Q1.

Answer the questions with a cross in the boxes you think are correct ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.

Sweating is normal when we are hot. It is part of our natural cooling mechanism. If you sweat visibly when you do not need to cool down, it can be a problem.

The sweating process is controlled by the brain, which sends signals down the nerves to the sweat glands.

Sweating is crucial to survival. We sweat to control body temperature and the sweat glands in our armpits can produce several litres of sweat in 24 hours. How much we sweat varies hugely from individual to individual and even from day to day.

Hyperhidrosis occurs when some areas of the body start sweating excessively. This affects about 1% of the population. There are two main types. The most common type is primary focal hyperhidrosis, which affects many parts of the body. There is no known cause, but it usually begins in childhood and often runs in families. Another type is secondary hyperhidrosis, which often doesn't begin until after the teenage years, and usually has an underlying medical cause. These causes can include diabetes, menopause or chronic infection. It can also be a result of eating certain foods. Stress can play a major role too.

(a) Which part of the brain controls sweating (line 4)?

(1)

☒ **A** cerebellum

☒ **B** cerebral hemispheres

☒ **C** hypothalamus

☒ **D** pituitary gland

(b) Which type of nerve sends signals to the sweat glands (lines 4 and 5)?

(1)

☒ **A** connector

☒ **B** motor

☒ **C** relay

☒ **D** sensory

(c) Describe how sweating controls body temperature (lines 6 and 7).

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(d) Explain the evidence in the passage that indicates primary focal hyperhidrosis is a genetic condition.

(3)

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(e) Secondary hyperhidrosis can be caused by diabetes. Give one risk factor for diabetes (line 16).

(1)

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(f) The passage states that how much we sweat varies from individual to individual and from day to day. Explain why this is the case in people without hyperhidrosis (lines 8 and 9).

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(Total for question = 14 marks)

Q2.
Read the passage below. Use the information in the passage and your own knowledge to answer the questions that follow.

The effects of alcohol

Humans have been drinking alcohol for thousands of years. Drinking too much alcohol over many years can cause diabetes, malnutrition and diseases of the central nervous system and the liver. One immediate side effect of drinking too much alcohol is increased urination.

Beer is about 95% water and only 5% alcohol. The liver converts that 5% of alcohol into the same volume of water and some carbon dioxide. So if a person drinks 200 cm^3 of beer (one unit), the end result is 200 cm^3 of water. However, this person will not just urinate 200 cm^3 of urine, in fact the person urinates a total of 320 cm^3 of urine. So in general each unit of alcohol makes the person urinate an extra 120 cm^3 of urine more than the normal urine output.

A person with a mass of 60 kg produces 60 cm^3 of urine an hour and a person with a mass of 80 kg produces 80 cm^3 an hour and so on. Therefore if a 60 kg person drinks 200 cm^3 of beer in an hour they will produce 60 cm^3 of urine plus 320 cm^3, making a total of 380 cm^3.

Alcohol interferes with the mechanism that regulates water levels in our body because alcohol affects a small gland called the pituitary gland. One hormone released by the pituitary gland is anti-diuretic hormone (ADH). Alcohol reduces how much ADH is released by the pituitary. Each unit of alcohol that a person drinks forces the kidneys to produce an extra 120 cm^3 of urine more than the normal output.

Logic suggests that drinking lots of water would replace the 120 cm^3 of urine produced, but it is not that simple. The body only retains half the water that a person drinks. The other half leaves the body in urine, so the person will become dehydrated even if they drink lots of water.

(a) (i) Where in the body is the pituitary gland (line 16)?

(1)

☒ **A** brain

☒ **B** kidney

☒ **C** liver

☒ **D** pancreas

(ii) Which system includes the pituitary gland (line 16)?

(1)

☒ **A** digestive

☒ **B** endocrine

☒ **C** nervous

☒ **D** skeletal

(b) A person weighs 75 kg and drinks 400 cm3 of beer in an hour (lines 11–14).

(i) Calculate the volume of urine produced by the person in this hour.

(3)

volume of urine = ... cm3

(ii) Calculate the percentage increase in the volume of urine produced by this person in this hour.

(3)

percentage increase = ... %

(c) Describe the effect of ADH on the kidney (line 17). **(2)**

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(d) Suggest the effects of dehydration on the blood after increased urination.

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(e) Explain why half of the extra water that the person drinks still leaves the body in the urine (lines 21–24).

