

Chapter 13 Practice Written Questions **KEY**

1. Define excretion.

Removing metabolic wastes from the blood via the kidneys through the process of pressure filtration, reabsorption and excretion.

2. Compare the composition of blood plasma and urine.

<u>Blood plasma</u>	<u>Urine</u>
<ul style="list-style-type: none"> • RBC • WBC • Platelets • Proteins • Nutrients (glucose, aa) • Water • Salts 	<ul style="list-style-type: none"> • Water • Salts • Ions (H⁺, NH₄⁺ ammonium) • Wastes (urea, uric acid, creatinine) • Drugs

3. Explain the way that urine is removed from the body after it is produced by the kidneys.

Urine is collected in the renal pelvis from collecting ducts. The urine is then transported into the ureters where it is transported from kidney to bladder by peristalsis. The urine is then stored in the urinary bladder until the micturition reflex.

1. Bladder stretches causing receptors to initiate action potentials which travel on a reflex (sensory neuron to interneuron to motor neuron).
2. The bladder contracts and the internal sphincter relaxes
3. During a convenient time, you relax the external sphincter to cause the reflex to proceed

Urine then enters the urethra and leaves the body by peristalsis.

4. Describe the complete process of urine production.

1. pressure filtration occurs at the glomerulus to allow small molecules and water to leave the blood and enter the glomerular capsule. Large molecules like RBCs, WBCs, platelets and proteins are not filtered.
2. the filtered molecules enter the capsule.
3. Nutrient reabsorption occurs at the PCT where most/all glucose and amino acids are reabsorbed along with a lot of water and Na⁺ (salt).
4. The filtrate now goes down through the descending limb of the loop of Henle (loop of nephron) where water reabsorption occurs (due being surrounded by the hypertonic medulla).
5. The filtrate goes up the ascending limb of the loop of Henle where Na⁺ (salt) is actively reabsorbed. This reabsorption creates the hypertonic medulla.
6. At the DCT, pH balance is maintained by H⁺ excretion and HCO₃⁻ reabsorption. There is also excretion of drugs and additional wastes like creatinine.
7. The final filtrate enters the collecting duct which passes through the hypertonic renal medulla again. This causes more water reabsorption which results in concentrating the urine and making it hypertonic to blood.

5. Explain how ADH and Aldosterone affects the concentration of ions in the blood.

ADH increases water reabsorption → this dilutes the blood therefore a decreased concentration of ions in the blood

→ ↑ conc. of urine

Aldosterone increases salt then water reabsorption → this increases the salt concentration in the blood (increased Na⁺ and Cl⁻) but also adds water so can result in a decreased concentration of ions in the blood.

→ ↑ conc. of urine

6. Explain how the conditions in the renal medulla result in the production of urine which is hypertonic to blood.

The renal medulla is hypertonic due to the Na⁺ (NaCl – salt) reabsorption at the ascending limb of the loop.

Since it is hypertonic, it causes reabsorption of water by osmosis from the descending limb and collecting duct.

Increased water reabsorption from the collecting duct causes the filtrate to become concentrated and as it exits the CD, it is hypertonic to the blood due to the excess water reabsorption.

7. Describe how the events listed below would change urine composition and urine output or volume.

Dehydration: concentrated urine and lower urine output

Prolonged exercise/sweating: concentrated urine and lower urine output

Drink forced fluids (3 liters): diluted urine and high urine output

Consumption of too much salt: concentrated urine and lower urine output

Excessive alcohol intake: diluted urine and high urine output

8. Following filtration how does the nephron return nutrient molecules back to the blood and what may occur if there is an excess of nutrients in the filtrate? Use a specific example to answer the question.

Nutrient reabsorption occurs at the PCT due to microvilli to increase surface area and mitochondria to provide the ATP for active transport. If the concentration of nutrient exceeds the maximal reabsorption rate at the PCT, there will be excess left in the urine.

EX. In diabetes, the glucose concentration is too high, so all of it cannot be reabsorbed at the PCT; therefore, glucose can be found in the urine – indicating diabetes.

9. Label the following diagram using the symbols below.

Label the diagram. Use the structures and processes listed below.

Nephron Structures

- A. Bowman's capsule
- B. proximal convoluted tubule
- C. descending limb
- D. ascending limb
- E. loop of Henle
- F. distal convoluted tubule
- G. collecting duct

Circulatory Structures

- 1. renal artery
- 2. afferent arteriole
- 3. glomerulus
- 4. efferent arteriole
- 5. peritubular capillary network
- 6. renal venule
- 7. renal vein

Urine Formation Processes

- I. pressure filtration
- II. selective reabsorption
- III. water reabsorption
- IV. tubular excretion

