The Water Balance

Trace how kidneys adjust urine to keep blood conditions stable.

HAP.14.1 "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 Circle each named part of the urinary system, and underline what it does. Use your marks to trace how the kidneys change urine while keeping blood conditions stable.

After the Final Whistle

1. At the end of a long, hot soccer practice, Maya's shirt is damp, but she has barely visited the bathroom. Sweat has removed water from her body, leaving less water in her blood. To keep cells working, the body must hold blood water and dissolved substances within useful ranges. Two kidneys help regulate these ranges by changing what leaves the body as urine. Blood enters each kidney through a renal artery and exits through a renal vein. The kidneys do not simply drain the blood: they sort materials, returning needed water and substances to circulation while removing wastes.

2. Inside each kidney, millions of nephrons carry out this sorting. Blood flows through tiny vessels in a nephron's glomerulus. Pressure pushes water and small dissolved substances into a surrounding capsule; blood cells and most proteins stay in the blood. The resulting fluid moves through a tubule. As it travels, useful substances such as glucose and much of the water move back into nearby blood vessels. Some additional wastes and excess ions move from the blood into the tubule. Together, filtration, reabsorption, and secretion adjust the fluid that will become urine, while helping the blood maintain its chemical balance.

3. After practice, Maya's brain senses that her blood is more concentrated and signals the pituitary gland to release more antidiuretic hormone, or ADH. ADH makes the kidney's collecting ducts return more water to the blood. Less water leaves as urine, so its volume falls and it becomes more concentrated. When Maya drinks enough water, ADH levels fall, and the collecting ducts return less water; more dilute urine can leave the body. From each kidney, urine flows through a ureter to the bladder for storage, then exits through the urethra. These changes restore blood water levels without stopping waste removal.

2 ANSWER WITH EVIDENCE

Use the passage

1. How do the glomerulus and capsule begin separating materials that will leave the body from materials that will stay in the blood?

2. How do the tubule's movements of substances in both directions help maintain the blood's chemical balance?

3. Why does Maya produce less, more concentrated urine after practice than she does after drinking enough water?

4. When the collecting ducts conserve water, how can wastes still leave Maya's body, and what route does the urine take?

3 YOUR TURN

Your own words

Suppose a person's nephron tubules can no longer return much water or glucose to the blood, but filtration still works. In three or four sentences, predict two changes in the urine and explain how these changes could disrupt the body's balance.

ANSWER KEY

The Water Balance

PART 1 · READ AND MARK

Circle each named part of the urinary system, and underline what it does. Use your marks to trace how the kidneys change urine while keeping blood conditions stable. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How do the glomerulus and capsule begin separating materials that will leave the body from materials that will stay in the blood?	**Pressure pushes water and small dissolved substances from the glomerulus into the capsule. Blood cells and most proteins stay in the blood.**
2	How do the tubule's movements of substances in both directions help maintain the blood's chemical balance?	**The tubule returns useful substances such as glucose and much of the water to the blood. Additional wastes and excess ions move from the blood into the tubule.**
3	Why does Maya produce less, more concentrated urine after practice than she does after drinking enough water?	**After practice, more ADH makes collecting ducts return more water to the blood, leaving less, more concentrated urine. After she drinks enough water, ADH falls, less water returns, and more dilute urine leaves.**
4	When the collecting ducts conserve water, how can wastes still leave Maya's body, and what route does the urine take?	**Wastes remain in the fluid that becomes urine. Urine flows from a kidney through a ureter to the bladder, then exits through the urethra.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

More water would remain in the tubules, so the person would produce more urine. Glucose would also remain in the fluid and leave in the urine. Losing too much water could lower the amount of water in the blood. Losing glucose would remove a substance the body could have used.

Accept predictions of increased urine volume and glucose in the urine, linked to loss of blood water or a useful nutrient. Students need not name a disease.