

# 11.3 The Kidney & Osmoregulation

## Question Paper

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

**Time allowed:** 60  
**Score:** /47  
**Percentage:** /100

### Question 1a

a)  
Much of the behaviour of water in living organisms is determined by the osmolarity of fluids within those organisms.

Define osmolarity.

[2 marks]

[2 marks]

### Question 1b

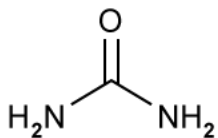
b)  
State the name of the structures which insects use to concentrate and excrete nitrogenous waste.

[1 mark]

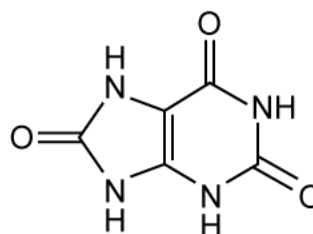
[1 mark]

### Question 1c

c)  
The image below shows two compounds, **A** and **B** involved in the excretion of nitrogenous waste from animals.



**Molecule A**  
Highly soluble excretion  
product in mammals



**Molecule B**  
Insoluble excretion  
product in insects

Identify **A** and **B**.

[2 marks]

[2 marks]

### Question 1d

d)

The image below represents part of a marine ecosystem and two of its inhabitants, a jellyfish and a lobster. Both animals have recently entered this part of the ecosystem from another area of the ocean.

7

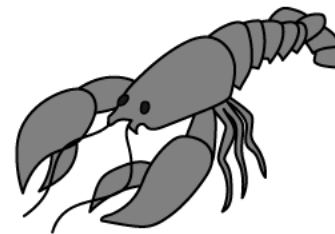


Jellyfish

9

Sea water

10



Lobster

The numbers represent the osmolarity of the cell contents of the organisms and that of the surrounding sea water, in arbitrary units.

Predict and explain the level of osmolarity of the **jellyfish's** cell contents after a period of time in this part of the ecosystem.

[2 marks]

[2 marks]

### Question 2a

a)  
The names of six blood vessel types that carry blood in and around the kidney are shown below as **A – F**.

**A. Efferent arteriole**

**B. Renal vein**

**D. Renal artery**

**C. Afferent arteriole**

**E. Capillaries alongside nephron**

**F. Glomerulus**

Place these blood vessels into the correct order through which blood passes during normal circulation.

[3 marks]

[3 marks]

### Question 2b

b)  
State the relationship between the length of an organism's Loop of Henlé and the conditions that the organism lives in.

[2 marks]

[2 marks]

### Question 2c

c)

Certain species of animal that survive in very arid habitats can drink very little water. Instead, they derive much of their water intake from respiratory water.

Explain what respiratory water is.

[2 marks]

[2 marks]

### Question 2d

d)

State the name of the hormone that controls the level of water that is excreted via the kidney.

[1 mark]

[1 mark]

### Question 3a

a)

Blood undergoes ultrafiltration in the kidney.

Define ultrafiltration.

[2 marks]

[2 marks]

### Question 3b

b)

Outline the composition and role of the basement membrane in ultrafiltration.

[2 marks]

[2 marks]

### Question 3c

c)

Explain the ways in which the following adaptations of the proximal convoluted tubule (PCT) help the PCT to carry out its function.

|    |  |  |
|----|--|--|
| 1. | Microvilli on the inner surface        |  |
| 2. | Many mitochondria in epithelial cells  |  |
| 3. | Tightly-packed cells in the epithelium |  |

[3 marks]

[3 marks]

### Question 3d

d)

Distinguish between the afferent and efferent arterioles in the kidney.

[2 marks]

[2 marks]

### Question 4a

a)

Maintaining water levels in cells and tissues is an example of a negative feedback system.

Define the term 'negative feedback'.

[2 marks]

[2 marks]

### Question 4b

b)

The negative feedback mechanism of osmoregulation relies on the hormone ADH, antidiuretic hormone.

Certain compounds, when in the blood, act as diuretics. Ethanol is one example.

Use your knowledge of the action of ADH to suggest the effect of a diuretic drug such as ethanol.

[2 marks]

[2 marks]

### Question 4c

c)

During haemodialysis treatment of kidney failure, the patient's blood and the dialysis fluid flow in opposite directions within the dialysis machine.

Identify the name of this kind of flow and give **one** reason why it is set up in this way.

[2 marks]

[2 marks]

### Question 4d

d)

Urinalysis can detect the presence of many compounds in the urine and can give information about the state of a person's renal health.

List **two** possible illnesses that could cause protein to be detected in urine.

[2 marks]

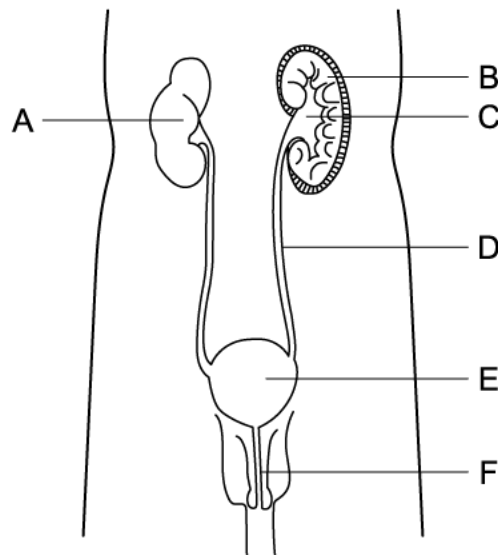
[2 marks]

### Question 5a

One mark is available for clarity of communication throughout this question.

a)

The drawing represents the human male urinary system.



Identify structures **A - F**.

[6 marks]

[6 marks]



**Question 5b**

b)

Several substances are filtered out of blood in the mammalian kidney.

List those that are later selectively reabsorbed into the blood and those that are not.

**[6 marks]****[6 marks]**

**Question 5c**

c)

Outline the main effects of dehydration on a human.

**[3 marks]****[3 marks]**