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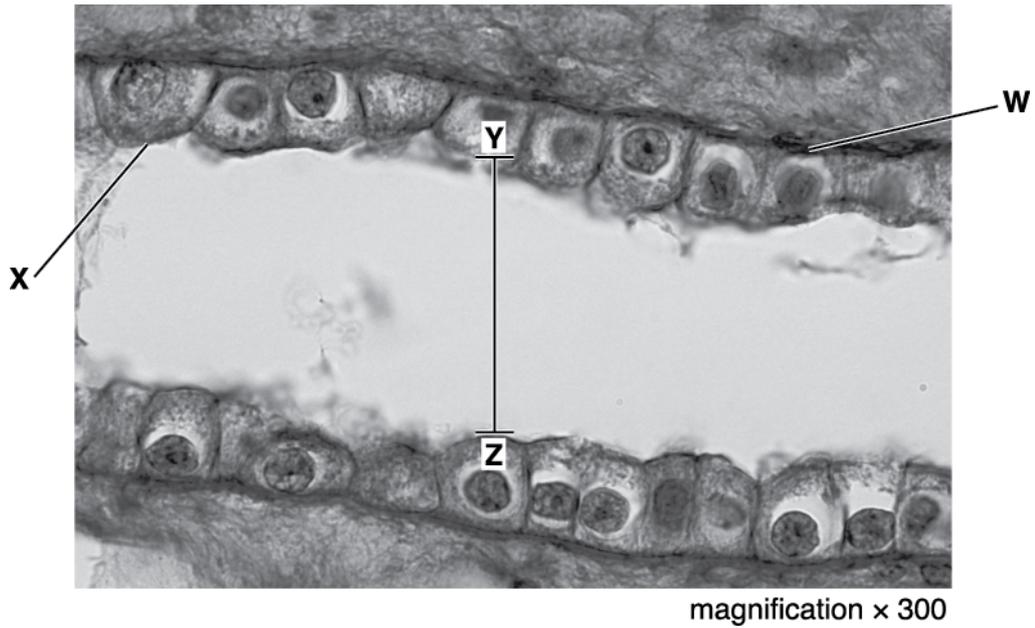
[9]

2(a). Excretion is the removal of metabolic waste products from the body. The kidney is one of the organs involved in excretion. One of the functions of the kidney is to remove nitrogenous waste.

Name **one** nitrogenous waste product that is removed by the kidney.

-----[1]

(b). The following figure is a photomicrograph of a longitudinal section through the cortex of a kidney, showing the epithelial tissue lining a collecting duct.



(i) Using the information in the figure, calculate the diameter of the lumen of the collecting duct between positions Y and Z.

Show your working. Give your answer to the nearest whole number.

Answer = ..... [2]

(ii) Suggest why the diameters of collecting ducts in the medulla of the kidney can be much wider than the diameters of collecting ducts in the cortex.

.....  
.....  
..... [1]

(c).

- (i) Name the hormone that binds to receptors at location **W** in the figure, **and** name the endocrine gland from which this hormone is released.

Hormone .....

Endocrine gland .....

[1]

- (ii) Describe how the **appearance** of membrane **X** in the figure would differ from that of a cell lining the wall of a **proximal convoluted tubule**.

.....

..... [1]



-----  
 -----  
 -----  
 ----- [5]

(ii) State one advantage of using a kidney transplant as an alternative to haemodialysis for treating kidney failure.

-----  
 ----- [1]

4. Different healthcare professionals are involved in the diagnosis and treatment of medical conditions and diseases.

Complete the table by inserting appropriate examples of the following in each row:

- the named medical condition or disease
- the healthcare professional
- a diagnostic test
- a treatment.

Medical condition or disease	Healthcare professional	Diagnostic test	Treatment
	radiographer	DEXA scan	calcium supplements
anaemia	nurse specialising in chronic kidney disease		
		pedigree analysis	
	paramedic	take core body temperature	application of ice packs

[6]

5(a). In humans, the kidneys are a key organ in the excretory system. They are also essential for the maintenance of blood volume and electrolyte balance.

Changes in the functioning of the kidneys can be detected by monitoring the composition of urine.

Explain why the kidneys can be considered as **excretory organs**.

-----  
-----  
-----  
----- [2]

(b). The functional unit of the kidney is the nephron. Fig. 5.1 shows a simplified diagram of a nephron.

