Name:	Target Grade:	Actual Grade:

BRIGHT CULTURE

EXCRETION IN HUMANS
MCQ and STRUCTURED QUESTIONS

READ THESE INSTRUCTIONS FIRST

INSTRUCTIONS TO CANDIDATES

1. Find a quiet, comfortable spot free place from distractions.

2. Spend one minute on each mark.

3. Time yourself for every single question.

4. Every chapter has their own question types. Ensure that you know the different question type for each chapter.

5. Make a conscientious effort to remember your mistakes, especially in terms of answering techniques. E.g Take a picture for the mistakes that you made, keep it in a photo album, and revise it over and over again.

6. Highlight question types that you tend to keep making mistakes and review them nearing exams.

7. Always review the common questions and question type that you tend to make mistakes nearing exams.

8. During exams, classify the question type and recall what you have learnt, how you need to analvse the questions for the different question type, what you need to take note of and answer with the correct answering techniques!

✨ **Wishing you all the best for this test!**

You've got this!

💡 **With lots of love,**
Bright Culture 💛

GOOD LUCK FOR YOUR EXAM!

MARKS

EXCRETION IN HUMANS MCQ

1 Which option shows the body's response towards dehydration?

1 decreased permeability of collecting duct wall

2 less water excreted

3 more dilute urine

4 more water reabsorbed into bloodstream

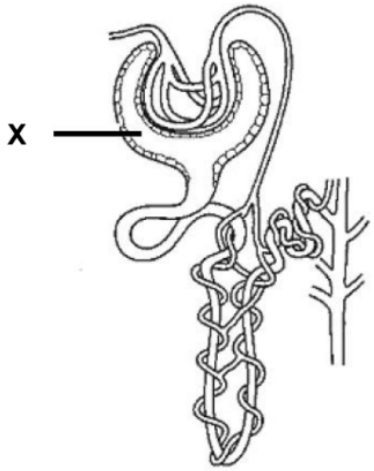
A 1, 2 and 4

B 2 and 3 only

C 2 and 4 only

D 2, 3 and 4

2 The diagram shows a kidney tubule.



Which option shows the substances present in X?

1 glucose

2 protein

3 salts

4 urea

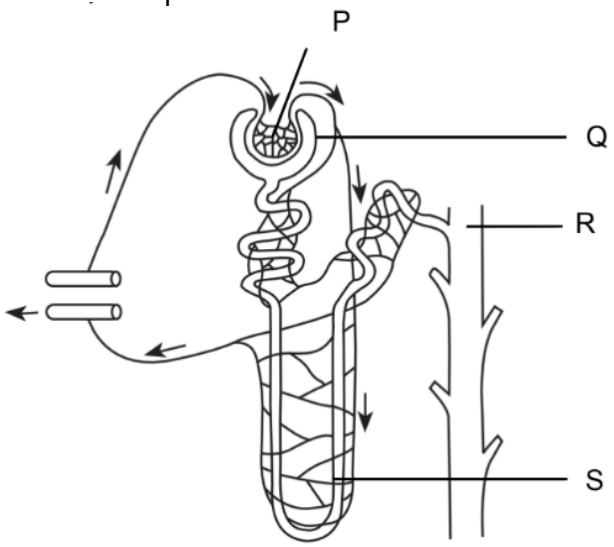
A 1 only

B 1, 2 and 3

C 1, 3 and 4

D 3 and 4 only

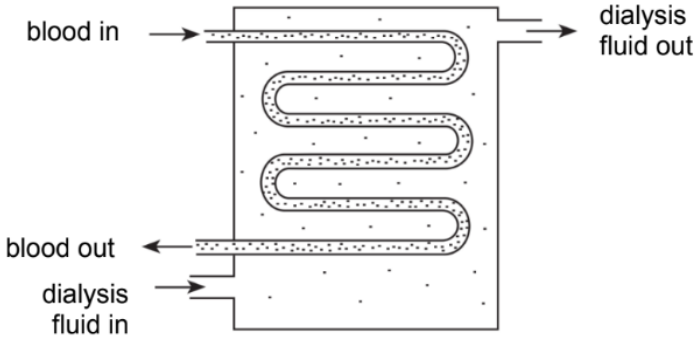
3 The diagram shows a nephron.



Which of the following correctly relates the structure to its respective function?

	structure	function
A	P	selective reabsorption
B	Q	ultrafiltration
C	R	ultrafiltration
D	S	secretion of ADH

4 The following diagram represents a dialysis machine.



Which substances in the dialysis fluid must be at the same concentration as that in blood?

A amino acids and urea

B glucose and amino acids

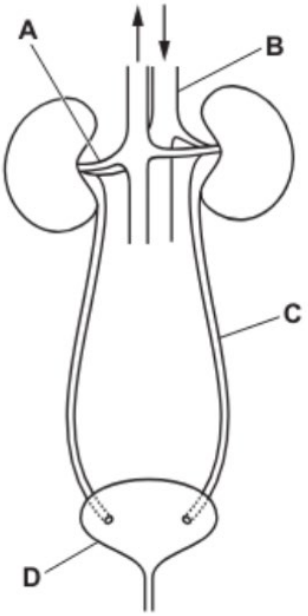
C glucose and urea

D urea and salts

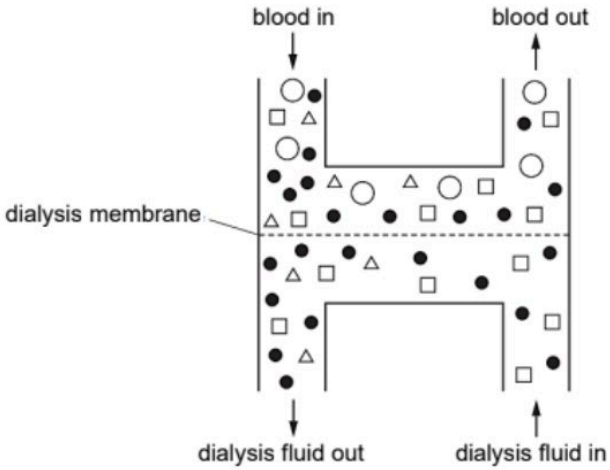
5 Which row shows where glucose will be found in the body of a healthy human?

	renal artery	renal vein	glomerulus	loop of Henle	ureter
A	yes	no	yes	yes	yes
B	yes	yes	yes	no	no
C	yes	yes	yes	yes	no
D	yes	no	no	no	no

6 In which structure is there a fluid with a low concentration of urea?



7 The diagram shows how a kidney dialysis machine works. Each shape represents a molecule found in blood or dialysis fluid.



Which shape represents urea?

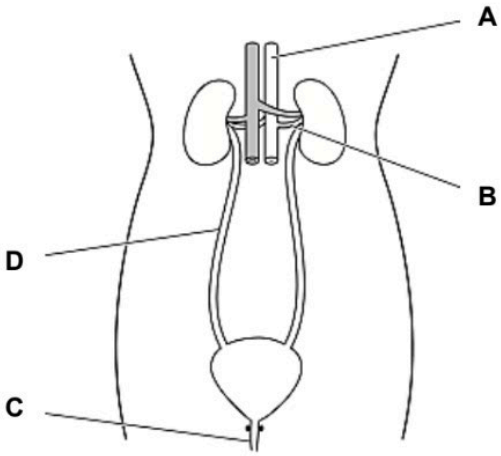
A ○

B ●

C □

D △

8 The diagram shows the human excretory system. Which labelled structure is the urethra?



9 The table shows the percentage concentration of some chemicals found in blood entering the kidney of a healthy person.

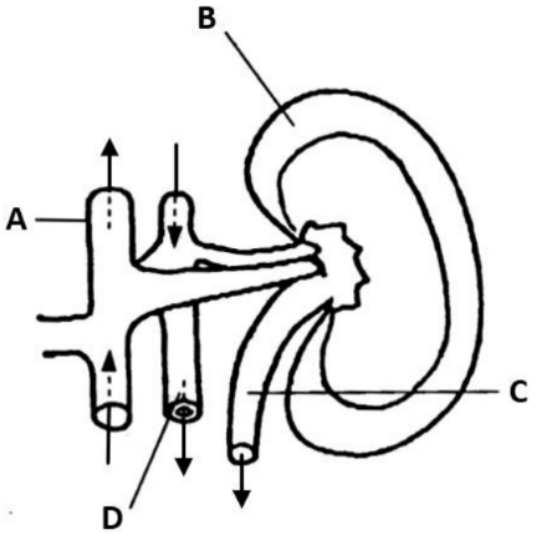
chemical	concentration in blood entering kidney / %
glucose	0.10
protein	8.00
urea	0.03

What is the percentage concentration of the same chemicals in the Bowman's capsule of a healthy person?

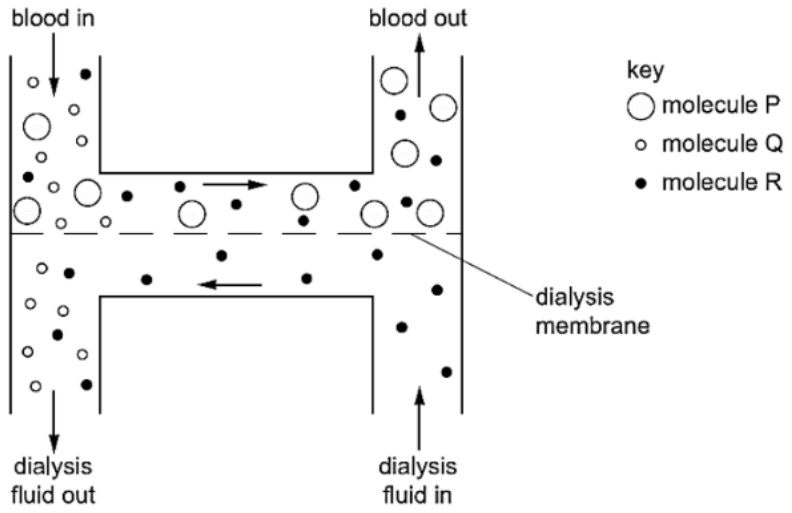
	concentration in urine / %		
	glucose	protein	urea
A	0.00	0.00	2.00
B	0.00	8.00	0.03
C	0.10	0.00	0.03
D	0.10	8.00	2.00

10 The figure below shows a kidney and associated structures.

Which part contains the lowest concentration of urea?



11 The diagram shows what happens to molecules of glucose, protein and urea as blood passes through a kidney dialysis machine.



What are molecules P, Q and R?

	molecule P	molecule Q	molecule R
A	glucose	protein	urea
B	glucose	urea	protein
C	protein	glucose	urea
D	protein	urea	glucose

12 **Which of the following is not an excretory product?**

A carbon dioxide

B creatinine

C fibre

D water

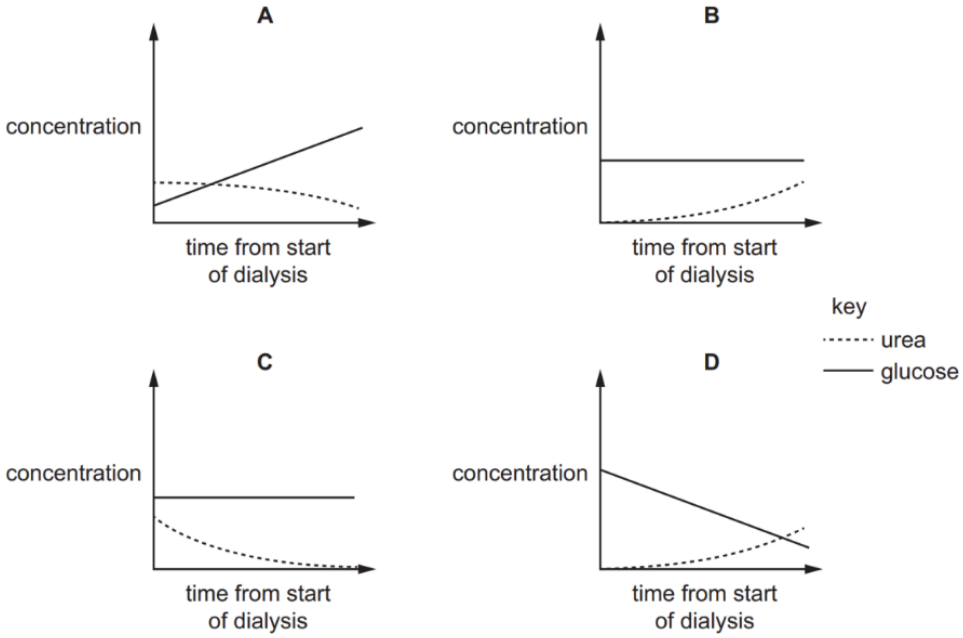
13 Gestational diabetes insipidus is a condition that occurs in women during pregnancy.

Pregnant mothers produce vasopressinase in the placenta. Vasopressinase breaks down anti-diuretic hormone.

