13. Excretion in humans

13.1 Excretion in humans

Paper 3 and 4

Question Paper

Paper 3

Questions are applicable for both core and extended candidates unless indicated in the question

1 **(d)** The lungs excrete waste gases.

(i) State the name of **one other** organ that excretes waste substances.

..... [1]

(ii) Circle **three** other substances that humans excrete.

amino acids	**glycerol**	**haemoglobin**	**ions**
mucus	**starch**	**urea**	**water**

[3]

2 **(a)** Fig. 5.1 is a diagram of some of the organs involved in the production and release of urine.

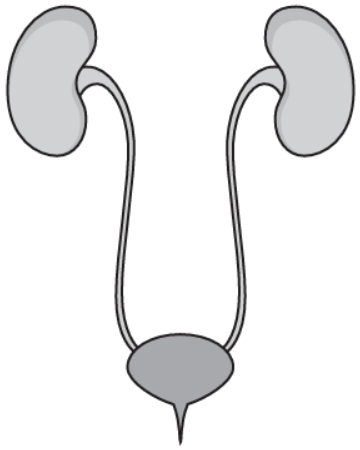

Fig. 5.1

Draw an **X** on Fig. 5.1 to identify the position of the bladder. [1]

(b) A scientist recorded the volume of urine released by different species of mammal during a 24-hour period.

The scientist collected urine from five individuals of each species of mammal.

The highest and lowest volumes of urine released were recorded to give a range for each species of mammal.

Table 5.1 shows the results.

Table 5.1

species of mammal	range of volumes of urine released in 24 hours / dm^3
A	2.10 – 12.60
B	15.30 – 40.50
C	0.08 – 0.16
D	1.00 – 2.00
E	0.60 – 2.40

(i) State the species of mammal that released the lowest volume of urine in Table 5.1.

..... [1]

(ii) State the species of mammal that has the largest range shown in Table 5.1.

..... [1]

(c) Explain why the volume of urine produced in humans can vary throughout the day. **(extended only)**

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..... [3]

(d) Urine contains urea, excess water and excess ions.

The list shows some organs.

kidney **liver** **ureter**

urethra **vagina**

(i) State the name of the organ from the list that produces urea. **(extended only)**

..... [1]

(ii) State the name of the organ from the list that excretes urea.

..... [1]

(e) State the name of the gas that is excreted through the lungs.

..... [1]

[Total: 9]

3 **(b)** Exercise levels, environmental temperature and changes in water intake can affect the volume and concentration of urine produced. **(extended only)**

Complete the sentences by circling the correct words **in bold**.

The first sentence has been done for you.

More exercise causes the volume of urine to **increase** / (**decrease**) / **stay the same** and the concentration of urine to (**increase**) / **decrease** / **stay the same**.

A greater intake of water causes the volume of urine to **increase** / **decrease** / **stay the same** and the concentration of urine to **increase** / **decrease** / **stay the same**.

A higher environmental temperature causes the volume of urine to **increase** / **decrease** / **stay the same** and the concentration of urine to **increase** / **decrease** / **stay the same**.

[2]

4 **(a)** Fig. 1.1 shows some of the structures involved in excretion.