(3)

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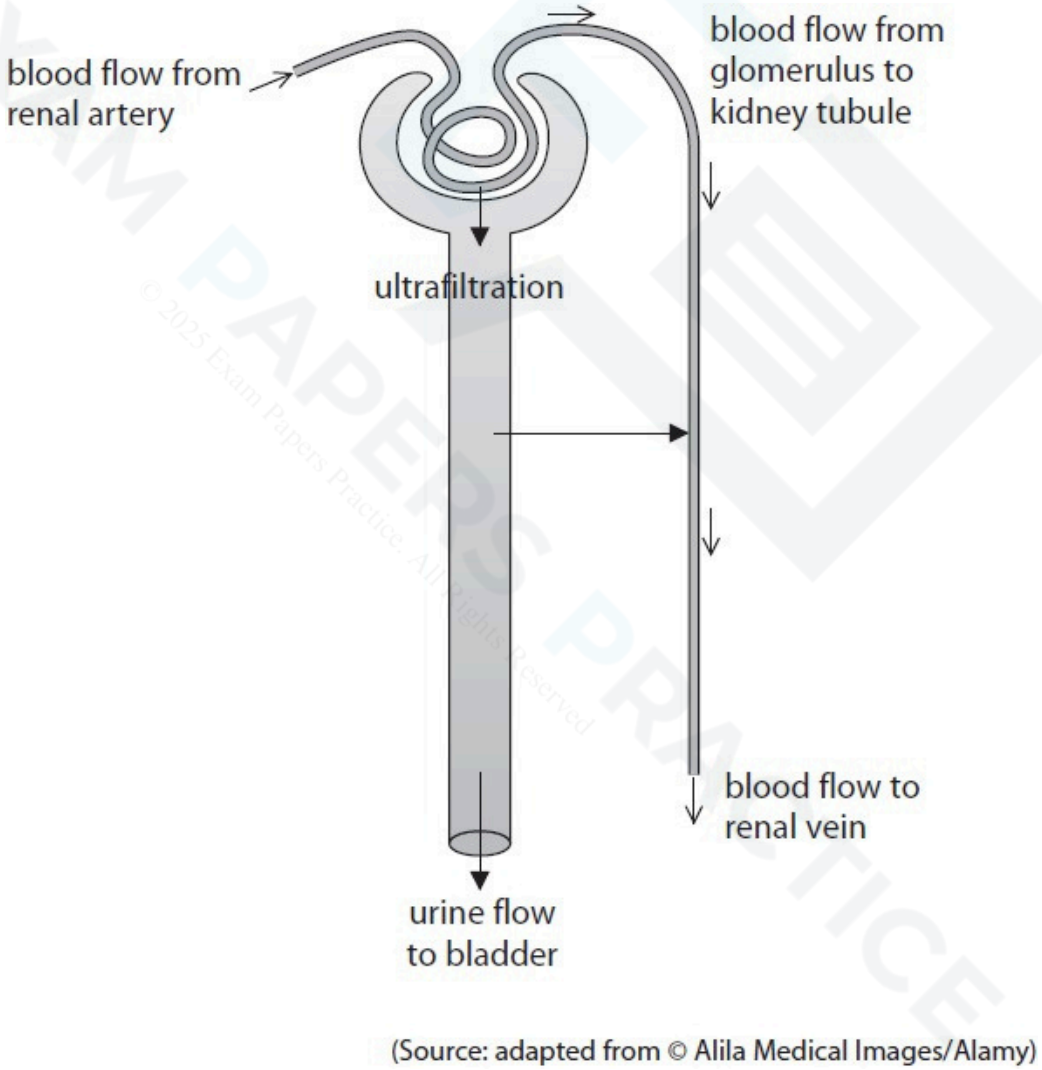
(Total for question = 15 marks)

Q3.

(a) The diagram shows part of a nephron in the human excretory system.



(Source: adapted from © Alila Medical Images/Alamy)

(i) Explain how ultrafiltration occurs in the Bowman's capsule.

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..... (ii)

Explain the differences in the composition of the blood flowing through the renal artery and through the renal vein.

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(b) The quantity of salt in the diet affects the concentration of urine produced. An investigation is set up to test this statement. This is the method used.

- ten people are each given a different food
- each food contains a different quantity of salt
- the volume of urine produced by each person is recorded each hour for six hours after eating the food

(i) State the independent variable in this investigation.

(1)

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(ii) Explain why this investigation is unlikely to produce valid results.

(2)

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(iii) State one change to the method that would make the results more valid.

(1)

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(Total for question = 10 marks)

Q4.