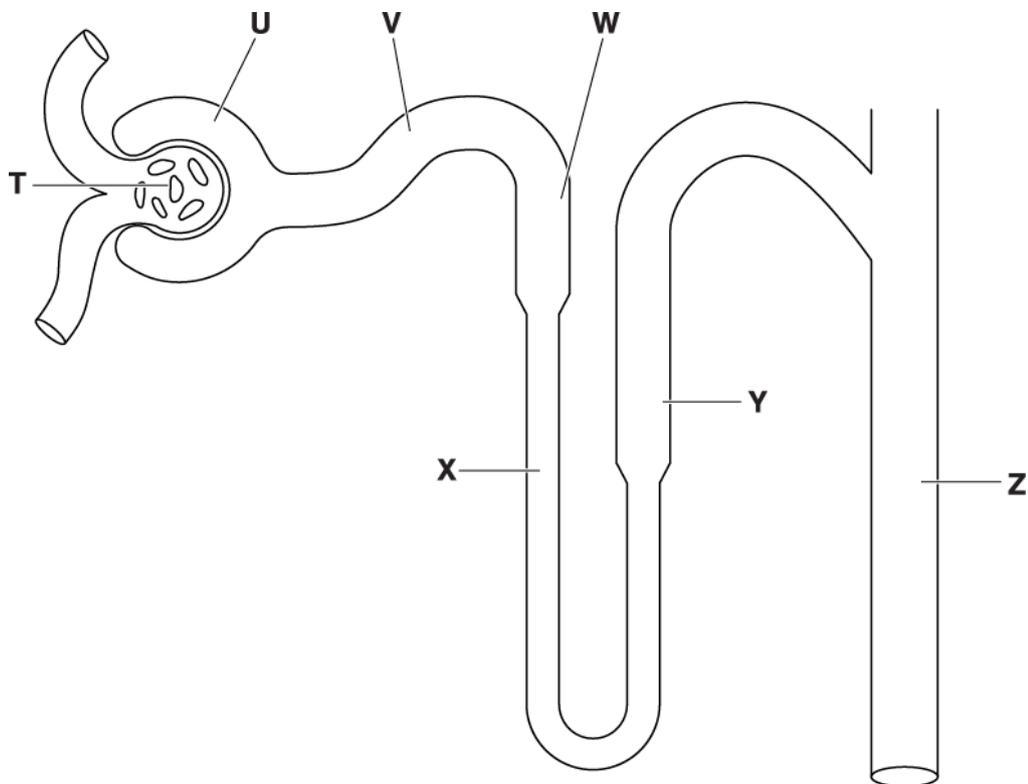


Fig. 5.1

(i) Identify the structures T and U and state the region of the kidney where these structures are found.

T

-----

U

-----  
Region of kidney -----

[3]

(ii) Complete the following paragraphs about the passage of filtrate through the loop of Henle by inserting the most appropriate word.

Electrolytes such as sodium ----- are actively reabsorbed from the filtrate at region Y, which is the ----- limb of the loop of Henle. This reabsorption reduces the ----- of the surrounding tissues in the ----- of the kidney.

The walls of the tubule in region X are ----- to water. The result is that water is reabsorbed from the filtrate by the process of -----.

[6]

(c). Reabsorption of glucose in the nephron takes place actively using glucose transport proteins. These transport proteins are located in regions **V** and **W** of the nephron.

In a condition known as familial glycosuria, the glucose transport proteins in region **W** are not functioning. This results in glucose being present in the urine.

(i) Predict the effect of a non-functioning glucose transport protein on the **volume** of filtrate leaving the loop of Henle. Explain the reason for your prediction.

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-----  
-----  
-----  
-----  
-----  
-----

[3]

(ii) Suggest why the management of familial glycosuria may involve a genetic counsellor.

-----  
-----  
-----

[1]

6(a). The control of blood glucose is essential because changes in blood glucose concentration will change the water potential of blood.

Water potential changes are detected by the osmoregulatory centre and adjustments are then made to the secretion of ADH.

(i) State **one** reason, other than the effect that it has on water potential, why blood glucose concentrations must be controlled.

-----  
-----  
----- [1]

(ii) State the location in the brain of the osmoregulatory centre and the source of ADH secretion.

osmoregulatory centre

-----

source of ADH secretion

-----

[1]

(b). Fig. 5.1 represents the structure of part of a kidney nephron and its surrounding blood vessels.

