	INDIAN SCHOOL AL WADI AL KABIR	
CLASS: XI	**DEPARTMENT: SCIENCE 2026-27** **SUBJECT: BIOLOGY**	**DATE: 08/08/2026**
WORKSHEET 6 **WITH ANSWERS**	**CH:16 EXCRETORY PRODUCTS AND THEIR ELIMINATION**	**NOTE:** **A4 FILE FORMAT**
CLASS & SEC:	**NAME OF THE STUDENT:**	**ROLL NO:**

I. Multiple Choice Questions (MCQs)

1. Nitrogenous wastes vary significantly in their toxicity and water requirements for elimination. Which of the following statements correctly describes these properties?
   A. Ammonia is the least toxic and requires the least amount of water for removal.
   B. Uric acid is the most toxic and is excreted as a large volume of dilute solution.
   C. Ammonia is highly toxic and requires large amounts of water for elimination via diffusion.
   D. Urea is more toxic than ammonia but requires less water for its excretion.

2. The filtration of blood in the Malpighian corpuscle occurs through a three-layered membrane. Which of the following correctly identifies the specific layers and structures involved in ultrafiltration?
   A. Endothelium of glomerular vessels, basement membrane, and podocytes with filtration slits.
   B. Epithelium of glomerular vessels, basement membrane, and cuboidal brush border cells.
   C. Endothelium of Bowman's capsule, basement membrane, and simple squamous epithelium.
   D. Afferent arteriole wall, efferent arteriole wall, and the renal columns of Bertini.

3. The Juxtaglomerular Apparatus (JGA) is a specialised sensitive region that regulates the Glomerular Filtration Rate (GFR). How does the JGA respond to a fall in GFR?
   A. It stimulates the hypothalamus to release ADH to increase water reabsorption.
   B. The JG cells release renin, which eventually stimulates glomerular blood flow to restore GFR.
   C. It triggers the release of Atrial Natriuretic Factor (ANF) to cause vasodilation.
   D. It increases the diameter of the efferent arteriole to build up hydrostatic pressure.

4. During the passage of filtrate through the Loop of Henle, significant changes in osmolarity occur. Which statement accurately describes the physiological behaviour of the limbs?
   A. The descending limb is impermeable to water, causing the filtrate to become diluted.
   B. The ascending limb is permeable to water, allowing electrolytes to be retained in the tubule.
   C. The descending limb is permeable to water, concentrating the filtrate as it moves down.
   D. The ascending limb is permeable to water but impermeable to electrolytes like NaCl.

5. The regulation of kidney function involves opposing hormonal mechanisms. Which of the following best describes the relationship between ANF and the Renin-Angiotensin mechanism?
   A. ANF stimulates the release of renin to increase blood pressure and GFR.
   B. The Renin-Angiotensin mechanism causes vasodilation, while ANF causes vasoconstriction.
   C. ANF causes vasodilation to decrease blood pressure, acting as a check on the Renin-Angiotensin mechanism.
   D. Both mechanisms work synergistically to increase the reabsorption of Na+ and water from the DCT.

II. ASSERTION AND REASONING

Two statements are given: one labelled Assertion (A) and the other labelled Reason (R). Select the correct answer to these questions from the codes (A), (B), (C) and (D) as given below.

a) Both Assertion (A) and Reason (R) are true, and Reason (R) is the correct explanation of the Assertion (A).
b) Both Assertion (A) and Reason (R) are true, but Reason (R) is not the correct explanation of the Assertion (A).
c) Assertion (A) is true, Reason (R) is false.
d) Assertion (A) is false, Reason (R) is true.

6. **Assertion (A):** Mammals are generally ureotelic animals.
   Reason (R): Ammonia produced by metabolism is converted into urea in the liver and released into the blood, which is filtered and excreted by the kidneys.

7. **Assertion (A):** The ascending limb of the Loop of Henle is essential for maintaining high osmolarity of medullary interstitial fluid.
   Reason (R): The ascending limb is impermeable to water but allows transport of electrolytes actively or passively.

8. **Assertion (A):** Presence of glucose and ketone bodies in urine is indicative of Diabetes Mellitus.
   Reason (R): Glycosuria and Ketonuria are common clinical conditions observed when the counter-current mechanism fails to concentrate urine.

9. **Assertion (A):** An excessive loss of fluid from the body can activate the osmoreceptors which stimulate the hypothalamus to release ADH.
   Reason (R): ADH facilitates water reabsorption from the latter parts of the tubule, thereby preventing diuresis.

