1 Urine is a liquid that is composed of a number of different substances.

(a) Urea is one compound that is excreted from the mammalian body in urine.

(i) Name the organ that **produces** urea.

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

(ii) It has been observed that the urea content of urine is relatively high when a person eats an excessive amount of protein in their diet.

Suggest why a high intake of protein in the diet will be likely to result in a high concentration of urea in urine.

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

(b) Suggest what condition is indicated by the presence of glucose in a person's urine.

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

(c) **(i)** Pregnancy may be detected by testing a woman's urine.

State the substance that is being tested for in urine when a pregnancy test is carried out.

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

(ii) Ovulation is the release of an egg cell from the ovary. In order for pregnancy to occur, the egg cell must be fertilised within 24 hours of its release from the ovary.

Immediately before ovulation, the body produces a large amount of luteinising hormone (LH). This is known as the LH surge and triggers ovulation. It is during this time that fertilisation is most likely to occur.

- If a woman is trying to get pregnant, it can be useful to know when ovulation has occurred.
- It is possible to identify the LH surge by using a test stick to detect LH in urine.
- The test stick for LH works in a similar way to the test stick used for detecting pregnancy.

Fig. 2.1 shows the features of a test stick that can be used to test for LH in urine.

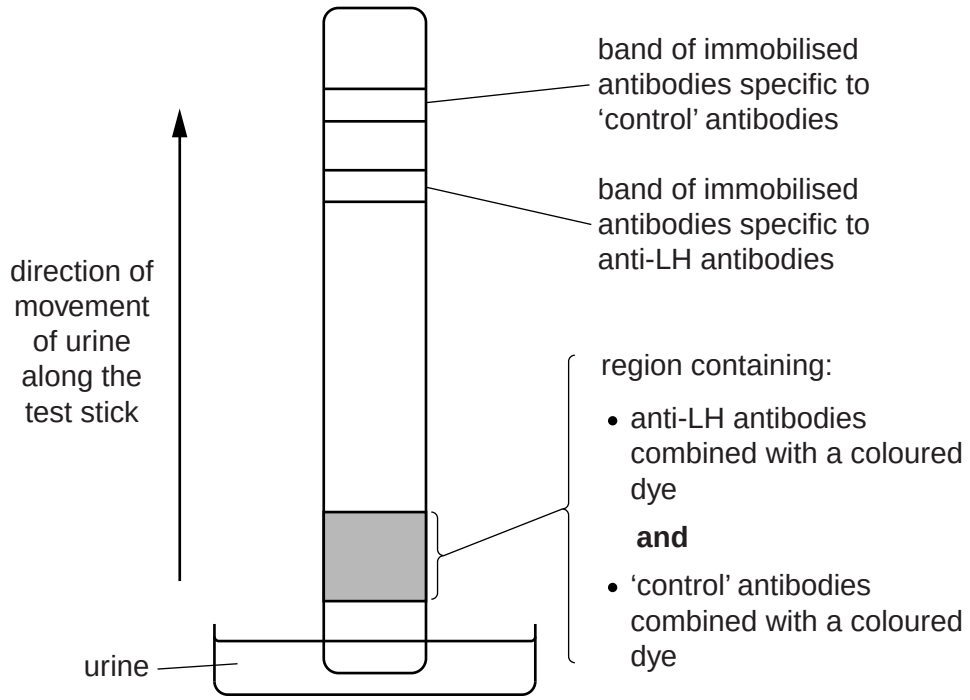

Fig. 2.1

Using your knowledge of how a test stick works, suggest how the test stick in Fig. 2.1 can be used to indicate a positive result for LH in urine.

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

[Total: 9]

