1 **(a)** Fig. 2.1 is a photomicrograph through the centre of a lobule of a mammalian liver.

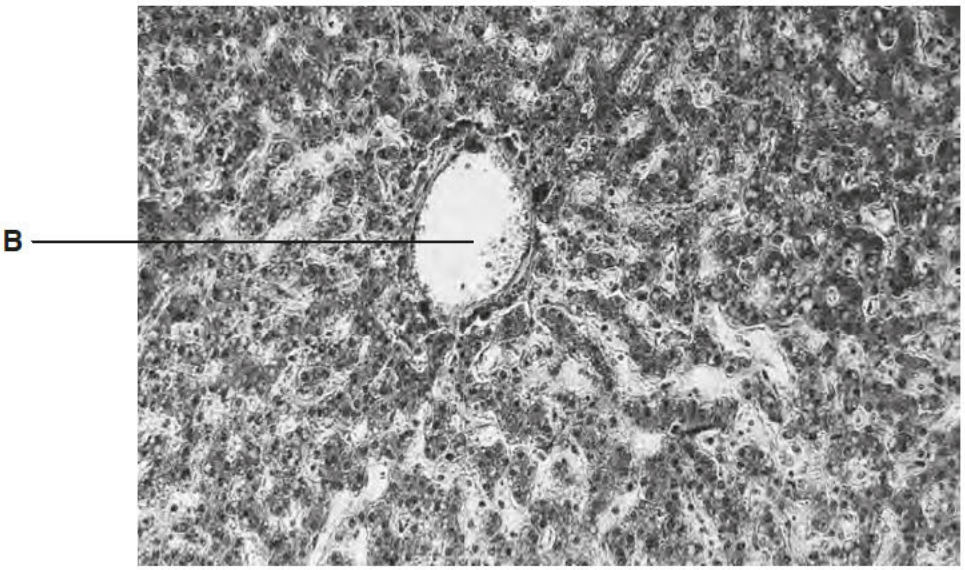


Fig. 2.1

(i) Name the type of vessel labelled **B**.

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

(ii) Name the cells that make up the lobule.

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

(b) Fig. 2.2 outlines the formation of urea in the liver.

