1. One role of the liver is detoxification. Detoxification includes the breakdown of drugs such as paracetamol.

   i. Fig. 4.1 is a diagram that represents the structure of part of a liver lobule.

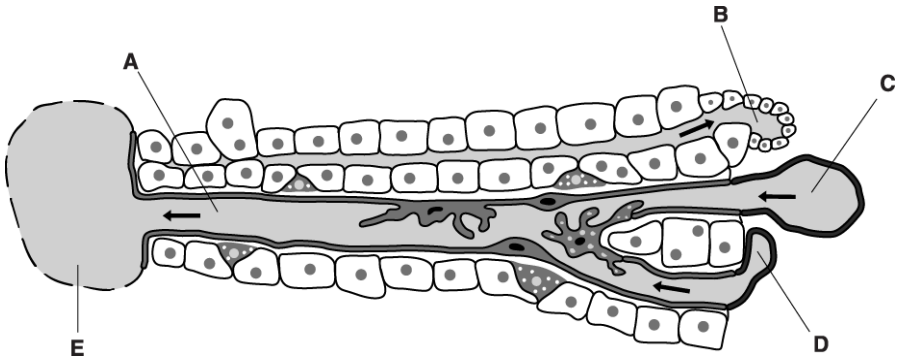


Fig. 4.1

Identify the parts labelled **A** to **E**.

A

B

C

D

E

[5]

ii. During detoxification, paracetamol is metabolised in the liver cells as follows:
- approximately 90% is combined with two chemicals, sulfate and glucuronide, and excreted
- approximately 5% is oxidised by the P450 enzyme system, which produces NAPQI
- the NAPQI is then metabolised using another compound called glutathione.

Once the sulfate and glucuronide reserves in the liver are used up, the P450 system takes over completely. However, continued metabolism of paracetamol will result in high concentrations of NAPQI accumulating in the liver cells, causing cell death.

Suggest a reason for the accumulation of high concentrations of NAPQI in the liver cells.

---

[1]

iii. The liver has considerable powers of regeneration, even if a high proportion of its cells are damaged.

Name the liver cells that can lead to this regeneration **and** the type of cell division that they carry out.

name of liver cells

---

type of cell division

---

[1]

2(a). **Fig. 17.1** is a diagram of the external view of a mammalian liver.

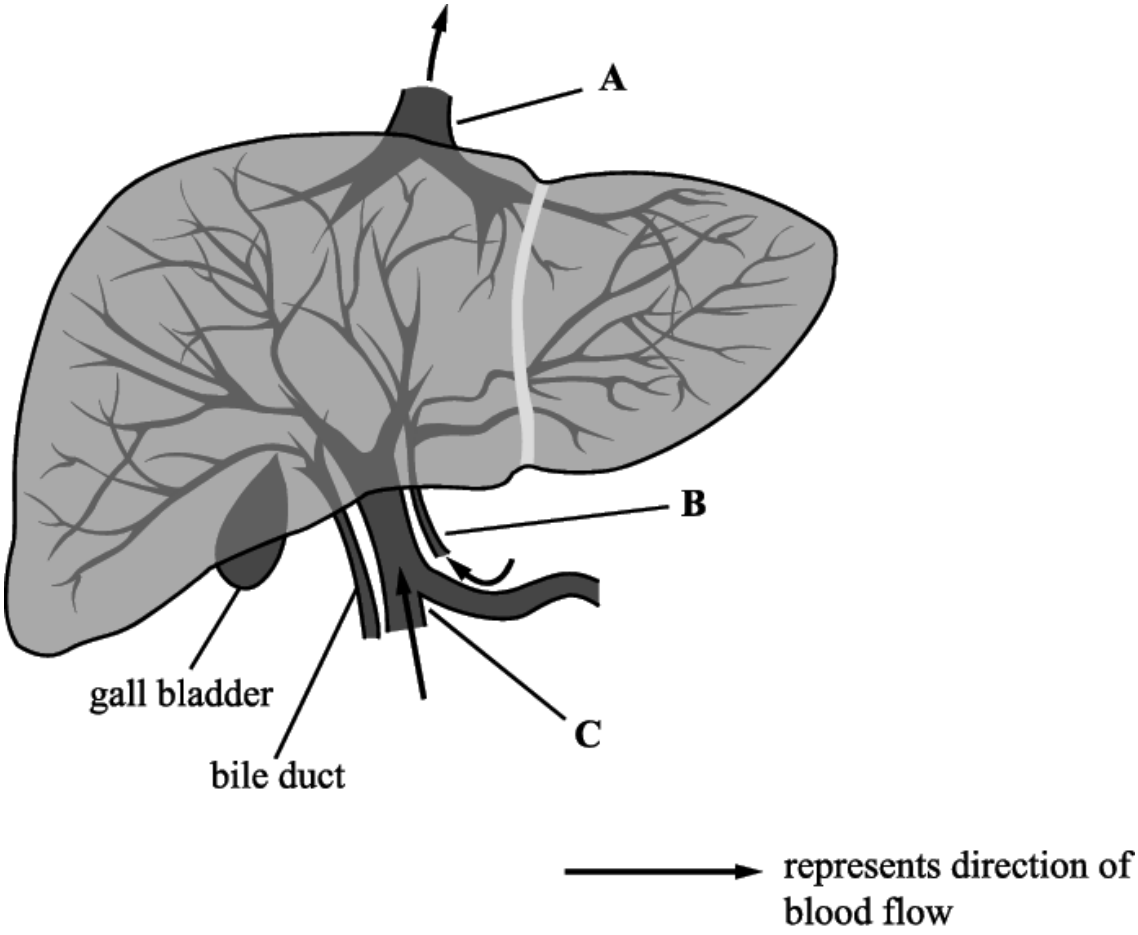


Fig. 17.1

Identify, with reasons, each of the blood vessels labelled **A** – **C** in **Fig. 17.1**.