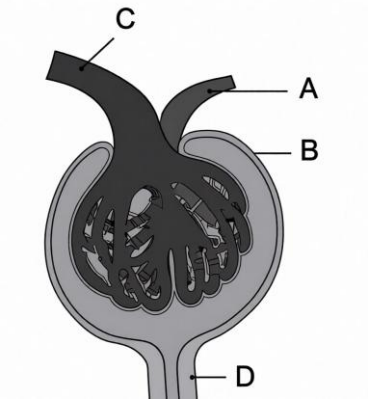
10. **Assertion (A):** The Proximal Convoluted Tubule (PCT) is the main site for the reabsorption of essential nutrients and electrolytes.
    Reason (R): PCT is lined by simple cuboidal brush border epithelium, which increases the surface area for reabsorption.

III. SHORT ANSWER TYPE QUESTIONS (2 MARKS EACH)

11. Differentiate between cortical nephrons and juxta-medullary nephrons based on their structural distribution within the kidney.
12. Define Glomerular Filtration Rate (GFR). What is the approximate GFR value for a healthy adult human per minute and per day?
13. Explain the specific role of podocytes in the process of ultrafiltration. How does their arrangement facilitate the movement of filtrate?
14. Why is the ascending limb of Henle's loop referred to as the 'diluting segment' of the nephron? Mention its permeability to water and electrolytes.

IV. LONG ANSWER TYPE QUESTION (3 MARKS EACH)

15. i) Identify and label the afferent arteriole and the efferent arteriole in the diagram below.



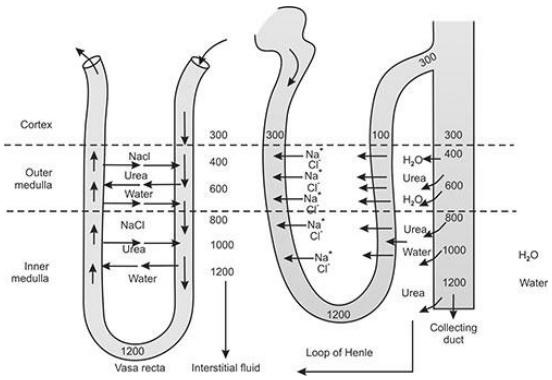
ii) Explain why the difference in diameter between these two vessels is crucial for the process of glomerular filtration.

16. Explain the difference between urea, uric acid, and ammonia as excretory products.
17. What are the differences between glomerular filtration, tubular reabsorption, and tubular secretion?
18. How have terrestrial organisms adapted themselves for the conservation of water?

V. CASE STUDY BASED QUESTIONS (4M)

19. Read the given passage & answer the following Questions:

A species of desert mammal, such as the Kangaroo Rat, inhabits an environment where liquid water is extremely scarce. To survive, these mammals must produce highly concentrated urine to minimise water loss. This physiological feat is achieved through the Counter-Current Mechanism that relies on a specific anatomical arrangement of the juxtamedullary nephrons and the vasa recta. By maintaining a steep osmotic gradient in the medullary interstitium ranging from 300 mOsmol/L at the cortex to 1200 mOsmol/L in the inner medulla the kidney can effectively pull water back into the body from the collecting duct.



a) Explain the specific roles of NaCl and Urea in maintaining the medullary osmotic gradient (300 to 1200 mOsmol/L).
b) Mention which segments of the tubule are responsible for their transport into the interstitium.
c) Describe how the "counter-current" arrangement of the Vasa Recta specifically prevents the dissipation (washing away) of the medullary gradient while still providing oxygen to the medullary tissues.

VI. VERY LONG ANSWER TYPE QUESTIONS (5 MARKS EACH)

20. Describe the three main processes involved in the formation of urine in a human kidney.
21. Compare the excretory systems of humans and birds.
22. (a)Define Glomerular Filtration Rate (GFR) and how it affects urine formation.
    (b)With the help of a neat labelled diagram, explain the structure of the basic unit of the kidney.

ANSWERS

I. **Multiple Choice Questions (MCQs)**	
1	C) Ammonia is highly toxic and requires large amounts of water for elimination via diffusion.
2	A) Endothelium of glomerular vessels, basement membrane, and podocytes with filtration slits.
3	B) The JG cells release renin, which eventually stimulates glomerular blood flow to restore GFR.
4	C) The descending limb is permeable to water, concentrating the filtrate as it moves down.
5	C) ANF causes vasodilation to decrease blood pressure, acting as a check on the Renin-Angiotensin mechanism.
II Assertion and Reason Questions	
6	A) Both A and R are true, and R is the correct explanation of A
7	D) A is false, but R is true.
8	C) A is true, but R is false.
9	C) A is true, but R is false.
10	A) Both A and R are true, and R is the correct explanation of A.
III **SHORT ANSWER TYPE QUESTIONS (2 MARKS EACH)**	
11	Cortical vs. Juxta-medullary Nephrons: Cortical: Loop of Henle is short and extends only a little into the medulla. Vasa recta are absent

