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# BIOLOGY

## ORGANISMS RESPOND TO CHANGES IN ENVIRONMENT

Level & Board	AQA (A-LEVEL)
TOPIC:	CONTROL OF BLOOD WATER POTENTIAL
PAPER TYPE:	QUESTION PAPER - 1
TOTAL QUESTIONS	6
TOTAL MARKS	20

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## **Control of blood water potential - 1**

**1.**

An inherited condition known as Alport syndrome (AS) affects the kidney glomeruli in both men and women. High levels of protein in the urine are present in affected people.

(a) Explain how proteinuria might result from AS. **(2)**



**(b)** A sex-linked mutation causes AS.

In a male with AS, where would the sex-linked mutation be located? **(1)**

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The homologous section of a Y chromosome

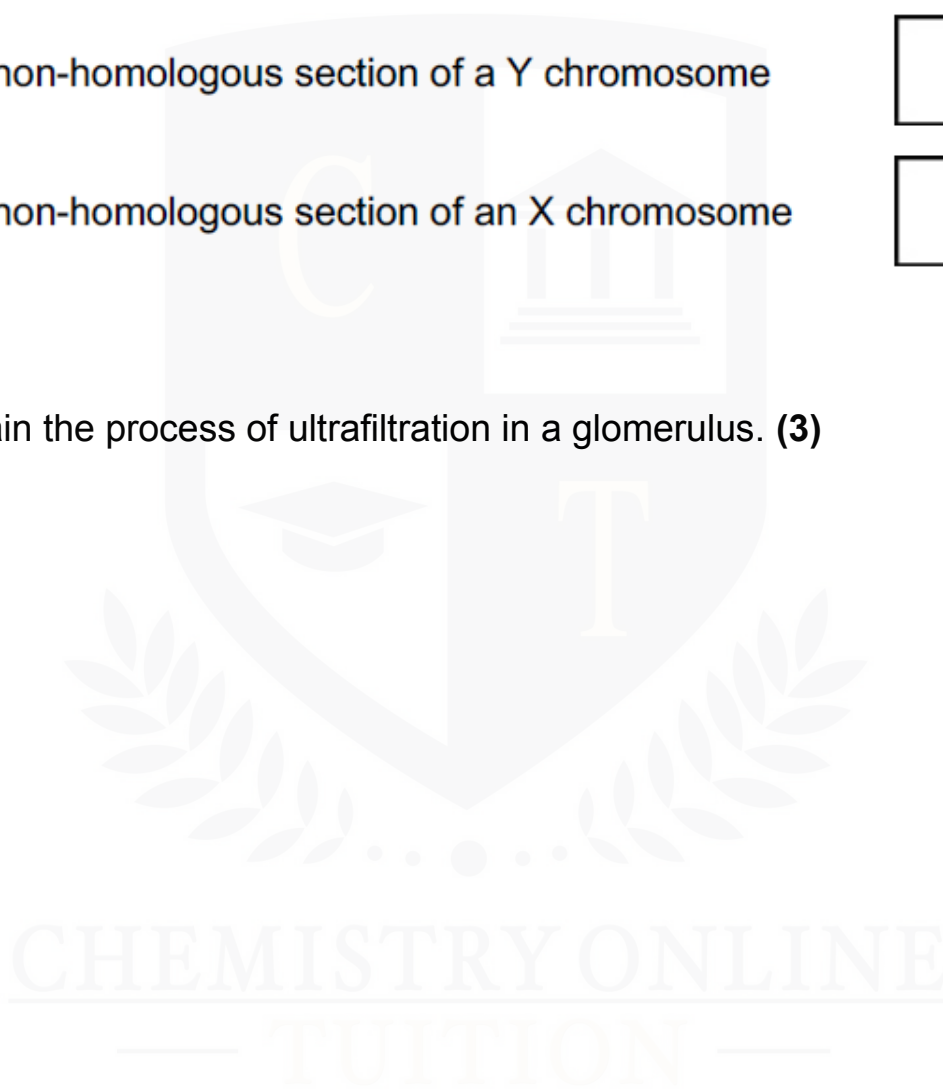
The homologous section of an X chromosome

The non-homologous section of a Y chromosome

The non-homologous section of an X chromosome

**2.**

**(a)** Explain the process of ultrafiltration in a glomerulus. **(3)**



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**(b)** An individual's proximal convoluted tubule reabsorbs water and glucose. **(1)**

Put a tick (✓) in the box next to the correct ways in which glucose and water are reabsorbed.

Glucose by active transport and water against a water potential gradient

Glucose by diffusion and water down a water potential gradient

Glucose by facilitated diffusion and active transport and water against a water potential gradient

Glucose by facilitated diffusion and active transport and water down a water potential gradient

**(c)** The link between the mean length of the Henle loop in millimeters (x) and the urine concentration in arbitrary units (y) is represented by the equation.

$$y = 0.72x + 4$$

Determine the average length of the Henle loop in a creature that excretes 16.56 arbitrary units of urine. **(1)**

