Following the Filter

Trace how nephrons shape urine and protect blood balance

HAP.14 "Students will investigate the structures and functions of the urinary system, including the cause and effect of diseases and disorders. Understand the structure and function of the urinary system in relation to maintenance of homeostasis..."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the substances that enter a nephron during filtration, circle those that stay in the blood, and number the structures in urine's exit route in order.

What Leaves, What Stays

1. After a long soccer game, Maya drinks water and later visits the restroom. Her kidneys continually filter blood, whether she is active or resting. Each kidney contains many nephrons, tiny working units supplied by capillaries. Pressure pushes water and small dissolved substances, including glucose, salts, and urea, from capillaries into a nephron's capsule. Blood cells and most proteins stay in the bloodstream because they are too large to pass through the filter. The filtered fluid then travels through a tubule. Urea, made when the body breaks down proteins, is one waste the kidneys must remove.

2. Filtering does not mean losing everything that enters a tubule. Selective reabsorption returns useful substances from the tubule to nearby blood. Healthy nephrons usually reclaim nearly all filtered glucose. They also adjust how much salt and water return, based on the body's needs. When more water returns to blood, urine becomes smaller in volume and more concentrated. Blood volume can rise, which can raise blood pressure. When less salt returns to blood, more salt leaves in urine, and water tends to leave with it. This can lower blood volume and blood pressure. Excess urea remains in the fluid for excretion.

3. Consider two patients at a clinic. In one, blood glucose stays so high that the nephrons cannot reclaim all the glucose they filter. Glucose appears in the urine and can draw extra water into it, increasing urine volume. In the other, a mineral deposit called a kidney stone blocks a ureter, the tube that carries urine from a kidney toward the bladder. Urine normally travels from collecting ducts through kidney chambers to the renal pelvis, then through a ureter to the bladder and out the urethra. A blocked ureter can cause pain and back pressure that damages the kidney if untreated.

2 ANSWER WITH EVIDENCE

Use the passage

1. Why does urea enter the nephron's capsule while blood cells usually do not?

2. If a nephron returns more water to the blood, what happens to urine volume, blood volume, and possibly blood pressure?

3. How can very high blood glucose change both the glucose content and volume of urine?

4. Why can a stone blocking a ureter harm a kidney if the blockage is not treated?

3 YOUR TURN

Your own words

Imagine a patient with normal blood glucose takes a drug that reduces salt reabsorption in the nephrons. In four sentences, predict changes in urine salt, urine water, blood volume, and blood pressure; explain whether glucose should appear in the urine; and trace the urine's route from the collecting ducts out of the body.

Following the Filter

PART 1 · READ AND MARK

Underline the substances that enter a nephron during filtration, circle those that stay in the blood, and number the structures in urine's exit route in order. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	Why does urea enter the nephron's capsule while blood cells usually do not?	**Urea is a small dissolved substance that passes through the filter. Blood cells are too large and stay in the bloodstream.**
2	If a nephron returns more water to the blood, what happens to urine volume, blood volume, and possibly blood pressure?	**Urine volume decreases, blood volume can rise, and blood pressure can rise.**
3	How can very high blood glucose change both the glucose content and volume of urine?	**The nephrons cannot reclaim all the filtered glucose, so some enters urine and draws extra water into it, increasing urine volume.**
4	Why can a stone blocking a ureter harm a kidney if the blockage is not treated?	**The blockage creates back pressure that can damage the kidney.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Less salt returns to the blood, so more salt leaves in the urine. Water tends to leave with the salt, increasing urine volume and lowering blood volume and blood pressure. Because the patient's blood glucose is normal, the nephrons should reclaim nearly all filtered glucose. Urine travels from the collecting ducts through kidney chambers to the renal pelvis, then through a ureter to the bladder and out the urethra.

Accept predictions that blood pressure may fall rather than stating it must fall. Urine glucose should be absent or very low if glucose reabsorption is working normally.