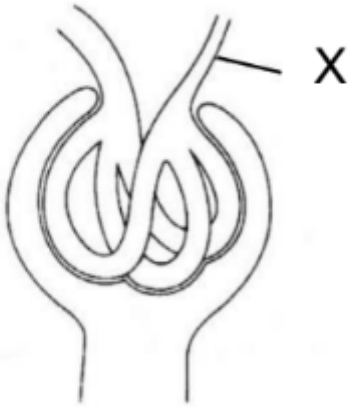
Which row shows the effect of gestational diabetes on a pregnant woman?

	amount of water reabsorbed by kidney tubule	effect on urine	
		quantity	concentration
A	decreased	decreased	concentrated
B	decreased	increased	diluted
C	increased	decreased	concentrated
D	increased	increased	diluted

14 Which graph shows the change in concentration of molecules in the dialysis fluid during dialysis for a person with kidney failure?



15 The diagram shows a glomerulus and Bowman's capsule of a mammalian nephron.



What might occur if the diameter of blood vessel X of all nephrons is enlarged?

A decreased glucose concentration in the urine

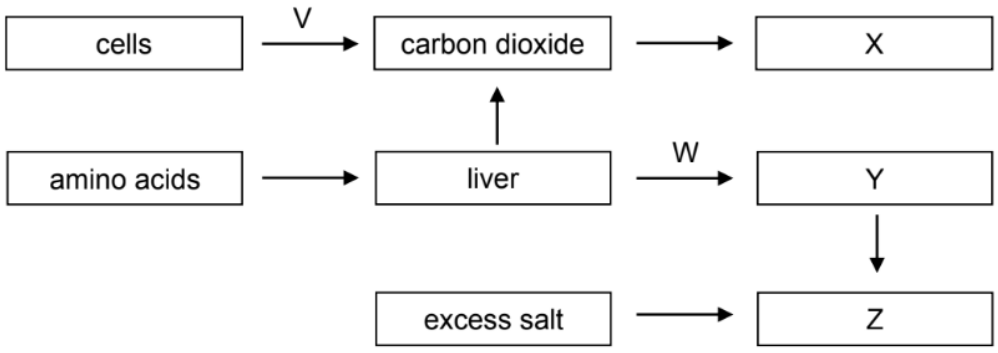
B increased concentration of sodium ions in the urine

C increased concentration of urea in the blood

D increased volume of water reabsorbed into the blood

16 The diagram below shows the production and excretion of materials in the body.

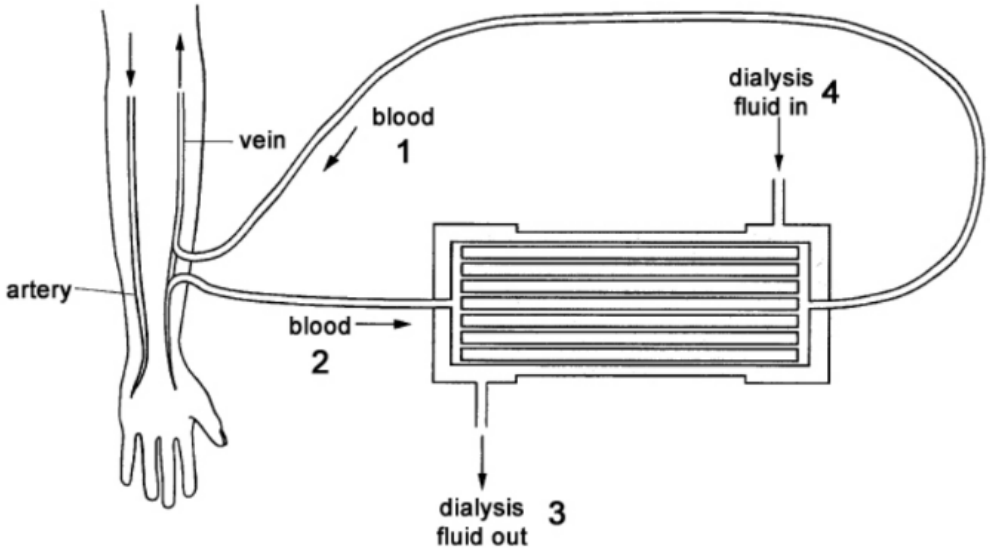
What are V, W, X, Y and Z in the diagram?



	V	W	X	Y	Z
A	aerobic respiration	deamination	lungs	urea	kidneys
B	aerobic respiration	filtration	urea	lungs	kidneys
C	anaerobic respiration	deamination	kidneys	urea	lungs
D	anaerobic respiration	filtration	lungs	lungs	urea

17 The diagram below shows the flow of blood and dialysis fluid through a dialysis machine.

Where would the urea concentration be the highest?



A 1 and 2

B 1 and 4

C 2 and 3

D 2 and 4

18 Two fluid samples were drawn from different parts of the kidney nephron and the components of the fluids were analysed. The results are shown in the table below.

component	fluid P (g / L)	fluid Q (g / L)
glucose	0.0	0.9
sodium ions	5.0	3.5
urea	20.0	0.3

Which parts of the kidney nephron were fluids P and Q extracted from?

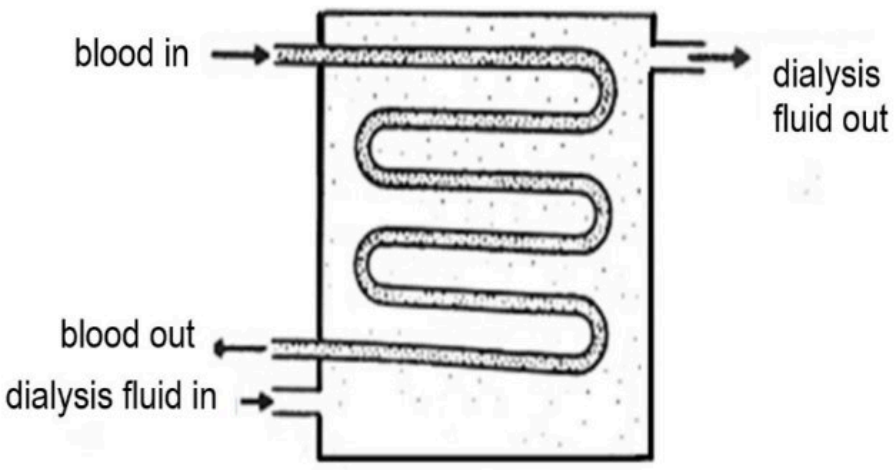
	fluid P	fluid Q
A	collecting duct	glomerulus
B	glomerulus	collecting duct
C	glomerulus	proximal convoluted
D	proximal convoluted tubule	tubule collecting duct

19 Urea is produced in one organ, filtered from the blood by a second organ and stored in a third organ before being expelled from the body.

Which organs carry out these functions?

	production	filtration	storage
A	kidney	bladder	liver
B	kidney	liver	bladder
C	liver	bladder	kidney
D	liver	kidney	bladder

20 The diagram represents a dialysis machine.



Which substances in the dialysis fluid should be at a lower concentration than in the blood?

A amino acids and glucose

B amino acids and salts

C glucose and salts

D salts and urea

21 Which row shows where glucose will be found in the body of a healthy human after eating a meal?

	renal artery	renal vein	glomerulus	Bowman's capsule	ureter
A	yes	no	yes	yes	yes
B	yes	yes	no	no	no
C	yes	yes	yes	yes	no
D	no	yes	no	no	yes

22 The table shows the concentration of sodium ions in blood plasma,

	blood plasma	glomerular filtrate	urine
concentration of sodium ions / arbitrary units	141	141	127

What is the percentage concentration of sodium ions reabsorbed in the kidney tubules?

A 0.0% **B** 9.9% **C** 10.9% **D** 14.0%

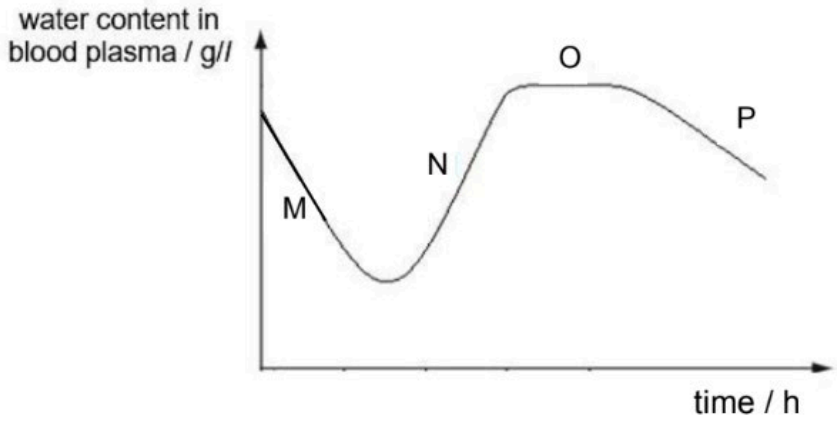
23 Which of the following best describes the excretion of urea?

	removal of undigested food	removal of metabolic wastes	removal of toxic products
A	✓	✗	✓
B	✓	✓	✗
C	✗	✓	✗
D	✗	✓	✓

Key

✓ true
✗ not true

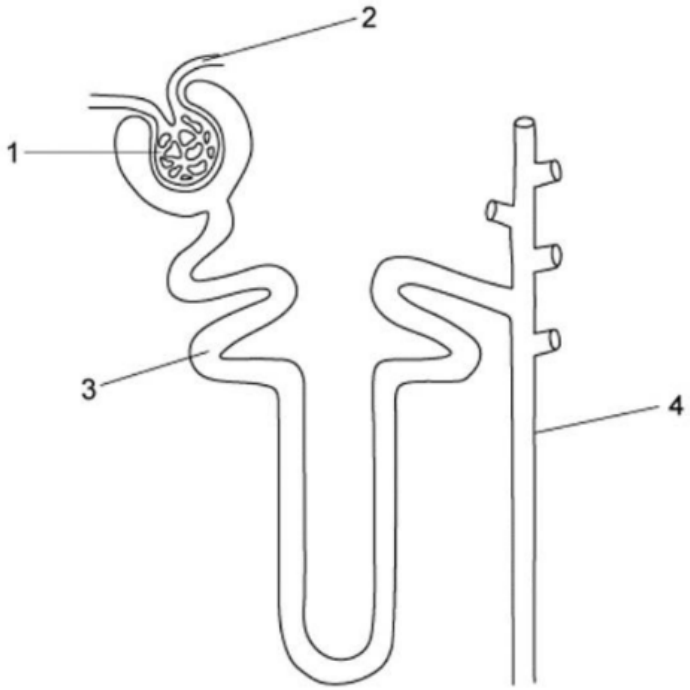
24 The graph shows the effect of antidiuretic hormone (ADH) on the regulation of water content in blood plasma.



Which part(s) of the graph reflect(s) the effect(s) of increased ADH secretion?

A M only
B M and P
C N only
D N and O

25 A nephron is shown below.



Where does movement of molecules across a membrane occur?

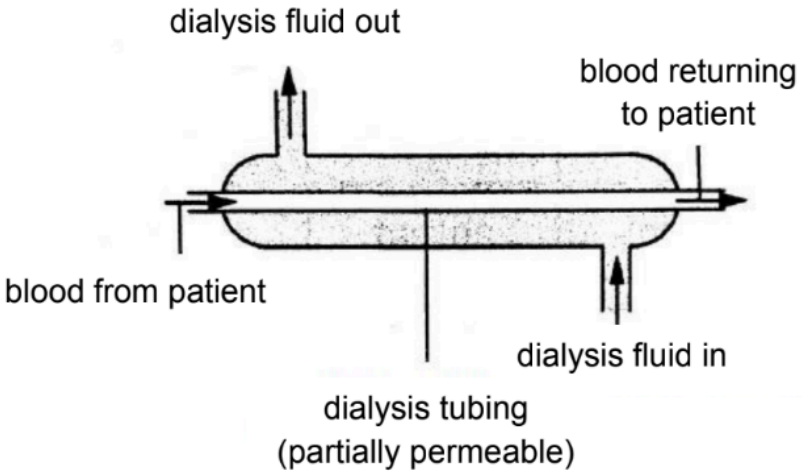
A 1 only

B 2 and 3 only

C 3 and 4 only

D 1, 3 and 4 only

26 An engineer has been tasked to improve efficiency of the dialysis machine shown in the diagram below.



He has made the following recommendations:

1 reverse the direction of blood flow

2 increase the rate at which dialysis fluid is replaced

3 increase the length of the dialysis fluid by coiling it

4 increase the diameter of the lumen of the dialysis tubing while keeping the thickness of the tubing membrane the same

Which of his recommendations will improve the efficiency of the dialysis process of a patient?

