Excretion

Model Answers 2

Level	A Level
Subject	Biology
Exam Board	OCR
Module	Communication, homeostasis and energy
Торіс	Excretion
Booklet	Model Answers 2

Time allowed:	54 minutes
Score:	/40
Percentage:	/100 AISTRYONLINE
Grade Boundaries:	

A*	А	В	С	D	E
>69%	56%	50%	42%	34%	26%

The image below shows the structure of the nucleotide base guanine.



Bird droppings are known as *guano* because they contain a high proportion of guanine. Unlike mammals, birds excrete nitrogenous waste as guanine instead of urea. Guanine is synthesised from ammonia in the liver.

The following statements relate to guanine:

- 1 ammonia is more toxic than guanine
- 2 urea is more soluble in water than guanine
- 3 guanine has a high proportion of nitrogen

Which of the statements correctly explains why birds excrete guanine?



- B. Only 1 and 2
- C. Only 2 and 3
- D. Only 1

[1]

The reason why ammonia is converted to guanine is it's less toxic. Droppings suggest it is

insoluble and as it is nitrogenous waste (in the question) it will have a high proportion of

nitrogen

Most excess amino acids are metabolised in the liver, resulting in products that are relatively harmless to the body.

(a) Fig. 6.1 outlines the first step in the metabolism of amino acids in the liver.





- (i) State the name given to this reaction.
- Deamination

The removal of ammonia from amino acids is known as deamination. The useful product is a keto acid which can enter respiration via pyruvate or acetyl CoA.

(ii) Identify the toxic product of the reaction.

Ammonia is the toxic product produced by deamination

(b) Complete the following passage by inserting the most suitable word or term. Fig. 6.1 shows the first step in the metabolism of amino acids in the liver. The next step involves a series of reactions known as the <u>ornithine</u> cycle. The toxic product X enters the cycle together with <u>carbon dioxide</u>, resulting in the formation of the final nitrogenous product <u>urea</u>. The nitrogenous product is transported to the <u>kidney</u> and then via the ureter to the <u>ureter</u> where it is stored as <u>urine</u>

before leaving the body.

(c) In addition to the reaction shown in Fig. 6.1, liver cells also use amino acids for protein synthesis.

Suggest **one** other use of amino acids in liver cell metabolism. [1]

- The keto acid can enter respiration in Krebs Cycle
- It can be used to make glucose

[1]

[1]

[6]

Question 3



Fig. 6.1 is a diagram that represents the nephron in a mammalian kidney.



- (a) Use the letter or letters from Fig. 6.1 to identify:
 - (i) the region or regions where glucose is selectively reabsorbed into the blood capillaries [1]

Q is the proximal convoluted tubule where glucose is reabsorbed into the blood capillaries

(ii) the region or regions present in the cortex

Q, J, K and L are all present in the cortex which is found on the outer region of the kidney

- (iii) the region or regions where podocytes are located.
 - Podocytes are located in Bowman's capsule which is J

Podocytes are a type of epithelium which is designed to create large spaces between the

cells. This arrangement allows the filtrate leaving the glomerulus to pass through this layer

easily and with little resistance.

Dr. Asher Rana 4 [1]

[1]

(b) The desert kangaroo rat, *Dipodomys deserti*, lives in dry and hot conditions. It excretes a very small volume of urine relative to its size.

The loops of Henle in the kidneys of these mammals are longer than those found in mammals of a similar size that do not live in desert conditions.

Explain how the longer loop of Henle is able to assist the desert kangaroo rat in preventing excessive water loss. [2]

• A longer Loop of Henlé allows more sodium ions to be pumped out of the ascending

limb into the medulla

- This creates a greater water potential gradient in the medulla
- More water is reabsorbed from the collecting duct by osmosis

A common misconception about the kidney is where most of the water is reabsorbed. The loop of Henlé does not reabsorb much water, however it is longer in creatures that need to reabsorb a lot of water. The role of the Loop is to create a water potential gradient that gets steeper further into the medulla, the water in the collecting duct is faced with this low water potential in the surrounding tissues, so it leaves by osmosis (if the walls are permeable in the presence of ADH).