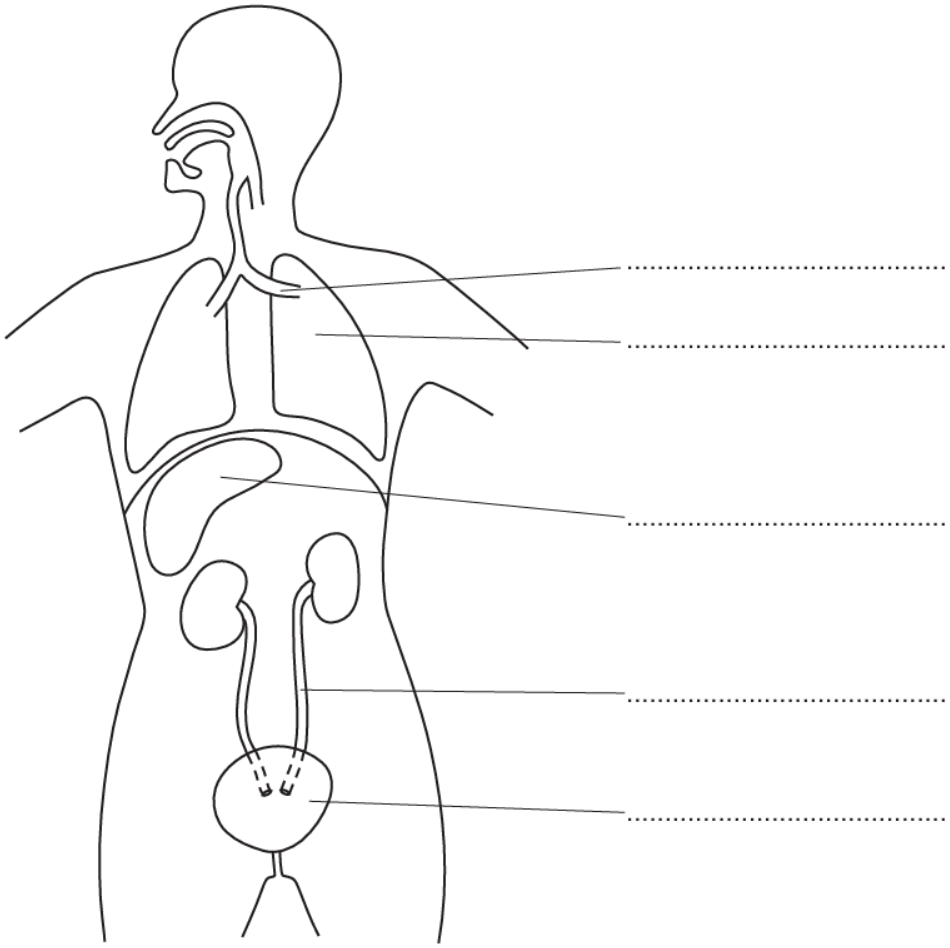

Fig. 1.1

Complete Fig. 1.1 by labelling the structures in the spaces provided.

Choose structures from the list:

bladder	**bronchus**	**heart**	**liver**	**lung**
pancreas	**trachea**	**ureter**	**urethra**	

[5]

(b) Urea is excreted. **(extended only)**

(i) State the name of the substance that urea is made from.

..... [1]

(ii) State where in the body urea is made.

..... [1]

(c) Urine produced by the kidneys contains three excretory substances: urea, water and mineral salts.

Table 1.1 shows the average mass of urea, water and mineral salts in 100 g of blood plasma and in 100 g of urine.

Table 1.1

substance	average mass / g	
	in 100 g of blood plasma	in 100 g of urine
water	90.00	95.00
urea	0.03	2.00
mineral salts	0.69	1.35

Calculate the percentage increase in the average mass of mineral salts between blood plasma and urine.

Give your answer to two decimal places.

Space for working.

..... %
[3]

5 **(b)** State **three** ways in which the human body may lose water.

1 .....

2 .....

3 .....
[3]

6 Excretion is the removal of toxic substances or substances in excess, from the body.

(a) Excess water is excreted from the lungs and the kidneys.

State the name of **one other** substance that is excreted from

the lungs .....

the kidneys .....

[2]

Paper 4

Questions are applicable for both core and extended candidates unless indicated in the question

7 **(a)** Fig. 3.1 shows a kidney nephron and its associated blood vessels.