Skin and hair contain a pigment called melanin.

(a) (i) Describe the function of the pigment melanin in the skin.

(2)

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(ii) State one other place, apart from hair and skin, where pigment is found in the body.

(1)

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(b) A condition known as white forelock is caused by a dominant allele H.

People with this condition have a white patch in their hair.

The condition causes a deficiency of the skin pigment melanin.
A woman who is heterozygous for white forelock produces children with a father who does not have the condition.
(i) Draw a genetic diagram to show the possible offspring from this cross.
The condition is not sex-linked.

(4)

(ii) Calculate the probability that these parents will produce a boy with the condition.

(3)

probability = ...

(c) White forelock is a result of a mutation in a molecule of DNA.

Describe how this mutation causes the white forelock phenotype. **(4)**

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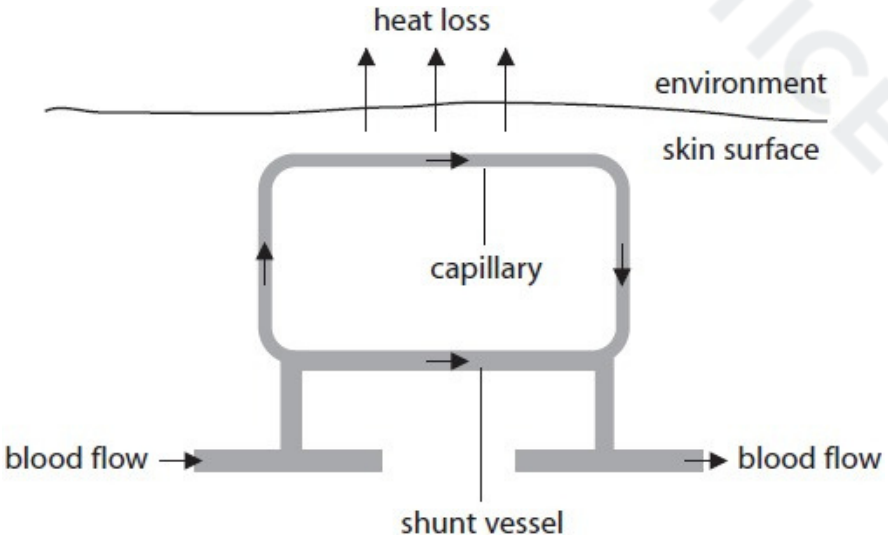
(Total for question = 14 marks)

Q5.

The diagram shows a section through skin on a cold day.



(a) Draw a diagram in the space to show how the section of skin shown in the diagram would be different on a hot day. **(2)**

(b) Explain why the section of skin shown in the diagram would be different on a hot day. **(4)**

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(c) Explain how the control of body temperature is an example of negative feedback.

(2)

