Mark scheme - Excretion (The Kidney)

Question			Answer/Indicative content	Marks	Guidance
1			D	1	
			Total	**1**	
2			D ✓	**1**	**Examiner's Comments** Only stronger candidates appeared to understand the processes involved in peritoneal dialysis. Many candidates were challenged by the nature of the question requiring them to rule out the incorrect statements.
			Total	**1**	
3			B ✓	**1**	**Examiner's Comments** This question proved challenging for some candidates with option **D** being the most commonly seen incorrect response.
			Total	**1**	
4			C ✓	1	**Examiner's Comments** This question proved challenging for some and required skills in applying knowledge to novel context to choose the most appropriate response.
			Total	**1**	
5			C ✓ **ALLOW** A	1 (AO2.5)	**Examiner's Comments** Candidates showed good knowledge and understanding of the role of the hypothalamus in the production of ADH and its role in osmoregulation.
			Total	**1**	
6	a	i	A = Glomerulus (1) B = Bowman's capsule (1)	2	**ALLOW** capillary (network)
		ii	190 (1)(1)	2	**AWARD ONE MARK** for: 0.03 or 3 / 160
	b	i	initial / AW, glucose concentration (on both sides	2	

			on the membrane) (1) volume of solution (1) length / diameter, of dialysis tubing (1) type / brand, of dialysis tubing (1)		
		ii	*alpha glucose* H above ring / OH below ring, on, carbon 1 / C1 **ORA** (1)	1	**ALLOW** a suitable annotated diagram
		iii	*(less reabsorption because) idea of* fewer H^+ ions in PCT cells (1) less / no, co-transport / facilitated diffusion, of Na^+ ions, into cells / from lumen (1) less / no, active transport of Na^+ ions into, blood (1)	3	
	c		Conclusion: No because month 3 is above 60 cm^3 min^{-1} (1) Month 2: 48.5 cm^3 min^{-1} Month 3: 67.2 cm^3 min^{-1} Month 4: 58.2 cm^3 min^{-1} (1)	2	 The second mark is for 3 correct calculations
			Total	**12**	
7		i	ribosomes ✓ mitochondria ✓ (rough / smooth) endoplasmic reticulum ✓ Golgi apparatus ✓ vesicle ✓ centriole ✓	3 max	**IGNORE** organelles not present in this cell, e.g. flagellum / chloroplast
		ii	one cell drawn **AND** clear continuous lines ✓ correct proportions ✓ uses ≥50% of area provided ✓	4 max	**DO NOT ALLOW** more than one cell **DO NOT ALLOW** ragged lines / any shading **ALLOW** if it is clear which cell the candidate has attempted to draw

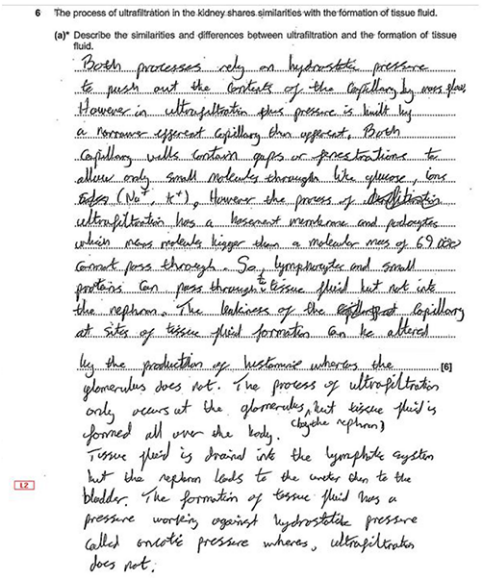
			labels: label lines drawn with a ruler to correct feature ✓ cell membrane **AND** nucleus **AND** cytoplasm ✓		**IGNORE** any annotations not mentioned here **DO NOT ALLOW** arrow heads
			Total	**7**	
8	a	i	**A ✓**	**1**	*mark the first letter only* **IGNORE** name unless contradicts a stated letter **Examiner's Comments** Generally, it appeared to Examiners that candidates were not fully familiar with the histology of the kidney and thus could not link what was shown in the image to the functional aspects required for responding to **Q22(a)(i)** and **(ii)**. Stronger candidates achieved maximum marks for both question parts, but there was no particular pattern evident in the incorrect responses.
		ii	**B, D ✓**	**1**	*If more than two letters given, 0 mark* **IGNORE** names unless contradicts a stated letter **Examiner's Comments** Generally, it appeared to Examiners that candidates were not fully familiar with the histology of the kidney and thus could not link what was shown in the image to the functional aspects required for responding to **Q22(a)(i)** and **(ii)**. Stronger candidates achieved maximum marks for both question parts, but there was no particular pattern evident in the incorrect responses.
	b	i	*similarities* **S1** both use <u>active transport</u> ✓ **S2** both involve, co-transport / described ✓ **S3** both involve <u>selective</u> reabsorption ✓	**3 max**	*maximum two marks for similarities or differences* **IGNORE** sodium / Na

