

11.3 The Kidney & Osmoregulation

Question Paper

Course	DP IB Biology
Section	11. Animal Physiology (HL Only)
Topic	11.3 The Kidney & Osmoregulation
Difficulty	Medium

Time allowed: 20
Score: /10
Percentage: /100

Question 1

Which of the following is **not** a reason why organisms need to maintain a safe balance of water and solutes in their cells?

- A. Cell damage might occur due to osmosis.
- B. Cells with a higher osmolarity than their surroundings will lose water and shrink.
- C. Cells with a higher osmolarity than their surroundings will gain water and could burst.
- D. Cells with a lower osmolarity than their surroundings will lose water and shrink.

[1 mark]

Question 2

Which of the following statements correctly describes a process that takes place in the excretory systems of land insects?

- A. Uric acid is actively transported from the haemolymph into the malpighian tubules.
- B. Salts and nitrogenous waste are actively transported from the haemolymph into the malpighian tubules.
- C. The malpighian tubules drain into the haemolymph.
- D. Nitrogenous waste is converted into urea.

[1 mark]

Question 3

Which of the following statements describe features that aid the process of ultrafiltration?

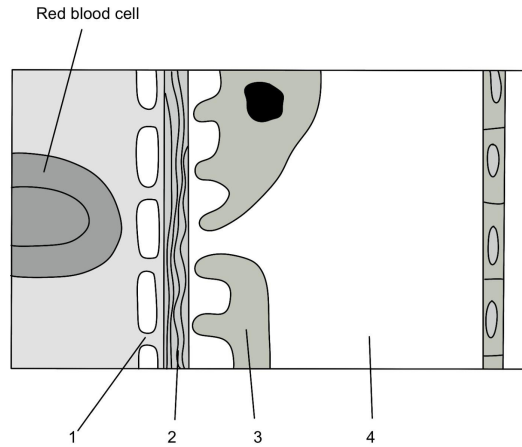
- I. The glomerulus has an afferent arteriole and an efferent arteriole.
- II. The blood in the afferent arteriole has a different composition to the blood in the efferent arteriole.
- III. The basement membrane prevents the passage of large proteins out of the glomerulus.
- IV. The afferent arteriole is wider than the efferent arteriole.

- A. I and II only
- B. II and III only
- C. III only
- D. III and IV only

[1 mark]

Question 4

The image below shows a section through the lining of the glomerulus and Bowman's capsule.



Identify the structures labelled 1–4 in the image above.

	1	2	3	4
A	Podocyte	Basement membrane	Capillary endothelium	Inside of capillary
B	Fenestration in the basement membrane	Capillary endothelium	Podocyte	Bowman's capsule lumen
C	Fenestration in the capillary endothelium	Basement membrane	Podocyte	Bowman's capsule lumen
D	Fenestration in the capillary endothelium	Basement membrane	Podocyte	Inside of proximal convoluted tubule

[1 mark]

Question 5

The table below shows the composition of blood plasma as it enters the glomerulus.

	Concentration / mol dm ⁻³ OR mg dm ⁻³
Urea	5
Na ⁺ ions	150
Glucose	5
Protein*	740

Which of the following is a possible correct composition of the glomerular filtrate of a healthy individual?

	Urea	Na ⁺ ions	Glucose	Protein
A	5	150	5	740
B	5	150	5	2
C	5	6	5	740
D	5	6	5	2

[1 mark]

Question 6

Water leaves the descending limb of the loop of Henlé by osmosis.

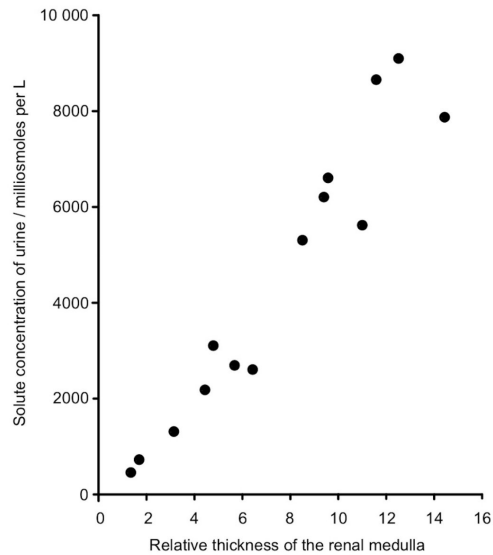
Which is the correct reason for this?