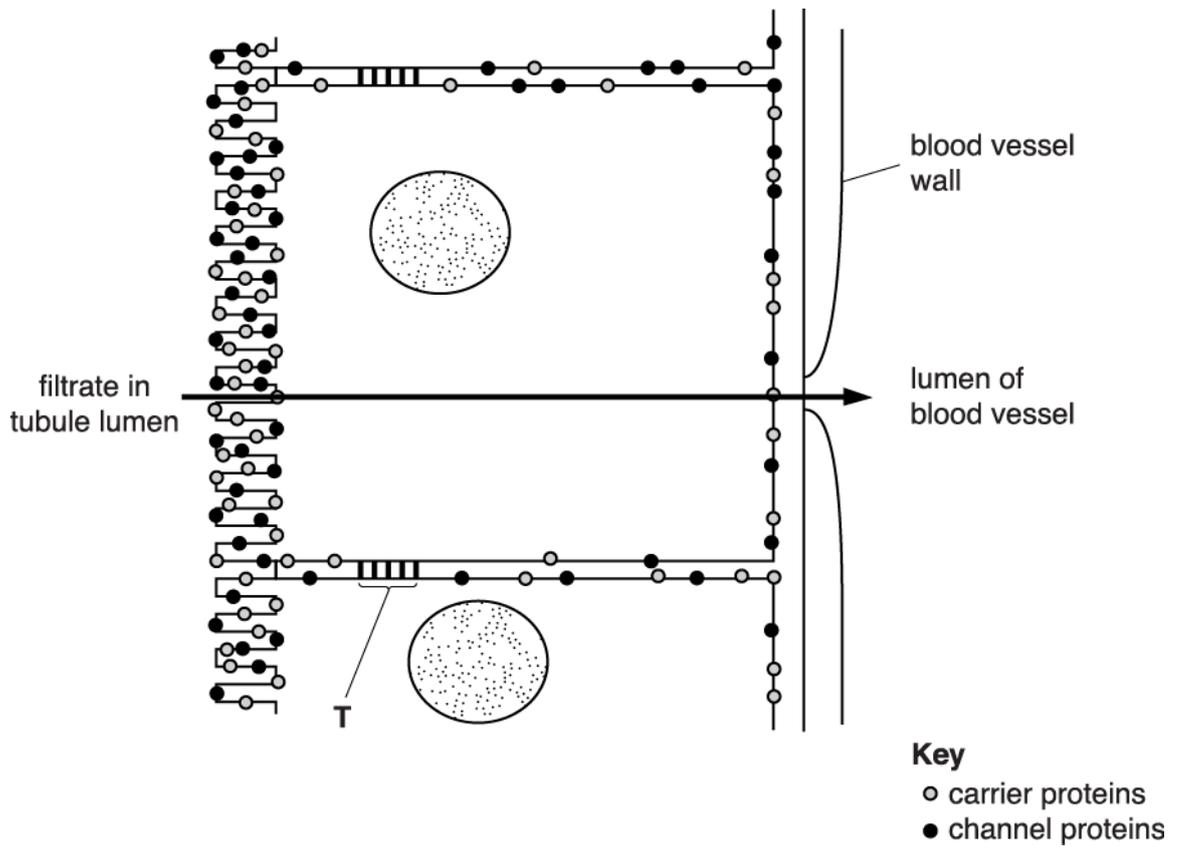


Fig. 5.1

(i) Using Fig. 5.1, identify, with a reason, the following:

the region of the nephron shown

-----

reason

-----

the type of blood vessel shown

-----

reason

-----



(c). Some people with diabetes will develop a condition called diabetic kidney disease. One of the symptoms of this condition is the appearance of the protein albumin in the urine.

(i) Suggest where albumin is normally found in the body.

----- [1]

(ii) Suggest, with reasons, which region of the kidney is damaged due to diabetic kidney disease.

-----  
-----  
-----  
-----  
-----  
----- [2]



(b). Some forms of **HUS** are not associated with *E. coli* O157 infections. These are known as atypical **HUS** or **AHUS**.

Some cases of **AHUS** are known to be due to an inherited gene mutation.

Carefully read and then complete the following passage about the inheritance of **AHUS** and the role of the genetic counsellor.

Some inherited forms of **AHUS** are due to a \_\_\_\_\_ mutant allele.

Parents show no symptoms of the disease so, if they have a child who develops **AHUS**, the child must be

\_\_\_\_\_ for this allele. Since neither parent shows symptoms, yet both carry the mutant

allele, the allele does not show \_\_\_\_\_ linkage.

A genetic counsellor would use a \_\_\_\_\_ diagram to explain the risk of any further children

either developing **AHUS** or being a carrier. Where unaffected parents have one child with **AHUS**, there would be

a \_\_\_\_\_ percent chance of having a child who is a carrier.

[5]

8(a). Dialysis is a common treatment for kidney failure.

Fig. 37.1 shows a haemodialysis machine at the beginning of a dialysis session.

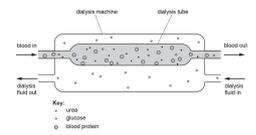


Fig. 37.1

(i) With reference to Fig. 37.1, describe how the composition of the blood changes over time.

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[2]

(ii) Explain the changes described in (i).