A

.....

.....

B

.....

.....

C

.....

.....

[3]

(b). One of the main functions of the liver cells is the formation of urea by the ornithine cycle, an outline of which is shown in **Fig. 17.2**.

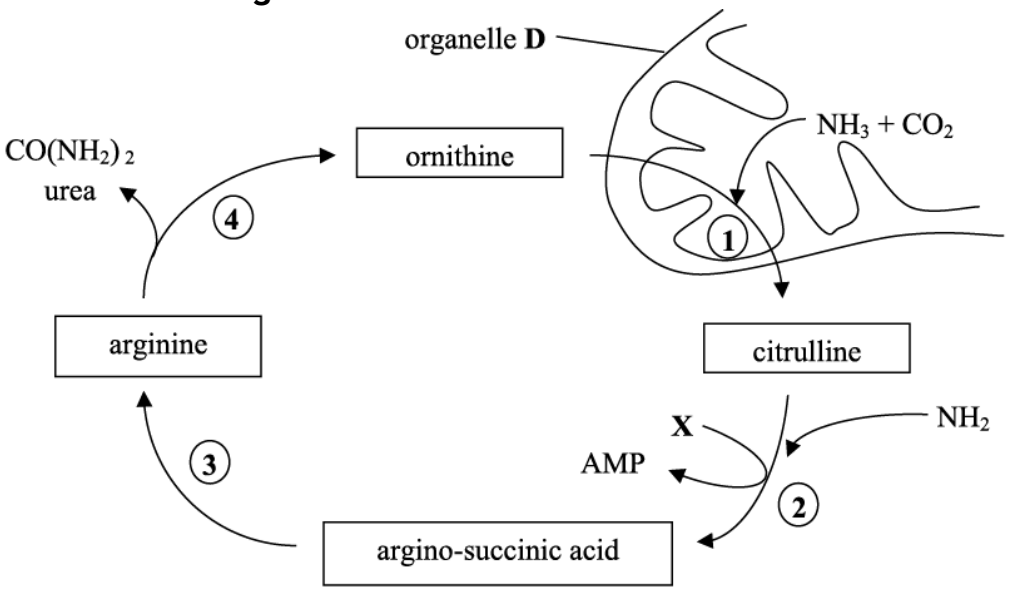


Fig. 17.2

i. Step **1** of the cycle takes place in the organelle represented by **D**.

Identify organelle **D**.

.....

[1]

ii. During the cycle ornithine moves into organelle **D** and citrulline moves out of the organelle.

Suggest the method by which these molecules move into and out of the organelle during the cycle. Give reasons for your choice.

.....

.....

.....

.....

[2]

iii. How has the ammonia that is used in step **1** been formed?

.....

.....

[1]

iv. Identify the compound labelled **X** in **Fig. 17.2**.

.....

[1]

(c). Liver cells have a high metabolic rate. Hydrogen peroxide is a metabolic product produced in significant quantities in liver cells. It needs to be removed in order to prevent serious damage to the liver cells.

Hydrogen peroxide is detoxified by the enzyme catalase:

$$2H_2O_2 \longrightarrow 2H_2O + O_2$$

Catalase has a very high turnover number. A single catalase molecule can catalyse the breakdown of approximately 6 million hydrogen peroxide molecules every minute. Catalase is found in peroxisomes inside the liver cells. Peroxisomes are organelles surrounded by a single membrane.

The activity of catalase was investigated in a laboratory, using chopped liver tissue and dilute hydrogen peroxide. When the chopped liver was added to the hydrogen peroxide large quantities of froth as bubbles of oxygen were produced in the liquid.

Fig. 17.3 shows the effect of increasing enzyme concentration on the rate of the reaction.

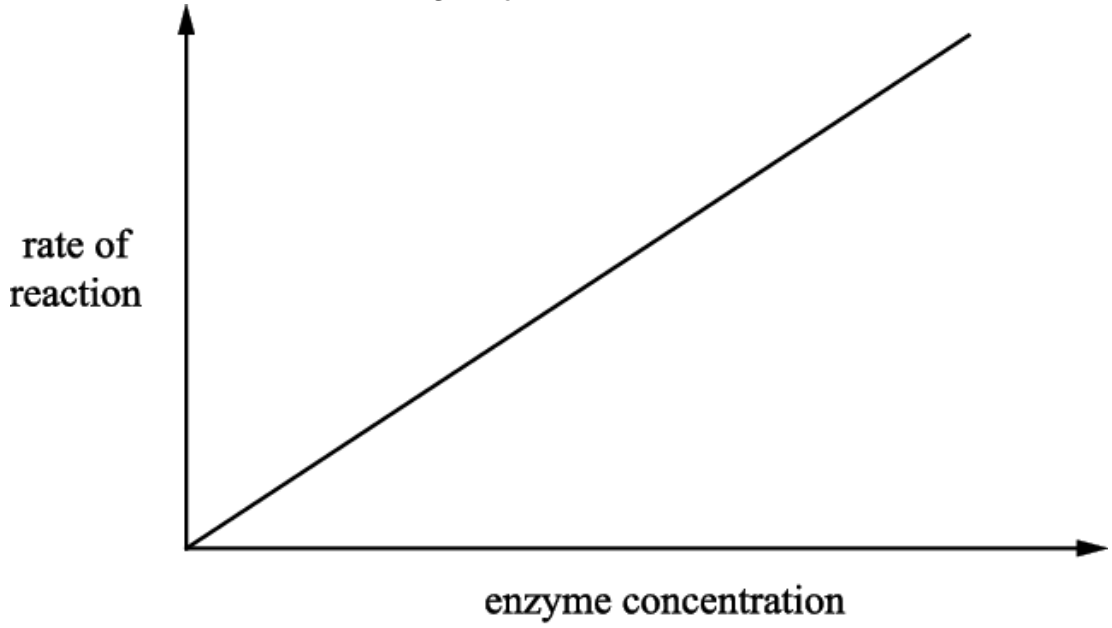


Fig. 17.3

i. Identify **two** variables that would need to be controlled in this laboratory investigation.