			S4 both involve use of, sodium ions / Na^+ ✓ *differences* **D1** DCT involves use of, calcium ions / Ca^{2+} ✓ **D2** (co-transport in) DCT involves ions only ✓ **D3** PCT involves ions and (named) molecules ✓		**IGNORE** calcium / Ca **e.g.** glucose / amino acid(s) **Examiner's Comments** **Q22 (b)(i)** required a comparison of similarities and differences between the convoluted tubules and some candidates struggled to structure their responses appropriately. Weaker candidates were inclined to repeat the information given without processing and in some cases it was unclear whether the comment related to the distal convoluted tubule (DCT), the proximal convoluted tubule (PCT), or both. Good responses were seen where candidates had drawn a table to show similarities and differences thereby clarifying the comparative aspects. Candidates should be encouraged to practise questions involving the command word *'compare'* to develop techniques for expressing similarities and differences within a response.
		ii	*symptom* high volume of / excess, urine **OR** always thirsty / AW ✓ *explanation* fewer / AW, aquaporins in the (plasma) membrane (of collecting duct cells) ✓	**2**	**ALLOW** large amount / lots, of urine **IGNORE** reference to, dilute urine / water potential / frequency of urination **ALLOW** protein water channels for aquaporins **Examiner's Comments** In **Q22(b)(ii)** many candidates recognised that there would be large quantities of urine produced but there were also responses that referred to dilute urine or increased frequency of urination which did not gain credit. Few candidates mentioned aquaporins for mark point two and of those that did mention it some had the idea that

					there would be more aquaporins inserted in the cell surface membrane or failed to mention membrane at all in their response.
	c	i	**1** have already / are, differentiated / specialized (so cannot divide) ✓ **2** are in, G_0 (phase of cell cycle) / resting phase ✓ **3** *idea that* shape is (too), irregular / asymmetrical (so cannot divide) ✓ **4** cytoskeleton cannot function / spindle (fibres) cannot form✓ **5** (if mitosis occurred) it would alter, number / size, of the, gaps / fenestrations ✓ **6** *idea that it* would alter an aspect of ultrafiltration ✓	**3 max**	**ALLOW** cannot pass G1 checkpoint / cannot go into S phase / remains in G_1 e.g. (podocyte) has projections (so cannot divide) **ALLOW** for aspect of ultrafiltration e.g. different sized molecules can pass through e.g. no / less, ultrafiltration e.g. changes rate of ultrafiltration e.g. changes composition of filtrate **Examiner's Comments** In **Q22(c)(i)** there were some excellent responses where candidates recognised that podocytes must already be differentiated and so in the G_0 stage. A surprisingly high number of candidates incorrectly stated that podocytes do not have a nucleus and that this is the reason why they could not undergo mitosis.
		ii	(adult stem cells) are <u>multipotent</u> ✓ (differentiate to) become any <u>cell</u> type within, kidney / nephron (tissue) ✓	**2**	**DO NOT ALLOW** totipotent / pluripotent **ALLOW** (adult stem cells) can, differentiate / specialise **Examiner's Comments** Many candidates knew that adult stem cells had the ability to differentiate to achieve mark point one in **Q22(c)(ii)**, but some contradicted their response by using the incorrect term, i.e. totipotent or pluripotent.
			Total	**12**	