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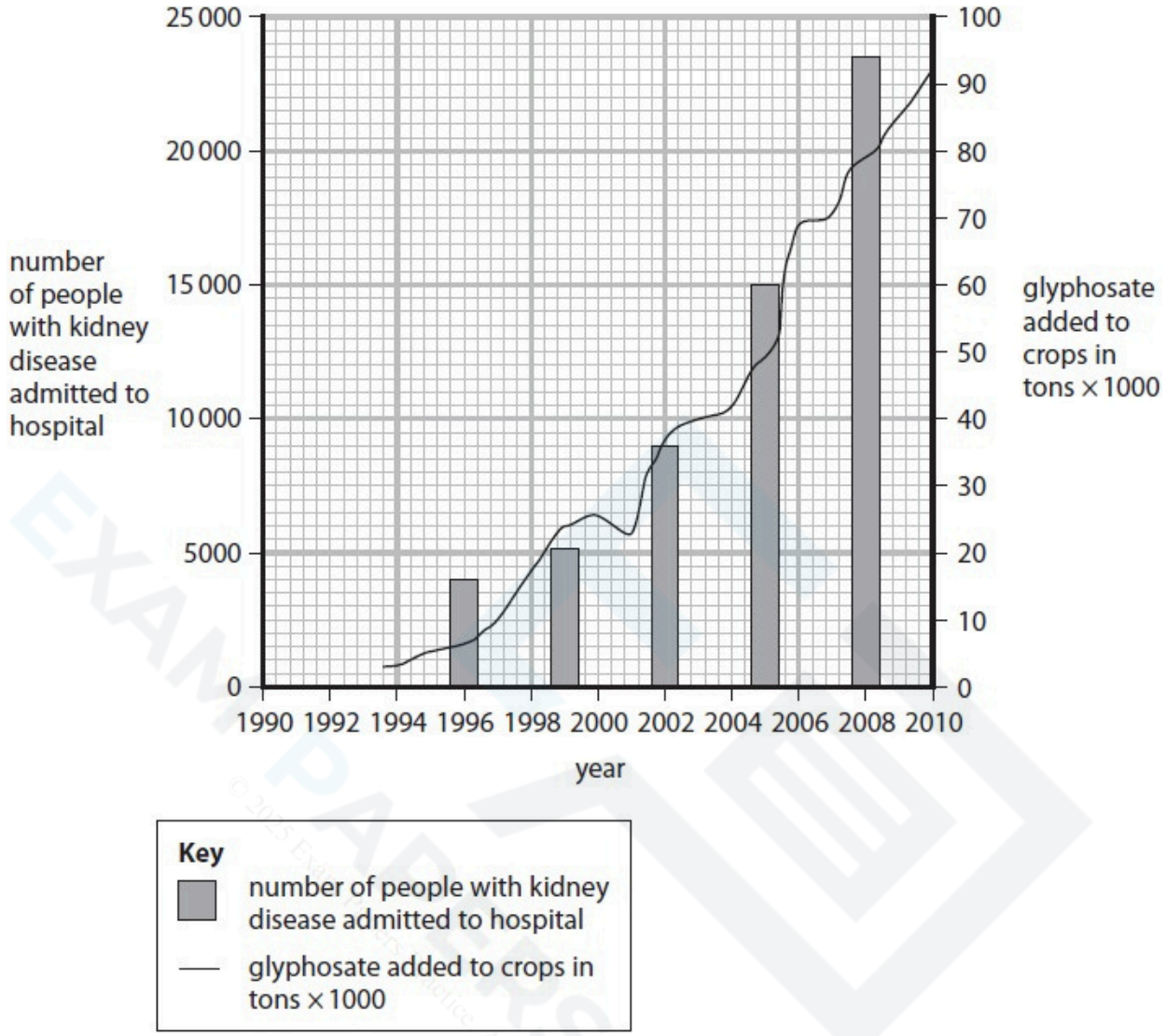
(Total for question = 8 marks)

Q6.

(a) Glyphosate is a chemical found in some weed killers.

The use of this chemical is linked to several health conditions including kidney disease.

The graph shows the number of people with kidney disease admitted to hospital and the amount of glyphosate added to crops.



(i) Calculate the percentage increase in the number of people admitted to hospital with kidney disease in 1996
compared with 2008.

(3)

percentage increase = ... %

(ii) Give a reason why the graph does not confirm that glyphosate is a cause of kidney disease.

(1)

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(b) Draw a diagram to show the structure of a kidney nephron. Add these labels to the diagram.

- glomerulus
- proximal convoluted tubule
- Bowman's capsule

(4)

(c) There is evidence to show that glyphosate causes inflammation of the glomeruli and the kidney tubules.
Suggest how these symptoms will affect the normal functioning of the kidney and the waste product that it produces.

(4)