1 .....

2 .....

[1]

ii. How could you control **one** of the variables that you identified in **(i)** in the laboratory investigation?

.....

.....

[1]

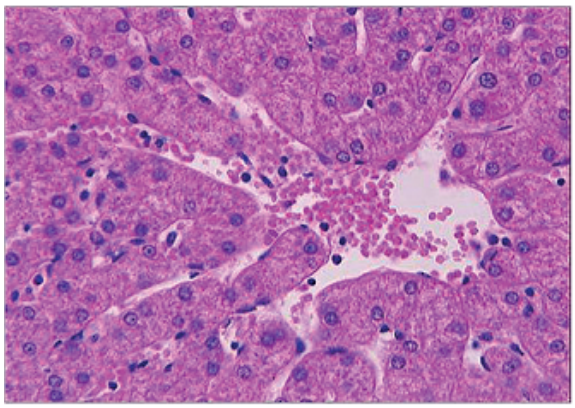
iii. * Using the information, deduce why and how catalase activity is regulated inside the liver cells.

[6]

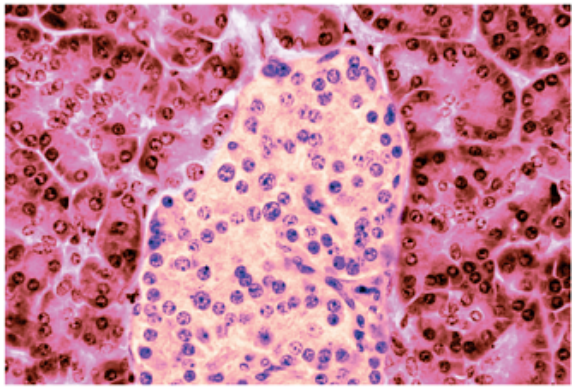
3.

A student looked at slides of different tissues under a light microscope.

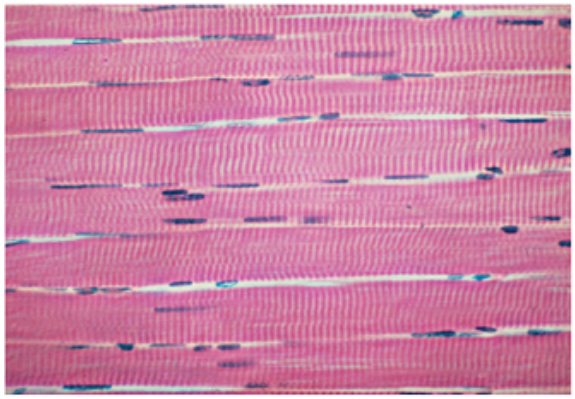
The four viewed images are labelled **W**, **X**, **Y** and **Z** in Fig. 23.1 below.



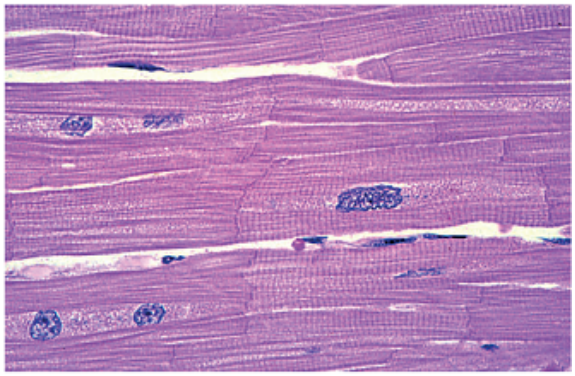
W



X



Y



Z

Identify tissues **W**, **X** and **Y**.

W .....

X .....

Y .....

[2]