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[3]

(b). Peritoneal dialysis is another form of dialysis that is used to treat kidney failure.

State **one** advantage and **one** disadvantage of peritoneal dialysis compared with haemodialysis.

advantage\_-----

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disadvantage\_-----

-----

[2]



### Mark Scheme

Question	Answer/Indicative content	Marks	Guidance
1	<p><b>* Level 3 (7–9 marks)</b>            Details of apparatus and a method to produce reliable data are provided to include the use of a dilution series to construct a standard curve. Most variables are identified, and the method states how most variables are controlled.  <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i></p> <p><b>Level 2 (4–6 marks)</b>            The apparatus and a method to provide reliable results are provided although some details may be missing. There is an outline of standard curve construction. Some variables are identified and the method states how some variables are controlled.  <i>There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.</i></p> <p><b>Level 1 (1–3 marks)</b>            Apparatus and an outline method are suggested to provide some results but information, such as standard curve construction, may be missing. Some variables are omitted.  <i>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.</i></p> <p><b>0 marks</b>            No response or no response worthy of credit.</p>	9	<p><b>Indicative scientific points could include:</b>  <b>Apparatus &amp; method:</b></p> <ul style="list-style-type: none"> <li>• cuvettes, test tubes</li> <li>• apparatus for volume measurement (pipettes, syringes)</li> <li>• distilled / deionised water</li> <li>• selection of appropriate filter (on colorimeter)</li> <li>• reference to zero or blank</li> <li>• details of quantitative preparation of dilution series (for salicylic acid) to include volumes and final concentration</li> <li>• standard curve construction</li> <li>• method of testing urine and obtaining a reading.</li> </ul> <p><b>Variables:</b></p> <ul style="list-style-type: none"> <li>• (curve) independent variable = dilution</li> <li>• dependent variable = colorimeter reading</li> <li>• correct units included</li> <li>• control variables e.g. filters (colorimeter), volumes, time, temperature.</li> </ul> <p><b>Reliability:</b></p> <ul style="list-style-type: none"> <li>• repeats (for dilutions and urine reading)</li> <li>• reference to quantitative processing of data e.g. calculation of means</li> <li>• reference to use of error bars on standard curve.</li> </ul> <p><b>Risk Assessment:</b></p> <ul style="list-style-type: none"> <li>• potential chemical hazards &amp; control</li> <li>• potential electrical hazards &amp; control</li> <li>• potential microbial hazards (urine) &amp; control.</li> </ul>
	<b>Total</b>	9	

### Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
2	a		urea / creatinine / uric acid;	1	<p><b>DO NOT CREDIT</b> urine or creatine or ammonia</p> <p><b>Examiner's Comments</b></p> <p>Overall, this question was probably the most challenging on the paper. A surprising number of candidates answered incorrectly with ammonia and amino acids being among the more common incorrect responses.</p>
	b	i	120 $\mu\text{m}$ ;;	2	<p>Correct answer with units = 2 marks Correct answer without units or unrounded = 1 mark</p> <p>If answer is incorrect look for</p> <p>36 000 <math>\div</math> 300 <b>OR</b> 36 <math>\div</math> 300 <b>OR</b> 3.6 <math>\div</math> 300</p> <p><b>AWARD 1 MARK</b> for an error carried forward from an incorrect measurement / : Answer must be a whole number have units</p> <p>e.g. 117 <math>\mu\text{m}</math> = 1 mark (from 35 mm measurement)</p>
		ii	<i>idea that</i> collecting ducts are, combining / merging <b>OR</b> so volume of, urine / filtrate / fluid, will be larger;	1	<p><b>IGNORE</b> ref to water</p> <p><b>Examiner's Comments</b></p> <p>In (i) the most common mistake was not converting correctly between units while only the more able candidates successfully answered (ii) in terms of merging collecting ducts or increasing volume. Numerous diagrams of the nephron have these 'branches' indicated suggesting that the significance of these is rarely brought to the attention of candidates.</p>
	c	i	ADH / Antidiuretic hormone <b>and</b> (posterior) pituitary;	1	<p>Both parts correct for 1 mark</p> <p><b>ACCEPT</b> phonetic spelling</p>

### Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		ii	(membrane) would have, microvilli / brush border / AW;	1	<p><b>ACCEPT</b> idea that it would be more folded. <b>DO NOT CREDIT</b> basal membrane more folded</p> <p><b>Examiner's Comments</b></p> <p>In (i) it was disappointing to see how many candidates identified ADH and then assigned it to the wrong endocrine gland with pancreas being the most common incorrect response. A number of candidates referred to the anterior pituitary. This issue has occurred in previous sessions - pituitary alone could be credited without reference to posterior but anterior pituitary is incorrect. In (ii) although some candidates did correctly identify microvilli in the proximal convoluted tubule, a large number failed to take into account the scale they were working to as indicated in the photomicrograph. While it is certainly true that various transport proteins would be present in the PCT membrane, they would not be visible on a photomicrograph.</p>
			<b>Total</b>	<b>6</b>	