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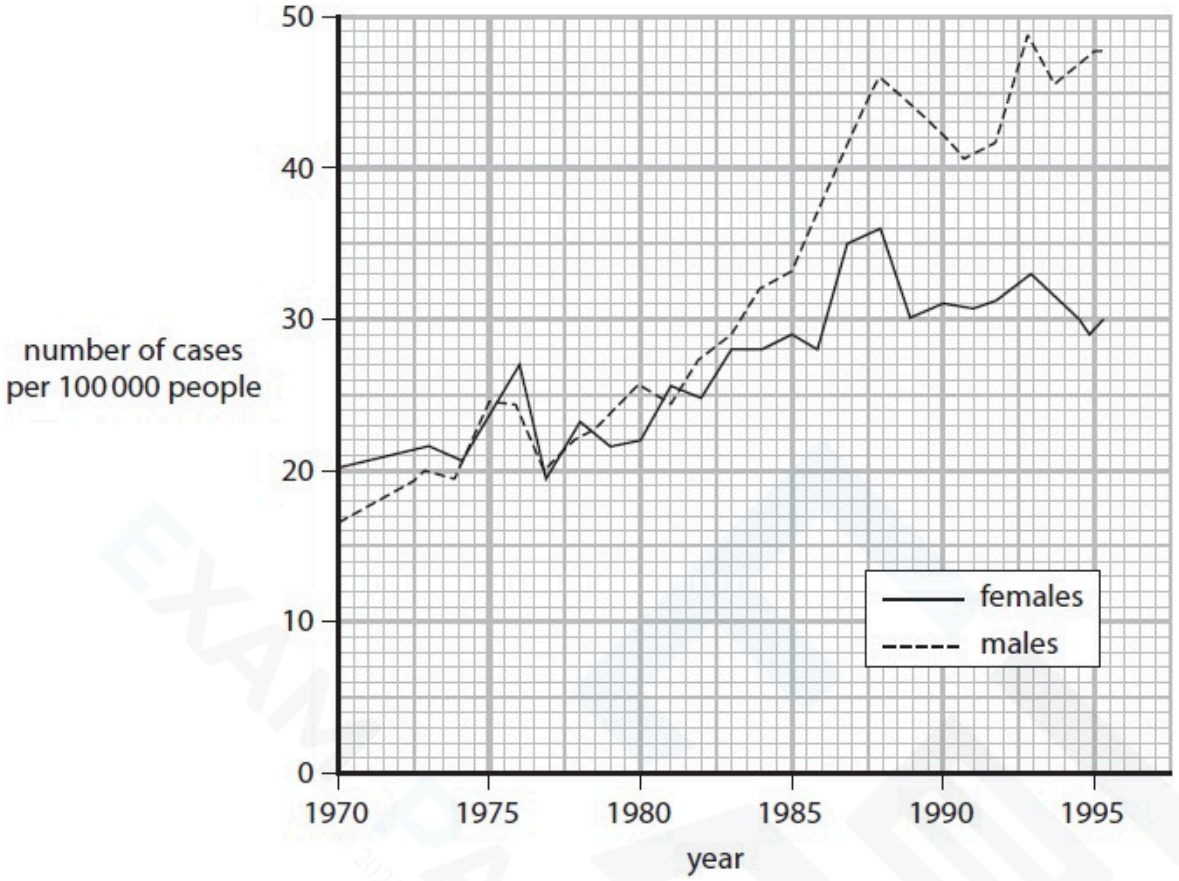
(Total for question = 12 marks)

Q7.

A form of skin cancer called melanoma has been increasing in both males and females.



(a) (i) Describe the trends shown by the graph. **(3)**

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(ii) Suggest why cancer can occur in the skin. **(2)**

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(b) (i) Calculate the mean increase in the number of melanoma cases per 100 000 males per year between 1970 and 1995.

(3)

mean increase per 100 000 males per year = ...

(ii) In 1970, the population of this area of the world was 7 million.
Calculate the number of females who had melanoma.

(3)

number of females with melanoma = ...

(Total for question = 11 marks)

Q8.
Homeostasis in humans involves the deamination of excess amino acids.
Deamination includes the removal of nitrogen from the amino acid and the formation of urea.
(a) (i) State what is meant by the term **homeostasis**.

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(ii) State where the process of deamination occurs.

(1)

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(b) Describe how a person obtains amino acids for the body to produce new proteins.

(3)

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..... (c) An investigation is carried out to show the daily amounts of nitrogen-containing compounds excreted in the urine of two people, A and B. The two people are on different diets. The results of the investigation are shown in the table.

Nitrogen-containing compound in urine	Mass excreted/g	
	person A	person B
urea	14.30	2.10
uric acid	0.16	0.08
ammonia	0.50	0.34
creatinine	0.60	0.60

(i) Explain how the diet of person **A** is different from the diet of person **B**.

Use information in the table to help you with your answer.

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..... (ii) The figures for creatinine do not vary even though the diets of person **A** and person **B** are different. State why the figures for creatinine do not vary.

(1)

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(d) If certain steroid drugs are taken, the balance of nitrogen-containing compounds in the body changes. This results in less nitrogen-containing compounds being excreted.
Suggest the effect that taking these drugs could have on the body.

(1)

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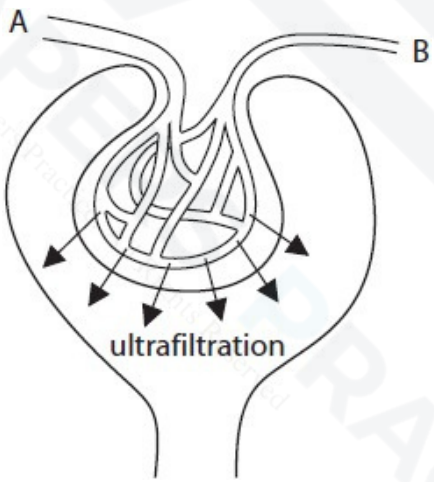
(Total for question = 12 marks)

Q9.