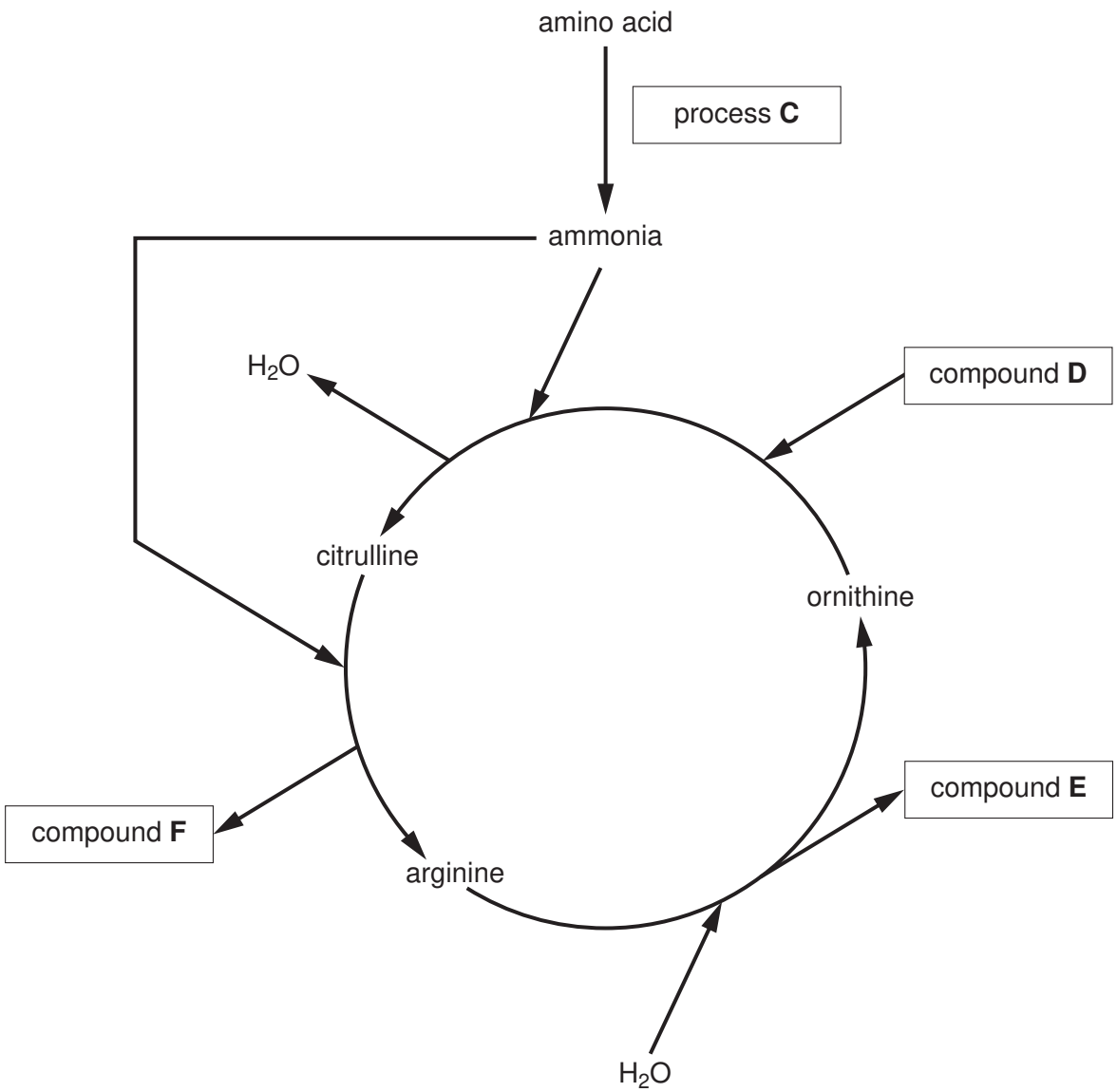


Fig. 2.2

Using Fig. 2.2, identify:

process **C** .....

compound **D** .....

compound **E** .....

compound **F** ..... **[4]**

(c) The urea formed in the ornithine cycle will be excreted from the body in urine. Urine also contains other chemicals.

Procedures have been developed to test for the presence of some of these chemicals, such as hormones.

(i) A pregnancy testing kit contains a testing 'stick' to detect a hormone in the urine.

Explain how the stick detects this pregnancy hormone.



In your answer, you should use appropriate technical terms, spelt correctly.

.....

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..... **[4]**

(ii) The urine of some high profile athletes has been tested and found to contain abnormally high levels of banned steroids or their metabolites.

The pressure on elite athletes to succeed in their sport leads some of them to resort to the use of these performance-enhancing steroids.

Comment on whether the use of steroids should be permitted in sport.

.....

.....

.....

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.....

.....

..... **[3]**

[Total: 13]

2 **(a)** Excretion and secretion are two processes that take place in the body of a mammal.

Complete the table below to compare the processes of excretion and secretion.

	excretion	secretion
one difference		
one example of a product		
one similarity		

[3]

(b) Aerobic respiration may be summarised by the following equation:

$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$$

Although carbon dioxide and water are products of aerobic respiration, the equation is an over-simplification of the process.

State **and** explain **one** way in which this equation is an over-simplification.

.....

.....

.....

..... **[2]**

(c) Over 2.3 million people in the UK are known to have diabetes. It is also estimated that a further 0.5 million people have the condition but are unaware of it.

(i) Explain how **Type 1** diabetes is caused.

.....

.....

.....

..... **[2]**

(ii) Describe **three** factors that increase a person's risk of developing **Type 2** diabetes.

.....

.....

.....

.....

.....

.....

.....

..... **[3]**

[Total: 10]

3 **(a)** Blood enters th s process 1200 cm^3 of blood every sma. As this blood passes through a glomerulus, 125 cm^3 of fluid passes into the renal tubule.

(i) Name the process by which the fluid passes from the glomerulus into the renal tubule.

