNORE** ref to surface area
			Total	14	

Question			Answer	Mark	Guidance
4	(a)	(i)	acetylcholine **;**	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** **CREDIT** other correct examples e.g. dopamine / noradrenaline / norepinephrine **ACCEPT** ACh
4	(a)	(ii)	***either*** post-synaptic membrane **;** (TRPA1) prevents attachment of (named) neurotransmitter to its receptor **;** ***or*** pre-synaptic membrane / (pre)synaptic knob / axon terminal / bouton / synaptic bulb **;** (TRPA1) prevents **,** release of (named) neurotransmitter / influx of calcium ions **;**	2	**Explanation must match correct location for 2 marks.** **If no location stated then explanation can be awarded independently for 1 mark.** **Incorrect location = 0 marks.** **IGNORE** 'interferes' (as in Q) **IGNORE** ref to dendrites / cell bodies /neurone(s) / synapse(s) **CREDIT** causes hyperpolarisation **DO NOT CREDIT** idea that TRPA1 is a free protein that will enter the ACh receptor and block it (rather like a competitive inhibitor occupying the active site of an enzyme) **ACCEPT** Ca^{2+}

Question			Answer	Mark	Guidance
4	(b)	(i)	**A** sinusoid **;** **B** (branch of) bile duct **;** **C** (branch of) hepatic portal <u>vein</u> **;** **D** (branch of) hepatic artery / arteriole **;** **E** (branch of) hepatic / central **,** <u>vein</u> **;**	5	**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** **B** **DO NOT CREDIT** canaliculus **C** **IGNORE** inter lobular **but** **DO NOT CREDIT** intra lobular **D** **IGNORE** inter lobular **but** **DO NOT CREDIT** intra lobular **E** **IGNORE** intra lobular **but** **DO NOT CREDIT** inter lobular
4	(b)	(ii)	**1** because there is not enough <u>glutathione</u> / <u>glutathione</u> has run out **;** **2** enzyme catalysing glutathione reaction is **,** working at V_{max} / inhibited / in short supply **;** **3** the NAPQI cannot **,** cross the cell (surface) membrane / leave the cell / leave (named) organelle **;**	1 max	**2** **DO NOT CREDIT** in context of P450 system **3** **IGNORE** ref to excretion
4	(b)	(iii)	hepatocytes **<u>and</u>** <u>mitosis</u> / <u>mitotic</u> (division) **;**	1	**CREDIT** (liver) stem cells / hepatic cells **IGNORE** liver cells unqualified **DO NOT CREDIT** Kupffer cells **ONLY CREDIT** correct spelling for mitosis / mitotic
			Total	**10**	