9	a		**Level 3 (5-6 marks)** Correctly describes similarities **and** differences between the processes *There is a well-developed line of reasoning, which is clear and logically-structured and uses scientific terminology at an appropriate level. All the information presented is relevant and forms a continuous narrative.* **Level 2 (3-4 marks)** Correctly describes a similarity and a difference between the processes *There is a line of reasoning presented with some structure and use of appropriate scientific language. The information presented is mostly relevant.* **Level 1 (1-2 marks)** Correctly describes similarities or differences between the processes *The information is communicated with only a little structure. Communication is hampered by the inappropriate use of technical terms.* **0 marks** No response or no response worthy of credit.	**6**	**Indicative scientific points may include** *Similarities:* • Small molecules are filtered from/diffuse out of the blood. • Both processes occur in capillaries. • Large molecules/proteins/ cells, remain in the blood. • High (hydrostatic) pressure in both processes. • Many molecules (e.g. water, sugars, ions) are reabsorbed back into capillaries. • Blood vessels become narrower to maintain (hydrostatic) pressure • Hydrostatic pressure greater than oncotic pressure in both • Neutrophils / lymphocytes, can pass through in both • Both involve basement membranes *Differences:* • Filtrate enters the Bowman's capsule and then the PCT in the kidney, but tissue fluid bathes cells/enters intercellular space. • Molecules that are not reabsorbed by capillaries form urine in the kidney, but molecules that are not reabsorbed from tissue fluid will, enter cells / form lymph. • Blood filtered through 3(named) layers in ultrafiltration, but only 1 (named) layer in formation of tissue fluid • knot of capillaries in ultrafiltration but a network of capillaries in formation of tissue fluid **<u>Examiner's Comments</u>** This was the more difficult of the Level of Response questions, but examiners saw the full range of marks credited. Those candidates who took the lead from the question and organised their answer into similarities and then differences gave

					significantly more coherent responses and were credited communication marks. Those who jumped around in their thinking, which was reflected in the poor organisation of the answers, lost the communication mark. Similarly, some listed features of the 2 systems independently and made little attempt to compare them and the communication mark was deducted. Similarities were more common – most candidates identified high hydrostatic pressure, small molecules to leave and large molecules (e.g. proteins) held back as similarities. Hence the majority of candidates succeeded in reaching at least L1 with 2 similarities. Correct differences were less common. The most common differences mentioned were the differences in number of filtering layers, and the location of the 2 processes. Common misconceptions seen involved misunderstanding the role of oncotic pressure in both and lack of awareness that ultrafiltration occurred at the Bowman's capsule and nowhere else in the kidney tubule. Weaker candidates confused ultrafiltration with selective reabsorption, and/or the formation of tissue fluid with its reabsorption and therefore wrote irrelevant answers. A tip for candidates would be to use sub headings to ensure they are covering both areas of the question. **Exemplar 3**



6 The process of ultrafiltration in the kidney shares similarities with the formation of tissue fluid.

(a)* Describe the similarities and differences between ultrafiltration and the formation of tissue fluid.