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

(ii) Calculate the percentage of plasma that passes into the renal tubule.

Show your working and **give your answer to one decimal place**.

Answer = ... % **[2]**

(b) Fig. 4.1, **on the insert**, is an electronmicrograph of a transverse section of part of a proximal convoluted tubule.

(i) Name the tissue that lines the proximal convoluted tubule.

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

(ii) Name the structures indicated by **X**.

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

(iii) Table 4.1 shows the approximate concentration of some of the substances in the blood plasma, the glomerular filtrate and the urine leaving the collecting duct.

Table 4.1

substance	concentration in blood plasma ($g\,dm^{-3}$)	concentration in glomerular filtrate ($g\,dm^{-3}$)	concentration in urine leaving collecting duct ($g\,dm^{-3}$)
amino acids	0.50	0.50	0.00
glucose	1.00	1.00	0.00
inorganic ions	7.30	7.30	15.60
nitrogenous waste (not including urea)	0.03	0.03	0.28
protein	80.00	0.00	0.00
urea	0.30	0.30	21.00

Some of the changes observed between the glomerular filtrate and the urine are as a result of activity in the proximal convoluted tubule.

With reference to Table 4.1, explain how these observed changes in concentration are brought about by the **proximal convoluted tubule**.

In your answer, you should use appropriate technical terms, spelt correctly.

.....

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..... **[4]**

(c) When the kidney ay be necessary.

Fig. 4.2 outlines the procedure of haemodialysis, a type of renal dialysis.

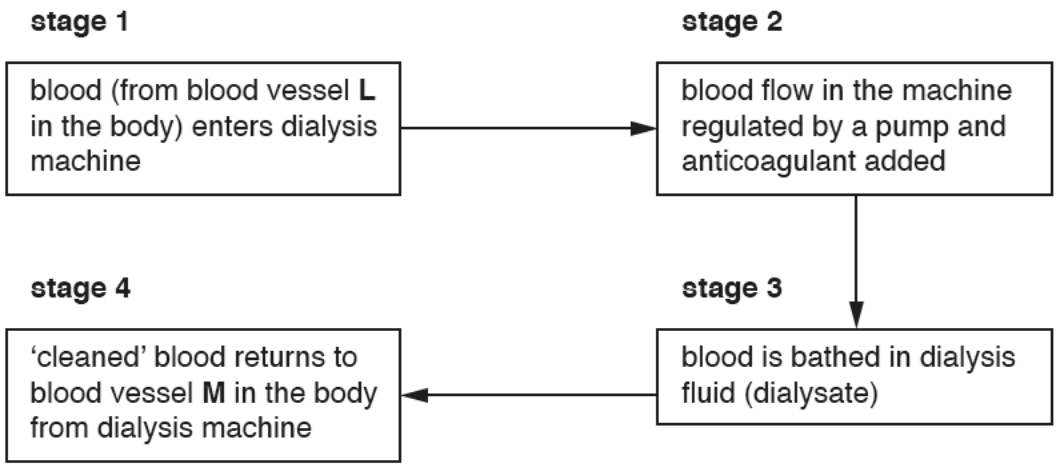


Fig. 4.2

Fig. 4.3 shows further detail of how **stage 3** is achieved.

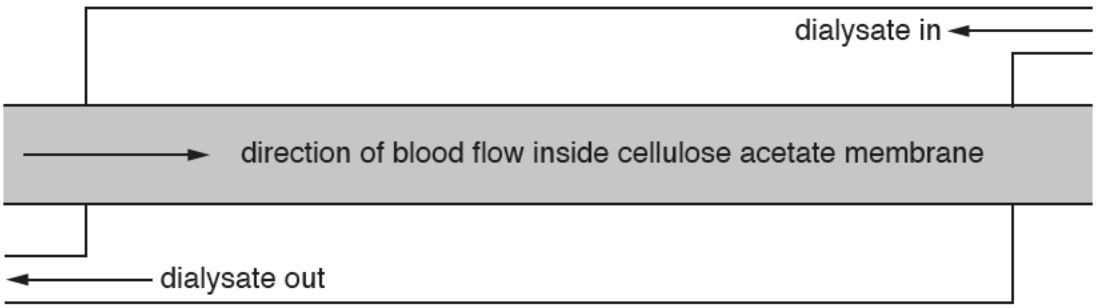


Fig. 4.3

(i) State the **types** of blood vessel represented by **L** and **M** in Fig. 4.2.

