Chapter 13

Excretion in humans

01. 0610_m19_qp_42 Q: 1

The kidney is one of the main excretory organs of the body.

(a) Define the term *excretion*.

.....

.....

.....

.....

..... [3]

(b) One of the roles of the kidney is to filter the blood.

Fig. 1.1 shows a section of a kidney.

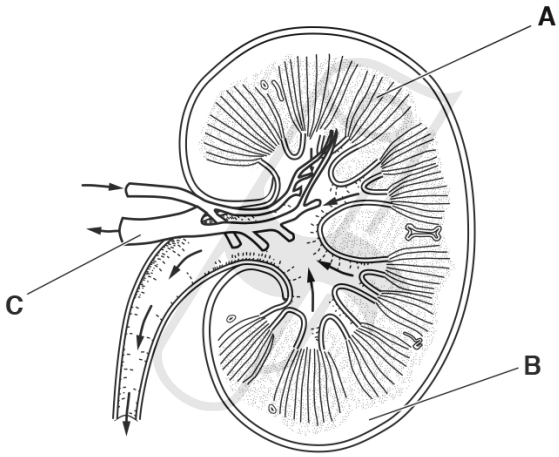

Fig. 1.1

State the name of the parts labelled **A**, **B** and **C** on Fig. 1.1.

A .....

B .....

C .....

[3]

(c) Table 1.1 shows the concentrations of four solutes:

- in the blood in the renal artery
- in the fluid in the kidney tubule
- in the urine.

Table 1.1

solute	solute concentration / g dm^{-3}		
	blood in the renal artery	fluid in the kidney tubule	urine
glucose	0.9	0.9	0.0
protein	83.0	0.0	0.0
salts	8.0	8.0	16.5
urea	0.2	0.2	20.0

(i) Calculate the percentage increase in the concentration of urea between the blood in the renal artery and the urine.

Show your working.

..... %
[2]

(ii) Describe the results for the concentration of salts shown in Table 1.1.

.....

.....

.....

.....

..... [2]

(iii) State the reason for the difference in the concentration of protein between the blood in the renal artery and the fluid in the kidney tubule.

.....

..... [1]

(iv) State the reason for the difference in the concentration of glucose between the fluid in the kidney tubule and the urine.

.....

..... [1]

(d) Dialysis is a treatment used for people with kidney failure.

Some people with kidney failure are given a kidney transplant.

State the advantages of having a kidney transplant instead of dialysis.

.....

.....

.....

.....

.....

.....

..... [3]

[Total: 15]

02. 0610_w19_qp_41 Q: 3

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.

[2]

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

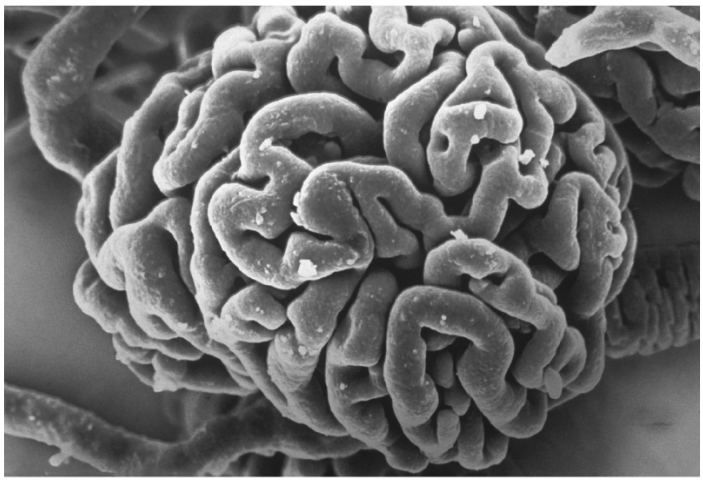

Fig. 3.1

(i) Describe the structure of a glomerulus.

You may refer to Fig. 3.1 in your answer.

.....

.....

.....

.....

..... [2]

(ii) Describe the role of the glomerulus.

.....

.....

.....

.....

..... [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.

.....

.....

.....

.....

.....

.....

.....

.....

..... [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.

human	mouse

.....

.....

..... [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.

..... [1]

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

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

..... [1]

[Total: 18]

03. 0610_w17_qp_42 Q: 1

The lungs and the kidneys are part of the excretory system of mammals.

(a) **(i)** State the name of **one** substance that is excreted from the lungs and state where in the body it is produced.

name .....

site of production .....
[2]

(ii) State the name of **one** excretory substance, that is removed by the kidneys, that contains nitrogen.