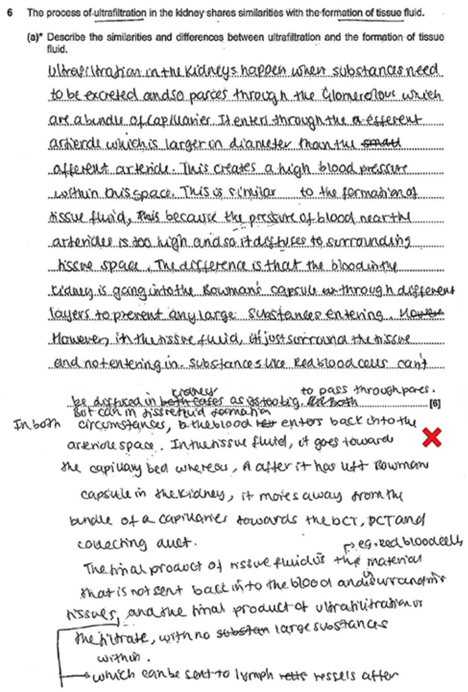
Both processes rely on hydrostatic pressure to push out the contents of the capillary by mass flow. However in ultrafiltration this pressure is built by a narrower efferent capillary than afferent. Both capillary walls contain gaps or penetrations to allow only small molecules through like glucose, ions (Na+, K+). However the process of deultration ultrafiltration has a basement membrane and podocytes which mean molecule bigger than a molecular mass of 69 kDa cannot pass through. So, lymphocytes and small proteins can pass through tissue fluid but not into the nephron. The leakiness of the capillary at sites of tissue fluid formation can be altered by the production of histamine whereas the glomerulus does not. The process of ultrafiltration only occurs at the glomerulus (bowmans capsule nephron) but tissue fluid is formed all over the body. [6]

Tissue fluid is drained into the lymphatic system but the nephron leads to the ureter then to the bladder. The formation of tissue fluid has a pressure working against hydrostatic pressure called oncotic pressure whereas, ultrafiltration does not.

L2

This candidate achieved a Level 3 for this response. It fulfilled the need for several similarities (both processes involve hydrostatic pressure and filtering of small molecules through capillary walls) and several differences (location of the processes, and what happens to the molecules following the two processes). Generally, the response is well organised, despite the incorrect statements about oncotic pressure and histamine.

Exemplar 4

<table>
<tr><td></td><td></td><td></td><td></td><td></td><td> 
6 The process of ultrafiltration in the kidney shares similarities with the formation of tissue fluid.
(a)* Describe the similarities and differences between ultrafiltration and the formation of tissue fluid.
Ultrafiltration in the kidneys happen when substances need to be excreted and so passes through the Glomerolous which are a bundle of capillaries. It enters through the efferent arteriole which is larger in diameter than the afferent arteriole. This creates a high blood pressure within this space. This is similar to the formation of tissue fluid, this because the pressure of blood near the arteriole is too high and so it diffuses to surrounding tissue space. The difference is that the blood in the kidney is going into the Bowman's capsule through different layers to prevent any large substances entering. However, in the tissue fluid, it just surround the tissue and not entering in. Substances like Red blood cells can't be diffused in kidney as too big, to pass through pores. but can in tissue fluid formation [6]
In both circumstances, the blood enters back into the arteriole space. In the tissue fluid, it goes toward the capillary bed whereas, after it has left Bowman capsule in the kidney, it moves away from the bundle of a capillaries towards the DCT, PCT and collecting duct.
The final product of tissue fluid is the material that is not sent back into the blood and surrounding tissues, e.g. red blood cells, and the final product of ultrafiltration is the filtrate, with no large substances within. which can be sent to lymph vessels after

In this case, we have a similarity- the high pressure needed in both processes- and a difference - where the processes occur- so it achieves a Level 1. It is not easy to pick out these points as the terminology used is not clear. There is also a lot of irrelevant material and so this response loses its communication mark.</td></tr>
<tr><td></td><td>b</td><td>i</td><td>age ✓
(because) GFR / kidney function , declines with age ✓

gender ✓
(because) men and women have different muscle mass ✓

exercise / muscle activity / muscle mass / fitness / pregnancy / body mass✓
(because this will) alter, metabolism of creatine (phosphate) / production of creatinine ✓</td><td>4 max</td><td>Mark first two characteristics given