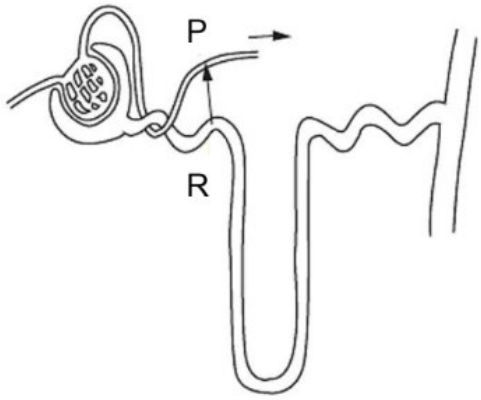
A 1 and 3

B 2 and 3

C 1, 2 and 3

D 2, 3 and 4

27 The diagram shows a kidney tubule and some of its associated blood vessels.



Which substance is entirely reabsorbed from the fluid at R to the blood at P?

A glucose

B salts

C urea

D water

28 What is an example of excretion?

A release of adrenaline from the adrenal glands

B release of mucus from the goblet cells

C removal of carbon dioxide from the lungs

D removal of faeces from the alimentary canal

29 What is the significance in the directions of flow of the dialysis fluid and blood in kidney dialysis?

A Speed up the flow of blood in the kidney dialysis machine.

B Slow down the transfer of waste products in the dialysis machine.

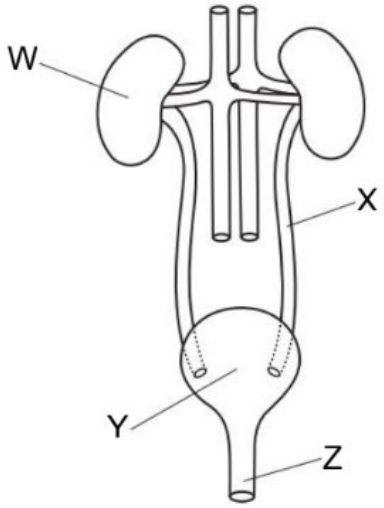
C Ensure that waste products will continuously enter the dialysis fluid.

D Ensure that the difference in the concentrations of waste products in blood and dialysis fluid is small.

30 Which row shows where glucose will be found in the body of a healthy human after eating a meal?

	renal artery	renal vein	glomerulus	nephron	ureter
A	no	yes	no	no	yes
B	yes	no	yes	yes	yes
C	yes	yes	no	no	no
D	yes	yes	yes	yes	no

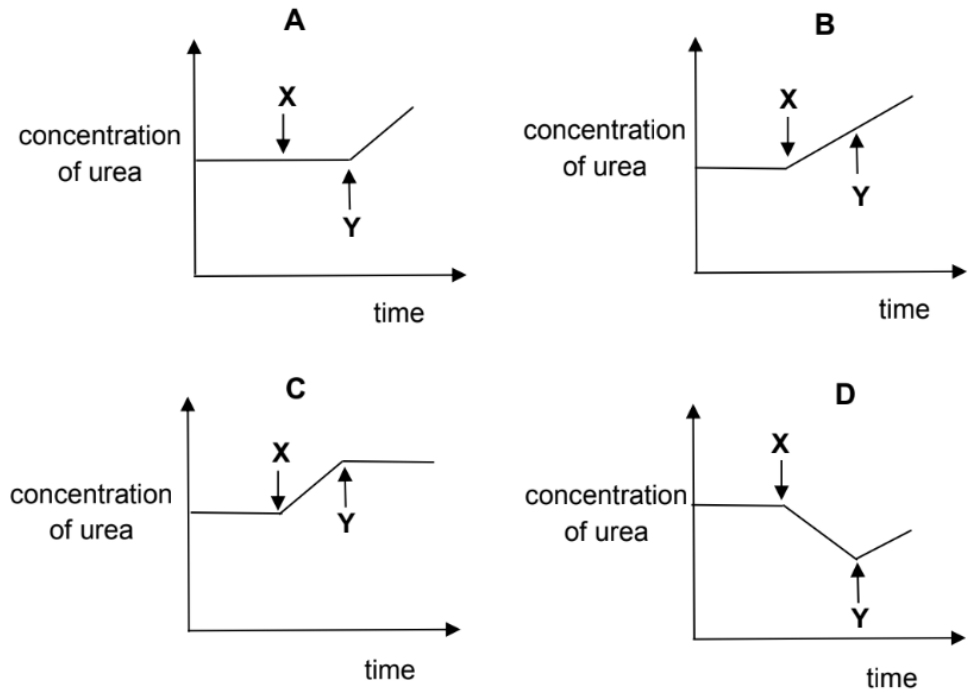
31 The diagram shows parts of the body involved in excretion in humans.



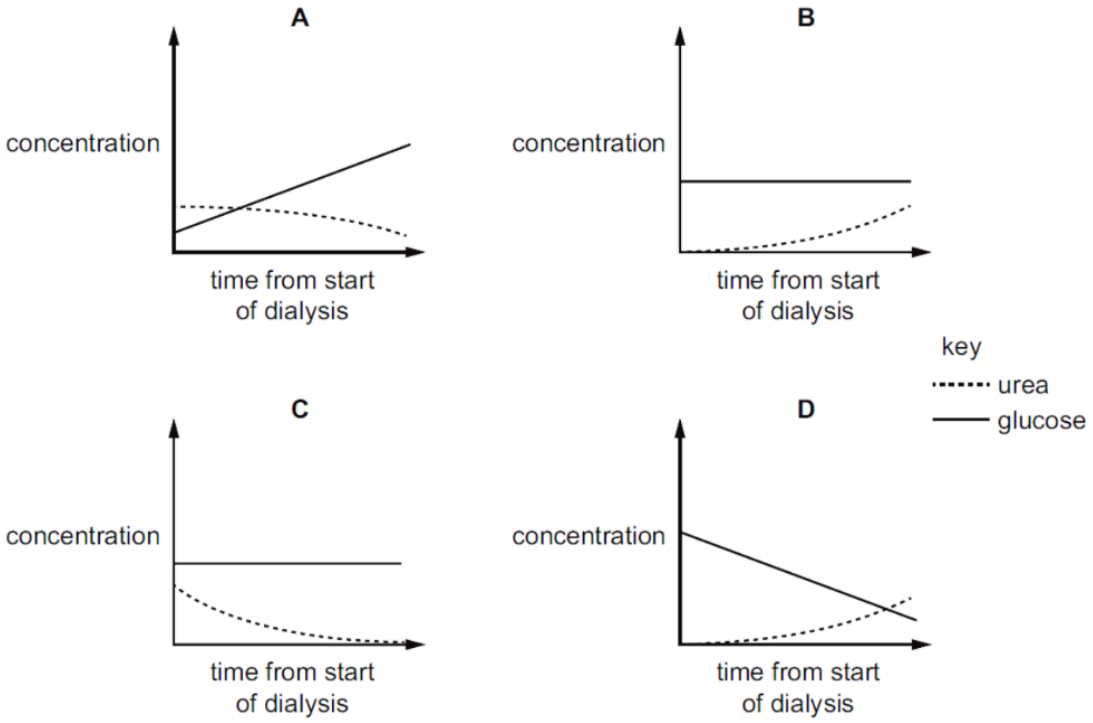
What are the labelled parts?

	W	X	Y	Z
A	bladder	ureter	kidney	urethra
B	bladder	urethra	kidney	ureter
C	kidney	ureter	bladder	urethra
D	kidney	urethra	bladder	ureter

32 Which graph, A, B, C or D, shows the effect on urea concentration in the blood after removing a mammal's kidneys at time X and its liver at time Y?



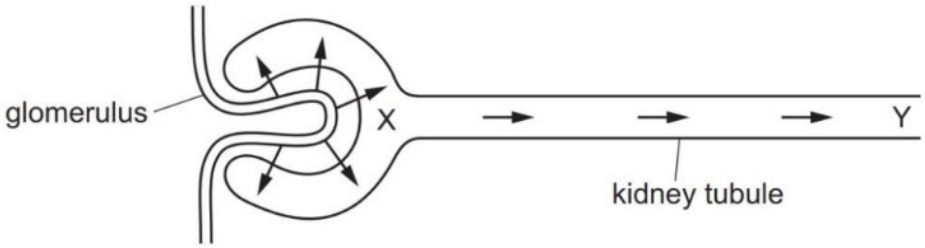
33 Which graph shows the change in concentration of molecules in the dialysis fluid during kidney dialysis?



34 Which row describes the functions of the bladder, kidneys and liver?

	production of urea	excretion of urea	storage of urine
A	liver	bladder	kidneys
B	bladder	kidneys	liver
C	liver	kidneys	bladder
D	kidneys	liver	bladder

35 Which statement correctly explains the difference in amino acid concentration in the kidney tubule between X and Y?



A Amino acid concentration is higher at X than at Y because amino acids move out of the kidney tubule by osmosis.

B Amino acid concentration is higher at X than at Y because amino acids have been actively transported out of the kidney tubule.

C Amino acid concentration is higher at Y than at X because amino acids diffuse into the kidney tubule.

D Amino acid concentration is higher at Y than at X because amino acids have been actively transported into the kidney tubule.

36 Which row shows where glucose will be found in the body of a healthy human after eating a meal?

	renal artery	renal vein	glomerulus	nephron	ureter
A	yes	no	yes	yes	yes
B	yes	yes	no	no	no
C	yes	yes	yes	yes	no
D	no	yes	no	no	yes

37 Which statement best describes dialysis fluid entering a dialysis machine?

A It has a higher concentration of urea than the blood entering the dialysis machine.

B It has a higher concentration of urea than the blood leaving the dialysis machine.

C It has a lower concentration of urea than the blood entering the dialysis machine.

D It has a lower concentration of urea than the blood leaving the dialysis machine.

38 At which part of the kidney tubule does anti-diuretic hormone (ADH) have its effect and what effect does it have?

	part	effect
A	glomerulus	less water reabsorbed
B	glomerulus	more water reabsorbed
C	collecting duct	less water reabsorbed
D	collecting duct	more water reabsorbed

RESPIRATION IN HUMANS STRUCTURED QUESTIONS

1 Fig 6.1 shows the structure of a kidney tubule.

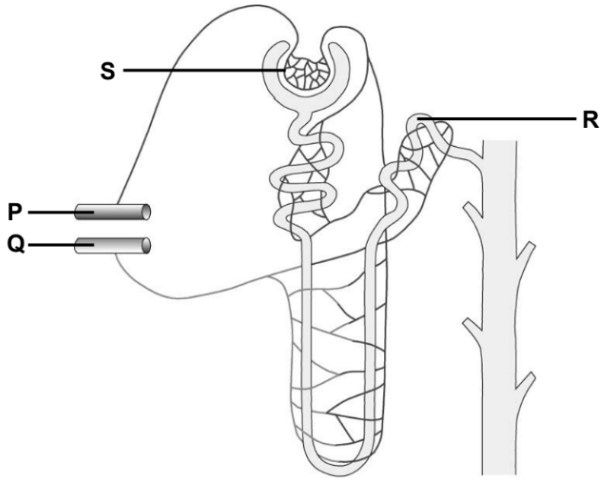


Fig 6.1

(a) Identify structures P and R.

P: .....

R: ..... [2]

(b) State two differences in the structure of P and Q.

.....

.....

..... [2]

(c) (i) Glomerular disease is a condition which affects structure S.

Proteins are found in the urine of patients with this condition.

Suggest how this may happen.

.....

.....

..... [2]

(ii) Suggest two other substances which may be found in a patient's urine which are not usually found in the glomerular filtrate.

substance 1: .....

substance 2: ..... [2]

(iii) For patients who have serious cases of glomerular disease, they may need to receive treatment using dialysis. Table 6.1 shows the concentration of various substances in the blood of a patient with serious glomerular disease.

substance	concentration in blood / arbitrary units	concentration in dialysis fluid / arbitrary units
glucose	5.5	
urea	4.2	
mineral salts		35.6

Complete Table 6.1 to suggest the concentration of the various substances in the blood and dialysis fluid of the patient. [2]

2 Maple syrup urine disease (MSUD) is a rare inherited human condition caused by mutation. MSUD is caused by a recessive allele.
MSUD is usually diagnosed in early childhood and can be controlled by having a low protein diet.

Fig. 4.1 shows the inheritance of MSUD in one family.

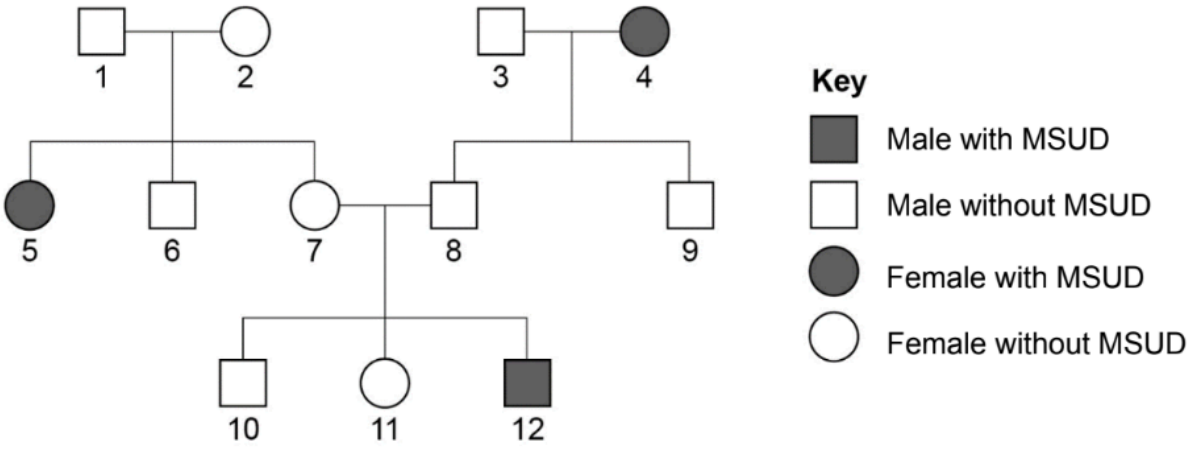


Fig. 4.1

(a) **(i)** Describe what is meant by mutation.