Explain why it is excreted.

name .....

explanation .....

.....
[2]

(b) Blood is filtered as it flows through the kidneys.

(i) State the name of the structure within a kidney that filters the blood.

.....[1]

(ii) State **two** components of blood that do **not** pass through the filter.

1 .....

2 .....
[2]

(c) The filtrate which is formed from the blood in the kidneys contains many useful substances, which are reabsorbed into the blood.

Fig. 1.1 is a photomicrograph of a cross-section of some of the cells that carry out reabsorption.

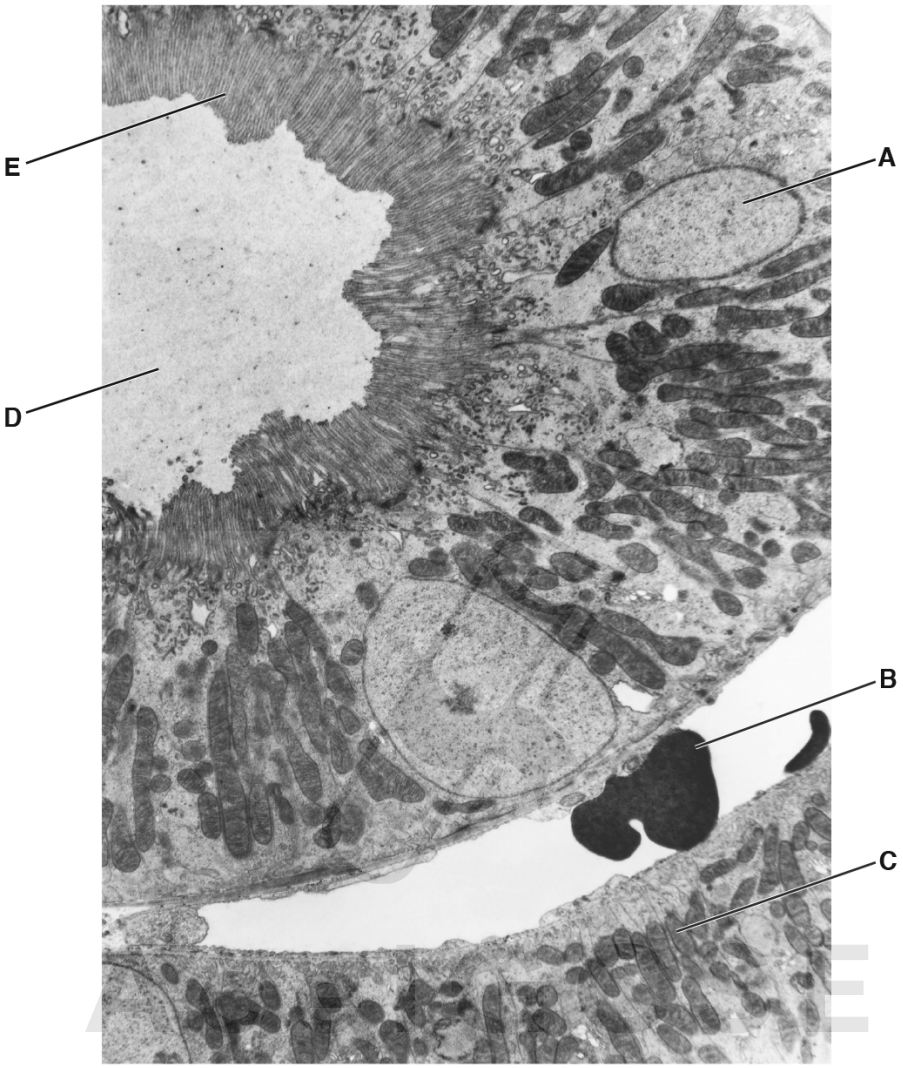

Fig. 1.1

(i) Complete the table by stating the letter in Fig. 1.1 that identifies each structure.

structure	letter on Fig. 1.1
microvilli	
nucleus	
mitochondrion	

[3]

(ii) State **one** function of the nucleus.

.....

.....[1]

(iii) State the name of **one** part of the mammalian body **other than** the kidney that has cells with microvilli.

.....[1]

(iv) The cells that line the kidney tubules, such as those in Fig. 1.1, absorb many compounds from the filtrate.

Use Fig. 1.1 to explain how the cells are adapted for absorption.

.....

.....

.....

.....

.....

.....

.....

.....