**Mark Scheme**

Question		Answer/Indicative content	Marks	Guidance																																																																
3	i	<p>1. <i>Evidence for:</i> Idea that countries / named country with the high(est) number of donors all have opt out policies;</p> <p>2. Data quoted correctly in support with correct units;</p> <p>3. <i>Evidence against</i> Same rates in some countries where policy is different;</p> <p>4. Data quoted correctly in support with correct units;</p> <p>5. <i>Idea that countries / named countries with the lowest number of donors all have opt out policies</i> <b>OR</b> Idea that countries / named country with opt in policy has more donors than, countries / named country with opt out policy;</p> <p>6. Data quoted correctly in support with correct units;</p>	4 max	<table border="1"> <thead> <tr> <th>OPT IN COUNTRY</th> <th>DONORS PER MILLION PEOPLE</th> <th>OPT OUT COUNTRY</th> <th>DONORS PER MILLION PEOPLE</th> </tr> </thead> <tbody> <tr> <td>IRELAND</td> <td>21</td> <td>SPAIN</td> <td>34</td> </tr> <tr> <td>SLOVENIA</td> <td>18</td> <td>LATVIA</td> <td>24</td> </tr> <tr> <td>ENGLAND</td> <td>13</td> <td>AUSTRIA</td> <td>24</td> </tr> <tr> <td>NETHERLANDS</td> <td>13</td> <td>PORTUGAL</td> <td>22</td> </tr> <tr> <td>GERMANY</td> <td>12</td> <td>BELGIUM</td> <td>22</td> </tr> <tr> <td></td> <td></td> <td>FRANCE</td> <td>20</td> </tr> <tr> <td></td> <td></td> <td>ITALY</td> <td>18</td> </tr> <tr> <td></td> <td></td> <td>HUNGARY</td> <td>17</td> </tr> <tr> <td></td> <td></td> <td>NORWAY</td> <td>14</td> </tr> <tr> <td></td> <td></td> <td>DENMARK</td> <td>13</td> </tr> <tr> <td></td> <td></td> <td>POLAND</td> <td>13</td> </tr> <tr> <td></td> <td></td> <td>SWEDEN</td> <td>11</td> </tr> <tr> <td></td> <td></td> <td>GREECE</td> <td>6</td> </tr> <tr> <td></td> <td></td> <td>BULGARIA</td> <td>1</td> </tr> <tr> <td>Mean</td> <td>15</td> <td></td> <td>17</td> </tr> </tbody> </table> <p><b>CREDIT</b> data quotes using calculated differences</p> <p><b>IGNORE</b> data quotes using total donors</p> <p><b>IGNORE</b> references to more countries having opt out policies as this is a sample</p>	OPT IN COUNTRY	DONORS PER MILLION PEOPLE	OPT OUT COUNTRY	DONORS PER MILLION PEOPLE	IRELAND	21	SPAIN	34	SLOVENIA	18	LATVIA	24	ENGLAND	13	AUSTRIA	24	NETHERLANDS	13	PORTUGAL	22	GERMANY	12	BELGIUM	22			FRANCE	20			ITALY	18			HUNGARY	17			NORWAY	14			DENMARK	13			POLAND	13			SWEDEN	11			GREECE	6			BULGARIA	1	Mean	15		17
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	i	QWC;	1	<p>Look for mps, 1 and 2 <b>AND</b> 3 and 4 <b>OR</b> 5 and 6</p>																																																																

