NCERT Exemplar Solutions of Class 11 Biology – Chapter 19: Excretory Products and their Elimination

MULTIPLE CHOICE QUESTIONS

1. The following substances are the excretory products in animals. Choose the least toxic form among them?

a. Urea
b. Uric acid
c. Ammonia
d. Carbon dioxide

Solution: (b) Uric acid

Enhanced Explanation:

- **Ammonia (NH_3)**: Most toxic nitrogenous waste, requires large amounts of water for dilution
- **Urea ($CO(NH_2)_2$)**: Moderately toxic, requires moderate water for excretion
- **Uric acid ($C_5H_4N_4O_3$)**: Least toxic among nitrogenous wastes, can be excreted as semi-solid paste with minimal water loss
- **Carbon dioxide**: Not a nitrogenous waste, excreted through respiratory system

Uric acid is the least toxic because it's relatively insoluble and can be concentrated without causing cellular damage.

2. Filtration of the blood takes place at

a. PCT (Proximal Convoluted Tubule)
b. DCT (Distal Convoluted Tubule)
c. Collecting ducts
d. Malpighian body

Solution: (d) Malpighian body

Enhanced Explanation: The Malpighian body consists of:

- **Glomerulus**: Cluster of capillaries where actual filtration occurs
- **Bowman's capsule**: Cup-shaped structure surrounding the glomerulus

Blood filtration occurs due to:

- High hydrostatic pressure in glomerular capillaries (~55 mmHg)
- Semi-permeable nature of glomerular membrane
- Formation of glomerular filtrate containing water, glucose, amino acids, urea, and salts

3. Which of the following statements is correct?

a. ADH – prevents the conversion of angiotensinogen in the blood to angiotensin
b. Aldosterone – facilitates water reabsorption
c. ANF – enhances sodium reabsorption
d. Renin – causes vasodilation

Solution: (a) ADH – prevents the conversion of angiotensinogen in the blood to angiotensin

Enhanced Explanation:

- **ADH (Anti-Diuretic Hormone/Vasopressin)**: Primarily increases water reabsorption in collecting duct, but also has some inhibitory effect on renin-angiotensin system
- **Aldosterone**: Primarily facilitates sodium reabsorption (not just water) in DCT and collecting duct
- **ANF (Atrial Natriuretic Factor)**: Decreases sodium reabsorption and promotes sodium excretion
- **Renin**: Causes vasoconstriction through angiotensin II formation, not vasodilation

4. Which of the following is removed from our body by lungs?

a. CO_2 only

b. H_2O only

c. CO_2 and H_2O

d. Ammonia

Solution: (c) CO_2 and H_2O

Enhanced Explanation: Lungs excrete:

- **Carbon dioxide (CO_2)**: Primary gaseous waste from cellular respiration
- **Water vapor (H_2O)**: Significant amount lost during expiration (approximately 400-500 mL/day)
- Small amounts of other volatile substances
- **Not ammonia**: Ammonia excretion through lungs occurs only in pathological conditions

5. The pH of human urine is approximately

a. 6.5

b. 7

c. 6

d. 7.5

Solution: (c) 6

Enhanced Explanation: Normal human urine pH ranges from 5.5 to 7.0, with an average of approximately 6.0

- **Acidic nature** due to presence of:
  - Organic acids (uric acid, creatinine)
  - Phosphoric acid from phosphate metabolism
  - Sulfuric acid from protein metabolism
- pH can vary based on diet, health status, and hydration levels

6. Different types of excretory structures and animals are given below. Match them appropriately and mark the correct answer from among those given below:

Excretory structure/organ → Animals

- A. Protonephridia → i. Prawn

- B. Nephridia → ii. Cockroach
- C. Malpighian tubules → iii. Earthworm
- D. Green gland or Antennal glands → iv. Flatworms

a. A-iv, B-iii, C-ii, D-i
b. A-iii, B-i, C-iv, D-ii
c. A-iii, B-iv, C-ii, D-i
d. A-iii, B-i, C-ii, D-iv

Solution: (a) A-iv, B-iii, C-ii, D-i

Enhanced Explanation:

- **Protonephridia**: Found in flatworms (Platyhelminthes) - flame cells for osmoregulation
- **Nephridia**: Found in earthworms (Annelids) - segmentally arranged excretory organs
- **Malpighian tubules**: Found in cockroaches (Arthropods/Insects) - tubular excretory structures
- **Green/Antennal glands**: Found in prawns (Crustaceans) - paired excretory glands near antennae

7. Which one of the following statements is incorrect?

a. Birds and land snails are uricotelic animals
b. Mammals and frogs are ureotelic animals
c. Aquatic amphibians and aquatic insects are ammonotelic animals
d. Birds and reptiles are ureotelic

Solution: (d) Birds and reptiles are ureotelic

Enhanced Explanation:

- **Birds and reptiles are uricotelic** (excrete uric acid), not ureotelic
- This adaptation helps conserve water in terrestrial environments
- **Uricotelic animals**: Birds, reptiles, land snails, insects
- **Ureotelic animals**: Mammals, adult amphibians
- **Ammonotelic animals**: Fish, aquatic amphibians, aquatic invertebrates

8. Which of the following pairs is wrong?

a. Uricotelic → Birds
b. Ureotelic → Insects
c. Ammonotelic → Tadpole
d. Ureotelic → Elephant

Solution: (b) Ureotelic → Insects

Enhanced Explanation:

- **Insects are uricotelic** (excrete uric acid), not ureotelic
- This adaptation allows insects to conserve water effectively
- **Correct pairs**:
    - Birds → Uricotelic

