Kidney Water Routes

Trace how tiny kidney structures help keep blood conditions steady.

HAP.11 "Use a model to illustrate the microanatomy of excretory structures and describe their functions. a. Construct an explanation of how the excretory system maintains homeostasis, including blood pressure and pH."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline each nephron structure, circle what moves between the nephron and the blood, and number the steps that help maintain blood pressure or pH. Use your marks to trace how a change in one tiny structure can affect the whole body.

After the Long Hike

1. After a long hike on a hot day, a runner has lost water in sweat. Inside each kidney, microscopic nephrons help keep the blood's fluid balance steady. Blood enters a knot of capillaries called the glomerulus. Pressure pushes water and small dissolved substances through a filter into Bowman's capsule, the start of a nephron tube. Blood cells and most proteins stay in the blood because they are too large to cross. The liquid in the capsule is called filtrate. It contains useful materials, such as glucose, as well as wastes, so filtering alone cannot produce final urine.

2. As filtrate flows through the proximal tubule, its wall cells return nearly all glucose, much of the water, and bicarbonate to nearby capillaries. In the loop of Henle, salt leaves the ascending limb while water leaves the descending limb; this helps build a salty region deep in the kidney. Farther along, the distal tubule can move hydrogen ions from blood into the tube. Collecting ducts carry filtrate past this salty region. When the body releases more antidiuretic hormone (ADH) after water loss, collecting ducts let more water move back into blood, leaving a smaller volume of concentrated urine.

3. These tiny transfers affect the whole body. After sweating, keeping more water in the blood helps preserve blood volume, which supports blood pressure. If blood pressure falls, the kidneys also release renin, beginning a hormone chain that increases sodium retention; water follows sodium, helping restore blood volume and pressure. Kidneys also help stabilize blood pH: tubules return filtered bicarbonate to blood and secrete excess hydrogen ions into fluid that becomes urine. Bicarbonate helps buffer acid in blood. Urine leaves each collecting duct and eventually passes through the ureter to the bladder. A nephron model should show both filtrate flow and movement between tubes and blood.

2 ANSWER WITH EVIDENCE

Use the passage

1. In a nephron model, which structure would you show filtering blood into the tube? Explain why the model must also show the proximal tubule returning material to blood.

2. Trace how the loop of Henle and collecting duct help the runner conserve water after sweating.

3. If the runner's blood pressure falls, how can kidney actions help restore it? Include what moves and where it goes.

4. Add two arrows to a written model of blood pH control. What should each arrow show moving between a nephron tube and the blood?

3 YOUR TURN

Your own words

Draw two side-by-side nephron models, one for normal hydration and one after heavy sweating. In each, label the glomerulus, proximal tubule, collecting duct, and nearby blood capillaries; use arrows for filtrate flow and water moving back to blood, then add a brief caption comparing urine volume and support for blood pressure.

Kidney Water Routes

PART 1 · READ AND MARK

Underline each nephron structure, circle what moves between the nephron and the blood, and number the steps that help maintain blood pressure or pH. Use your marks to trace how a change in one tiny structure can affect the whole body. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	In a nephron model, which structure would you show filtering blood into the tube? Explain why the model must also show the proximal tubule returning material to blood.	**Show the glomerulus filtering water and small substances into Bowman's capsule. Show the proximal tubule returning useful materials such as glucose to blood because filtrate is not yet final urine.**
2	Trace how the loop of Henle and collecting duct help the runner conserve water after sweating.	**The loop helps create a salty region deep in the kidney. With more ADH after water loss, the collecting duct lets more water move back into blood as filtrate passes that region, producing less, more concentrated urine.**
3	If the runner's blood pressure falls, how can kidney actions help restore it? Include what moves and where it goes.	**The kidneys release renin, starting a hormone chain that increases sodium retention. Water follows sodium into the blood, raising blood volume and helping restore blood pressure.**
4	Add two arrows to a written model of blood pH control. What should each arrow show moving between a nephron tube and the blood?	**One arrow shows bicarbonate returning from the tube to blood, where it helps buffer acid. The other shows excess hydrogen ions moving from blood into the tube to leave in urine.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Normal hydration panel: Label the glomerulus, proximal tubule, collecting duct, and nearby blood capillaries. Draw a filtrate arrow from the glomerulus into the tube and onward through the proximal tubule to the collecting duct. Draw a water arrow from the collecting duct to the capillaries. Heavy sweating panel: Repeat those labels and the filtrate arrow, but draw a thicker water arrow from the collecting duct to the capillaries. Caption: After sweating, more water returns to blood, supporting blood volume and pressure. Less urine leaves the kidney.

Accept models that place a loop and distal tubule between the proximal tubule and collecting duct. Water arrows must point from the collecting duct toward blood in both panels, with more water returned after sweating.