

A Nephron Activity: Answers

- Osmosis** is the diffusion of water through a semi-permeable membrane from highest concentration to lowest concentration.

Active transport is the movement of materials across the membrane usually against the concentration gradient. It requires energy and the use of a transport protein.

Filtration is the separation of substances according to size. This occurs in the glomerulus. (Large proteins/blood cells are kept in circulation, while smaller molecules pass through the glomerulus filter.)

Reabsorption is the act of reclaiming certain substances that the body needs like ions, glucose, and water which are returned to the general blood circulation.
- The kidneys are located in the posterior abdominal cavity outside of the peritoneum (membrane covering abdominal organs) on either side of the spine. The right kidney is lower in position than the left due to the size and position of the liver. The kidneys are posterior to all other abdominal organs such as the digestive organs and are inferior to (below) the heart. The abdominal aorta branches off to each kidney as the renal artery. The inferior vena cava branches off to each kidney as the renal vein.
- The nephron is the functional filtering unit of the kidney. It filters out vital proteins and blood cells, reclaims useful nutrients, salts and other nutrients and excretes waste fluid as "urine". Each nephron ends as a collecting duct. All collecting ducts come together in the renal pelvis of the kidney and waste is sent out of the kidney to the bladder via the ureter.
- Parts of the nephron are: the afferent and efferent arterioles, glomerulus, Bowman's capsule, proximal convoluted tubule, loop of Henle, distal convoluted tubule, surrounding capillaries, and collecting duct.

Sample #	Position in nephron	How is this sample different from the previous sample?	What might have caused these changes? (Mechanisms)
Blood plasma	Afferent arterioles	Sample contains protein (a), glucose (b), urea (c), Na ⁺ (d), and NH ₄ ⁺ (e) Rate of flow is the highest (500).	Blood contains nutrients as well as waste products of metabolism which circulate in bloodstream to the kidney to be reclaimed (nutrients/H ₂ O) or excreted (urea, NH ₄ ⁺)
1	Bowman's capsule	Rate of flow has decreased significantly (to 100). No protein present. Same amount of glucose, Na ⁺ , NH ₄ ⁺ , and urea as previous sample.	High pressure filtration keeps large proteins and blood cells in circulation.
2	Loop of Henle	Rate of flow is much lower (20). No glucose or proteins present. 3X original concentration of urea.	Some water is reclaimed by osmosis which causes urea to become more concentrated. Active transport of glucose out of the loop of Henle returns the glucose to the bloodstream.
3	Collecting tubule	Rate of flow is lowest (1) because it is furthest away from the glomerulus where blood pressure from arterioles is highest. 60X more urea. 2X more Na ⁺ . 150X more NH ₄ ⁺ .	Osmosis causes wastes to become more concentrated.

Formation of Urine in the Nephron

Site in nephron	What is occurring?	Mechanisms Involved
Glomerulus	Smaller molecules move through glomerulus into Bowman's capsule.	High pressure filtration
Proximal Convoluted Tubule	Reabsorption of useful molecules (glucose, amino acids, ions, H ₂ O).	Osmosis Active transport of amino acids and glucose. Diffusion of ions.
Loop of Henle	Reabsorption of water due to high Na ⁺ concentration in surrounding tissues in the medulla area of the kidney. Na ⁺ is actively transported out in the ascending loop. Cl ⁻ ions are attracted and follow the Na ⁺ by diffusion.	Osmosis Active transport Diffusion
Distal Convoluted Tubule	Removal of other ions, drugs and other wastes from blood (such as creatinine—from muscle metabolism).	Active transport (tubular secretion)
Collecting Tubule	Waste "urine" leaves each nephron as the tubules come together in the renal pelvis area of the kidney. Waste will leave via the ureter to the bladder.	Collection