Only award mark for explanation if correctly linked to characteristic

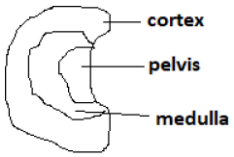
IGNORE chances of kidney failure increase with age

ALLOW ‘more / less, creatinine / product (in blood)’
ALLOW 'more / less, creatine (in muscle)
ALLOW use of creatine supplements

<u>Examiner’s Comments</u>

Many candidates used age, exercise or diet as the two characteristics. These were often explained well. Less able candidates did not comprehend the question fully, and listed causes of kidney failure or other medical conditions such as high blood pressure,</td></tr>
</table>

			diet ✓ (because this will) affect levels of, creatine (phosphate) / creatinine (in the blood) ✓ ethnicity / genetic make up ✓ different alleles, affect metabolism of creatine (phosphate) / production of creatinine ✓		diabetes and heart disease as factors to consider, which were not relevant to the way in which GFR was being measured.
		ii	idea that large proteins, should remain in the blood / not enter, Bowman's capsule / nephron ✓	**1**	e.g. 'proteins / albumin, too large to cross the basement membrane' ' proteins are too large to be filtered and be present in the urine' **Examiner's Comments** Candidates generally had the right idea, but forfeited the mark through an inability to express themselves clearly. Better answers referred to the large molecular size of albumin. Many thought the damage was a result of a problem with reabsorbing the protein. A very common error was in using the term 'filtered out' or 'not filtered out' – and it was difficult to understand what the candidate was trying to express with this terminology.
			Total	**11**	
10	a		line drawing with clear continuous lines ✓ pelvis, medulla and cortex correctly labelled ✓	2 (AO1.1) (AO2.3)	**ALLOW** a variety of shapes and sizes for the cortex medulla and pelvis (but they must be in the correct positions and clear) **ALLOW** any orientation of drawing e.g. pelvis on the left **DO NOT ALLOW** incomplete, overlapping or sketched lines **DO NOT ALLOW** shading or cross-hatching **DO NOT ALLOW** ureter or blood vessels shown **DO NOT ALLOW** if label lines incorrectly drawn (e.g. not straight or have arrowheads) or do not start exactly at the structure being labelled e.g. 2 marks for the answer below:

					
	b	i	(re)absorption / regulation, of (named) ions ✓	1 (AO1.1)	Cl^- / K^+ / Na^+ / Ca^{2+}, reabsorption / regulation **ALLOW** words rather than formula (e.g. 'potassium ion' rather than 'K^+') **ALLOW** active transport of (named) mineral ions **ALLOW** (re)absorbs water **ALLOW** regulation of pH **IGNORE** 'changes / adjusts, salt concentrations' **IGNORE** 'creates a steep water potential gradient' **IGNORE** term 'selective'
		ii	increase(s) surface area for, (re)absorption/active transport ✓ has, cotransporters / membrane proteins, for, (re)absorption / active transport, of Na^+ / amino acid /glucose ✓	1 max (AO2.1)	
		iii	B **AND** (because) <u>water</u>, is reabsorbed / removed, earlier in the nephron/AW ✓	1 (AO2.1)	**ALLOW** '<u>water</u> has exited by this point' **IGNORE** selective reabsorption has already occurred
			Total	**5**	
11	a		**M** ✓	1	
	b		salted crisps **AND** boiled sweets reduce water potential of blood (because of high sugar / salt content) ✓ osmoreceptors in hypothalamus, detect change in water potential in blood / cause increased release of ADH ✓ ADH causes production of	4 max	**IGNORE** descriptions of graph