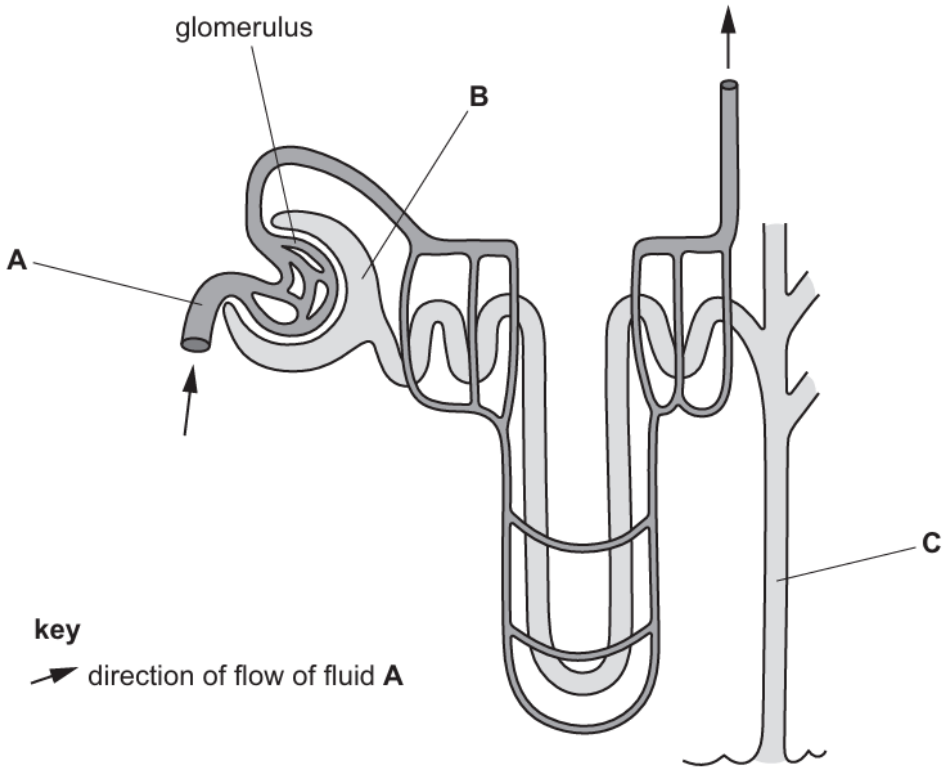

Fig. 3.1

The compositions of fluids **A**, **B** and **C** were analysed.

Table 3.1 shows the results for five components of the fluids.

Table 3.1

component	percentage concentration in fluid **A**	percentage concentration in fluid **B**	percentage concentration in fluid **C**
water	90.00	90.00	94.00
glucose	0.10	0.10	0.00
protein	8.00	0.00	0.00
urea	0.03	0.03	2.00
ions	0.72	0.72	1.50

(i) State the names of fluid **A** and fluid **C** in Fig. 3.1. **(extended only)**

A .....

C .....

[2]

(ii) Using the information in Fig. 3.1 and Table 3.1, describe **and** explain the differences in the compositions of fluids **A**, **B** and **C**. **(extended only)**

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..... [5]

8 **(d)** Describe the role of the liver in excretion. **(extended only)**

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..... [4]

9 The kidneys filter blood, separate useful molecules from excretory wastes and control the water content of the blood.

Fig. 2.1 is a diagram of a kidney tubule and associated blood vessels. The arrows show the direction of blood flow.

Fig. 2.2 is a drawing of a vertical section through a cell from the lining of region 2 of the tubule.

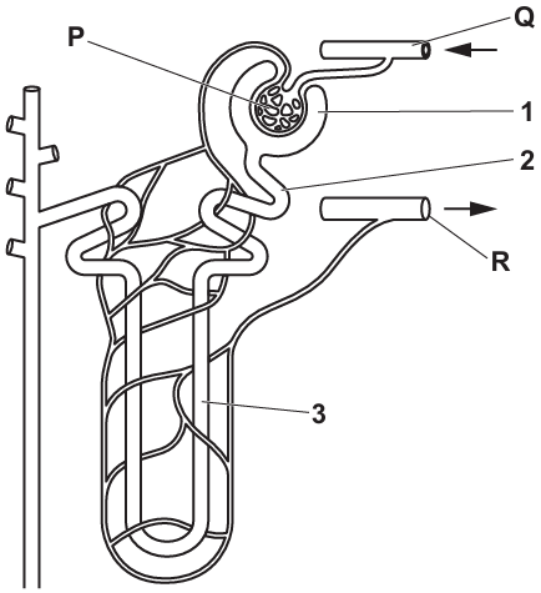

Fig. 2.1

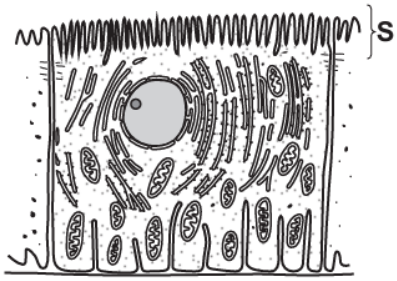

Fig. 2.2

(a) (i) State the name of structure **P**. **(extended only)**

..... [1]

(ii) Blood vessel **Q** has the highest blood pressure.

Suggest why. **(extended only)**

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..... [1]

(b) Table 2.1 shows the concentrations of some substances in blood plasma and in the regions labelled 1 and 3 on the tubule shown in Fig. 2.1.

Table 2.1

substance	concentration / mg per cm^3		
	blood plasma	region 1	region 3
protein	8000	0	0
glucose	100	100	0
salts	320	320	300
urea	30	30	2000

Outline how the kidney tubules function to produce urine from the substances in blood plasma.

Use the information in Fig. 2.1, Fig. 2.2 and Table 2.1 to support your answer. **(extended only)**

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..... [6]

10 **(a)** State **two** factors that affect the volume of urine produced in the human body. **(extended only)**

1 .....

2 .....

[2]

11 **(b)** Urea is a toxin that is excreted by the kidneys in humans.