4. Fig. 6.1 is a diagram that represents the nephron in a mammalian kidney.

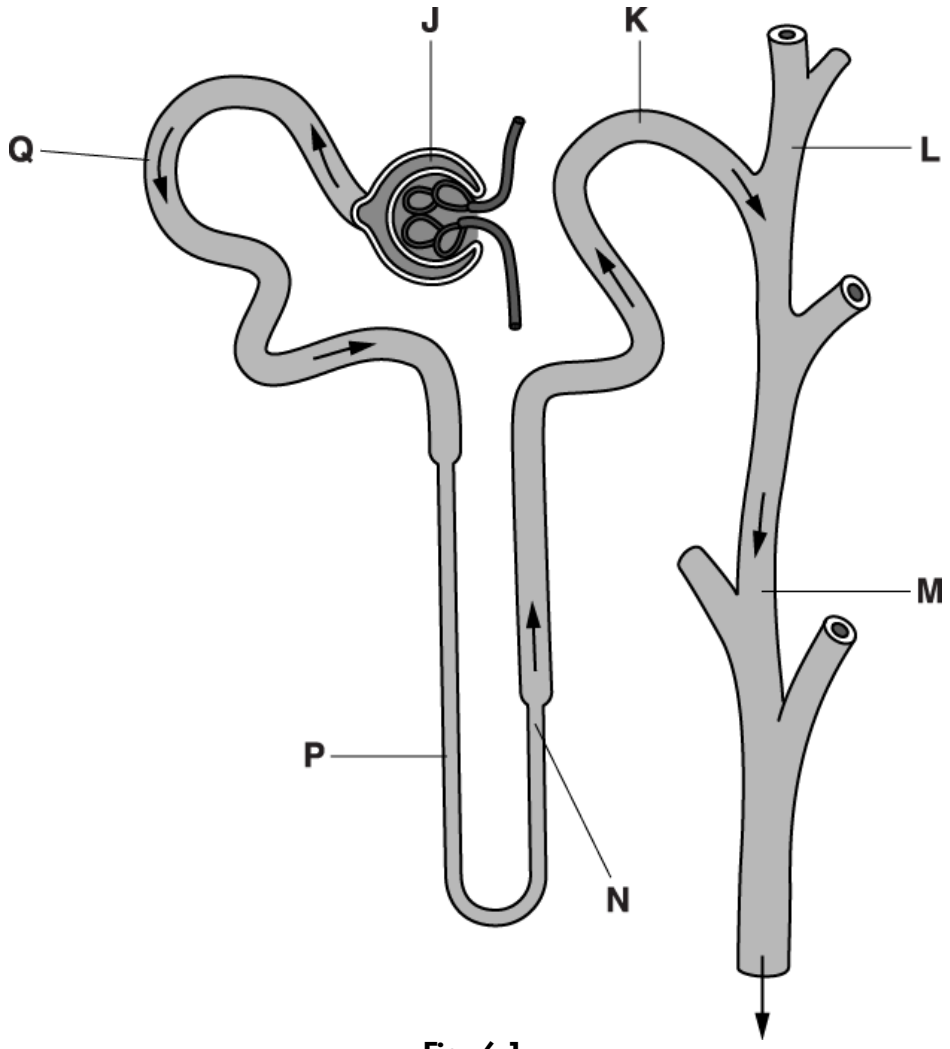


Fig. 6.1

Use the letter or letters from Fig. 6.1 to identify:

i. the region or regions where glucose is selectively reabsorbed into the blood capillaries

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

ii. the region or regions present in the cortex

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

iii. the region or regions where podocytes are located.

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

5(a). Fig. 22.1, below, is a cross section of part of the cortex of a mammalian kidney.

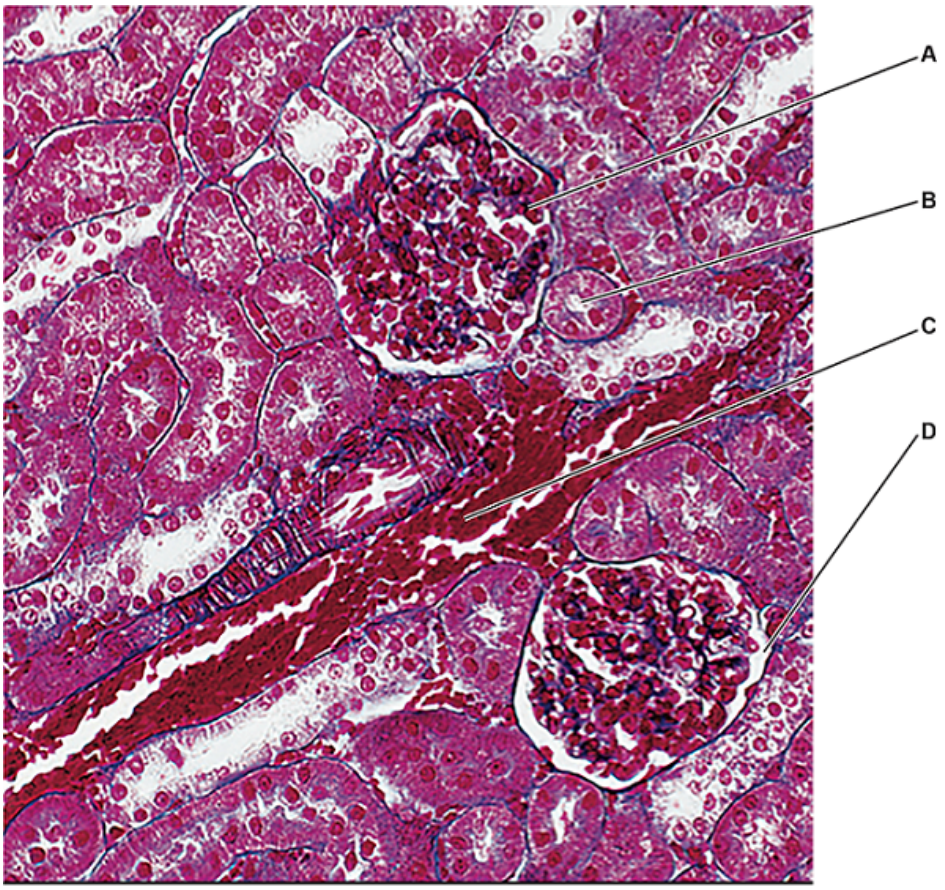


Fig. 22.1

i. Which letter identifies the region with the highest hydrostatic pressure?

.....[1]

ii. Which **two** letters identify regions that **do not** contain plasma proteins?

.....[1]

(b). Studies of the cell surface membranes of the **distal** convoluted tubule have provided the following evidence:

- Sodium-potassium pumps:
  - move potassium ions from the blood to the tubule fluid
  - move sodium ions from the tubule fluid to the blood
  - use ATP in these processes.
- Sodium-calcium co-transport proteins:
  - move calcium ions from the tubule fluid to the blood
  - move sodium ions into the tubule fluid
  - use the electrochemical gradient of sodium ions to drive this process.

i. Using this information and your own knowledge, compare the processes occurring in the **proximal** and **distal** convoluted tubules.