2 Fig. 5.1 is a photomicrograph of a horizontal section through the cortex of a mammalian kidney.

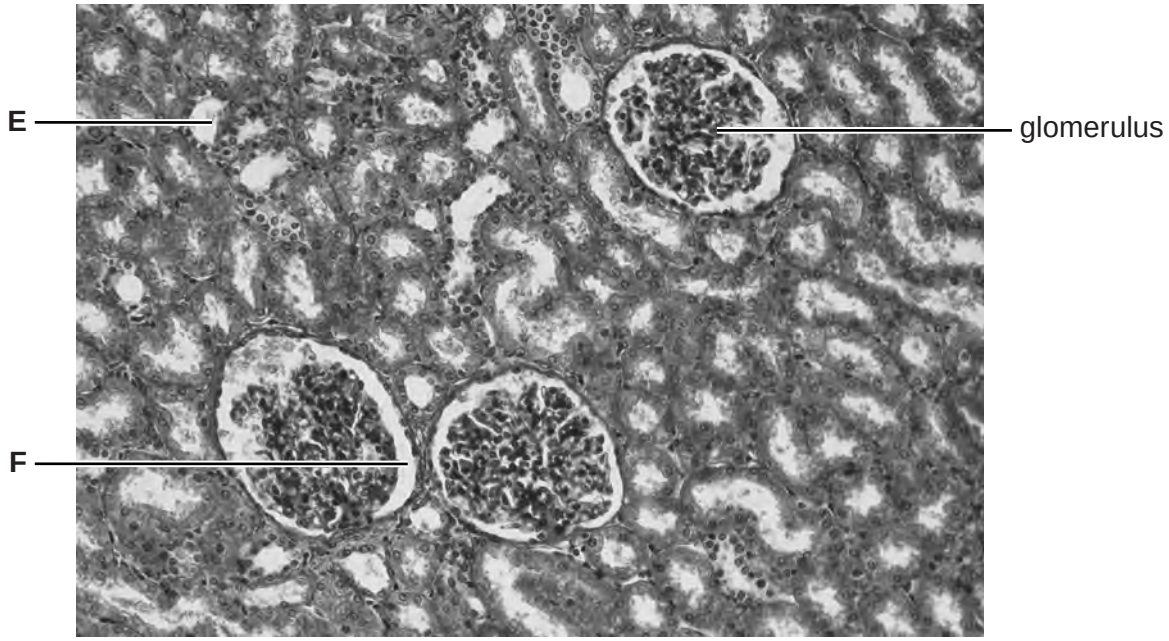

Fig. 5.1

(a) Identify the structures labelled **E** and **F** in Fig. 5.1.

E .....

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

(b) **(i)** Explain how the glomerulus is able to perform its function.

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

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

(ii) **Name** the specialised cells present in structure **F** that assist in the function you described in **(b)(i)**.

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

(c) Kidney failure has serious consequences for the individual.

(i) Suggest the effects of complete kidney failure on the **composition of the blood**.

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

(ii) One way of treating a person with kidney failure is by giving them a kidney transplant.

Explain the need for close matching of the donated kidney to the recipient.

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

[Total: 11]

3 **(a)** Fig. 5.1 is a drawing representing a vertical section through a mammalian kidney.

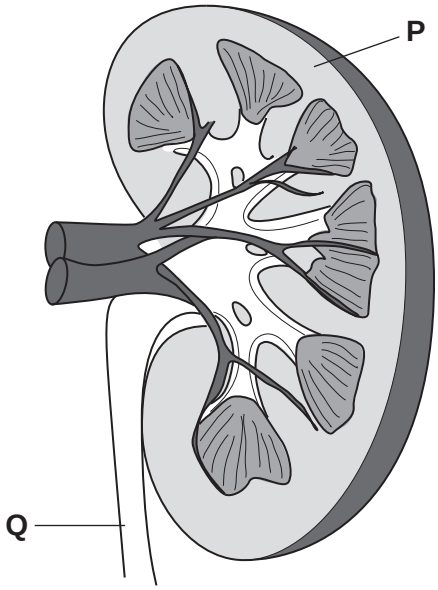

Fig. 5.1

Name the region **P** and the structure **Q**.

P .....

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

(b) (i) Each kidney contains approximately one million nephrons. Each section of a kidney nephron is adapted to perform its function effectively.

Describe the features of the **glomerulus** and **Bowman's capsule** that allow them to perform their function effectively.

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

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

(ii) Nephritis is a condition in which the tissue of the glomerulus and proximal convoluted tubule becomes inflamed and damaged.

Suggest **two** differences in the composition of the urine of a person with nephritis when compared to the urine of a person with healthy kidneys.

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

(c) Caffeine is a mild diuretic. Caffeine prevents the introduction of additional aquaporins into the wall of the collecting duct of the nephron and therefore additional water is not removed from the urine.

Aquaporins are channels in the cell surface membrane that allow water molecules to pass through.

Fig. 5.2 represents an aquaporin.