			aquaporins in collecting duct so more water is reabsorbed (into capillaries) ✓ bread / milk / chocolate, increase water potential of blood ✓ causes reduced ADH release ✓		
			Total	**5**	
12	a		***Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.*** ***In summary:*** *Read through the whole answer. (Be prepared to recognise and credit unexpected approaches where they show relevance.)* *Using a 'best-fit' approach based on the science content of the answer, first decide which of the level descriptors,* ***Level 1****,* ***Level 2*** *or* ***Level 3****, best describes the overall quality of the answer.* *Then, award the higher or lower mark within the level, according to the Communication Statement (shown in italics):* ○ *award the higher mark where the* ***Communication Statement*** *has been met.* ○ *award the lower mark where aspects of the Communication Statement have been missed.* • ***The science content determines the level.***	6 (AO1.2) (AO2.5)	**Indicative scientific points may include (but are not limited to):** *AO1.2 Demonstrate knowledge and understanding of scientific processes* *Endocrine system* • hypothalamus causes release of ADH from pituitary aldosterone released from adrenal cortex • ADH released from pituitary gland • ADH binds to receptors on the cell membranes of collecting duct cells … • … and this increases permeability to water (regulated by aquaporins) • role of cAMP *Nervous system:* • hypothalamus is part of nervous system • osmoreceptors in the hypothalamus … • … detect a low water potential in the blood • ADH is produced in the hypothalamus • posterior pituitary is extension of hypothalamus • correct reference to negative feedback *AO2.5 Apply knowledge and understanding of scientific processes in a theoretical context.* *Aldosterone:*

			• ***The Communication Statement determines the mark within a level.*** **Level 3 (5-6 marks)** Describes with some detail the roles of the nervous **and** endocrine systems in enabling water reabsorption. It is likely that the role of more than one hormone is included. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated* **Level 2 (3-4 marks)** Describes how the nervous system **and** endocrine system enable water reabsorption. There is a line of reasoning with some structure. The information presented is relevant and supported by some evidence. **Level 1 (1-2 marks)** Describes how the nervous system **or** endocrine system enables water reabsorption **or** Outlines the role of both systems in water reabsorption. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence and the relationship to the evidence may not be clear.* **0 marks** *No response or no response worthy of credit.*		• sodium ions pumped out of collecting duct cells (into tissue fluid) (and potassium ions pumped in) • lowers water potential in tissue fluid • concentration gradient established • sodium ions reabsorbed from the collecting duct lumen • water diffuses into collecting duct cells / out of lumen via osmosis.
	b	i	Y **AND**	1 (AO3.2)	

			idea of reduces blood volume the most ✓		e.g. 'the concentration of water in the blood would be reduced more than with the other diuretics' e.g. 'more urine is produced'. e.g. 'less water is reabsorbed into the blood'. **ALLOW** X **AND** increases the (blood) potassium ion concentration the most *(as increased blood potassium linked to more sodium ion loss in urine and reduction in tension in blood vessel walls)*
		ii	X **AND** *idea of* does not raise (blood) <u>glucose</u> (concentration) ✓	1 (AO3.2)	e.g. 'has no effect on (blood) <u>glucose</u>' **DO NOT ALLOW** 'raises (blood) glucose the least' **<u>Examiner's Comments</u>** Many candidates appeared to be unfamiliar with the requirements for a good biological drawing required for question **(a)**. Drawings often had sketchy or incomplete lines rather than clear continuous lines and the inclusion of features not visible in Fig 1.1, such as the ureter and blood vessels. Labelling errors were frequent, with tissues misidentified and label lines drawn free hand or with arrow heads. Many candidates could not interpret the photomicrograph in Fig 1.2, and so could not describe the function of structure A as increasing surface area for reabsorption for question **(b)(ii)**. Most candidates understood the role of the distal convoluted tubule in water or ion reabsorption for **(b)(i)** and correctly identified lumen B as having the highest concentration of urea due to water being reabsorbed from an earlier part of the tubule for **(b)(iii)**. A surprisingly large number of candidates did not identify diuretic Y as being the most effective at reducing blood pressure due to reducing the blood volume the most. Most candidates correctly identified diuretic X as being the most suitable for use by a person with diabetes, although some candidates