[3]

ii. Nephrogenic diabetes insipidus is a disease of the kidney that affects the regulation of water potential in the blood. One cause is lithium poisoning. Lithium ions enter the kidney tubules through sodium channels.

This prevents the cells of the collecting duct from responding to ADH in the blood.

State and explain **one** symptom you would expect to observe as a result of nephrogenic diabetes insipidus.

[2]

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

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

[6]

(b). A person's glomerular filtration rate (GFR) provides an indication of the health of their kidneys. The GFR is a measure of the volume of blood that can be filtered by the kidneys every minute.

GFR can be estimated by monitoring the blood concentration of creatinine, which is a breakdown product of creatine phosphate in muscles.

i. Suggest **two** characteristics of a patient that must be taken into account when using this GFR measurement to diagnose kidney damage.

Explain why each characteristic must be considered.

1 ----------

---

2 ----------

---

[4]

ii. If kidney damage is suspected, the patient's urine is likely to be tested for the protein albumin.

Explain why the presence of albumin in the urine indicates kidney damage.

---

[1]

7(a). A scientist investigated the effect of different types of food on the rate of urine production in adults.

- The subjects were given one food type for a period of three hours.
- After this, their rate of urine production was measured for the following three hours.
- Over the 6 hours of the procedure they consumed a controlled volume of water.

Fig. 19.2 is a graph of the results.

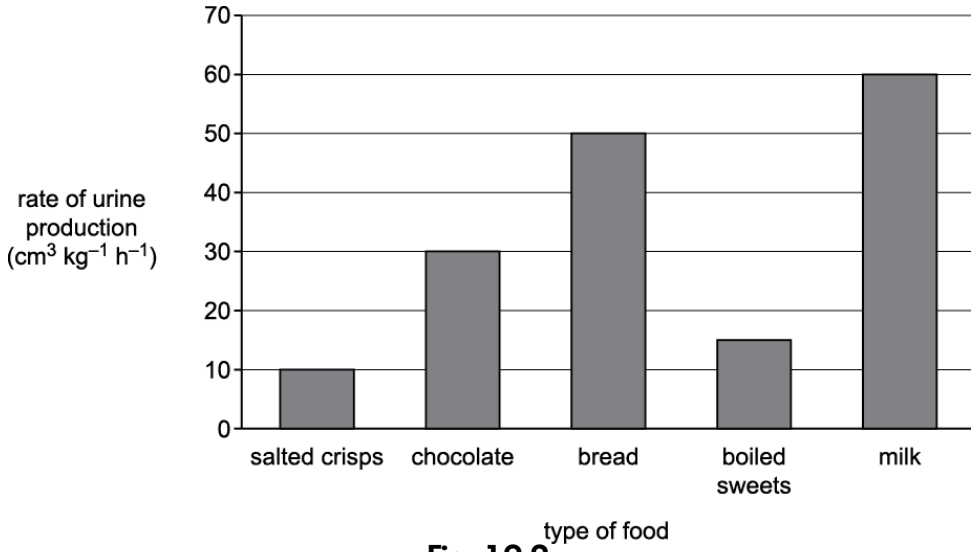


Fig. 19.2

Explain, with reference to Fig. 19.2, why some foods affect urine production.

[4]

(b). Fig. 19.1 is a diagram of a nephron from a mammalian kidney.