(c) Urine can be tested to detect a person's misuse of certain drugs in body-building.
State the **type** of drug that can be misused in this way. [1]

Anabolic steroids are drugs often misused by body builders

[Total:6]



The kidney is composed of many nephrons.

Fig. 2.1 is a diagrammatic representation of a nephron. The numbers represent the relative concentrations of solutes in the tubule and the tissue fluid surrounding the tubule.



Fig. 2.1

(a) Name the parts of the nephron labelled L, M and N.

- L glomerulus
- M Bowman's capsule
- N proximal convoluted tubule



(b) Which part(s) of the nephron corresponds to each of the statements in the table below? [5]

statement	part(s) of the nephron		
walls are impermeable to water	Ascending limb of the Loop of Henlé		
glucose is reabsorbed into the blood	Proximal convoluted tubule		
ADH acts on the walls	Collecting duct		
contains podocytes	Bowman's capsule		
most of the water is reabsorbed into the blood	Proximal convoluted tubule		

A common misconception about the kidney is where most of the water is reabsorbed. The loop of Henlé does not reabsorb much water, however it is longer in creatures that need to reabsorb a lot of water. This is because its role is to create a water potential gradient that gets steeper further into the medulla, the water in the collecting duct is faced with this low water potential in the surrounding tissues so it leaves by osmosis (if the walls are permeable in the presence of ADH).

All the glucose is reabsorbed into the bloodstream in the proximal convoluted tubule, this lowers the water potential of the blood, so 80% of the water in the filtrate leaves here by osmosis as it follows the glucose.

(c) With reference to Fig. 2.1, explain the role of the loop of Henle in the production of urine.

In your answer, you should use appropriate technical terms, spelt correctly.

- The role of the loop of Henlé is to establish a water potential gradient that decreases down the medulla
- The ascending limb actively transport sodium ions out •
- The descending limb is permeable to the sodium ions and water •
- The sodium ions diffuse into the descending limb and concentrate at the base of the loop creating a low water potential in the tissues around this area (which lies in the medulla)
- Water passing down the collecting duct is faced with the lower water potential in the • tissues outside
- Water leaves the collecting duct by osmosis from the collecting duct into the surrounding blood capillaries in the tissues
- This results in a lower volume of concentrated urine •

[5]

The kidney is a vital organ in the body and is responsible for excretion. It also plays an important role in homeostasis.

(a) Complete the passage, using the most suitable term in each case.

(b) One aspect of the kidney's homeostatic role is the ability of anti-diuretic hormone (ADH) to increase the number of aquaporins in the plasma membranes of the cells lining the collecting duct. This increases the amount of water reabsorbed.

ADH is released in response to a decrease in the water potential of the blood plasma.

- (i) State precisely where the cells that detect a decrease in the water potential of the blood plasma are found. [1]
- Cells which are sensitive to the water potential of the blood are in the hypothalamus
- (ii) Name the cells that detect this decrease.

[1]

[5]

Osmoreceptors

(c) Fig. 6.1 outlines some of the events that take place if the blood volume decreases, for example, due to a significant loss of blood.



Fig. 6.1

(i) Name the part of the adrenal gland that releases aldosterone.

The cortex of the adrenal glands secrete aldosterone

- (ii) Suggest **and** explain what effect the action of aldosterone will have on the secretion of ADH.
 - The water potential of the blood would decrease or become more negative
 - ADH secretion would increase

According to the question, aldosterone increases the uptake of sodium ions from the filtrate, more sodium ions in the blood will lower its water potential so more ADH will increase the reabsorption of water from the collecting duct to increase the water potential of the blood back to normal

[1]

[2]

(iii) As the action of aldosterone takes effect, this is detected by receptors in the body and secretion of aldosterone decreases.

State the name of the mechanism that results in this decrease in aldosterone secretion.

[1]