.....

..... [1]

(ii) State the name of one factor which increases the rate of mutation.

..... [1]

(iii) State one piece of evidence from Fig. 4.1 which shows that MSUD is a recessive condition.

.....

.....

..... [1]

(iv) Persons 7 and 8 in Fig. 4.1 are expecting a fourth child.

Determine the probability that the child will have MSUD by completing the genetic diagram.

Use the symbol N for the dominant allele and n for the recessive allele.

father x mother

genotypes of parents ....

gametes ....

genotypes of offspring ....

phenotypes of offspring ....

Probability that the child will have MSUD: .....% [4]

(b) Fig. 4.2 shows chemical reactions involved in the normal breakdown of some types of amino acid inside body cells.

A person with MSUD cannot make Enzyme 2. This leads to the accumulation of amino acids in the blood and urine, giving the urine a characteristic sweet smell.

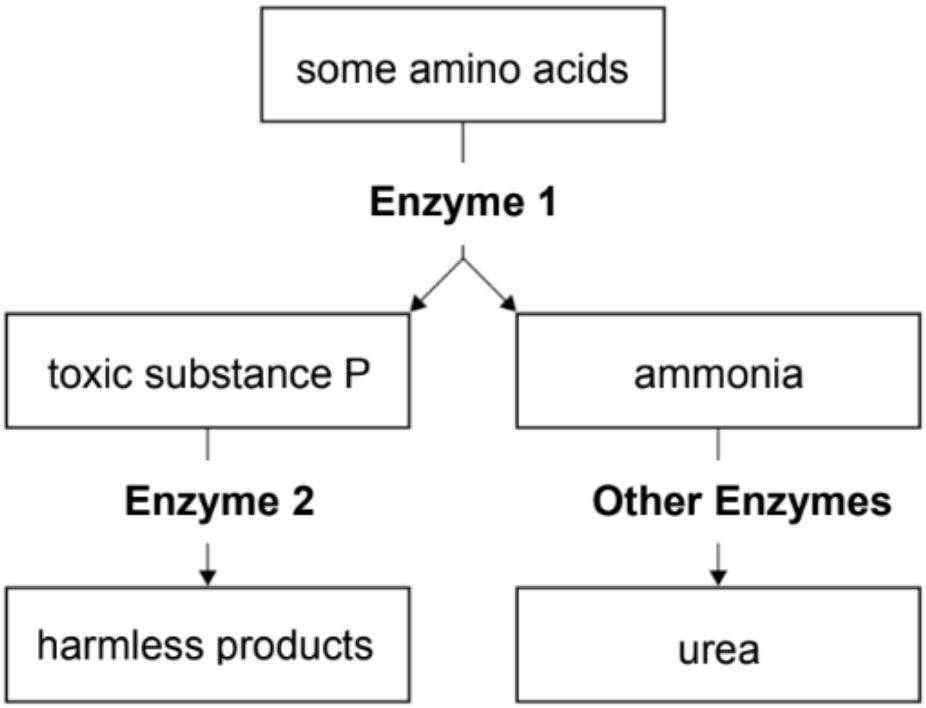


Fig. 4.2

(i) One of the final products shown in Fig. 4.2 is urea.

Which part of the human body are the reactions shown in Fig. 4.2 is most likely to occur?

..... [1]

(ii) Scientists can analyse urine samples to see if a person has MSUD.

Explain why the urine of a person with MSUD will have high concentration of toxic substance P.

.....

.....

.....

.....

..... [2]

(iii) Explain why a person with MSUD must have a low-protein diet.

.....

.....

.....

.....

.....

..... [3]

[Total: 13]

3 Fig. 2.1 shows a kidney nephron.

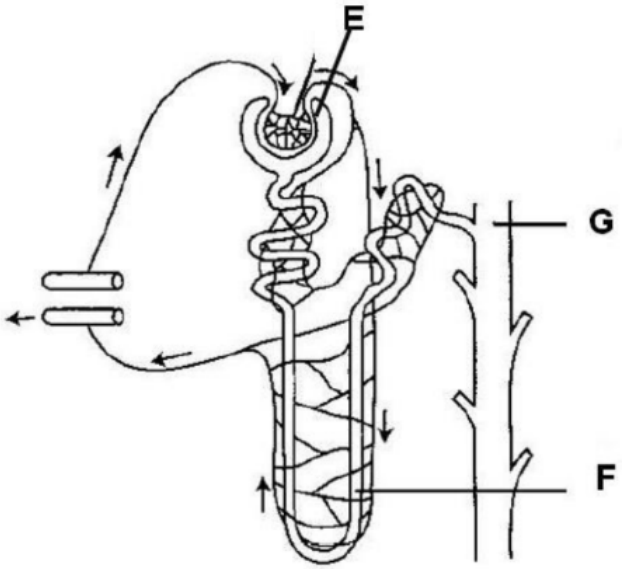


Fig. 2.1

(a) Describe the role of structures E and F in the formation of urine.[3]

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.....

.....

.....

.....

(b) Describe the effect of anti-diuretic hormone (ADH) on the structure labelled G and its effect on urine formation. [2]

.....

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.....

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.....

.....

[Total: 5]

4 Kidney failure can be treated by using dialysis.

Fig. 2.1 shows a patient connected to a simplified drawing of a dialysis machine.

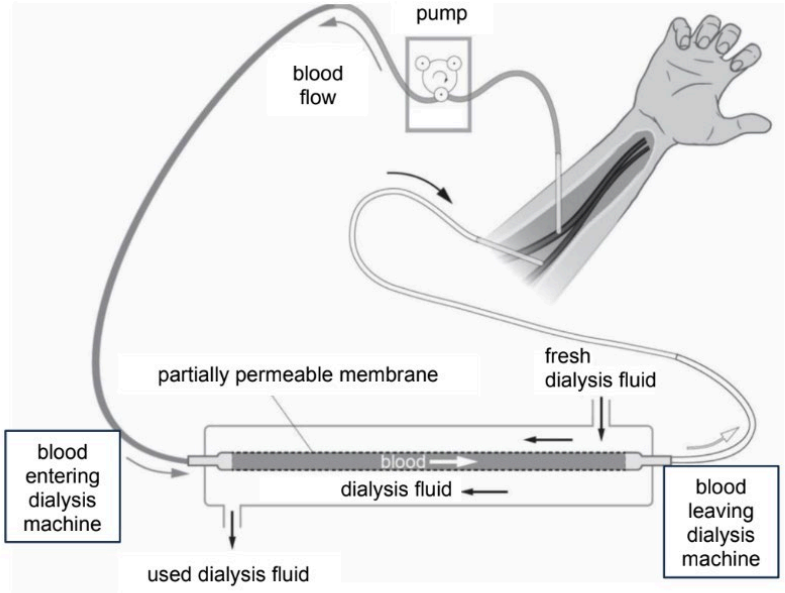

Fig 2.1

(a) **(i)** Explain why the blood and the dialysis fluid flow in opposite directions through the machine.

.....

..... [1]

(ii) Suggest an improvement that could be made to the dialysis machine and give a reason why the feature is important.

.....

.....

.....

..... [2]

(b) **(i)** Define excretion.

.....

..... [1]

(ii) State one excretory waste product and explain the importance of removing it from the body.

.....

..... [1]

(c) Table 2.1 shows the concentrations of various substances present in the different fluids found in the dialysis machine.

Table 2.1

substances	concentration/ arbitrary units		
	blood entering the dialysis machine	fresh dialysis fluid	used dialysis fluid
sodium ions	140	130	150
chloride ions	100	90	110
glucose	100	?	100
urea	20	0	18
protein	4	0	0

(i) Explain why there is no protein found in the used dialysis fluid.

.....

..... [1]

(ii) With reference to Table 2.1, suggest and explain the concentration of glucose present in the fresh dialysis fluid.

concentration of glucose in fresh dialysis fluid

.....arbitrary units

explanation

.....

..... [2]

[Total: 8]

5 Fig. 7.1 shows a diagram of a kidney nephron.

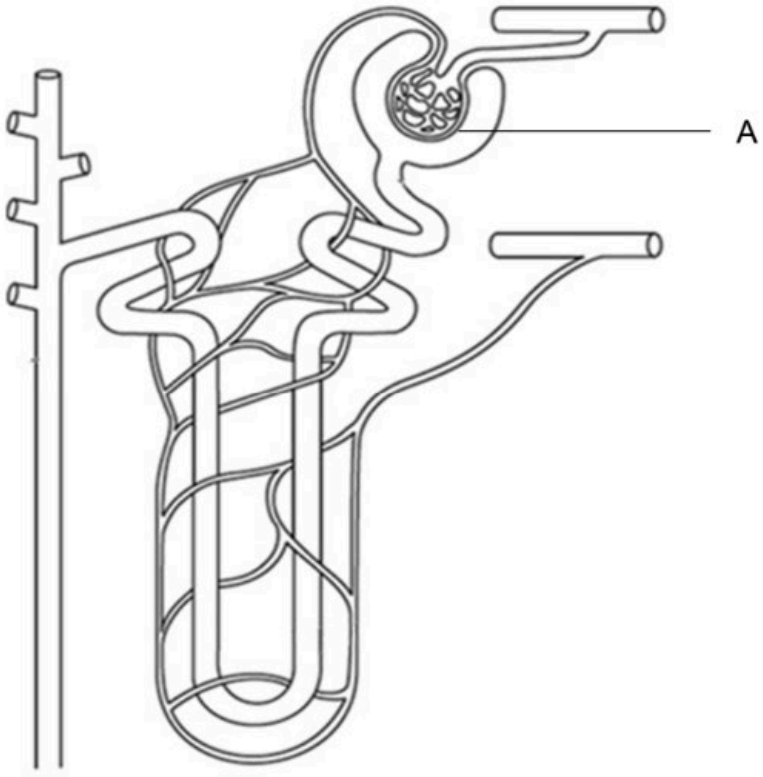

Fig. 7.1

(a) Describe one feature of the structure of A and explain how this feature aids in the formation of urine.

.....

.....

..... [2]

(b) Fig. 7.2 shows the proportions of certain components in glomerular filtrate and urine from a healthy person.

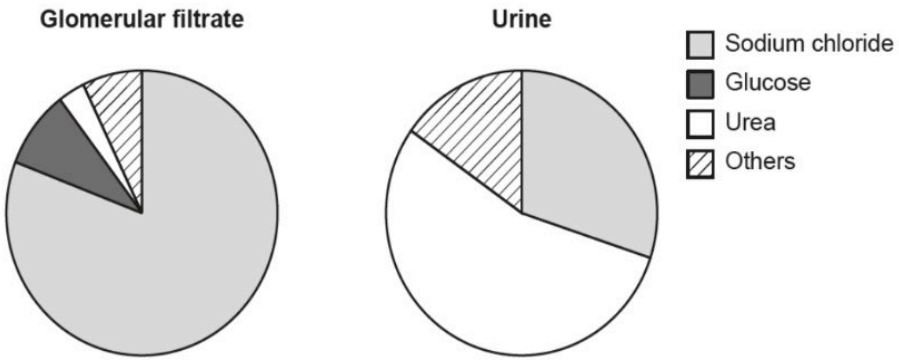

Fig. 7.2

(i) Draw a line labelled G on Fig. 7.1 to show where the glomerular filtrate was obtained. [1]

(ii) Use information from Fig. 7.2 to show that selective reabsorption occurs in the kidney tubule.

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.....[3]

(iii) Explain how the proportion of the components in the glomerular filtrate would change after eating a diet rich in meat.