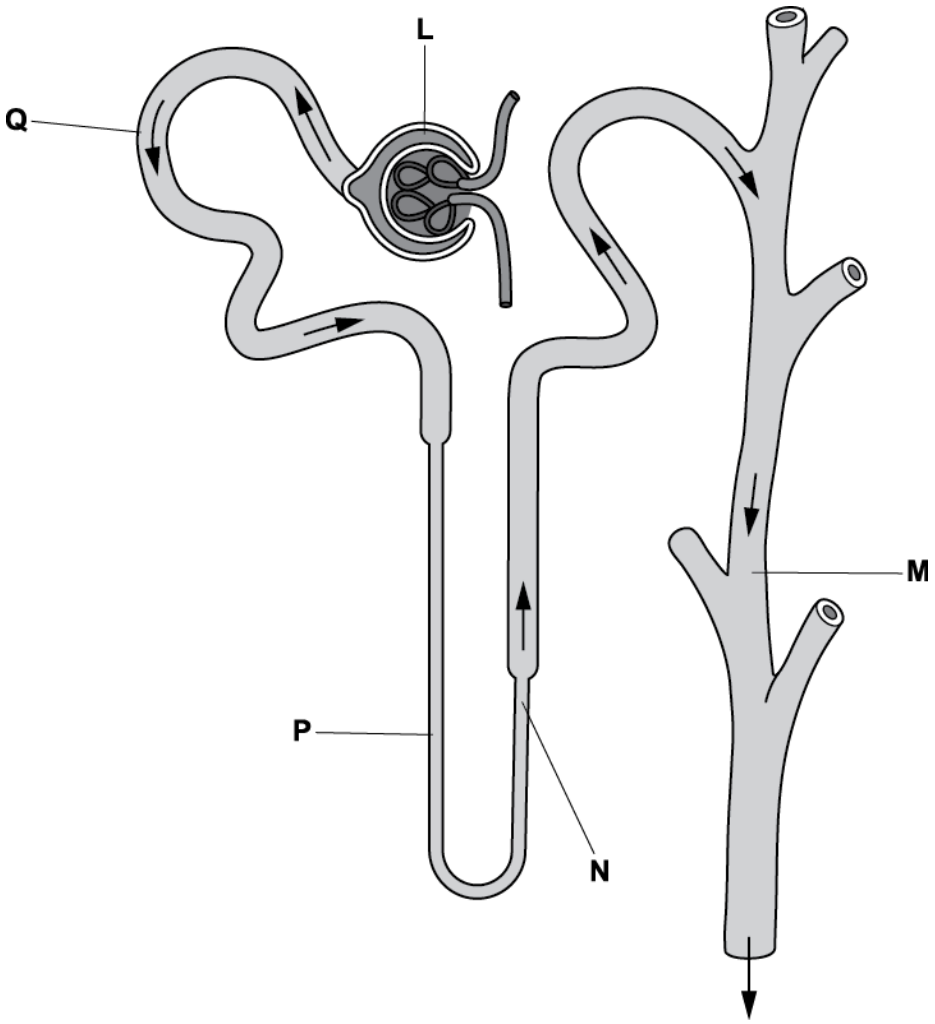


Fig. 19.1

Which letter or letters label areas of the nephron which are directly affected by ADH?

.....[1]

8. The desert kangaroo rat, *Dipodomys deserti*, lives in dry and hot conditions. It excretes a very small volume of urine relative to its size.

The loops of Henle in the kidneys of these mammals are longer than those found in mammals of a similar size that do not live in desert conditions.

Explain how the longer loop of Henle is able to assist the desert kangaroo rat in preventing excessive water loss.

[2]

9. i. Another result of cycasin poisoning can be kidney damage. Increasing numbers of pet owners in the USA and Asia are using dialysis to treat animals with damaged kidneys.

There are two types of dialysis: peritoneal dialysis and haemodialysis. Both of these dialysis methods remove waste from the blood.

- Peritoneal dialysis occurs within the abdominal cavity and uses active transport as well as diffusion.
- Haemodialysis involves a dialysis machine and relies on simple diffusion.

Explain why peritoneal dialysis can use active transport and diffusion while haemodialysis relies on diffusion alone.

[2]

ii. Suggest **one** advantage and **one** disadvantage of a kidney transplant compared to dialysis.

advantage

disadvantage

[2]

10. The hormone hCG can be detected in urine using pregnancy tests.

Which of the following properties of the hormone hCG allows it to be detected in urine?

A hCG is a polar molecule
B hCG has a molecular mass of less than 69,000
C hCG is a polypeptide
D hCG binds to cells using glycoproteins

Your answer ☐ **[1]**

END OF QUESTION paper

Mark scheme

Question			Answer/Indicative content	Marks	Guidance
1		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 **Examiner's Comments** This was answered well, showing good factual recall. Full marks were commonly awarded. Most confusion arose between C and D - the hepatic portal vein and hepatic artery. Common errors were to describe B including the term 'canaliculus' and D including the term 'portal'. A few candidates gave answers which included references to the pancreas or kidney, despite the question referring clearly to 'part of a liver lobule'.
		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 **Examiner's Comments** This question was good at differentiating between those candidates who had really read and absorbed the stimulus material and those who had either been confused by it or who had paid only cursory attention to the detail. Good answers appreciated the fact that there might not be enough glutathione and some excellent answers included more than one correct suggestion. Misconceptions included thinking that glutathione is actually formed from NAPQI rather than being used in its metabolism and that sulphate and glucuronide run out rather than the glutathione. A few candidates focused on the toxicity of NAPQI or described a lack of NAD.
		iii	hepatocytes	1	**CREDIT** (liver) stem cells / hepatic cells **IGNORE** liver cells unqualified

			and mitosis /mitotic (division);		**DO NOT CREDIT** Kupffer cells **ONLY CREDIT** correct spelling for mitosis / mitotic **Examiner's Comments** This question was well answered, although some incorrectly referred to Kupffer cells, meiosis and cell differentiation. Incorrect spelling of mitosis was not credited, but some candidates had obviously been taught to clearly print when giving terms that could be confused.
			Total	**7**	
2	a		**A** hepatic vein as blood leaving liver (1) **B** hepatic artery as blood entering liver through narrow vessel (1) **C** hepatic portal vein as blood (from gut) entering liver through branched vessel (1)	3	
	b	i	mitochondrion	1	**ALLOW** mitochondria.
		ii	*either* facilitated diffusion (1) conversion of ornithine into citrulline creates concentration gradients **or** (molecules are not lipid soluble so) require protein channels to cross membrane (1) ***or*** active transport (1) ornithine and citrulline need to be moved into and out of **D** more quickly than would be met by diffusion (1)	2	
		iii	deamination / removal of NH_2 group from amino acid (1)	1	
		iv	ATP (1)	1	
	c	i	*two from* pH temperature substrate / hydrogen peroxide concentration (1)	1	Two answers required for 1 mark. **DO NOT ALLOW**an answer that includes mass of liver / enzyme concentration.
		ii	*pH* take pH reading / ensure hydrogen peroxide is same pH for all enzymes concentrations tested (1) *temperature*	1	

			use liver tissue and hydrogen peroxide at room temperature / same temperature for all enzyme concentrations tested (1) *substrate concentration* use same concentration and volume of hydrogen peroxide for all enzyme concentrations tested (1)		
		iii	*** Level 3 (5–6 marks)** Deduction includes coherent interpretation of the evidence, clearly linking all ideas to explain why and how activity is regulated. *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)** Deduction includes clear use of some evidence to support conclusion but ideas may not be clearly linked for both how and why. *There is a line of reasoning presented with some structure. The information presented is in the most-part relevant and supported by some evidence.* **Level 1 (1–2 marks)** A simple deduction about how or why based on a limited interpretation of the evidence. *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.	6	**Relevant points include:** *Why* • large quantities of hydrogen peroxide and high turnover number of catalase would mean vigorous reaction and lots of oxygen produced very quickly. *How* • isolation of catalase in peroxisomes • released in small quantities • cells can limit expression of catalase • this effectively limits enzyme concentration and therefore reduces reaction rate • cells have no control over temperature or substrate concentration so enzyme concentration is the only method of control.
			Total	**9**	
3			**W** liver / hepatic ✓ **X** pancreas / pancreatic ✓	3	**IGNORE** cells **ALLOW** Islet of Langerhans / acini **Examiner's Comments**