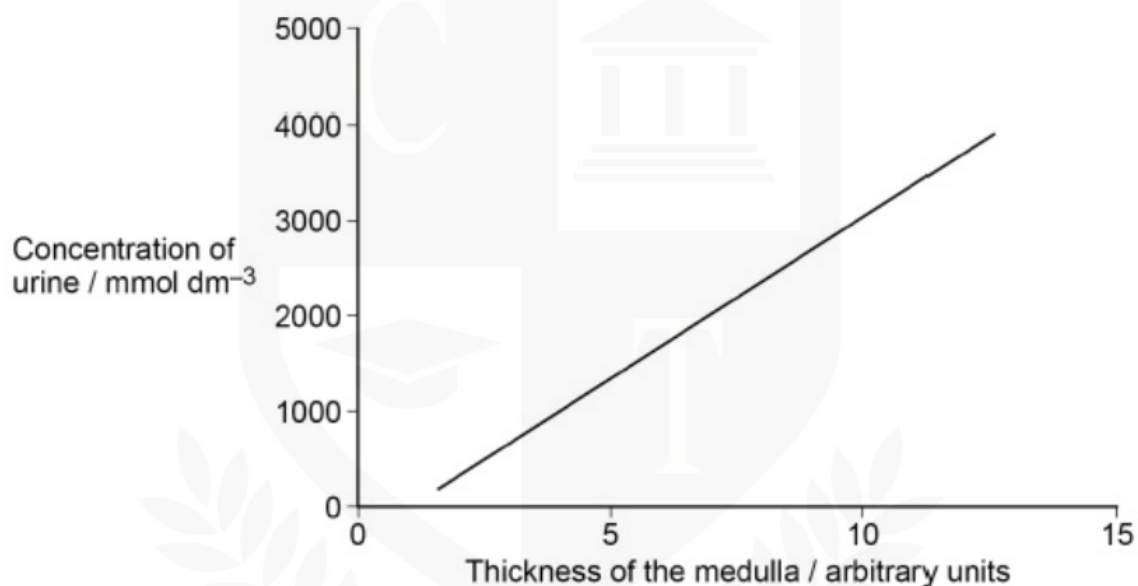
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3.

(a) Researchers looked at the connection between urine concentration and the thickness of the renal medulla in several mammal species.

Their results are displayed in the graph.



Explain the pattern shown by the results in the graph above. (3)

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#### 4.

Drugs like furosemide and CVT are used to help the body rid itself of extra fluid.

Researchers looked into how these medications affected the amount of urine produced by volunteer humans. The scientists employed this technique.

- At random, they separated the volunteers into three groups: A, B, and C.
- For three days, they fed the same food to every participant.
- After three days, the participants in group A received a tablet containing furosemide, group B received a tablet with CVT, and group C received a placebo (a tablet containing neither medication).
- The average amount of urine that each group produced over the four hours following pill administration was then determined.

Among the findings the researchers came up with are

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**Table 1**

<b>Group</b>	<b>Mean volume of urine produced in 4 hours / cm<sup>3</sup> (<math>\pm</math> 2 standard deviations)</b>
<b>A</b> (furosemide)	1980 ( $\pm$ 152)
<b>B</b> (CVT)	1201 ( $\pm$ 119)
<b>C</b> (placebo)	312 ( $\pm$ 57)

**(a)** For three days, the same food was served to each volunteer.

Provide a hypothesis and an explanation for the identical meal being served to them. **(2)**

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**(b)** What conclusions can you draw about the efficacy of furosemide and CVT in the body's elimination of excess fluid based on Table 1? **(2)**



**(c)** Sometimes high blood pressure is treated with furosemide. Explain how a drop in blood pressure could be brought on by furosemide. **(1)**

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5.

The mean pace at which blood plasma enters the kidneys was also measured by the scientists.

Table 2 displays the findings that the scientists were able to get.

**Table 2**

<b>Group</b>	<b>Mean rate of flow of blood plasma into the kidneys / cm<sup>3</sup> min<sup>-1</sup></b>
<b>A</b> (furosemide)	380
<b>B</b> (CVT)	342
<b>C</b> (placebo)	295

(a) 60% of the average blood flow rate into the kidneys is made up of blood plasma.

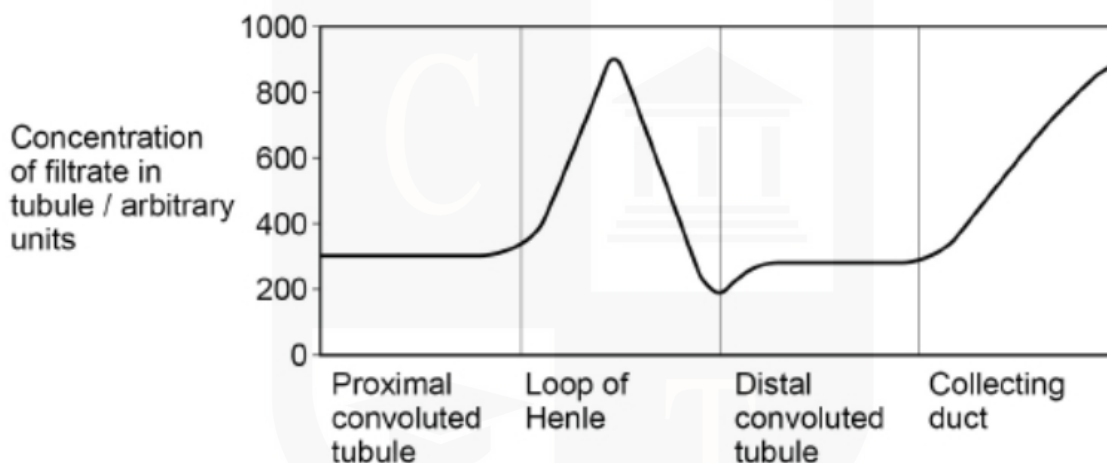
Over the course of the four hours of the study, how much more blood entered the kidneys when using furosemide than when using group C (placebo)? Please respond in cm<sup>3</sup>. (1)

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6.

The graph below shows the concentration of the filtrate in different parts of one kidney tubule.



**(a)** In the proximal convoluted tubule, about 99% of biological molecules are reabsorbed from the filtrate.

The amount of fluid in this tubule doesn't change in spite of this.

Describe your reasoning. **(1)**

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**(b) Describe the curve shape in the graph Henle loop. (2)**



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