L .....

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

(ii) Suggest why it is necessary to add an anticoagulant to the blood in **stage 2**.

.....

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

(iii) Suggest why **no** anticoagulant is added to the blood towards the end of a dialysis session.

.....

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

(iv) State the process by which molecules and ions, **other than water**, will move from the blood into the dialysate.

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

(v) Suggest why the direction of flow of the blood and the dialysate is as shown in Fig. 4.3.

.....

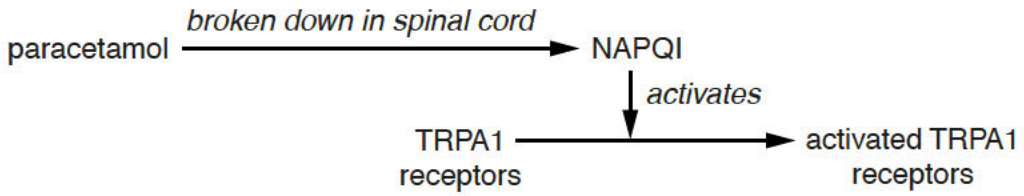
..... **[1]**

[Total: 14]

4 **(a)** Paracetamol is a drug that is commonly used as a painkiller. For many years, scientists have been uncertain about the way in which paracetamol works.

A recent study has shown that:

- paracetamol is broken down in the spinal cord into a compound called NAPQI
- NAPQI activates a receptor protein called TRPA1
- TRPA1 is found on the plasma (cell surface) membranes of neurones
- the activated receptor protein, TRPA1, interferes with the transmission of the nerve impulses from one neurone to the next.



(i) Name **one** chemical that transfers a nerve impulse from one neurone to another.

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

(ii) Suggest the part of the neurone where the plasma membrane has TRPA1 receptors.

Explain your answer.

part of neurone .....

explanation .....

.....

.....

.....

[2]

(b) 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.

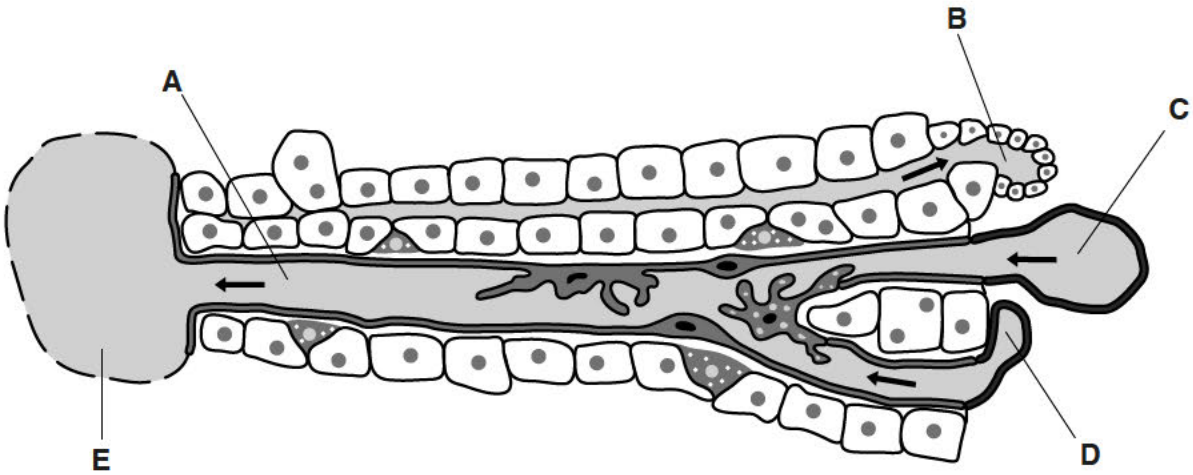


Fig. 4.1

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]**

[Total: 10]