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.....[3]

[Total: 9]

6 Fig. 3.1 shows the content of blood plasma before it enters the kidney and the content of urine after it passes through the kidney

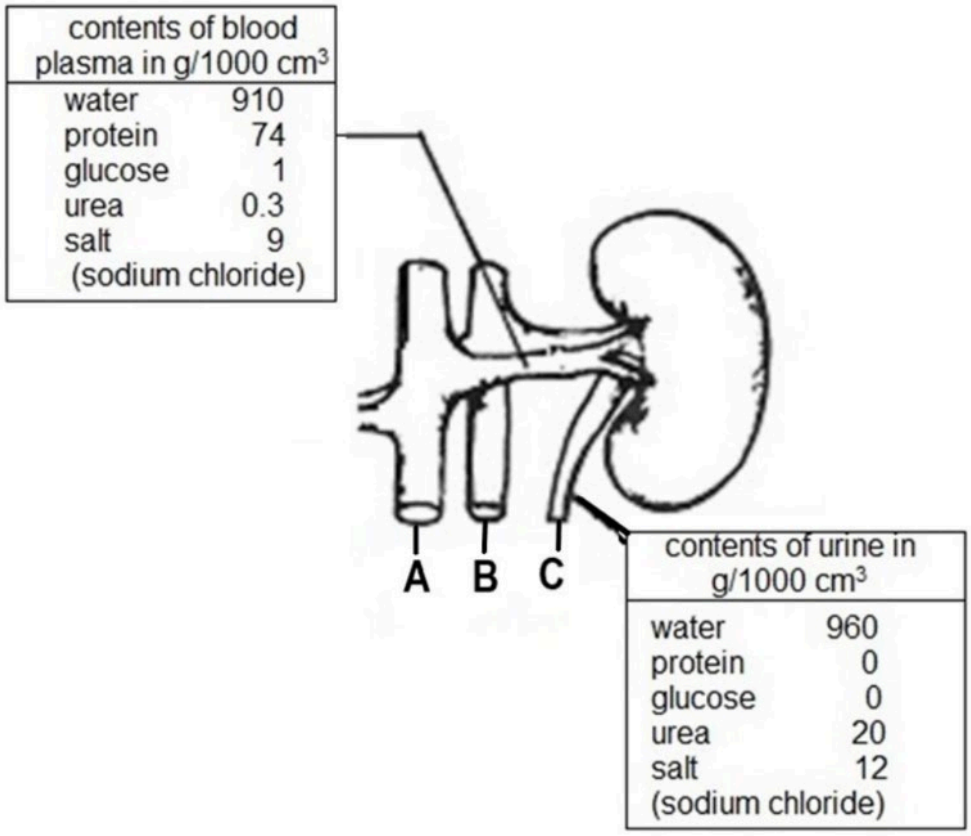

Fig. 3.1

(a) Name the structures labelled A to C.

A: .....

B: .....

C: ..... [3]

(b) The concentration of urea and salt are higher in urine than in blood plasma.

Explain the cause for this.

.....

..... [1]

(c) Suggest two ways in which the composition of sweat may differ from that of urine.

.....

.....

.....

..... [2]

(d) On average, human produces 500 cm3 of sweat per day. The recommended amount of water intake for human is 1500 cm3.

However, in very hot surroundings, as much as 5000 cm3 of sweat may be lost in a day.

If a man worked for a day under very hot conditions, and his water intake remained at 1500 cm3,

(i) describe the difference in the urine produced by this man compared to that produced when he stayed in a cool place the whole day.

.....

.....

.....

..... [2]

(ii) explain how the increased in sweat production under such conditions may endanger the life of the man.

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..... [2]

[Total:10]

7 **(a)** Fig. 4.1 shows a portion of the kidney nephron and the feedback mechanism involved in controlling blood water potential.

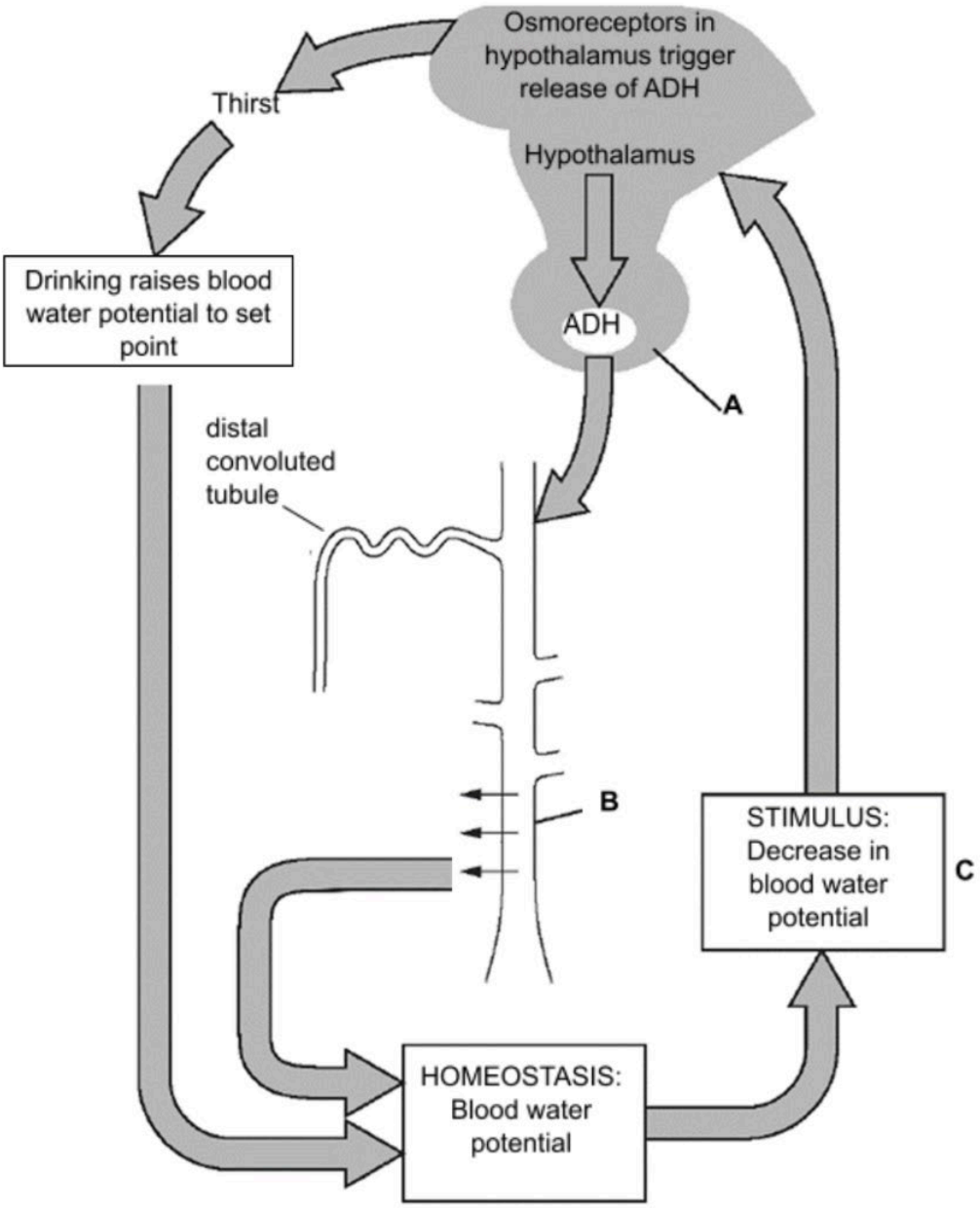

Fig. 4.1

(i) Name structures A and B as shown in Fig. 4.1 above.

A……..

B…….. [2]

(ii) Give an example of what might cause a decrease in blood water potential as shown in box C in Fig. 4.1.

…….. [1]

(b) Table 4.1 shows the concentrations of dissolved substances in different regions of a kidney nephron, including the distal convoluted tubule and structure B from Fig. 4.1, in the presence and absence of anti-diuretic hormone (ADH).

Region of kidney nephron	Concentration of dissolved substances / arbitrary units	
	ADH absent	ADH present
proximal convoluted tubule	300	300
loop of Henle	1000	1000
distal convoluted tubule	150	150
structure B	50	1000

With reference to Fig 4.1 and Table 4.1, describe the effect of ADH on different regions of the kidney nephron and explain how it affects the concentration of dissolved substances in these regions.

……..……..……..

……..……..…….

[3]

[Total: 6]

8 The kidneys regulate the concentration of substances in the blood.

(a) Glucose is found in the blood but not in the urine. Describe the processes that prevent glucose from being excreted in the urine. [3]

.....

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.....

.....

(b) Table 9.1 shows the concentrations of dissolved substances in the urine of a healthy person and in the urine of a person with one type of kidney disease.

Table 9.1

substance	concentration in grams per dm^3	
	urine of a healthy person	urine of a person with kidney disease
protein	0	7
glucose	0	0
amino acids	0	0
urea	24	24
mineral ions	17	17

(i) Explain the difference in composition of the urine between the healthy person and the person with kidney disease.[2]

.....

.....

.....

.....

(ii) The person with the kidney disease could be treated either by using a dialysis machine or by a kidney transplant operation. Compare the advantages and disadvantages of these two methods of treatment.

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.....[5]

[Total: 10]

9 **(a)** Fig. 3.1 shows a nephron and the blood capillary surrounding it.

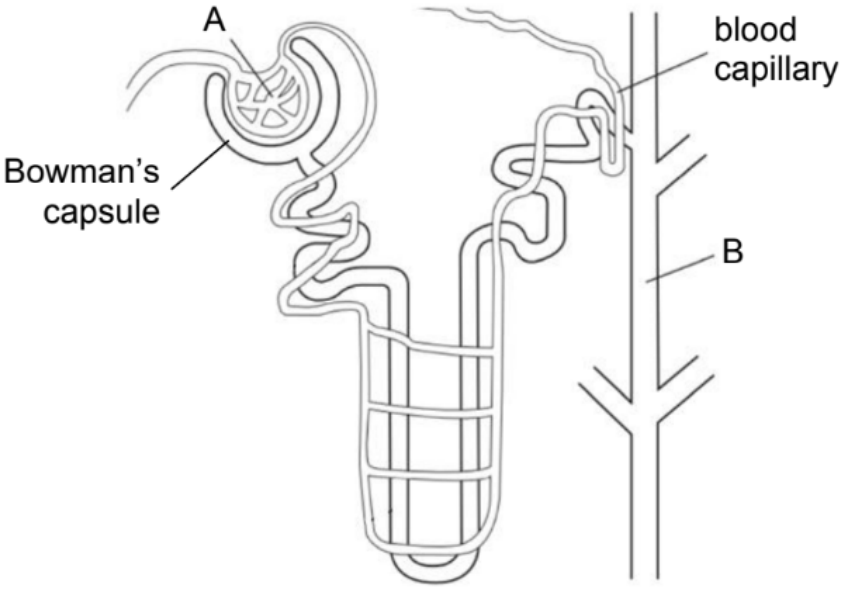

Fig. 3.1

(i) Name structures A and B.

A: .....

B: ..... [2]

(ii) Some substances in A are forced out into the Bowman's capsule of the nephron.

Explain how these substances are forced into the Bowman's capsule.

.....

.....

.....[2]

(b) Fig. 3.2 shows a type of dialysis where the dialysis fluid enters the abdominal cavity.

Exchange of materials will take place across the membrane that surrounds the abdominal cavity. This removes the waste products from the blood. After a few hours, the used fluid is drained out of the cavity, and fresh fluid will re-enter the abdominal cavity.

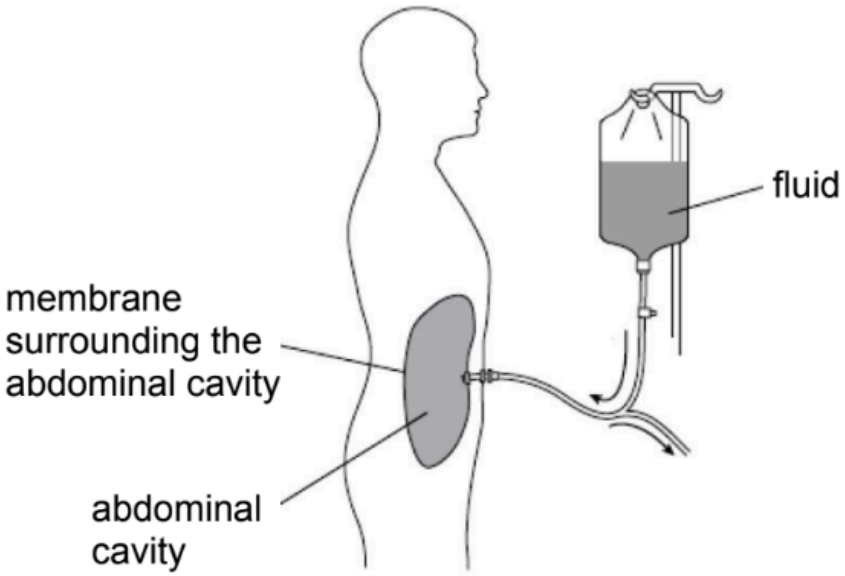

Fig. 3.2

Suggest why the fluid must be changed after a few hours.

.....

.....

.....[2]

[Total: 6]

10 Urea is a waste product formed in an organ.

(a) **(i)** Describe how urea is formed in the organ.

.....

.....

..... [1]

(ii) Describe the route taken by a molecule of urea formed in the organ to the kidneys.

Your answer should include all the blood vessels and organs involved.

.....

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..... [3]

(b) Kidneys are involved in the excretion of urea in urine.

Fig. 4.1 shows a drawing of a nephron in the human kidney and associated blood vessels.

