Answers to Questions for Comprehension

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Q1. The basic function of the excretory system is to regulate the volume and composition of body fluids by removing wastes and returning needed substances to the body for reuse.

Q2. Four examples of metabolic wastes produced in the human body include carbon dioxide, water, nitrogenous wastes (ammonia, urea, uric acid), and salts (Na^+, Cl^-, H^+).

Q3. Any waste can pose a threat to health if it is allowed to accumulate in the body. By excreting nitrogenous wastes, the excretory system rids the body of toxic substances.

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Q4. The structures of the human excretory system are the kidneys, ureters, urinary bladder, and urethra. The renal artery transports blood to the kidney for filtration. The filtered blood returns to the circulatory system through the renal veins, which connect to the inferior vena cava.

Q5. Urine leaves the body through these structures:
kidneys → ureters → urinary bladder → urethra

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Q6. The three regions of the kidney are the renal cortex, the renal medulla, and the renal pelvis.

Q7. Blood flow through the nephron renal artery → glomerulus → arteriole → capillary network → venule → renal vein

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Q8. The two factors that contribute to glomerular filtration are the size of the pores of the capillaries that form each glomeruli and blood pressure.

Q9. The glomerular filtrate contains small dissolved molecules in approximately the same concentration as plasma. The large molecules (proteins) are too large to pass through the capillary into the filtrate.

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Q10. The cells of the proximal tubule are richly endowed with mitochondria, which use the energy-releasing power of ATP to drive the active transport of sodium ions and other solutes back into the blood.

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Q11. As the filtrate moves up the ascending limb of the loop of Henle, it becomes more dilute (i.e., less concentrated) as sodium ions are actively transported and other ions are passively transported out of the filtrate.

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Q12. Osmoreceptors are cells that are sensitive to osmotic pressure. The osmoreceptors send impulses that cause the release of antidiuretic hormone (ADH).

Q13. If the blood becomes concentrated, osmoreceptors signal the release of ADH, which increases the permeability of the distal tubule and collecting duct, allowing more water to be reabsorbed into the blood. If the blood becomes too dilute, osmoreceptors stop, or prevent, the release of ADH. As a result, the distal tubule and the collecting duct become less permeable to water, which allows more water to become excreted in the urine.

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Q14. The kidneys regulate salt balance in the blood by controlling the excretion and reabsorption of various ions. The reabsorption of salt increases blood volume and pressure because more water is reabsorbed. A drop in blood Na^+ results in release of the hormone aldosterone. Aldosterone stimulates the distal tubule and collecting ducts to reabsorb Na^+ ions. Aldosterone also stimulates the secretion of K^+ ions into the distal tubules and collecting ducts.

Q15. The kidneys keep blood pH within normal limits. They reabsorb HCO_3^- ions and excrete H^+ ions as needed to maintain the pH at about 7.4. The chemical reactions that act to maintain a constant pH are linked to the respiratory system because H_2CO_3 reacts in solution to form carbon dioxide and water. Therefore, levels of H_2CO_3 are linked to levels of CO_2, which are regulated by breathing.

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Q16. Renal insufficiency is a general term used to describe the state in which the kidneys cannot maintain homeostasis due to damage to their nephrons.

Q17. Hemodialysis uses an artificial membrane in an external device—in essence, an artificial kidney—that is connected to an artery and a vein in a person's arm.

Peritoneal dialysis uses the lining of the intestines, called the peritoneum, as the dialysis membrane. Dialysate is introduced to the abdominal cavity, where the large surface area and rich supply of capillaries of the peritoneum slowly filter the blood.

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Q18. Dialysis enables people with kidney disease to live their lives in a relatively unchanged way. However, dialysis is not a cure and it is not intended to be a long-term solution to the problem of kidney disease. Individuals with kidney functions of ten percent or less will eventually have to replace their kidneys.

Q19. The short-term success would depend on the availability of organs for transplantation, surviving surgery, and contracting an infection. Long-term success depends on the success of anti-rejection drugs and solving the problem that caused the original kidney disease.