- Tadpoles → Ammonotelic (aquatic environment)
- Elephant → Ureotelic (mammal)

9. Which one of the following statements is incorrect?

a. The medullary zone of the kidney is divided into a few conical masses called medullary pyramids projecting into the calyces

b. Inside the kidney, the cortical region extends in between the medullary pyramids as renal pelvis

c. Glomerulus along with Bowman's capsule is called the renal corpuscle

d. Renal corpuscle, proximal convoluted tubule (PCT) and distal convoluted tubule (DCT) of the nephron are situated in the cortical region of the kidney

Solution: (b) Inside the kidney, the cortical region extends in between the medullary pyramids as renal pelvis

Enhanced Explanation: The statement is incorrect because:

- The cortical region extends between medullary pyramids as **renal columns (columns of Bertini)**, not renal pelvis
- **Renal pelvis** is the funnel-shaped space that collects urine from calyces
- **Renal columns** are cortical tissue extensions between pyramids containing blood vessels and portions of nephrons

10. The condition of accumulation of urea in the blood is termed as

a. Renal Calculi

b. Glomerulonephritis

c. Uremia

d. Ketonuria

Solution: (c) Uremia

Enhanced Explanation:

- **Uremia**: Accumulation of urea and other nitrogenous wastes in blood due to kidney failure
- **Renal Calculi**: Kidney stones (crystalline deposits)
- **Glomerulonephritis**: Inflammation of glomeruli
- **Ketonuria**: Presence of ketone bodies in urine
- Uremia can lead to nausea, vomiting, confusion, and potentially coma if untreated

11. Which one of the following is also known as an antidiuretic hormone?

a. Oxytocin

b. Vasopressin

c. Adrenaline

d. Calcitonin

Solution: (b) Vasopressin

Enhanced Explanation:

- **Vasopressin = ADH (Antidiuretic Hormone)**

- Produced by hypothalamus, released by posterior pituitary
- **Functions**:
    - Increases water reabsorption in collecting duct
    - Vasoconstriction (hence the name vasopressin)
    - Regulation of blood osmolarity and volume

12. Match the terms given in Column I with their physiological processes given in Column II and choose the correct answer

Column I → Column II

- A. Proximal convoluted tubule → i. Formation of concentrated urine
- B. Distal convoluted tubule → ii. Filtration of blood
- C. Henle's loop → iii. Reabsorption of 70-80% of electrolytes
- D. Counter-current mechanism → iv. Ionic balance
- E. Renal corpuscle → v. Maintenance of concentration gradient in medulla

a. A-iii, B-v, C-iii, D-ii, E-i

b. A-iii, B-iv, C-i, D-v, E-ii

c. A-i, B-iii, C-ii, D-v, E-iv

d. A-iii, B-i, C-iv, D-v, E-ii

Solution: (b) A-iii, B-iv, C-i, D-v, E-ii

Enhanced Explanation:

- **PCT**: Reabsorbs 70-80% of electrolytes (Na^+, K^+, Cl^-) and 65% of water
- **DCT**: Maintains ionic balance through selective reabsorption/secretion
- **Henle's loop**: Creates concentration gradient essential for concentrated urine formation
- **Counter-current mechanism**: Maintains concentration gradient in medulla
- **Renal corpuscle**: Site of blood filtration

13. Match the abnormal conditions given in Column A with their explanations given in Column B and Choose the correct option

Column A → Column B

- A. Glycosuria → i. Accumulation of uric acid in joints
- B. Renal calculi → ii. Inflammation in glomeruli
- C. Glomerular nephritis → iii. Mass of crystallised salts within the kidney
- D. Gout → iv. Presence of glucose in the urine

a. A-i, B-iii, C-ii, D-iv

b. A-iii, B-ii, C-iv, D-i

c. A-iv, B-iii, C-ii, D-i

d. A-iv, B-ii, C-iii, D-i

Solution: (c) A-iv, B-iii, C-ii, D-i

Enhanced Explanation:

- **Glycosuria**: Presence of glucose in urine (diabetes mellitus)
- **Renal calculi**: Kidney stones - crystallized salt masses

- **Glomerular nephritis**: Inflammatory condition of glomeruli
- **Gout**: Accumulation of uric acid crystals in joints causing severe pain

14. We can produce a concentrated/dilute urine. This is facilitated by a special mechanism. Identify the mechanism.

a. Reabsorption from PCT
b. Reabsorption from Collecting Duct
c. Reabsorption/Secretion in DCT
d. Countercurrent mechanism in Henle's loop/Vasa recta

Solution: (d) Countercurrent mechanism in Henle's loop/Vasa recta

Enhanced Explanation: The countercurrent mechanism involves:

- **Henle's loop**: Creates osmotic gradient (300-1200 mOsm/L from cortex to medulla)
- **Vasa recta**: Maintains gradient through counter-current flow
- **Process**:
    - Descending limb: Permeable to water, concentrates filtrate
    - Ascending limb: Impermeable to water, actively transports salts
    - Creates hypertonic medullary interstitium
- Allows production of urine 4-5 times more concentrated than plasma

15. Dialysing unit (artificial kidney) contains a fluid which is almost same as plasma except that it has

a. High glucose
b. High urea
c. No urea
d. High uric acid

Solution: (c) No urea

Enhanced Explanation: Dialysis fluid composition:

- **Similar to plasma**: Contains glucose, electrolytes, amino acids
- **No urea or other nitrogenous wastes**: Creates concentration gradient for waste removal
- **Principle**: Diffusion and osmosis remove wastes from blood
- **Process**: Blood and dialysis fluid flow in opposite directions across semi-permeable membrane