

Pre-Class Preparation for “Renal Revolt: A Deeper Understanding of Nephron Anatomy and Urine Formation”

by

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Nephron Anatomy

Read the following article to learn about the anatomy of the nephron and then complete the question below.

- Khan Academy. (2025). MCAT: Unit 8 Lesson 3 Renal System: Anatomy of the kidney and nephron. <<https://www.khanacademy.org/test-prep/mcat/organ-systems/the-renal-system/a/anatomy-of-the-kidney-and-the-nephron>>

Question

1. The article you read describes the anatomy of a nephron and its collecting duct. Draw a nephron and label the structures listed below. (*Note:* the loop of Henle is also referred to as the nephron loop.)
 - Ascending limb of the nephron loop
 - Bowman’s capsule
 - Collecting duct
 - Descending limb of the nephron loop
 - Distal convoluted tubule (DCT)
 - Proximal convoluted tubule (PCT)

Urine Formation

Watch the following video to learn about urine formation. Complete the questions below.

- Nucleus Medical Media. (2016). How your kidneys work. [Video]. Running time: 3:32 min. YouTube. <<https://youtu.be/CShAIAD-ask>>

Questions

2. Urine formation utilizes three processes. Complete Table 1 below. In the first column, list each process. For each process, provide a one sentence summary describing what is occurring. Be sure to list associated substances. In the final column, list the location and which part(s) of the nephron are associated with each process. Some table cells have been filled in as examples. A word bank is provided to assist you.

Word Bank

<i>Structures</i>	afferent arteriole, Bowman's capsule, collecting duct, distal convoluted tubule, efferent arteriole, glomerulus, loop of Henle (nephron loop), peritubular capillaries, proximal convoluted tubule, renal corpuscle
<i>Substances</i>	amino acids, glucose, calcium ions (Ca^{2+}), hydrogen ions (H^+), sodium ions (Na^+), nitrogenous waste, red blood cells, plasma proteins, potassium ions (K^+), water

Table 1. Three processes of urine formation.

<i>Process</i>	<i>Description</i>	<i>Location</i>
		Renal corpuscle, which includes the glomerulus and Bowman's capsule
Tubular reabsorption		
	Movement of substances from the blood into the nephron lumen including hydrogen ions and potassium ions.	

3. The glomerulus is fed by the afferent arteriole and drained by the efferent arteriole. Which of these arterioles has a larger diameter and why is that important for urine formation?

Glomerular Filtration Rate (GFR)

Watch the following video to learn about glomerular filtration rate and then complete the questions below.

- Byte Size Med. (2020). Glomerular filtration. [Video]. Running time: 7:07 min. YouTube.
<<https://youtu.be/wxaEd8p2EQM>>

Questions

4. Filtrate should not include red blood cells and in general should not contain proteins. How does the structure of the glomerulus and Bowman's capsule accomplish this task?
5. Write the given definition of glomerular filtration rate (GFR).
6. Starling forces drive glomerular filtration. Complete Table 2 below to summarize the forces. Put an * by the primary driver of filtration.

Table 2. Starling forces.

<i>Pressure</i>	<i>Does it come from fluid pressure or protein pulling?</i>	<i>Does it encourage or oppose filtration?</i>
Glomerular hydrostatic pressure		Encourages
	Fluid Pressure	
Bowman's capsule colloid osmotic pressure		Negligible

7. Describe the relationship between the diameter of the afferent and efferent arterioles and glomerular hydrostatic pressure.
8. What is used to measure GFR and how is it measured?
9. Describe the relationship between creatinine clearance and GF.

Urinalysis

Read the following article to learn about urinalysis.

- NKF Patient Education Team. (2024). Urinalysis (urine test). [Webpage]. National Kidney Foundation.
<<https://www.kidney.org/kidney-topics/urinalysis-urine-test>>

Questions

10. How is a urinalysis conducted?
11. What components of the urine are evaluated?