(a) The diagram shows a Bowman's capsule and its associated blood supply.



(i) Describe what is meant by the term **ultrafiltration**.

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..... (ii) State three differences between the composition of blood in vessel A and the composition of blood in vessel B.

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(iii) Explain how blood vessel A and blood vessel B help the process of ultrafiltration. **(4)**

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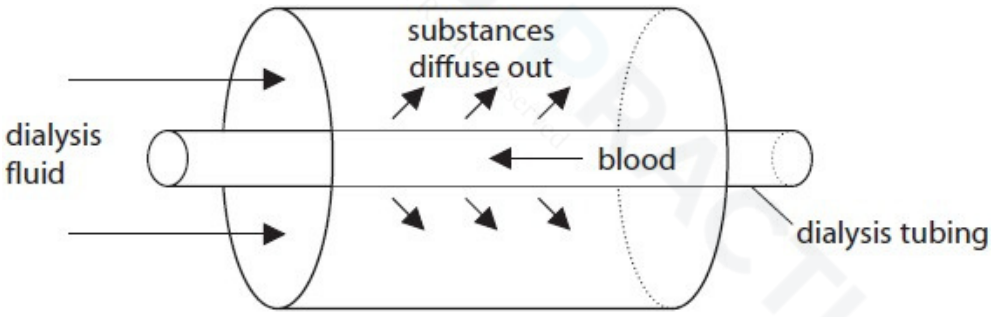
(b) The diagram shows part of a kidney dialysis machine.



The dialysis fluid contains glucose at the same concentration as in the blood flowing through the dialysis tubing.
Suggest the effect on a person undergoing dialysis if the concentration of glucose was below that of the blood flowing through the dialysis tubing.

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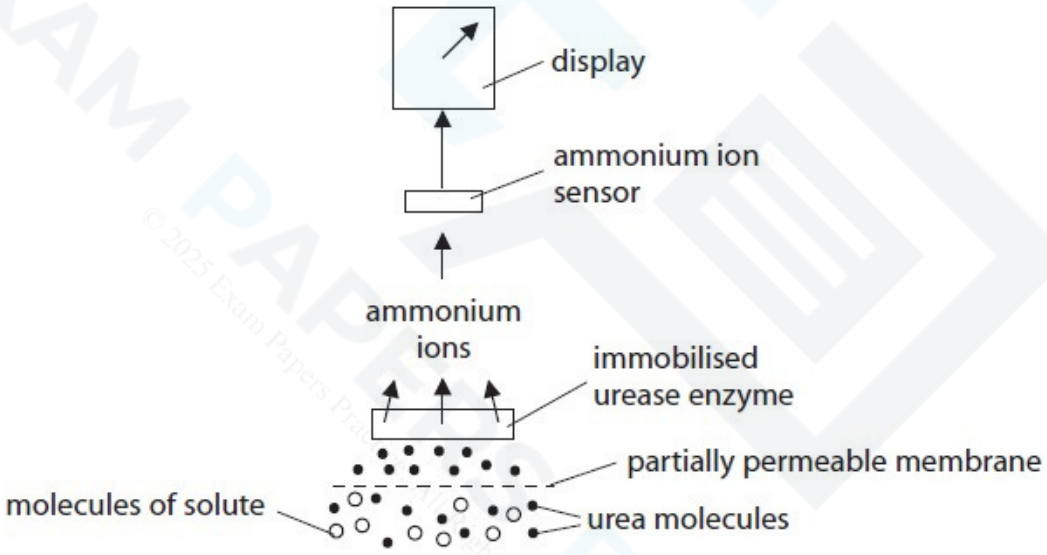
(Total for question = 12 marks)

Q10.

The diagram shows a biosensor that can be used to measure the concentration of urea in urine.



(a) (i) The urea molecules are in solution.

State the name of the solvent.

(1)

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(ii) Explain the function of the partially-permeable membrane.

(2)

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(iii) Suggest the function of the urease enzyme.

(3)

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(b) A scientist wants to use the biosensor to compare the urea concentration of two urine samples. Explain why it is important to do the tests at the same temperature.

(4)

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(c) Immobilised enzymes are also used in industry to produce useful molecules. Give two advantages of using immobilised enzymes instead of enzymes that are free to move in solution.

(2)

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(Total for question = 12 marks)