					incorrectly stated that this diuretic raised blood glucose the least, this was not given credit. **OCR support** Support for drawing skills can be found in the Biological drawing skills handbook: https:/www.ocr.org.uk/Images/251799-biology-drawing-skills-handbook.pdf **AfL** Showing students images of photomicrographs from which they need to identify structures and describe what they see may help them to answer similar questions in the future.
			Total	**8**	
13	a	i	peritoneal wall is made up of living cells ✓ (so) produces ATP to carry out active transport ✓ dialysis membranes, only allow diffusion / cannot do active transport ✓	2 max	
		ii	*advantage:* does not require repeated dialysis **OR** diet less limited **OR** better quality of life / no longer chronically ill ✓ *disadvantage:* *idea of* difficulty finding donor organ **OR** risks of surgery **OR** risks from, organ rejection / long term immunosuppressant drugs ✓	2	**ALLOW** ORA
	b		test urine ✓	1	
			Total	**5**	

14	a		have , thin wall / valves , so will , distend / bulge ✓ large lumen / wide , as contains , large volume of / slow-moving , blood ✓ found closer to the , surface / skin , than arteries ✓	3(AO2.1)	**ALLOW** ORA e.g. arteries are found further away from surface than veins **Examiner's Comments** This part of the question, which was assessing AO2, proved challenging and there were few correct responses with many candidates repeating information from the stem of the question. Many candidates gained one mark for realising the implied comparison with arteries, and for stating that arteries are found further away from the skin surface (to protect them). Those candidates who didn't gain this mark often used inappropriate wording such as veins 'travelling' 'pushing' or 'moving' closer to the skin. It was common for candidates to state that veins had a large lumen or thin walls, but they did not continue their response with an explanation as to why this would make them more visible. **Exemplar 3** (a) Explain why the visible blood vessels are likely to be veins. Veins are wider than arteries as hold large volume of blood. If they were arteries the pumping of blood would be visible. ~~Arteries are deeper in the body.~~ Veins have right organ but cannot be seen. Arteries lie deeper in the body. They're blue showing deoxygenated blood. [3] This exemplar shows a good response achieving two out of the three marks. Few candidates achieved full marks.
	b		1. (skin has) large surface area for absorption ✓ 2. (skin has) many / network of , capillaries ✓ 3. (steroids are) lipid-soluble / non-polar ✓	2 max(AO2.5)	**ALLOW** can cross , cell surface / plasma , membranes

<table>
<tr>
<td></td><td></td><td></td>
<td>4. (so) can cross phospholipid bilayer ✓
5. muscles are close to the skin (surface) so short diffusion , pathway / distance ✓</td>
<td></td>
<td><u>Examiner's Comments</u>

Candidates achieving both marks for this part of the question understood that steroid hormones were lipid-soluble and would therefore cross the phospholipid bilayer in cell membranes. Other good responses included the idea that there would be a short diffusion distance between muscles and the skin surface. Some candidates often suggested that steroids could diffuse into the veins or blood stream. This was possibly due to confusion with the previous question and the proximity of veins to the skin surface.</td>
</tr>
<tr>
<td></td><td>c</td><td>i</td>
<td>(any number in range) 180 to 279 ✓✓✓</td>
<td>3 (AO3.1) (AO2.8)</td>
<td>ALLOW ANY number between 180 and 279 for 3 marks
IGNORE +/-

<table>
<tr><th>Year</th><th>% containing testosterone</th><th>No of urine samples</th><th>Number of positive tests</th></tr>
<tr><td>1988</td><td>1.7</td><td>46000</td><td>782</td></tr>
<tr><td>1991</td><td>0.65</td><td>85000</td><td>553</td></tr>
</table>

If incorrect response:

ALLOW for 2 marks
number testing positive in 1988 – number testing positive in 1991
e.g. 799 - 546
OR
e.g. (1.7 ÷ 100) x 47000 – (0.65 ÷ 100) x 84000

ALLOW for 1 mark
Calculation of number of samples testing positive in EITHER 1988 or 1991
e.g. (1.7 ÷ 100) x 47000
OR
e.g. 1.7% of 46000