- A. Ions are pumped out of the ascending limb of the loop of Henlé, raising the osmolarity of the surrounding medulla.
- B. Ions are pumped out of the descending limb of the loop of Henlé, raising the osmolarity of the surrounding medulla.
- C. Ions are pumped out of the ascending limb of the loop of Henlé, lowering the osmolarity of the surrounding medulla.
- D. Water is reabsorbed into the vasa recta from the surrounding medulla.

[1 mark]

Question 7

Which is the correct explanation for the relationship between urine solute concentration and relative medullary thickness shown in the graph below?

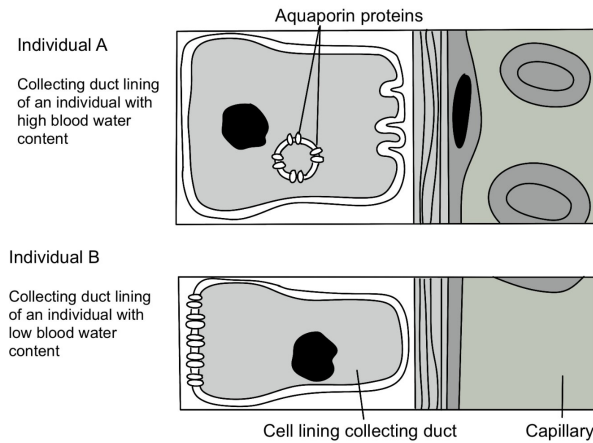


- A. A thicker medulla provides space for more kidney nephrons.
- B. A thicker medulla allows for longer kidney nephrons.
- C. A thicker medulla allows for longer loops of Henlé.
- D. A thicker medulla allows more blood to be filtered by the kidney.

[1 mark]

Question 8

The image below shows the appearance of the cells that line the collecting duct when a healthy human has high blood water content (A) and low blood water content (B). Note that aquaporins are transport proteins that allow the passage of water molecules.



Which of the following correctly explains the difference between the collecting duct cells of individual A and individual B?

- A. There is more ADH in the blood of individual B.
- B. There is less ADH in the blood of individual B.
- C. Individual B has a longer loop of Henlé.
- D. The collecting duct of individual B descends further into the medulla where the concentration gradient is steepest.

[1 mark]

Question 9

Animals excrete nitrogenous waste in various forms.

Which of the following is **not** a correct statement relating to the excretion of nitrogenous waste?

- A. Insects excrete uric acid via a system of malpighian tubules.
- B. Less water is needed for the excretion of uric acid than for ammonia or urea.
- C. All mammals excrete nitrogenous waste in the form of urea.
- D. Nitrogenous waste comes only from the breakdown of excess protein.

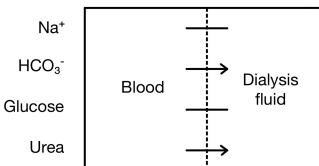
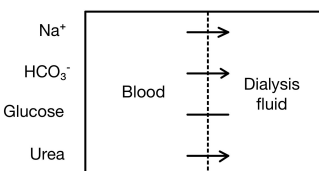
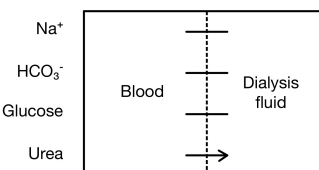
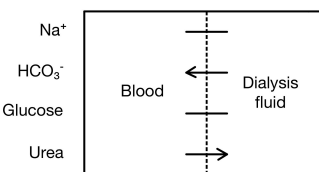
[1 mark]

Question 10

The table below shows the composition of normal blood plasma and the dialysis fluid used in haemodialysis.

	Normal blood plasma / mmol L ⁻¹	Dialysis fluid / mmol L ⁻¹
Na⁺ ions	145	145
HCO₃⁻ ions	20	35
Glucose	5	5
Urea	25	0

Which of the following diagrams shows the correct movement for each of the substances shown? An arrow represents the direction of movement while a line indicates no overall movement.

- A. 
- B. 
- C. 
- D. 

[1 mark]