	or highly reduced. Juxta-medullary: Loop of Henle is very long and runs deep into the medulla. Well-developed vasa recta present.
12	GFR Definition and Values: Definition: The amount of filtrate formed by the kidneys per minute. Values: 125 ml/minute or 180 litres per day in a healthy adult.
13	Role of Podocytes: Podocytes are epithelial cells of Bowman's capsule arranged intricately to leave minute spaces called filtration slits or slit pores. They allow all plasma constituents except proteins to pass into the lumen (ultrafiltration).
14	Ascending Limb as 'Diluting Segment': It is impermeable to water but allows transport of electrolytes (NaCl) actively or passively. As electrolytes leave the tubule into the medullary fluid, the filtrate becomes diluted. Role of Liver: In ureotelic animals, ammonia produced by metabolism is converted into urea in the liver via the ornithine cycle. This urea is then released into the blood for filtration by the kidneys.
IV LONG ANSWER TYPE QUESTION (3 MARKS EACH)	
15	Labelling: Afferent arteriole (wider diameter, entering) and Efferent arteriole (narrower diameter, exiting). Analysis: The afferent arteriole is wider than the efferent arteriole. This diameter difference creates hydrostatic pressure in the glomerulus, which is the driving force for ultrafiltration.
16	Urea: Found in humans and most mammals, moderately toxic, and water-soluble. Uric acid: Found in birds and reptiles, least toxic, and excreted as a paste to conserve water. Ammonia: Found in aquatic animals, highly toxic, and excreted directly in large amounts of water.
17	Glomerular filtration: Blood is filtered in the glomerulus, and filtrate containing water, salts, glucose, and urea enters Bowman's capsule. Tubular reabsorption: Essential substances like glucose, amino acids, and ions are reabsorbed into the blood from the nephron. Tubular secretion: Additional waste products like hydrogen ions and drugs are secreted from the blood into the nephron tubules for excretion.
18	Terrestrial adaptation requires the production of less toxic nitrogenous waste like urea and uric acid to conserve water. Ammonia excreted by aquatic animals requires a large amount of water to dissolve. But for terrestrial animals, such a huge amount of water is unnecessary. They need less water for excretion and are either ureotelic or uricotelic.
V CASE STUDY BASED QUESTIONS (4M)	
19	a) Roles of NaCl and Urea: NaCl is transported out of the ascending limb of Henle's loop and exchanged with the vasa recta. Small amounts of urea enter the thin ascending limb and are transported back to the

	medullary interstitium by the collecting duct. Together they maintain the 300-1200 mOsmol/L gradient. b) Vasa Recta Arrangement: The counter-current flow in vasa recta limbs ensures that NaCl entering the descending limb is returned to the interstitium by the ascending limb. This preserves the high osmolarity of the medulla (preventing "washout") while providing blood supply to the tissue.
VI VERY LONG ANSWER TYPE QUESTIONS (5 MARKS EACH)	
20	Urine Formation: Glomerular Filtration: Ultrafiltration of plasma (minus proteins) through 3 layers. Reabsorption: 99% of filtrate recovered; active (glucose) and passive (water, urea) transport. Secretion: Tubular cells secrete ammonia into filtrate to maintain ionic/pH balance.
21	**Feature** / **Humans** / **Birds** **Excretory Product**: Urea (ureotelic) / Uric acid (uricotelic) **Water Conservation**: Moderate / High (paste-like excretion) **Excretory Organ**: Kidneys / Kidneys with uricotelic adaptation **Storage**: Urinary bladder (stores urine) / No urinary bladder; excretion through cloaca
22	a) **Define Glomerular Filtration Rate (GFR) and how it affects urine formation.** **Glomerular Filtration Rate (GFR):** GFR is the **amount of filtrate formed by both kidneys per minute**. In a healthy adult, it is about **125 mL/min** (approximately **180 L/day**). **Effect on urine formation:** • GFR determines the **rate of filtration** in the kidneys. • A **higher GFR** results in more filtrate being formed, leading to **increased urine formation** (unless more water is reabsorbed). • A **lower GFR** reduces filtration, resulting in **less urine formation**. • The kidneys regulate GFR through a mechanism called the **Juxtaglomerular Apparatus (JGA)** to maintain normal filtration. b) Structure of the Basic Unit of Kidney (Nephron)

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