Describe how **and** where in the body urea is formed. **(extended only)**

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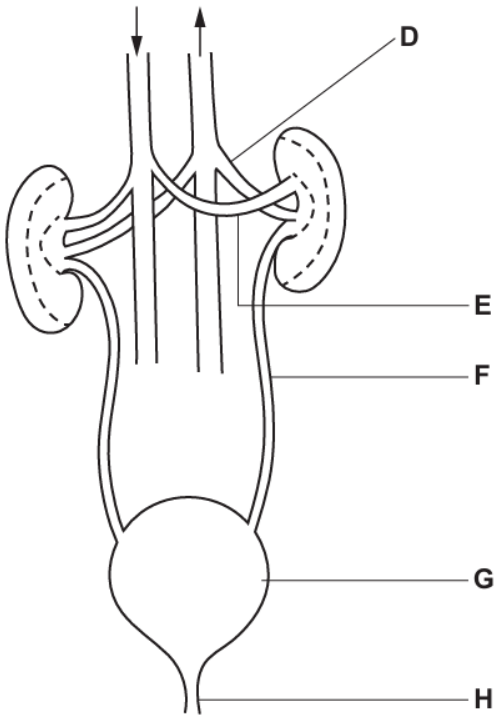
..... [3]

(c) Fig. 3.2 shows part of the human excretory system and associated blood vessels.

The arrows indicate the direction of blood flow.



not to scale

Fig. 3.2

(i) Draw a label line and the letter **X on Fig. 3.2** to show the location of the cortex in one of the kidneys. **(extended only)** [1]

(ii) Table 3.1 contains statements about the labelled structures in Fig. 3.2.

Complete the table by:

- stating the name of the structure
- identifying the letter that labels that structure.

Table 3.1

description	name of structure	letter from Fig. 3.2
organ that stores urine		
tube that carries urine out of the kidney		
blood vessel with the lowest concentration of urea		
blood vessel with the lowest concentration of carbon dioxide		
tube that carries urine out of the body		

[5]

(d) Doctors wanted to investigate the effect of exercise on the excretion of salts.

They collected urine from people before and after running a long distance on a hot day.

The results of their investigation are shown in Table 3.2.

Table 3.2

	before running	after running
average volume of urine / cm^3	1156.0	569.0
average concentration of sodium in urine / mmol per dm^3	85.6	78.2

(i) Suggest why there is a difference in the volume of urine produced before running compared with after running.

Use the information in Table 3.2 in your answer. **(extended only)**

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..... [2]

(ii) Calculate the percentage decrease in the average sodium concentration after running compared with before running.

Give your answer to one significant figure.

Space for working. **(extended only)**

..... %
[3]

(iii) Describe how the kidney tubules enable the excretion of salts. **(extended only)**

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..... [3]

(e) Large plasma proteins are usually prevented from entering the urine.

State the name of **one** protein found in blood plasma. **(extended only)**

..... [1]

12 Kidneys are important for excretion.

(a) Explain the purpose of excretion.

.....

.....

..... [2]

(b) Sketch a simple diagram of a human kidney and its ureter.

Label the cortex, medulla and ureter on your diagram. **(extended only)**

[2]

(c) Fig. 3.1 is a photomicrograph of a glomerulus in a kidney.

Fig. 3.1

(i) Describe the structure of a glomerulus.

You may refer to Fig. 3.1 in your answer. **(extended only)**

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..... [2]

(ii) Describe the role of the glomerulus. **(extended only)**

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..... [2]

(d) Table 3.1 shows some comparisons between a human and a mouse.

Table 3.1

feature	human	mouse
body mass/kg	60.0	0.025
kidney mass/g	320.0	0.310
water intake/dm^3 per day	1.5	0.005
water reabsorption/dm^3 per day	179.0	0.168
salt filtration rate/g per day	580.0	0.556
salt reabsorption/g per day	575.0	0.551

(i) Table 3.1 shows that salts are reabsorbed in the kidneys of both humans and mice.

Describe how salts are reabsorbed **against** a concentration gradient. **(extended only)**

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..... [4]

(ii) Scientists stated a hypothesis:

"humans and mice reabsorb salt at almost the same rate in relation to the size of their kidneys"

Determine whether the data in Table 3.1 supports this hypothesis.

Show your working. **(extended only)**

human	mouse

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..... [4]

(iii) Table 3.1 also shows that water is reabsorbed in the kidneys of both humans and mice.

State the name of the process that mammals use to reabsorb water. **(extended only)**

..... [1]

(iv) Water and salt are reabsorbed in the kidneys. **(extended only)**

State the name of one **other** molecule that is also reabsorbed in kidney tubules.

..... [1]