ALLOW for % testosterone + / - 0.02%
ALLOW for number of urine samples +/- 1000

<u>Examiner's Comments</u></td>
</tr>
</table>

					The graph in Fig.19.2 proved difficult to decipher for some candidates. However, this was taken into account and a range of answers were accepted for this calculation; many candidates achieved all three marks.
		ii	Using a 'best-fit' approach based on the science content of the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer using the guidelines described in the level descriptors in the mark scheme. Once the level is located, award the higher or lower mark. **The higher mark** should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met. **The lower mark** should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing. **In summary:** • **The science content determines the level.** • **The communication statement determines the mark within a level.** **Level 3 (5–6 marks)** Full and detailed evaluation including reference to factors that both support and contradict the statement, as well as reference to the issues	6 (AO3.2)	**Indicative scientific points may include…** ***Evidence in support of the statement:*** • General trend: reduction in % samples with testosterone from start to end of test • From 1988 to 1991, % samples with testosterone decreased as test numbers increased • Increase in number of tests carried out over time • More testing shows , more awareness / scrutiny / acts as deterrent ***Evidence against the statement:*** • From 1986 to 1988 there was an increase in % tests with testosterone / number of positive tests • Correlation does not show causation • More tests but more athletes competing • After 1991 / in 1992 and 1993 there was an increase in % tests with testosterone / number of positive tests • Fewer samples with testosterone is not the same as less incidence of abuse • No clear pattern / trend in positive samples • From 1986 to 1994 the number of positive tests increases ***Issues of validity with data:*** • Only a limited / short time was studied or only valid for the time studied • Other steroids used and not detected

			of validity which affect the data. *There is a well-developed argument including a good range of evidence. The information presented is relevant and clearly explained.* **Level 2 (3–4 marks)** Detailed evaluation including reference to at least one factor that supports and one that does not support the statement. *There is a reasonable attempt at evaluation including a small range of evidence. The information presented is mostly relevant and clearly explained.* **Level 1 (1–2 marks)** Evaluation is attempted including reference to a factor that supports **or** contradicts the statement, **or** refers to an issue of validity which affect the data. *The information is basic and communicated in an unstructured way. The information is supported by limited evidence which may be unclear.* **0 marks** No response or no response worthy of credit.		• Other drugs mask testosterone levels • Testosterone levels may vary naturally in the population (AW) • No details provided for the method used / modern technology may have improved the sensitivity of the test over time • No detail of a control group • Security of testing / cheating / corruption / bribery • Not turning up for testing / times of testing • Reference to significance of data • No statistical tests / SD bars / range bars • Could be same sport being tested or different sports • Could be same athletes repeatedly tested or different athletes **Examiner's Comments** This Level of Response question assessed candidate skills in AO3 by using secondary data to formulate an evaluation. The majority of candidates understood the need to discuss 'something for' and 'something against' the statement to provide a balanced argument. There were some excellent responses that included points such as 'correlation doesn't mean causation' and also went on to include statements about validity issues with the data. Such statements often mentioned the limited time span for the study and that steroids other than testosterone may have been in use but not tested for. **Exemplar 4**

					"The IOC is succeeding in reducing the level of steroid abuse in professional sport." For + Against. Evaluate this statement using the data in Fig. 19.2. They are correct in the fact that there was a decrease in testosterone abuse from 1988 - 1991 (1.7% - 0.64%) * But wise can these however it is unsure as to whether the testosterone abuse has decreased from 1991 - 1994 as the number of samples is not even. There was also increase in testosterone usage from 1991 - 1993 (0.64% - 1.4%) and so they have not actually reduced the level of steroid abuse. They are not specific about testorone - the abuse of a different steroid may have increased No statistical tests used to back up data or no repeats. [6] Additional answer space if required. * And from 1993 - 1994 (1.3% - 0.98%) This is a good example of a Level 3, 6 mark response. The candidate provided a concise, well-written response to the question in the available space provided.
			Total	**14**	