.....[4]

[Total: 16]

01. 0610_m19_MS_42 Q: 1

	Answer	Mark	Partial Marks
(a)	removal from the, body / organism / cell ; toxic substances ; waste product(s), of metabolism / respiration ; (named) substances in excess (of requirements) ;	3	
(b)	**A** – medulla ; **B** – cortex ; **C** – renal vein ;	3	
(c)(i)	9900 (%) ;;	2	
(c)(ii)	concentration of salts is the same in the blood in the renal artery **and** the fluid in the kidney tubule ; concentration of salts, increases between the blood in the renal artery and the fluid in the kidney tubule and the urine / (approximately) doubles ;	2	
(c)(iii)	proteins are (too) big (to be filtered) / AW ;	1	
(c)(iv)	(all) glucose is reabsorbed ;	1	
(d)	*idea of convenience:* no need to visit hospital / time not taken up with dialysis ; no need for a restricted diet ; *idea of* improved quality of life / AW ; cost effective in the long term ; ref. to having a working kidney / long-lasting / ref. to cure / one-time treatment ;	3	

	Answer	Mark	Partial Marks
(a)	remove from the, body / organism / cell ; waste / poisons / toxins / harmful substances ; (waste products) of metabolism / respiration ; (named) substances in excess ;	2	
(b)	the outline shape of a kidney, with one tube attached, drawn ; tube labelled ureter, outer portion of kidney labelled as cortex, medulla labelled inside the kidney ;	2	
(c)(i)	ref. to capillaries ; (capillaries are) one cell thick / thin / AW ; *idea of* fenestrations / pores ; network (of capillaries) / tangled / knotted / tightly packed tubes ; description of shape e.g. round / ball-shaped ;	2	
(c)(ii)	provides blood at high pressure ; provides a large surface area ; (ultra)filtration ; *ref. to* small *or* soluble molecules / water / glucose / urea / salts, (are filtered) out ; *ref.* to (named) large OR insoluble (molecules) / blood cells, stay in the glomerulus ; AVP ;	2	
(d)(i)	(by) active transport ; from a low to a high concentration / AW ; (through cell) membrane ; ref. to proteins (pumps / channels / AW) ; uses energy ; from respiration ;	4	
(d)(ii)	*human* 575 □ 320 =1.797 or 1.8 ; *mouse* 0.551 □ 0.31 =1.778 or 1.8 ; g (salt) per day per g (kidney) ; similar or the same, results / rates / ratios, so hypothesis is supported ;	4	
(d)(iii)	osmosis ;	1	
(d)(iv)	glucose / AVP ;	1	

03. 0610_w17_MS_42 Q: 1

	Answer	Mark	Partial Marks
(a)(i)	carbon dioxide / CO_2 / water / H_2O (vapour) ; (respiring / all) cells / tissues / mitochondria / named tissue(s) / named organ(s) ;	2	**R** alveoli / lungs
(a)(ii)	urea ; toxic / poisonous / harmful / waste / AW ;	2	**A** ammonia / ammonium / creatin(ine) / uric acid / urine
(b)(i)	glomerulus ;	1	**A** ball / knot / AW, of capillaries **A** Bowman's capsule / basement membrane
(b)(ii)	red (blood) cells / erythrocytes ; phagocytes ; lymphocytes ; named plasma proteins ;; platelets ;	2	 e.g. albumen / fibrinogen / insulin / glucagon / thrombin / antibodies / clotting factors
(c)(i)	microvilli – **E** ; nucleus – **A** ; mitochondrion – **C** ;	3	
(c)(ii)	stores / contains, chromosomes / genes / alleles / genetic information / DNA ; controls the (activity / reactions of the) cell ; controls how cells, develop / divide / reproduce / grow ; *idea that it* stores instructions for, making proteins / protein synthesis / making RNA ; AVP ;	1	**I** 'controls movement of cell' **I** giving instructions unqualified **A** 'codes for protein' e.g. making ribosome(s)
(c)(iii)	small intestine / duodenum / ileum ;	1	**A** villi / jejunum / tongue / liver / egg cell / white blood cells / ear / nose
(c)(iv)	(microvilli give a) large surface area ; for diffusion / described as movement down a concentration gradient ; lots of, mitochondria / **C** ; **C** / mitochondria, are the site of (aerobic) respiration ; **C** / mitochondria, provide energy / make ATP ; energy / ATP, is needed for active transport ; (active transport needed for) movement against concentration gradient ; ref to carrier proteins (in cell membrane) ; AVP ;	4	mp2 is linked to mp1 **R** 'produces energy' e.g. substances pass to blood to maintain concentration gradient