

Excretory Products and Their Elimination — CBSE Pattern Test 1

Class 11 Biology · 90 minutes · 40 marks · Sections A–D with answer key · Narayan Gurukul Academy

Test 1 — CBSE Pattern (90 minutes, 40 marks)

Class 11 Biology · Excretory Products and Their Elimination · Narayan Gurukul Academy (ClassApna)

General Instructions: (1) This paper has four sections — Section A (1×10), Section B (2×4), Section C (3×4) and Section D (5×2) — total 40 marks. Time allowed: 90 minutes.
(2) All questions are compulsory. For MCQ questions choose the single correct option; for VSA questions write a single line.
(3) Quotation of NCERT values (GFR ≈ 125 mL/min, osmolarity $300 \rightarrow 1200$ mOsmolL⁻¹, etc.) is expected wherever relevant. Use of a calculator is not permitted.

Section A — MCQ & VSA ($10 \times 1 = 10$ marks)

- The functional unit of the kidney is the —
(A) nephron
(B) calyx
(C) medullary pyramid
(D) renal pelvis
- The glomerulus is a tuft of capillaries formed by the —
(A) afferent arteriole
(B) efferent arteriole
(C) peritubular capillaries
(D) vasa recta
- The ascending limb of the loop of Henle is —
(A) impermeable to water
(B) freely permeable to water
(C) permeable only to urea
(D) permeable to glucose
- Which hormone promotes water reabsorption from the distal parts of the renal tubule?
(A) ADH
(B) ANF
(C) renin
(D) aldosterone
- Nearly 99% of the glomerular filtrate is —
(A) reabsorbed by the renal tubules
(B) excreted as urine
(C) secreted into Bowman's capsule
(D) stored in the urinary bladder
- Define GFR and give its normal value in a healthy adult.
- What is uremia?
- Name the excretory structure of crustaceans like prawns.
- What is the function of the brush border in the PCT?
- Where is the micturition reflex coordinated, and what initiates it?

Section B — Short Answer I ($4 \times 2 = 8$ marks)

11. Why are reptiles and birds mainly uricotelic?
12. Distinguish between the renal cortex and the medulla of the kidney.
13. Explain the role of the juxta glomerular apparatus (JGA) in regulating GFR.
14. Describe the role of the liver in excretion.

Section C — Short Answer II ($4 \times 3 = 12$ marks)

15. Give a brief account of the counter current mechanism of urine concentration.
16. Describe the three processes of urine formation — glomerular filtration, reabsorption and secretion.
17. Explain the neural mechanism of micturition.
18. Describe the functions of the PCT and the loop of Henle with reference to reabsorption.

Section D — Long Answers ($2 \times 5 = 10$ marks)

19. (a) Describe the structure of a nephron along with its blood supply. (b) Explain how ADH regulates the water balance of the body.
20. (a) Explain the principle and working of hemodialysis. (b) Distinguish between cortical and juxta medullary nephrons.

Answer Key (Marking Scheme)

- Q1 — (A) nephron. Q2 — (A) afferent arteriole. Q3 — (A) impermeable to water. Q4 — (A) ADH (vasopressin). Q5 — (A) reabsorbed by the renal tubules.
- Q6 — GFR is the volume of filtrate formed by the kidneys per minute; $\approx 125 \text{ mL/min}$ ($\approx 180 \text{ L/day}$) in a healthy adult.
- Q7 — Uremia is a condition in which urea accumulates in the blood because the kidneys fail to eliminate nitrogenous wastes.
- Q8 — Green glands (antennal glands).
- Q9 — The brush border (microvilli) greatly increases the absorptive surface of the PCT for maximum reabsorption of nutrients, electrolytes and water.
- Q10 — The micturition reflex is initiated by stretch receptors in the wall of the distended urinary bladder and is coordinated in the spinal cord/CNS.
- Q11 — Reptiles and birds are uricotelic: uric acid is almost insoluble in water and is eliminated as a thick paste/solid, so practically no water is lost — essential for land animals where water is scarce.
- Q12 — Cortex: outer region containing the malpighian (renal) corpuscles; medulla: inner region of medullary pyramids and renal columns containing the loops of Henle, collecting ducts and vasa recta.
- Q13 — On a fall in GFR, the JG cells of the JGA release renin, which helps restore glomerular blood flow and hence the GFR to normal — autoregulation.
- Q14 — The liver forms urea (converts ammonia) and excretes bilirubin, biliverdin, cholesterol, degraded steroid hormones, vitamins and drugs through bile into the digestive wastes.
- Q15 — The loop of Henle and the vasa recta run in opposite (counter) directions. NaCl transported out by the ascending limb and urea returned by the collecting duct maintain the osmolarity gradient ($300 \rightarrow 1200 \text{ mOsmolL}^{-1}$), which enables the formation of concentrated urine ($\sim 4\times$ the filtrate).
- Q16 — Filtration: blood is ultrafiltered at the glomerulus into Bowman's capsule; Reabsorption: $\approx 99\%$ of the filtrate (glucose, amino acids, Na^+ , water) is reabsorbed, mainly by the PCT; Secretion: the tubules secrete H^+ , K^+ and ammonia to maintain the pH and ionic balance of the blood.

Q17 — Distension of the bladder stimulates its stretch receptors → impulses to the CNS → motor messages contract the bladder smooth muscle and relax the urethral sphincter → urine is released (micturition reflex).

Q18 — PCT: reabsorbs nearly all nutrients, 70–80% of electrolytes and water (brush border); Loop of Henle: descending limb concentrates the filtrate by losing water, ascending limb actively transports NaCl into the interstitium while staying impermeable to water — together they build the medullary osmotic gradient.

Q19 — (a) Glomerulus + Bowman's capsule = malpighian/renal corpuscle; renal tubule = PCT, loop of Henle (descending/ascending), DCT opening into the collecting duct. Blood: renal artery → afferent arteriole → glomerular capillaries → efferent arteriole → peritubular capillaries/vasa recta. (b) A rise in blood osmolarity triggers ADH release from the posterior pituitary; ADH increases the water permeability of the DCT and collecting duct, so more water is reabsorbed and concentrated urine is produced — restoring fluid volume.

Q20 — (a) Blood is drawn from a vein, heparin added, and passed through the coiled tube of a dialysing unit whose semipermeable membrane is bathed in dialysing fluid (plasma composition minus nitrogenous wastes); urea and uric acid diffuse out and the cleaned blood is returned to the vein. (b) Cortical nephrons: short loop of Henle into the medulla, vasa recta reduced/absent. Juxtamedullary nephrons: long loop deep into the medulla, well-developed vasa recta — responsible for the counter current mechanism.