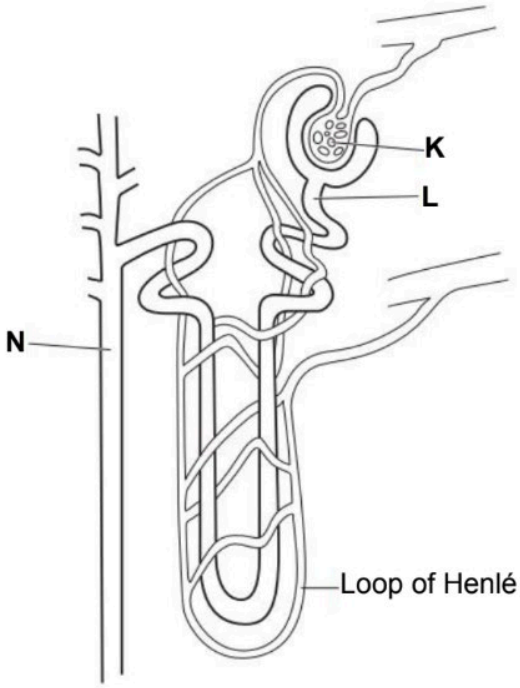

Fig. 4.1

(b) **(i)** Describe how structures **K** and **L** in Fig. 4.1 produce urine.

.....

.....

.....

.....

..... [2]

(ii) Explain how anti-diuretic hormone (ADH) affects structure **N** to produce urine with a high concentration of urea.

.....

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.....

.....

..... [2]

[Total: 8]

ANSWERS FOR RESPIRATION IN HUMANS MCQ

Q1: C	Q11: D	Q21: C	Q31: C
Q2: C	Q12: C	Q22: B	Q32: C
Q3: B	Q13: B	Q23: D	Q33: B
Q4: B	Q14: B	Q24: C	Q34: C
Q5: B	Q15: C	Q25: D	Q35: B
Q6: A	Q16: A	Q26: B	Q36: C
Q7: D	Q17: C	Q27: A	Q37: C
Q8: C	Q18: A	Q28: C	Q38: D
Q9: C	Q19: D	Q29: C	
Q10: A	Q20: D	Q30: D	

ANSWERS FOR RESPIRATION IN HUMANS STRUCTURED QUESTIONS

1 Fig 6.1 shows the structure of a kidney tubule.

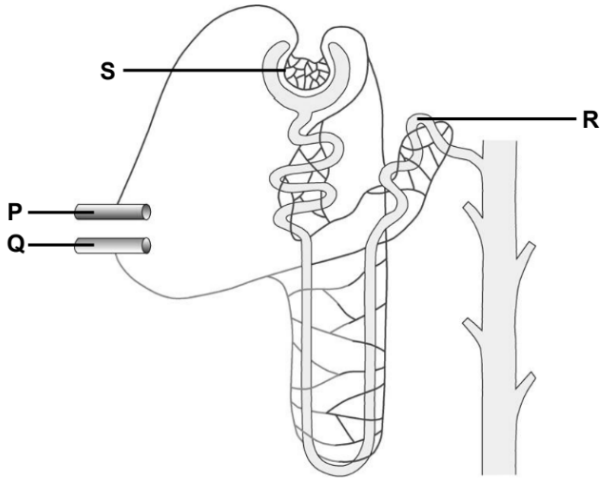

Fig 6.1

(a) Identify structures P and R.

P: Branch of the renal artery

R: Distal convoluted tubule [2]

(b) State two differences in the structure of P and Q.

P does not have valves, Q has valves;

P has thicker, more muscular walls than Q

P has a smaller lumen than Q [2]

(c) (i) Glomerular disease is a condition which affects structure S.

Proteins are found in the urine of patients with this condition.

Suggest how this may happen.

The partially permeable basement membrane of glomerulus is damaged/pores become larger/more permeable;

It allows larger molecules such as proteins to pass through into the glomerular filtrate.

S is affected (stated in the question already) – 0m

Prevent S from working (how?) – 0m [2]

(ii) Suggest two other substances which may be found in a patient's urine which are not usually found in the glomerular filtrate.

substance 1: .....

substance 2: .....

Platelets, Red blood cells, White blood cells, hormones (any two) 2 [2]

(iii) For patients who have serious cases of glomerular disease, they may need to receive treatment using dialysis. Table 6.1 shows the concentration of various substances in the blood of a patient with serious glomerular disease.

substance	concentration in blood / arbitrary units	concentration in dialysis fluid / arbitrary units
glucose	5.5	5.5
urea	4.2	0
mineral salts	35.6	35.6

Complete Table 6.1 to suggest the concentration of the various substances in the blood and dialysis fluid of the patient. [2]

3 pts – 2m, 2 pts – 1m, 1 pt – 0m

2 Maple syrup urine disease (MSUD) is a rare inherited human condition caused by mutation. MSUD is caused by a recessive allele.
MSUD is usually diagnosed in early childhood and can be controlled by having a low protein diet.

Fig. 4.1 shows the inheritance of MSUD in one family.

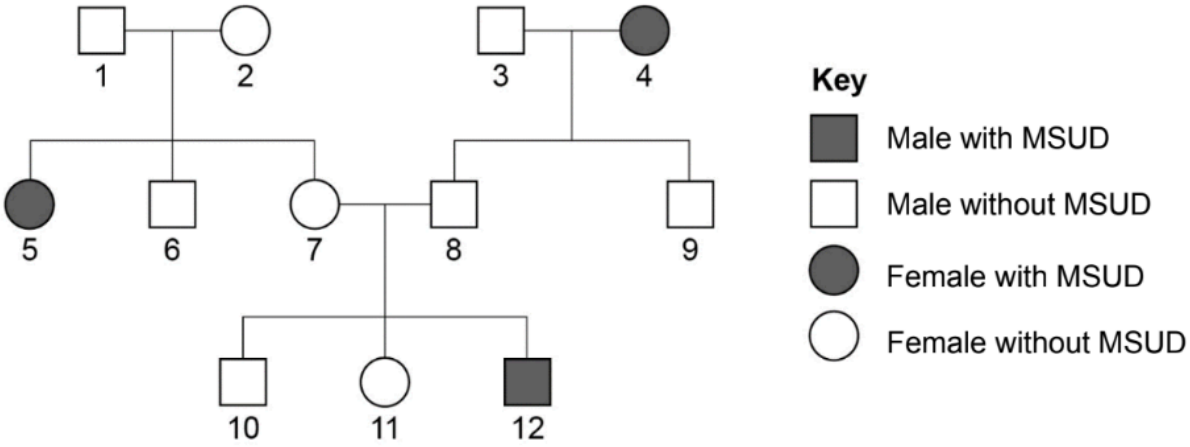

Fig. 4.1

(a) **(i)** Describe what is meant by mutation.

Mutation is spontaneous / random change in the structure of the gene or the number of chromosome. [1]

(ii) State the name of one factor which increases the rate of mutation.

formaldehyde; radiation; x-ray; tar 1 [1]

(iii) State one piece of evidence from Fig. 4.1 which shows that MSUD is a recessive condition.

Parent without MSUD has a child who has MSUD;

Parent 1 and 2 without MSUD have child 5 with MSUD;

Parent 7 and 8 without MSUD have child 12 with MSUD. [1]

(iv) Persons 7 and 8 in Fig. 4.1 are expecting a fourth child.

Determine the probability that the child will have MSUD by completing the genetic diagram.

Use the symbol N for the dominant allele and n for the recessive allele.

father x mother

Correct genotype of parents and gametes: N + n and N + n

Correct genotypes of offspring: NN / Nn / Nn / nn

Correct phenotypes of offspring.

Probability that the child will have MSUD: 0.25 / 1⁄4 / 25%

R ratio

(b) Fig. 4.2 shows chemical reactions involved in the normal breakdown of some types of amino acid inside body cells.

A person with MSUD cannot make Enzyme 2. This leads to the accumulation of amino acids in the blood and urine, giving the urine a characteristic sweet smell.

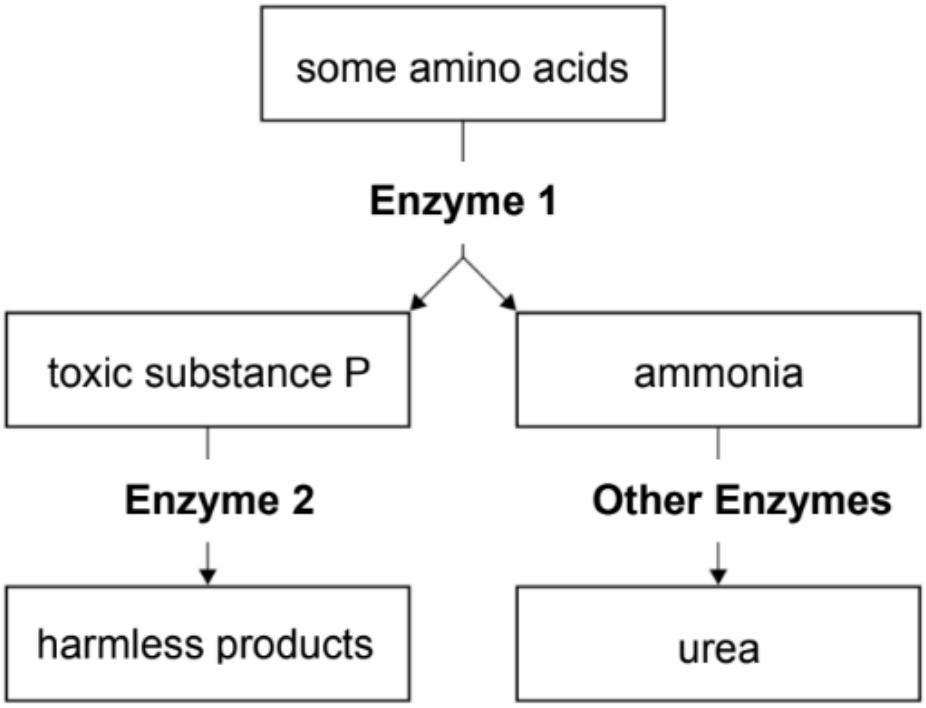

Fig. 4.2

(i) One of the final products shown in Fig. 4.2 is urea.

Which part of the human body are the reactions shown in Fig. 4.2 is most likely to occur?

liver 1 [1]

(ii) Scientists can analyse urine samples to see if a person has MSUD.

Explain why the urine of a person with MSUD will have high concentration of toxic substance P.

[1] Toxic substance P passes through the (glomerulus) in the kidney.

[2] Not all of the toxic substance P is reabsorbed back into the blood capillaries and end up in the urine.

[3] Only some of the toxic substance P is reabsorbed into the blood capillaries.

Any two points 2 [2]

(iii) Explain why a person with MSUD must have a low-protein diet.

[1] proteins are broken down into amino acids / proteins are made up of / contain amino acids.

[2] must keep amino acids in low amount /amino acids do not build up / less amino acids produced. [AW]

[3] so that toxic substance P does not build up in the body and cause damage to cells / tissues / organs. [AW] [3]

[Total: 13]

3 Fig. 2.1 shows a kidney nephron.

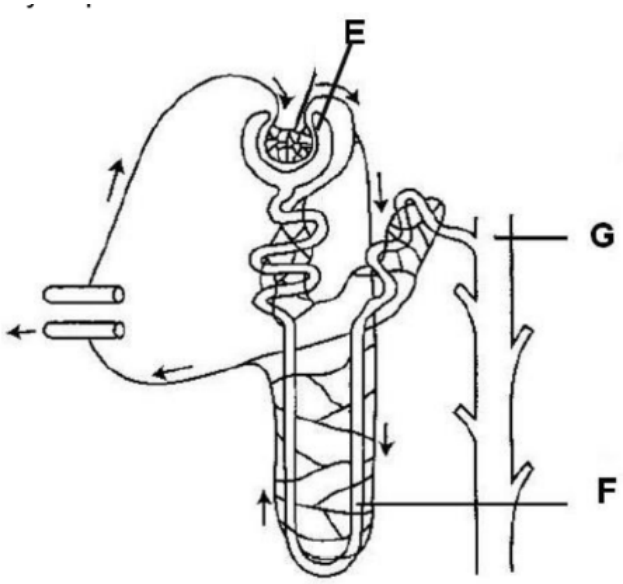

Fig. 2.1

(a) Describe the role of structures E and F in the formation of urine.[3]

- **Glucose, amino acids** and **urea is first removed at the glomerulus** (E) via **ultrafiltration**. [1]
- **Water and salts** are are then **selectively reabsorbed** at the **Loop of Henle** (F) from the filtrate. [1]
- The filtrate contains **only metabolic waste such as urea,** forming urine. [1]

(b) Describe the effect of anti-diuretic hormone (ADH) on the structure labelled G and its effect on urine formation. [2]

- **ADH increases water permeability of collecting ducts** (G) in kidneys [1]
- **increases the volume of water reabsorbed** and a **lower volume of urine produced**. [1]

Teacher's Comments:Some students thought that glomerulus reabsorbed glucose

[Total: 5]

4 Kidney failure can be treated by using dialysis.

Fig. 2.1 shows a patient connected to a simplified drawing of a dialysis machine.