**Mark Scheme**

Question		Answer/Indicative content	Marks	Guidance																				
	ii	<p><i>Idea that can lead an independent life / AW;</i></p> <p>AVP;</p>	1	<p><b>CREDIT</b> examples e.g. not needing regular / frequent periods on dialysis machine / able to work regular hours</p> <p><b>IGNORE</b> ref to better quality of life unqualified or cost</p> <p>e.g. less need to control sodium intake</p> <p><b>Examiner's Comments</b></p> <p>Part (i) was answered well although a failure to refer to the figures correctly was not uncommon among weaker candidates - 1 donor rather than 1 donor per million people. The best responses made their arguments clear using terms such as 'However' or 'On the other hand' to structure their statement. In part (ii) some explanation was required of what a 'better quality of life' was.</p>																				
		<b>Total</b>	<b>6</b>																					
4		<table border="1"> <thead> <tr> <th>Medical condition or disease</th> <th>Healthcare Professional</th> <th>Diagnostic Test</th> <th>Treatment</th> </tr> </thead> <tbody> <tr> <td>1. osteoporosis ;</td> <td></td> <td></td> <td></td> </tr> <tr> <td></td> <td></td> <td>2. (red) blood cell count ;.</td> <td>3. RhEPO ;</td> </tr> <tr> <td>4. PKU/cystic fibrosis / AW ;</td> <td>5. genetic counsellor ;</td> <td></td> <td></td> </tr> <tr> <td>6. hyperthermia / heat stroke ;</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Medical condition or disease	Healthcare Professional	Diagnostic Test	Treatment	1. osteoporosis ;						2. (red) blood cell count ;.	3. RhEPO ;	4. PKU/cystic fibrosis / AW ;	5. genetic counsellor ;			6. hyperthermia / heat stroke ;				6	<p><b>MP2 CREDIT</b> erythrocyte count / (total) blood cell count / haemoglobin concentration / haemocytometer count / haematocrit</p> <p><b>MP3 CREDIT</b> erythropoietin / EPO. <b>IGNORE</b> Iron tablets</p> <p><b>MP4 CREDIT</b> alternative examples of an inherited or genetic condition or disease</p> <p><b>Examiner's Comments</b></p> <p>This was answered well although vague descriptions to 'blood tests' could not be credited. Some candidates did not pick up on the reference to chronic kidney disease and answered in terms of iron tablets or even transfusions.</p>
Medical condition or disease	Healthcare Professional	Diagnostic Test	Treatment																					
1. osteoporosis ;																								
		2. (red) blood cell count ;.	3. RhEPO ;																					
4. PKU/cystic fibrosis / AW ;	5. genetic counsellor ;																							
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		<b>Total</b>	<b>6</b>																					

### Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
5	a	<p>(because) they contain, group of / more than one type of / different / tissue(s);</p> <p>(because) they remove urea / metabolic waste / nitrogenous waste / product of amino acid breakdown;</p>	2	<p><b><u>Examiner's Comments</u></b></p> <p>Weaker candidates wrote in terms of toxins or waste without referring to metabolic waste. Some candidates wrote that urea was produced in the kidneys. The main reason for not scoring both marks was a failure to address the question which required some idea of the kidney as an organ and not just a definition of excretion. There are a number of 'compound' terms on the specification (eg autosomal linkage) which need to be 'unpicked' during teaching and this was a synoptic question with F221.</p>
	b	i	3	<p><b>Mark the first answer on each prompt line.</b> If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer = 0 marks</p> <p><b>IGNORE</b> ref to nephron</p>
		ii	6	<p><b>Mark the first answer on each prompt line.</b> If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer = 0 marks</p> <p><b>DO NOT CREDIT</b> 'and potassium' as this implies it is the metals that are transferred rather than the ions</p> <p><b><u>Examiner's Comments</u></b></p> <p>Parts (i) and (ii) were accessible to most candidates with the commonest mistake being to confuse the cortex and medulla or to answer 'nephron' for the region in part (i) despite the fact that this was given in the question.</p>



### Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
6	a	i	<p><i>idea that</i> glucose is a respiratory substrate <b>OR</b> (plasma) glucose is the only respiratory substrate for neurones <b>OR</b> if blood glucose too low neurones lose function / AW;</p>	1	<p><b>IGNORE</b> ref to preventing hyper or hypo glycaemia without further qualification</p> <p><b>CREDIT</b> idea of preventing a coma</p> <p><b>Examiner's Comments</b></p> <p>In (i) the question required applying knowledge of the role of blood glucose other than its effect on water potential. High blood pressure and damage to cells are due to the osmotic effect of glucose. A number of candidates also think that high blood glucose causes diabetes rather than being a symptom of it. Many candidates did answer in terms of the role of glucose as a respiratory substrate.</p>
		ii	<p>hypothalamus <b>AND</b> (posterior) pituitary;</p>	1	<p><b>Mark the first answer</b> on each line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = <b>0 marks</b></p> <p><b>BOTH</b> answers required for 1 mark</p> <p><b>DO NOT CREDIT</b> anterior pituitary</p> <p><b>Examiner's Comments</b></p> <p>In (ii) many candidates lost marks by stating the anterior pituitary gland as the source of ADH secretion.</p>

### Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
	b i	<p><i>(region)</i> proximal convoluted tubule  <b>AND</b>  <i>(blood vessel)</i> capillary;</p> <p>(PCT) has microvilli / has carrier / channel proteins (for uptake);</p> <p>(capillary has) wall one cell thick / AW  <b>OR</b>                      (capillary has) fenestrations / gaps / pores;</p>	2	<p><b>IGNORE</b> 'because this is the region where glucose is reabsorbed' as a reason as this does not use the diagram.</p> <p><b>Examiner's Comments</b></p> <p>Many candidates correctly identified the PCT and capillary in (i). The presence of microvilli and transport proteins as evidence for the region being the PCT was the commonest way of gaining the second mark. Where candidates had identified the capillary, vague answers such as 'thin wall' or 'one cell thick' did not gain credit. Part (ii) was a stretch and challenge question. Relatively few candidates linked the movement of proteins to the fluid mosaic structure of the membrane.</p>
	ii	<p><i>idea that</i> (membrane has) fluid (mosaic) structure;</p> <p><i>Idea that</i> proteins 'float' in (phospho)lipid bilayer;</p>	2	<p><b>Examiner's Comments</b></p> <p>Part (ii) was a stretch and challenge question. Relatively few candidates linked the movement of proteins to the fluid mosaic structure of the membrane.</p>

### Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
	iii	<p><i>mechanism</i> facilitated diffusion / active transport / co-transport;</p> <p><i>idea that</i> number of (channel / carrier) proteins is limiting / AW;</p> <p><i>idea that</i> glucose is filtered out but not all reabsorbed;</p> <p>no glucose, transport proteins / uptake, in other regions of nephron;</p>	3	<p>IGNORE ref to incorrect part of nephron</p> <p>ACCEPT descriptions e.g. 'there are too many glucose molecules for channels to cope with'</p> <p>ACCEPT 'glucose in filtrate is not reabsorbed'</p> <p><b>Examiner's Comments</b></p> <p>Part (iii) also had elements of stretch and challenge. Most candidates were able to identify a transport mechanism which required a protein but only the most able could describe the number of available protein channels as a limiting factor in glucose uptake. Weaker candidates are clearly very confused by the terminology of kidney function and use 'ultrafiltration' and 'selective reabsorption' as interchangeable terms.</p>
c	i	blood/ plasma;	1	<p>ACCEPT liver</p> <p><b>Examiner's Comments</b></p> <p>In part (i) a lot of 'guessing' had taken place. 'Liver' was allowed as one role of the liver is the synthesis of plasma proteins such as albumin.</p>

### Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
		ii	<p>(region) cortex / AW;</p> <p>(reason) <i>idea that</i> proteins normally too large to cross (basement membrane);</p>	2	<p><b>ACCEPT</b> ref to glomerulus / glomeruli / basement membrane <b>IGNORE</b> renal capsule</p> <p><b>ACCEPT</b> idea of proteins being too large to be filtered out of glomerulus</p> <p><b>Examiner's Comments</b></p> <p>Additional information regarding the protein albumin was given in part (d) but many weaker candidates attempted to answer (ii) in terms of glucose in the urine. There was also confusion between ultrafiltration and selective reabsorption. Some candidates suggested that damage to the PCT meant that the protein could not be reabsorbed.</p>
			<b>Total</b>	<b>12</b>	

### Mark Scheme

Question			Answer/Indicative content	Marks	Guidance
7	a	i	<p><i>Named treatment for short term:</i> Haemodialysis; peritoneal dialysis;</p> <p><i>long term treatment</i> kidney transplant;</p> <p><i>organ / donor detail</i> matched MHC antigens / blood groups between donor and recipient <b>OR</b> use of close relative to obtain tissue match <b>OR</b> ref to cadaver / xenotransplants;</p> <p><i>recipient detail</i> use of immunosuppressant to prevent rejection; <i>idea of control of diet / low salt;</i></p> <p><i>operation detail</i> connection of renal artery and vein / connection to alternative artery (iliac) / old kidney left in place;</p> <p><i>detail of alternative long term treatment</i> <i>peritoneal</i> <i>dialysis</i> dialysis fluid introduced into abdominal cavity <b>OR</b> peritoneum acts as the partially permeable membrane <b>OR</b> reference to CCPD / described</p>	5	<p><b>DO NOT CREDIT</b> 'kidney or renal' dialysis <b>DO NOT CREDIT</b> haemodialysis as a <b>long term</b> treatment</p> <p><b>ACCEPT</b> 'alternative treatment' as 'long term'</p> <p><b>ACCEPT</b> alternative correct details</p> <p><b>CREDIT</b> description of CCPD such as attached overnight to a dialysis exchanger</p> <p><b>Examiner's Comments</b></p> <p>In part (i) many candidates misread the question which was about treating kidney failure not treating an E.coli infection. The error was frequently compounded as description was only required for the long term treatment. Many candidates did score maximum marks but many failed to take into account the context of the question.</p>

