Excretion as an example of homeostatic control – 2021/20 GCE Biology A Component 01

1. Nov/2021/Paper_H420/1/No.1

Which of the options is **not** a function of the liver?

A production of urea in the ornithine cycle

B removal of amino groups from amino acids

C storage of excess amino acids as protein

D storage of glucose as glycogen

Your answer ☐ **[1]**

2. Nov/2021/Paper_H420/1/No.18(a)

The liver is an organ with a wide variety of functions.

(a) **Fig. 18.1**, **in the insert**, shows a light micrograph of a section of normal human liver.

(i) Identify the structures labelled **N** and **O** in **Fig. 18.1**.

N .....

O .....

[2]

(ii) The walls of the structure labelled **M** in **Fig. 18.1** are lined with cells.

Suggest and explain how these cells are adapted to carry out their function.

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..... **[2]**

3. Nov/2021/Paper_H420/1/No.21(a, b)

The formation of tissue fluid is an example of ultrafiltration. Osmosis plays an important part in ultrafiltration.

(a) The water potential of the blood depends on the concentration of solutes such as glucose, amino acids and mineral ions as well as large plasma proteins.

(i) State the effect on the water potential of the blood if the concentration of glucose increases.

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..... **[1]**

(ii) Explain why the oncotic pressure of the blood depends **only** on the concentration of large plasma proteins.

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..... **[2]**

(b) The table below compares a capillary with the surrounding tissue fluid.

Property	Capillary	Tissue fluid
Oncotic pressure	4.2 kPa	0.03 kPa
Hydrostatic pressure	4.5 kPa	0.15 kPa
Concentration of the protein albumin	0.04 g cm^{-3}	0.02 g cm^{-3}

Net movement of fluid between the capillary and tissue fluid depends on the net driving force (J_v):

$J_v = (P_c - P_i) - \sigma (\pi_c - \pi_i)$

Where:

P_c = capillary hydrostatic pressure

P_i = tissue fluid hydrostatic pressure

π_c = capillary oncotic pressure

π_i = tissue fluid oncotic pressure

σ = reflectance factor

The reflectance factor is a measure of how permeable the capillary is to albumin. It varies between 0 (totally permeable) and 1 (totally impermeable).

Inflammation can reduce the value of the reflectance factor.

(i) In one type of capillary the reflectance factor was found to be 0.75.

Use this information and the data in the table to calculate a value for the net driving force and predict the direction of movement.

Net driving force, J_v = ... kPa

Direction of movement .....

[2]

(ii) Nephrotic syndrome is a kidney disease where protein is excreted in the urine.

One group of patients with nephrotic syndrome had a plasma albumin concentration of $0.015\,g\,dm^{-3}$.

Explain what effect this would have on the net driving force. (There is no need to perform a further calculation.)

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..... **[2]**

(iii) A medical student concluded that a patient with kidney disease and a plasma albumin concentration of $0.015\,g\,dm^{-3}$ would show signs of swelling, such as swollen ankles.

Evaluate the student's conclusion.

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..... **[4]**

4. Nov/2020/Paper_H420/03/No.1(a, b)

(a) A student dissected a kidney. Fig. 1.1 shows one half of the dissected kidney.

Fig. 1.1

Draw a simple diagram of the kidney in Fig. 1.1 in the space below.

On your diagram, label the pelvis, medulla and cortex.

[2]

(b) A photomicrograph of a stained section of kidney tissue is shown in Fig. 1.2.

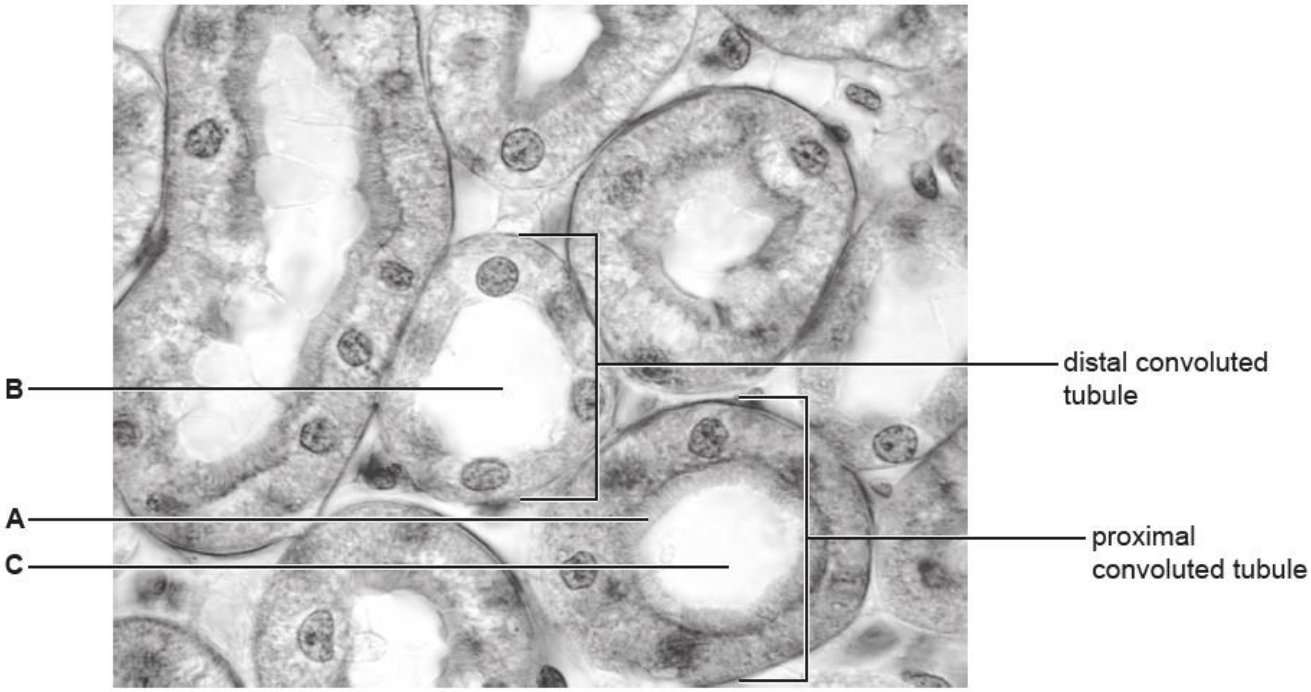

Fig. 1.2

(i) State one function of the distal convoluted tubule.

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..... **[1]**

(ii) Describe the function of the structures labelled **A** in Fig. 1.2.

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..... **[1]**

(iii) Suggest which lumen, **B** or **C**, has the highest concentration of urea. Explain your answer.

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