			Yskeletal / striated , muscle✓		Generally this question was well-answered and it was clear that many candidates had seen images of tissues similar to those shown in Fig. 23.1. Credit could not be given for 'skeletal' or 'muscle' (tissue) for **Y** which were commonly seen incorrect responses. 'Skeletal' could also apply to other types of tissue found in the skeleton e.g. bone, and 'muscle' could also apply to other types of muscle tissue e.g. smooth muscle.
			Total	**3**	
4		i	**Q**;	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** named region as question requires candidates to identify the relevant regions from the diagram. **Examiner's Comments** Most candidates accessed 2/3 marks here. The most common error was to reverse the positions of the cortex and medulla. Almost all answers correctly followed the instruction to use letters rather than the names of the relevant parts of the nephron.
		ii	**Q and J and K and L;**	1	**All 4 letters required for the mark.** **If additional letters given, = 0 marks** **IGNORE** named region as question requires candidates to identify the relevant regions from the diagram. **Examiner's Comments** Most candidates accessed 2/3 marks here. The most common error was to reverse the positions of the cortex and medulla. Almost all answers correctly followed the instruction to use letters rather than the names of the relevant parts of the nephron.
		iii	**J**;	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** named region as question requires candidates to identify the relevant regions from the diagram. **Examiner's Comments** Most candidates accessed 2/3 marks here. The most common error was to reverse the positions of the cortex and medulla. Almost all answers correctly followed the instruction to use letters rather than the names of the relevant parts of the nephron.
			Total	**3**	
15	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

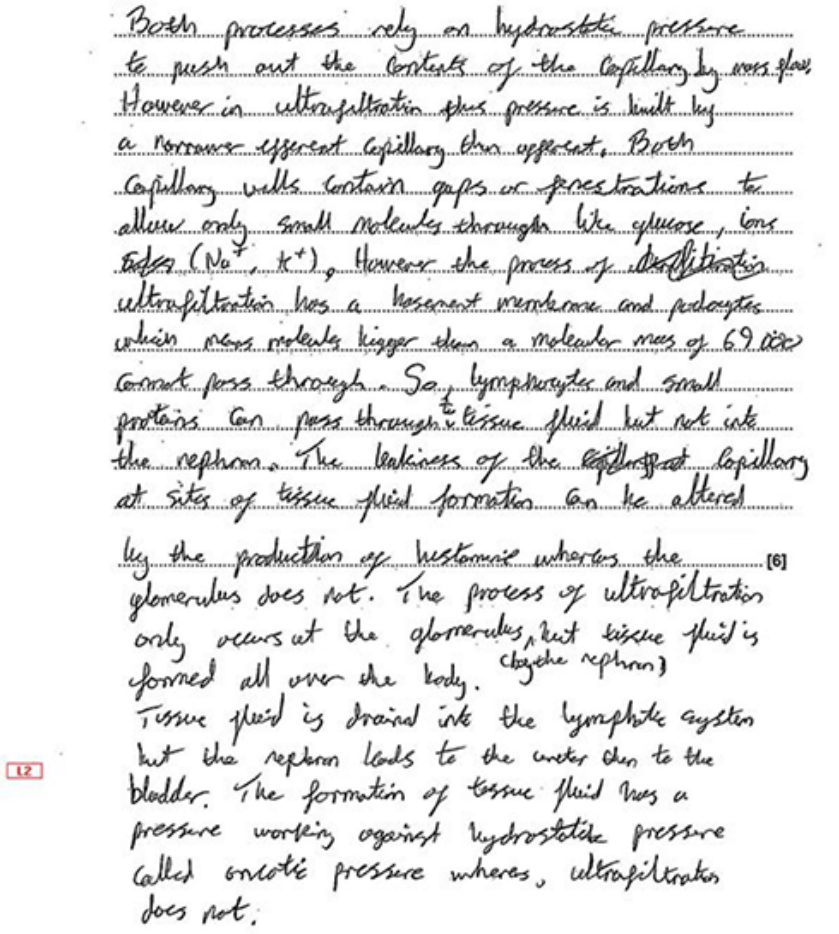
					responding to **Q22(a)(i)** and **(ii)**. Stronger candidates achieved maximum marks for both question parts, but there was no particular pattern evident in the incorrect responses.
		ii	**B, D**✓	**1**	*If more than two letters given, 0 mark* **IGNORE** names unless contradicts a stated letter **Examiner's 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 ✓ **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 ✓	**3 max**	*maximum two marks for similarities or differences* **IGNORE** sodium / Na **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**<u>protein</u>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.
			Total	**7**	
16	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 fenestrations to allow only small molecules through like glucose, ions (Na+, K+). However the process of ultrafiltration ultrafiltration has a basement membrane and podocytes which mean molecule bigger than a molecular mass of 69 000 cannot pass through. So, lymphocytes and small proteins can pass through to tissue fluid but not into the nephron. The leakiness of the ~~capillary~~ capillary at sites of tissue fluid formation can be altered by the production of histamine whereas the [6]
glomerulus does not. The process of ultrafiltration only occurs at the glomerulus, but tissue fluid is formed all over the body. (by the nephron)
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 wheres, ultrafiltration does not.

