Q1. Osmoreceptors are specialised cells that respond to changes in the water potential of the blood.

(a) Give the location of osmoreceptors in the body of a mammal.

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(1)

(b) When a person is dehydrated, the cell volume of an osmoreceptor decreases. Explain why.

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(2)

(c) Stimulation of osmoreceptors can lead to secretion of the hormone ADH. Describe and explain how the secretion of ADH affects urine produced by the kidneys.

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(4)

The efficiency with which the kidneys filter the blood can be measured by the rate at which they remove a substance called creatinine from the blood. The rate at which they filter the blood is called the glomerular filtration rate (GFR).

In 24 hours, a person excreted 1660 mg of creatinine in his urine. The concentration of creatinine in the blood entering his kidneys was constant at 0.01 mg cm^{-3}.

(d) Calculate the GFR in cm^3 $minute^{-1}$.

Answer = ...

(1)

(e) Creatinine is a breakdown product of creatine found in muscle tissues. Apart from age and gender, give **two** factors that could affect the concentration of creatinine in the blood.

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(1)

(Total 9 marks)

Q2. In a mammal, urea is removed from the blood by the kidneys and concentrated in the filtrate.

(a) Describe how urea is removed from the blood.

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(b) Explain how urea is concentrated in the filtrate.

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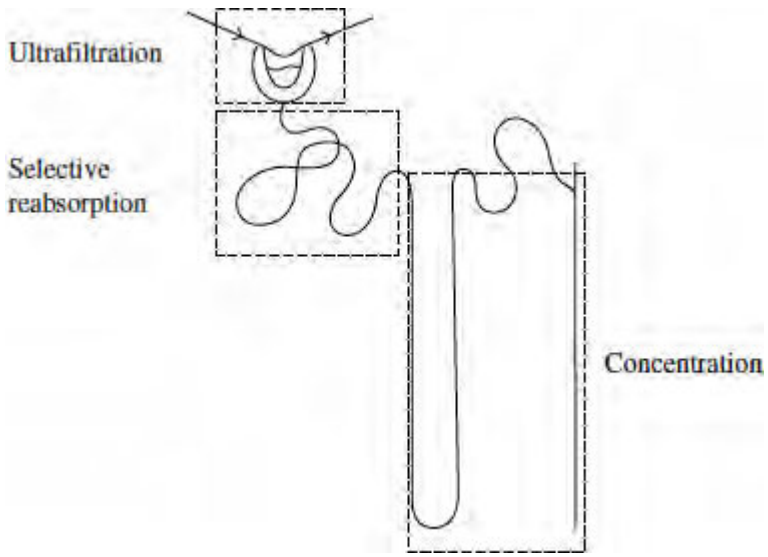
(3)
(Total 5 marks)

Q3. Three processes are involved in the formation of urine in a mammalian kidney. These are ultrafiltration, selective reabsorption and concentration. The diagram shows where these processes take place in a nephron.



(a) Describe how ultrafiltration produces glomerular filtrate.

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(5)

(b) Some people who have diabetes do not secrete insulin. Explain how a lack of insulin affects reabsorption of glucose in the kidneys of a person who does not secrete insulin.

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(4)

(c) Some desert mammals have long loops of Henle and secrete large amounts of antidiuretic hormone (ADH). Explain how these two features are adaptations to living in desert conditions.

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(6)
(Total 15 marks)

Q4.(a) A diabetic person and a non-diabetic person each ate the same amount of glucose. One hour later, the glucose concentration in the blood of the diabetic person was higher than that of the non-diabetic person. Explain why.

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(3)

(b) (i) The urine of a non-diabetic person does **not** contain glucose. Explain why.

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(2)

(ii) A high blood glucose concentration could cause glucose to be present in the urine of a diabetic person. Suggest how.

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(2)

(c) A test for glucose in urine uses immobilised enzymes on a plastic test strip. One of these enzymes is glucose oxidase. Explain why the test strip detects glucose and no other substance.

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(2)

(d) If the glomerular filtrate of a diabetic person contains a high concentration of

glucose, he produces a larger volume of urine. Explain why.

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(3)

(e) In some forms of kidney disease, proteins from the blood plasma are found in the urine. Which part of the nephron would have been damaged by the disease to cause proteins from blood plasma to be present in the urine? Explain your answer.

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(Extra space).....

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(3)
(Total 15 marks)

Q5. The kangaroo rat is a small desert mammal. It takes in very little water in its food and it rarely drinks. Its core body temperature is 38 °C.

The kangaroo rat takes in some water by feeding and drinking. Describe another method by which the kangaroo rat could obtain water.

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(Total 2 marks)