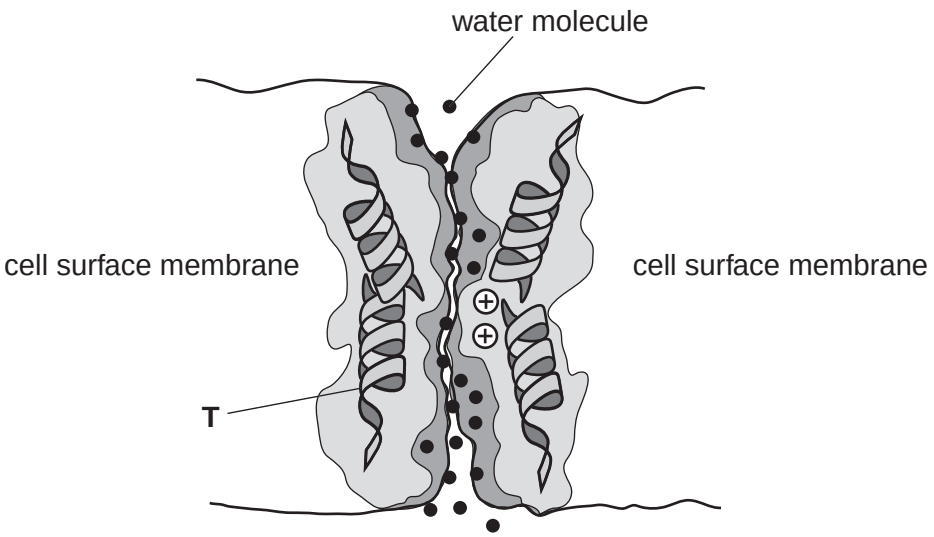

Fig. 5.2

(i) Identify the type of molecule labelled **T**.

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

(ii) The aquaporin allows water to travel from the collecting duct into the surrounding tissues but prevents the passage of ions such as sodium ions and potassium ions.

With reference to Fig. 5.2, suggest **two** ways in which the structure of this aquaporin prevents the passage of ions.

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

[Total: 11]

4 Osmoregulation is a key feature of homeostasis and maintains the water potential of the blood within certain limits. This is achieved by the action of anti-diuretic hormone (ADH).

(a) Explain the likely effect on the blood cells if the water potential of the plasma was allowed to increase significantly.

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

Fig. 4.1 is a simplified diagram of the structure of ADH.

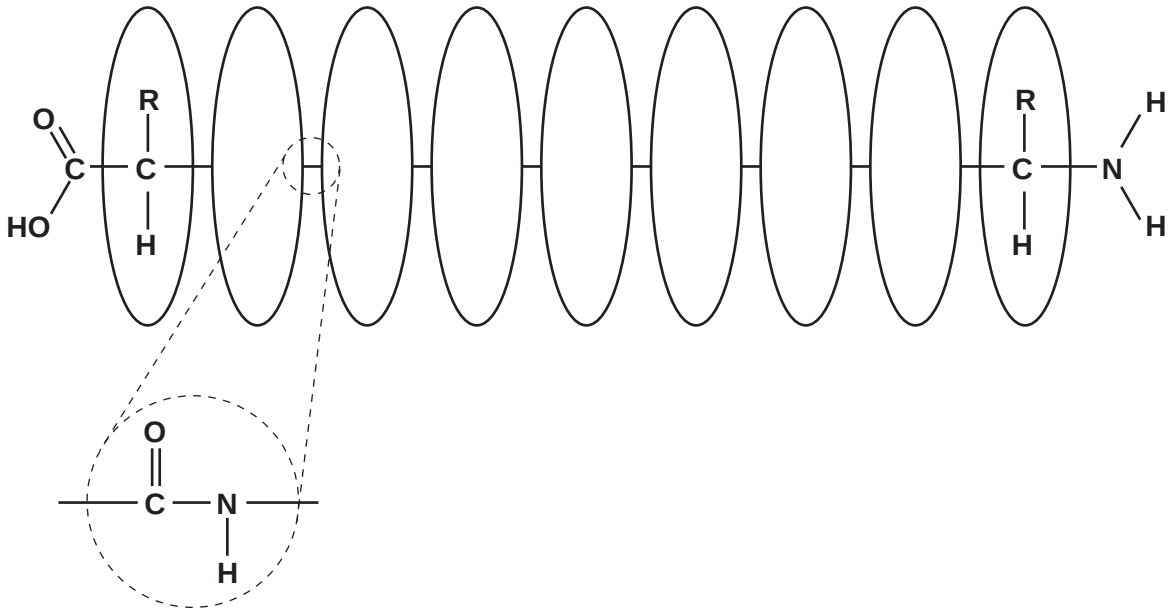

Fig. 4.1

(b) Name the type of monomer that makes up a molecule of ADH and the bond that joins the monomers together.

type of monomer.....

name of bond..... **[2]**

(c) Complete the following passage, using the **most suitable** term in each case:

ADH is a hormone that is produced by specialised nerve cells known as

..... cells. These cells detect changes in the water

potential of the blood flowing through the ..... . If the water

potential of the blood is too low then ADH is released.

ADH is not secreted immediately into the blood but passes along the

..... of the specialised nerve cells to the

.... gland, from where it is

released into the blood.

ADH acts on the cells of the ....

The ADH molecule attaches to receptors on the ..... of these

cells and causes protein channels known as ..... to insert

themselves into the membrane. Water passes through these channels by

..... and a smaller volume of more concentrated urine is produced.

[8]

(d) ADH does not stay in the blood indefinitely.

Suggest where ADH is removed from the blood **and** describe what then happens to the ADH molecule.

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

[Total: 15]