### Mark Scheme

Question		Answer/Indicative content	Marks	Guidance
	ii	<p>(injections of) erythropoietin / EPO;</p> <p><i>explanation:</i>                      (EPO) stimulates, RBC synthesis;                      as (damaged) kidneys not making EPO;</p> <p><b>OR</b></p> <p>(packed red blood cell, whole blood) transfusion;</p> <p>as {damaged} kidneys not making EPO;                      (so) RBC synthesis not stimulated (by EPO);</p>	3	<p><b>Examiner's Comments</b></p> <p>There were some good answers on EPO treatment and on blood transfusions in (ii) but many candidates again had lost the context of the question which was kidney damage and answered in terms of iron supplements.</p>
	b	<p>recessive;                      homozygous / double, recessive;                      sex;                      pedigree;                      fifty / 50;</p>	5	<p><b>Examiner's Comments</b></p> <p>Answers were good with the majority of candidates scoring at least 3 marks. The commonest mistakes were autosomal rather than sex linkage and mistake on the probability at the end suggesting this was a guess rather than using a Punnett square. Many scripts did show evidence that this is what good candidates did.</p>
		<b>Total</b>	<b>13</b>	

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Question			Answer/Indicative content	Marks	Guidance
8	a	i	<p>any 2 from:</p> <p>decrease in urea concentration (in blood) ✓</p> <p>glucose concentration (of blood) remains unchanged ✓</p> <p>protein, composition / concentration, (of blood) remains unchanged ✓</p>	max 2	<p><b>IGNORE</b> reference to glucose increasing or decreasing</p> <p><b>Examiner's Comments</b></p> <p>(a)(i) and (ii) both referred to <b>Fig</b> and serve to emphasise how important it is for candidates to read command words. The question was not asking about what happens in the kidney so any references to glucose diffusing out to the tubule and being selectively reabsorbed or proteins being too large to pass through the basement membrane did not gain credit. This was a question about movement of molecules across a partially permeable membrane in the context of dialysis and successful candidates studied the figure and used it to describe and explain the movement of molecules. Those candidates who suggested that glucose would diffuse into the tubing probably made the error based on number of molecules rather than concentration.</p>

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	ii	<p>passage of molecules through partially permeable membrane via (passive) <u>diffusion</u> ✓</p> <p>urea (diffuses) from a high concentration to a low concentration / down concentration gradient ✓</p> <p>glucose (stays the same) because of, equilibration of molecules either side of membrane / no net diffusion ✓</p> <p>protein too large to pass through membrane / tubing ✓</p>	max 3	<p><b>ALLOW</b> 'semi-permeable membrane'</p> <p><b>DO NOT ALLOW</b> ECF from 37 (a)(i)</p> <p><b>Examiner's Comments</b> (a)(i) and (ii) both referred to <b>Fig</b> and serve to emphasise how important it is for candidates to read command words. The question was not asking about what happens in the kidney so any references to glucose diffusing out to the tubule and being selectively reabsorbed or proteins being too large to pass through the basement membrane did not gain credit. This was a question about movement of molecules across a partially permeable membrane in the context of dialysis and successful candidates studied the figure and used it to describe and explain the movement of molecules. Those candidates who suggested that glucose would diffuse into the tubing probably made the error based on number of molecules rather than concentration.</p>
	b	<p><i>Advantage:</i> <b>1 from:</b> no need for specialist equipment ✓ can be done, at home / by patient ✓ patient can be mobile during treatment ✓</p> <p><i>Disadvantage:</i> <b>1 from:</b> risk of infection ✓ required more frequently than haemodialysis ✓</p>	2	<p><b>AW</b></p> <p><b>Examiner's Comments</b> (b) was accessible to, and well answered by, most candidates.</p>
		<b>Total</b>	<b>7</b>	

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Question		Answer/Indicative content	Marks	Guidance
9		<p>(have more accurate) match to, antigens on red blood cells / MHC ✓</p> <p>use patients' own stem cells ✓</p> <p>(which will) differentiate into kidney cells ✓</p> <p>(not rejected because) genetically identical / seen as 'self' ✓</p> <p>(could use) induced pluripotent stem cells / iPSCs ✓</p> <p>(these are examples of) therapeutic cloning ✓</p>	3 max	<p><b>ALLOW</b> more accurate blood grouping</p> <p><b>IGNORE</b> growing kidneys</p> <p><b><u>Examiner's Comments</u></b></p> <p>This was well answered for at least 1 mark with most candidates suggesting using patients own stem cells. Many candidates discussed growing whole kidneys without appreciating the need to differentiate into cells then tissues first. Many candidates just discussed immunosuppression without relating it to a future advance.</p>
		<b>Total</b>	<b>3</b>	