1(a). Furosemide is a type of drug known as a diuretic that acts on the nephron to decrease reabsorption of water in the collecting ducts. Diuretics are often prescribed to treat high blood pressure.

Furosemide is on the list of banned substances published by the International Olympic Committee.

i. State **one** other type of drug on the list of banned substances that can be detected in urine samples.

[1]

ii. Furosemide can also be misused by jockeys or boxers who need to be below a certain weight.

Explain how a diuretic could help to reduce weight.

[2]

iii. Furosemide is a banned substance because it can be used as a masking agent, to hide the use of performance enhancing drugs.

Suggest how furosemide could act as a masking agent.

[1]

(b). Urine analysis can also be used in medical diagnosis.

i. Bladder cancer can be diagnosed by surgical removal of a small piece of bladder tissue (a biopsy sample).

State **one** advantage of urine analysis over a biopsy sample.

[1]

ii. Give **one** other application of urine analysis in diagnosis.

State the substance measured and the corresponding medical condition.

Substance

Medical condition

[1]

(c). Describe the homeostatic mechanisms that regulate the water content of the blood by changing how much water is reabsorbed from the collecting duct.

You do **not** need to describe how the loop of Henle sets up a water potential gradient in your answer.

[6]

2. Changes to kidney function during pregnancy can be confused with some diseases, such as chronic kidney disease or kidney failure.

The estimated glomerular filtration rate (eGFR) in a healthy 30–39-year-old is 107 $cm^3\ min^{-1}$. The eGFR usually decreases with age but in pregnancy, can increase by between 50 and 85%.

The table shows the results of some of the physiological measurements that a clinic carried out on two 35-year-old women. One of the patients was pregnant.

Measurement	Patient A	Patient B
eGFR ($cm^3\ min^{-1}$)	162	35
Blood glucose concentration	Normal	Slightly high
Urine glucose concentration	Moderately high	Slightly high
Urine protein concentration	Slightly high	Very high
Blood electrolytes Na^+, K^+, Cl^-	Normal	High

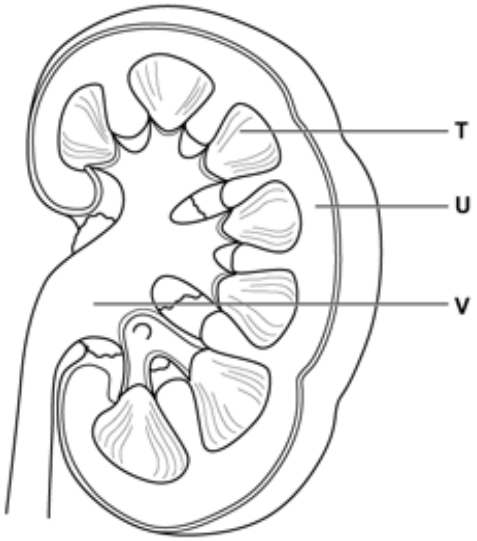
A doctor concluded that patient A was undergoing a normal pregnancy whereas patient B was suffering from kidney failure.

Explain the doctor's conclusion.

[4]

3(a).

i. The figure below is a drawing of a longitudinal section of a kidney.



Identify the parts of the kidney labelled **T**, **U** and **V**.

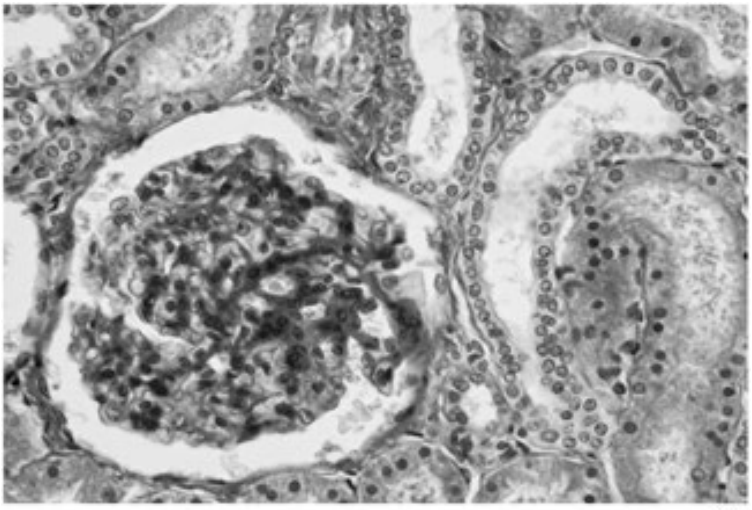
T

U

V

[3]

ii. The figure below is a photomicrograph of a cross-section of part of the kidney.



× 360

Using the letter **T**, **U** or **V** from the drawing, identify the part of the kidney that was used to make the cross-section in the photomicrograph.

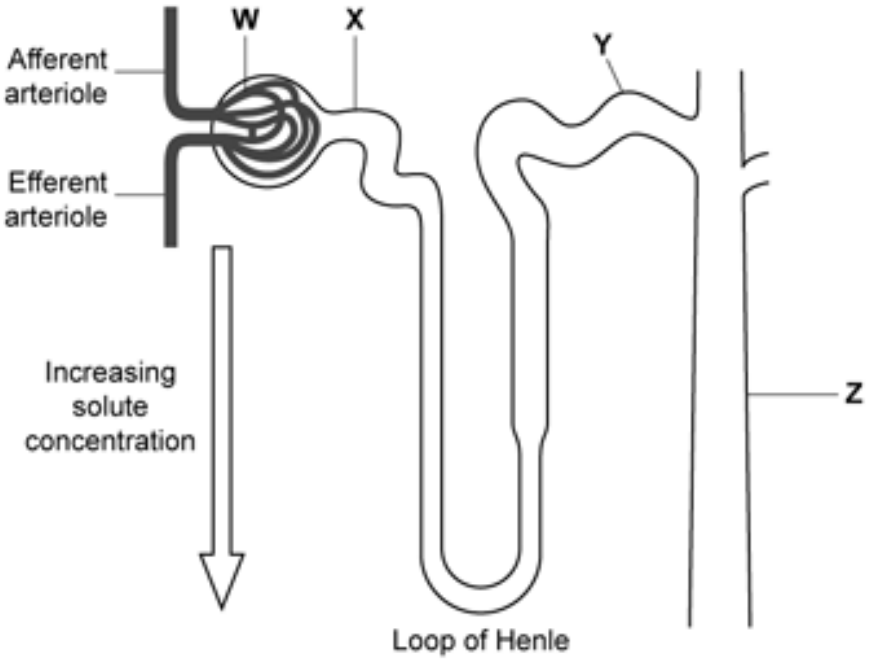
Give a reason for your identification.

Letter representing part of the kidney _____

Reason _____

_____ **[2]**

(b). The figure below is a diagram of a single nephron.



i. Complete the table using the most appropriate letter or letters, **W** to **Z**, to show which part(s) of the nephron correspond to each of the statements.

Each letter may be used once, more than once or not at all.

Statement	**Letter or letters**
ADH increases the permeability of the walls	
This region has the highest hydrostatic pressure	
Movement of mineral ions occurs to maintain the balance of mineral ions in the blood	

[3]

ii. The figure shows an increasing solute concentration.

Outline the processes in the loop of Henle that cause the solute concentration to increase.

[3]