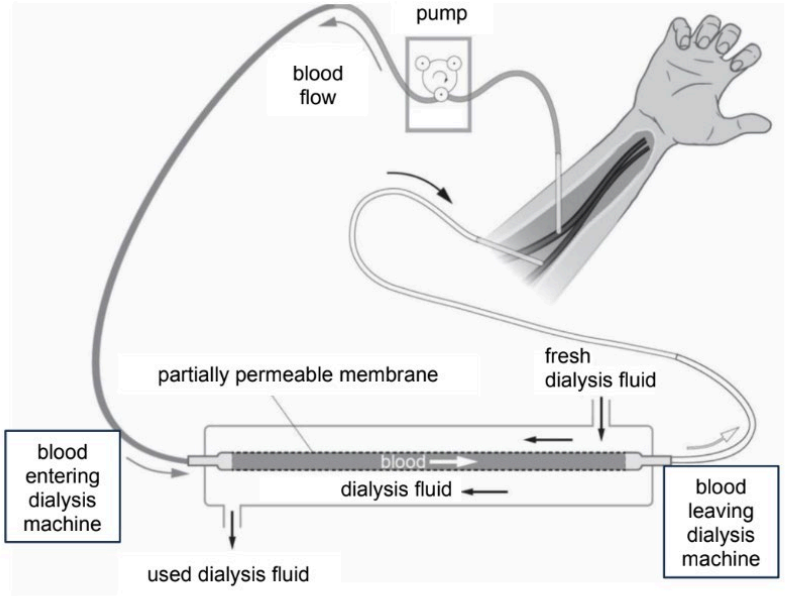

Fig 2.1

(a) **(i)** Explain why the blood and the dialysis fluid flow in opposite directions through the machine.

To create a steep concentration gradient between the blood and the dialysis fluid + to increase the rate of diffusion (of waste molecules) [1]

(ii) Suggest an improvement that could be made to the dialysis machine and give a reason why the feature is important.

• Increase number of coils of tubing in the dialysis machine.[1]

• To **increase surface area to volume ratio** that helps to **speed up** the **rate** of exchange of substances between patient's blood and dialysis fluid.[1] [2]

(b) **(i)** Define excretion.

Removal of nitrogenous waste products from the body. [1]

(ii) State one excretory waste product and explain the importance of removing it from the body.

Urea + Become toxic to the body if allowed to accumulate OR

carbon dioxide + acidic gas, will decrease pH of blood [1]

(c) Table 2.1 shows the concentrations of various substances present in the different fluids found in the dialysis machine.

Table 2.1

substances	concentration/ arbitrary units		
	blood entering the dialysis machine	fresh dialysis fluid	used dialysis fluid
sodium ions	140	130	150
chloride ions	100	90	110
glucose	100	?	100
urea	20	0	18
protein	4	0	0

(i) Explain why there is no protein found in the used dialysis fluid.

Protein molecules are too big to pass through (the pores) of the dialysis tubing [1]

(ii) With reference to Table 2.1, suggest and explain the concentration of glucose present in the fresh dialysis fluid.

concentration of glucose in fresh dialysis fluid

100 or more; arbitrary units

explanation

Ensure that the essential blood glucose molecules will not diffuse out of the blood.[1] [2]

[Total: 8]

5 Fig. 7.1 shows a diagram of a kidney nephron.

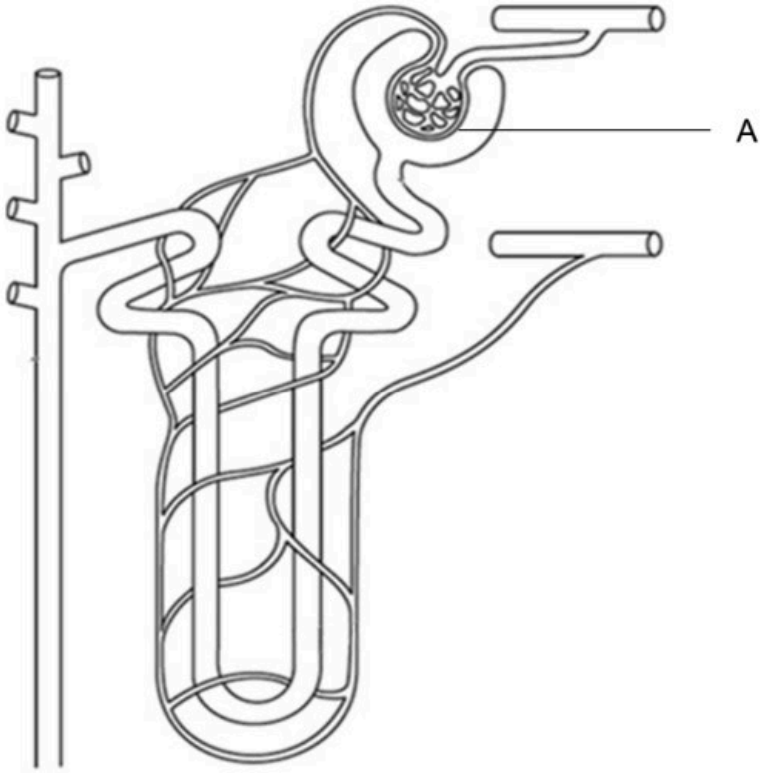

Fig. 7.1

(a) Describe one feature of the structure of A and explain how this feature aids in the formation of urine.

Any set of ans

The blood capillaries have one-cell thick walls/ tiny pores in the membranes; to speed up the process of ultrafiltration;

OR

The blood capillaries have a thin partially permeable membrane; that allows only small soluble molecules or ions to pass through; [2]

(b) Fig. 7.2 shows the proportions of certain components in glomerular filtrate and urine from a healthy person.

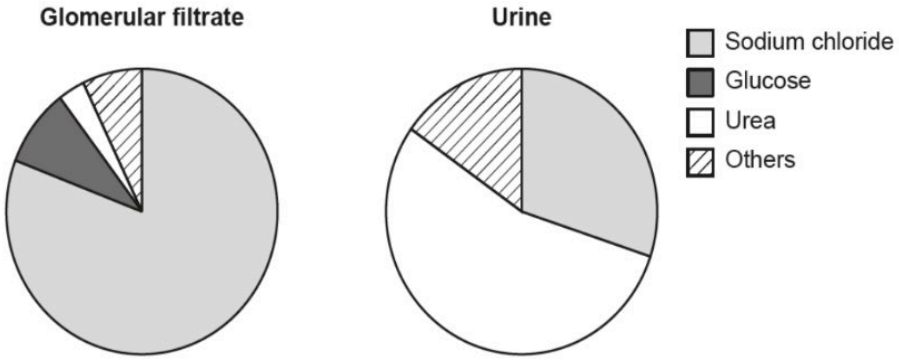

Fig. 7.2

(i) Draw a line labelled G on Fig. 7.1 to show where the glomerular filtrate was obtained. [1]

Label Bowman's capsule G; [1]

(ii) Use information from Fig. 7.2 to show that selective reabsorption occurs in the kidney tubule.

There is a decrease in the concentration of glucose as all the glucose is reabsorbed back into the blood stream;[1]

There is a decrease in the concentration of sodium chloride as some mineral salts are reabsorbed back into the blood stream;[1]

Urea concentration increases in urine as it is not reabsorbed back into the blood stream;[1] [3]

(iii) Explain how the proportion of the components in the glomerular filtrate would change after eating a diet rich in meat.

After consuming a meal rich in meat, there would be increased amino acids in the bloodstream;[1]

Excess amino acids would be deaminated in the liver to form more urea;[1]

In glomerular filtrate, there would be a higher level of urea;[1]

. [3]

[Total: 9]

6 Fig. 3.1 shows the content of blood plasma before it enters the kidney and the content of urine after it passes through the kidney

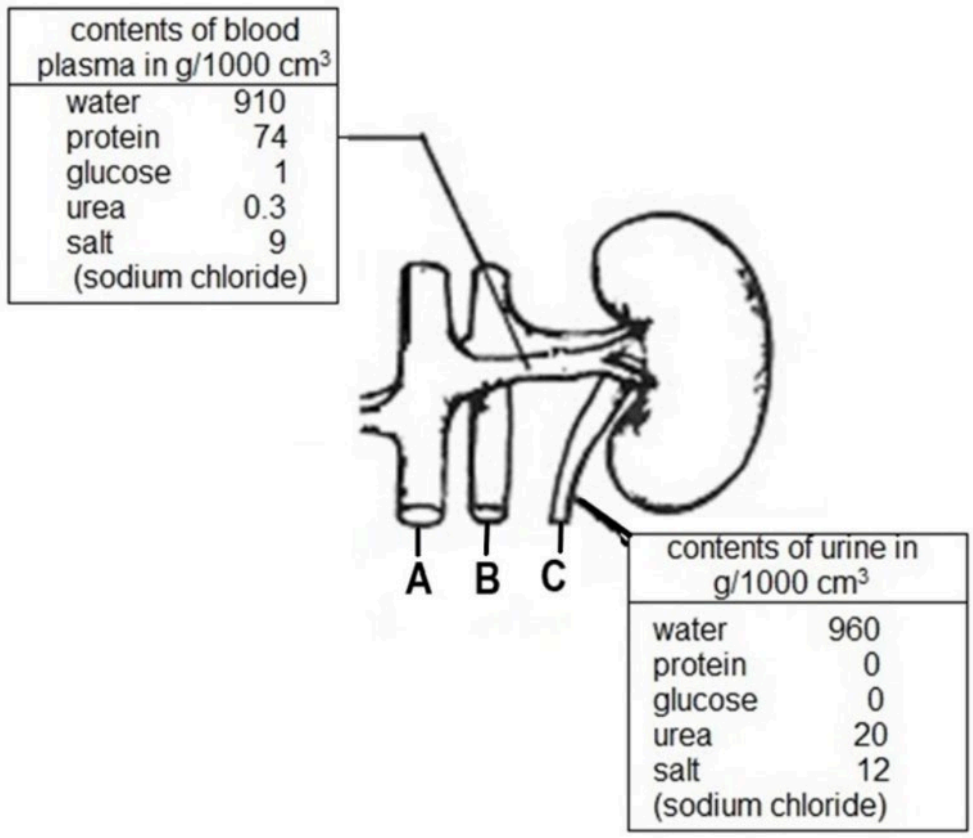

Fig. 3.1

(a) Name the structures labelled A to C.

A: renal artery [1]

B: renal vein [1]

C: ureter [1] [3]

(b) The concentration of urea and salt are higher in urine than in blood plasma.

Explain the cause for this.

1. Urea and excess mineral salt are higher as they are not selectively reabsorbed [1]

(c) Suggest two ways in which the composition of sweat may differ from that of urine.

1. composition of sweat has less urea than that of urine[1]

2. composition of sweat has no coloured matter/ pale appearance compared to that of urine [1]

3. more mineral salts in urine than in blood plasma[1]

any two [2]

(d) On average, human produces 500 cm3 of sweat per day. The recommended amount of water intake for human is 1500 cm3.

However, in very hot surroundings, as much as 5000 cm3 of sweat may be lost in a day.

If a man worked for a day under very hot conditions, and his water intake remained at 1500 cm3,

(i) describe the difference in the urine produced by this man compared to that produced when he stayed in a cool place the whole day.

1. Less urine will be released [1]

2. More concentrated urine produced [1]

[2]

(ii) explain how the increased in sweat production under such conditions may endanger the life of the man.

1. If the person is not hydrated, the person might suffer from heat stroke. [1]

2. The waste products produced may not be totally removed (as less urine is produced). [1]

[2]

[Total:10]

7 **(a)** Fig. 4.1 shows a portion of the kidney nephron and the feedback mechanism involved in controlling blood water potential.