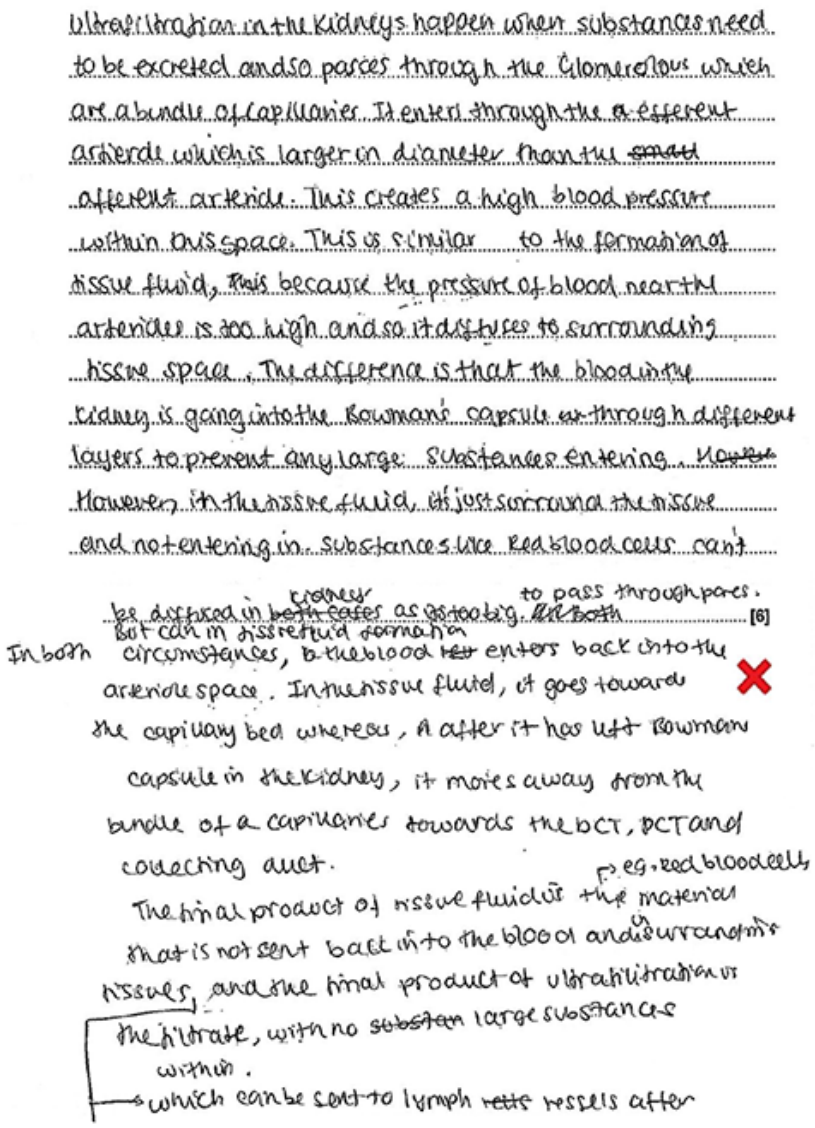
L2

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

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 Glomerulous which are a bundle of capillaries. It enters through the afferent arteriole which is larger in diameter than the ~~small~~ efferent 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 arterioles 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 ~~w~~ through different layers to prevent any large substances entering. ~~However~~ However in the tissue fluid, it just surround the tissue and not entering in substances like Red blood cells can't be diffused in ~~both~~ kidney cases as ~~too~~ big. ~~But~~ Both to pass through pores. But can in tissue fluid formation [6]

In both circumstances, b the blood ~~re~~ enters back into the arteriole space. In the tissue fluid, it goes toward the capiliary bed whereas, A 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 surrounds tissues, and the final product of ultrafiltration is the filtrate, with no ~~substan~~ large substances within.

which can be sent to lymph ~~vess~~ 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.

	b	i	age ✓ (because) GFR / kidney function , declines with age ✓	**4 max**	**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)'

			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 ✓ 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 ✓		**ALLOW** 'more / less, creatine (in muscle) **ALLOW** use of creatine supplements **Examiner's Comments** 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, 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**	
7	a		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 aquaporins in collecting duct so more water is reabsorbed (into capillaries) ✓ bread / milk / chocolate, increase water potential of blood ✓ causes reduced ADH release ✓	4 max	**IGNORE** descriptions of graph

	b		**M**✓	1	
			Total	**5**	
8			**1** more (sodium and chloride) ions pumped, out of ascending limb / into medulla; **2** builds up greater water potential gradient; **3** allows, reabsorption / removal, of *more* water from,collectingduct /M;	2	**1** **CREDIT**active transport / AW, for 'pumped' **IGNORE** salts / diffusion **2** **ACCEPT*even more*** negative water potential in medulla (than other mammals) **Examiner's Comments** This question was a good discriminator. Most candidates had a good idea of the role of the loop of Henle but they found it less easy to clearly communicate the significance of the loop being 'longer' in the desert mammal. There was often imprecise use of terminology - selective reabsorption of water / movement of salts / greater concentration gradients etc. Reabsorption of water often centred on the descending limb or distal convoluted tubule rather than on the collecting duct as urine formation was often thought to have been completed before this part was reached. The main reasons for marks not being awarded were for not clearly stating locations or using correct comparative terms - more / even more / greater etc.
			Total	**2**	
9		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
			Total	**4**	
10			B ✓	**1**	**Examiner's Comments** This question proved challenging for some candidates with option **D** being the most commonly seen incorrect response.
			Total	**1**	