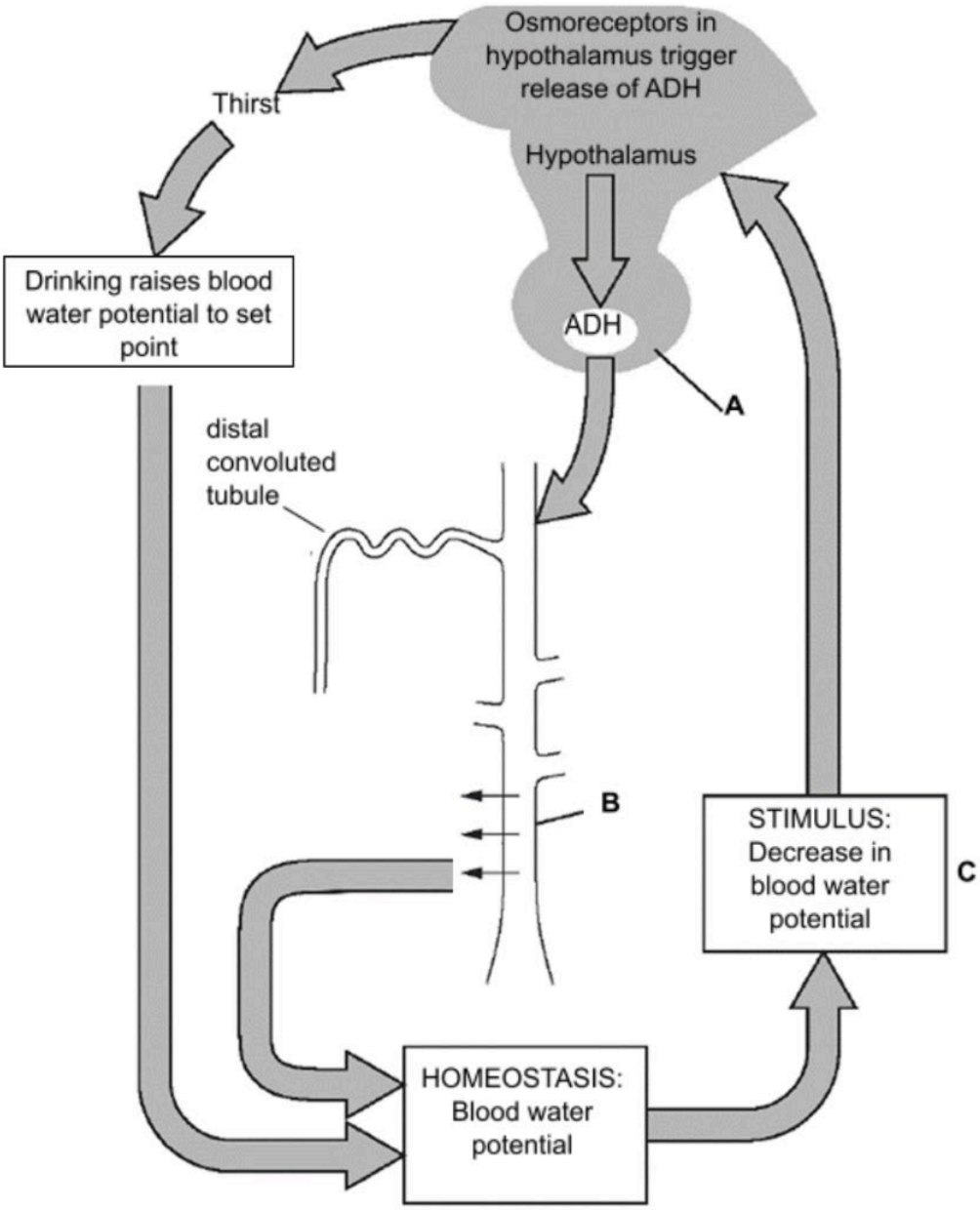

Fig. 4.1

(i) Name structures A and B as shown in Fig. 4.1 above.

A: pituitary gland [1]

B: collecting duct [1] [2]

(ii) Give an example of what might cause a decrease in blood water potential as shown in box C in Fig. 4.1.

After vigorous exercise/ on a hot day/ increased sweating [1]

(b) Table 4.1 shows the concentrations of dissolved substances in different regions of a kidney nephron, including the distal convoluted tubule and structure B from Fig. 4.1, in the presence and absence of anti-diuretic hormone (ADH).

Region of kidney nephron	Concentration of dissolved substances / arbitrary units	
	ADH absent	ADH present
proximal convoluted tubule	300	300
loop of Henle	1000	1000
distal convoluted tubule	150	150
structure B	50	1000

With reference to Fig 4.1 and Table 4.1, describe the effect of ADH on different regions of the kidney nephron and explain how it affects the concentration of dissolved substances in these regions.

Describe:[1]

- The concentration of dissolved substances in these regions: proximal convoluted tubule, loop of Henle and distal convoluted tubule **remains the same** however there **is an increase in concentration of dissolved substances** in structure B from 50 to 1000AU, when ADH is present

Explain: [2]

- This is because **ADH increases the permeability of the walls of B/ collecting duct to water**

- **hence increasing reabsorption of water into the blood capillaries**, (with lesser water in the tubules), the concentration of the dissolved substances increases.

[3]

[Total: 6]

8 The kidneys regulate the concentration of substances in the blood.

(a) Glucose is found in the blood but not in the urine. Describe the processes that prevent glucose from being excreted in the urine. [3]

1. glucose is small enough to be filtered out of the blood during ultrafiltration [1]

2. the filtered glucose is then selectively reabsorbed into the blood [1]

3. by active transport by the proximal convoluted tubule [1]

(b) Table 9.1 shows the concentrations of dissolved substances in the urine of a healthy person and in the urine of a person with one type of kidney disease.

Table 9.1

substance	concentration in grams per dm^3	
	urine of a healthy person	urine of a person with kidney disease
protein	0	7
glucose	0	0
amino acids	0	0
urea	24	24
mineral ions	17	17

(i) Explain the difference in composition of the urine between the healthy person and the person with kidney disease.[2]

In a healthy person, proteins are not present because proteins are large (molecules) hence they are unable to pass through the partially permeable membrane of the glomerular blood capillary [1]

in person with disease the filter allows protein through, broken blood vessel/ glomerulus [1]

(ii) The person with the kidney disease could be treated either by using a dialysis machine or by a kidney transplant operation. Compare the advantages and disadvantages of these two methods of treatment.

Advantages of transplant over dialysis

- don't need restricted diet / restricted fluid intake
- a lot of time is wasted on dialysis
- prevent high blood pressure
- no build-up of toxins / keeps blood concentration constant
- blood clots may result from dialysis
- infection may result from dialysis
- with dialysis, blood may not clot properly due to anti-clotting drugs
- cost issues (i.e. a transplant is cheaper over the long term)

[accept any 3 answers]

Disadvantages of transplant over dialysis

- rejection / problem finding tissue match
- use of immuno-suppressant drugs leading to other infections
- dangers during operation

[accept any 2 answers]

[5]

[Total: 10]

9 **(a)** Fig. 3.1 shows a nephron and the blood capillary surrounding it.

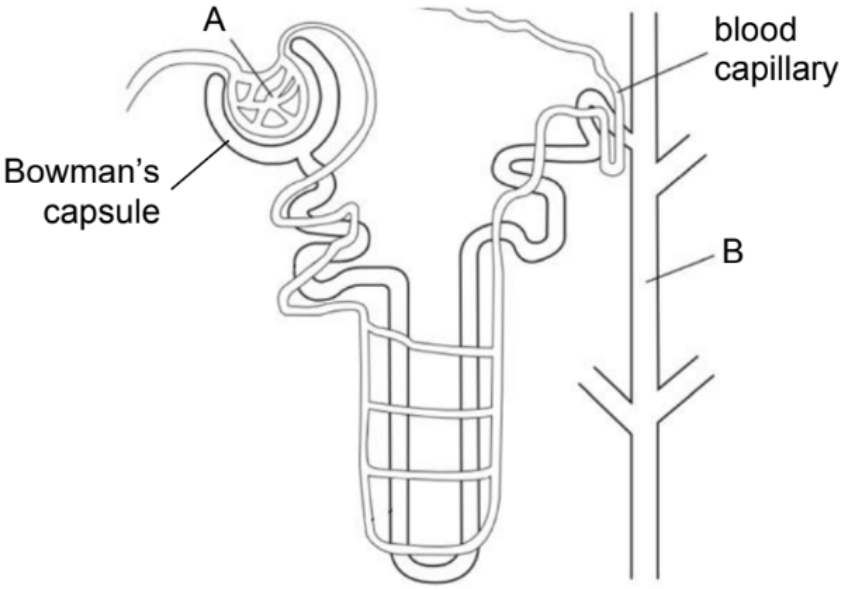

Fig. 3.1

(i) Name structures A and B.

A – glomerulus;

B – collecting duct;

[2]

(ii) Some substances in A are forced out into the Bowman's capsule of the nephron.

Explain how these substances are forced into the Bowman's capsule.

Afferent arteriole's lumen is bigger than efferent arteriole's;

Creates a high hydrostatic/blood pressure in the glomerulus to force small substances out;

[2]

(b) Fig. 3.2 shows a type of dialysis where the dialysis fluid enters the abdominal cavity.

Exchange of materials will take place across the membrane that surrounds the abdominal cavity. This removes the waste products from the blood. After a few hours, the used fluid is drained out of the cavity, and fresh fluid will re-enter the abdominal cavity.

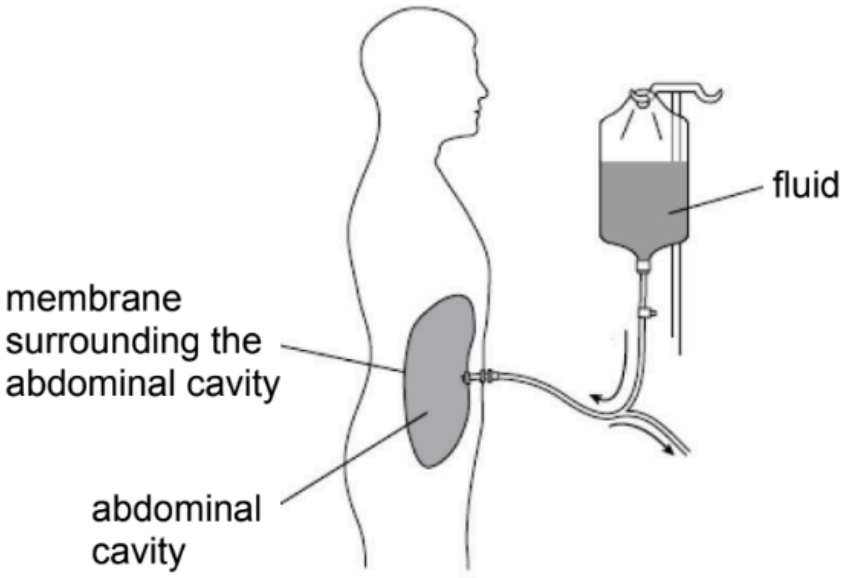

Fig. 3.2

Suggest why the fluid must be changed after a few hours.

Maintain a steep concentration gradient between fluid and blood;

(must write properly)

[2]

[Total: 6]

10 Urea is a waste product formed in an organ.

(a) **(i)** Describe how urea is formed in the organ.

Amino groups of excess amino acids are deaminated and converted to urea [1]

(ii) Describe the route taken by a molecule of urea formed in the organ to the kidneys.

Your answer should include all the blood vessels and organs involved.

1 The molecule of urea is transported by the hepatic vein from the liver / organ D to the right atrium of the heart via the vena cava

2 From right atrium, the molecule of urea then enters right ventricle and exit to the lungs via the pulmonary artery and returns to the left atrium of the heart via pulmonary vein

3 From left atrium, the molecule of urea then enters the left ventricle and exit the heart via the aorta to the kidney via the renal artery [3]

(b) Kidneys are involved in the excretion of urea in urine.

Fig. 4.1 shows a drawing of a nephron in the human kidney and associated blood vessels.

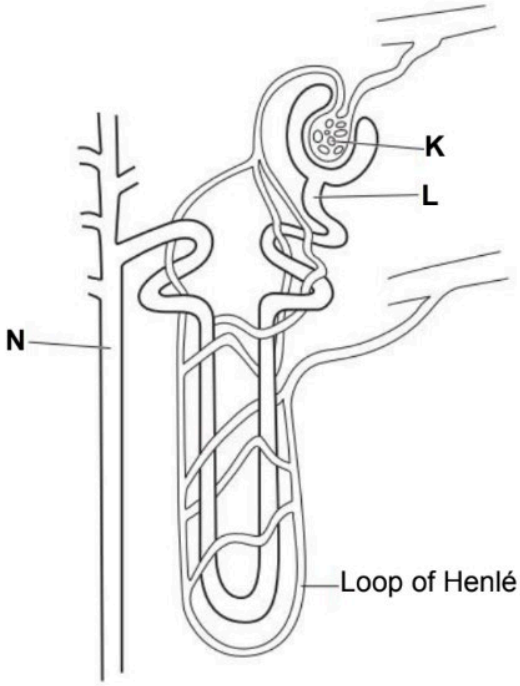

Fig. 4.1

(b) **(i)** Describe how structures **K** and **L** in Fig. 4.1 produce urine.

1 ultrafiltration happens at the glomerulus / K where the high hydrostatic pressure of blood forces small molecules such as water / glucose / urea / ions into proximal convoluted tubule / L

2 selective reabsorption occurs at proximal convoluted tubule / L, where all glucose and amino acids are reabsorbed while urea and some water are not reabsorbed

if no description of ultrafiltration and selective reabsorption is mentioned = 1m

[2]

(ii) Explain how anti-diuretic hormone (ADH) affects structure **N** to produce urine with a high concentration of urea.

1 An increased concentration of ADH stimulates the increased permeability of the collecting duct to water molecules

2 Hence, more water molecules are reabsorbed into the blood capillaries, resulting to a lower volume of water in the collecting duct

[2]

[Total: 8]