

Section 9.3: Review Answers

Student Textbook page 326

1. The amount of water reabsorbed from the filtrate influences two important characteristics of blood: its volume and the concentration of plasma solutes (its osmotic pressure).
2. Both sides of this diagram are identical, so either side could be used to represent the mechanism by which osmotic pressure of body fluids is increased or decreased. However, if students use the diagram on page 317 as their reference, then they will complete captions for the labels as follows:

 - (a) A: Body fluids too dilute (osmotic pressure too low)
B: Osmoreceptors in the hypothalamus send signal to decrease the release of ADH.
C: Decreased reabsorption of water in kidney tubules and collecting ducts; increased water in urine
D: Osmotic pressure of body fluids increases.
E: Body fluids too concentrated (osmotic pressure too high).
F: Osmoreceptors in hypothalamus sense increased osmotic pressure, and send signals to the pituitary gland to release ADH into the bloodstream.
G: Increased reabsorption of water in kidney tubules and collecting ducts; decreased water in urine.
H: Osmotic pressure of body fluids decreases.
 - (b) Alcohol is a diuretic because it partially decreases ADH release, which decreases the permeability of the tubules and collecting ducts to water. Less water is reabsorbed from the nephron, increasing the water content of the urine.
3. A person with diabetes insipidus produces very little ADH. The distal tubule and the collecting duct remain impermeable to water. This allows more water to be excreted in the urine, causing excessive urination. The excess water loss triggers the thirst sensation because the osmotic pressure of body fluids is too high. Water continues to be lost very rapidly and thirst persists, unless the individual is given medication containing ADH.
4. (a) The distal tubule and collecting duct are involved in water absorption.
 - (b) If a person drinks very little water, the blood plasma becomes too concentrated. In response, osmoreceptors send impulses that cause the release of ADH. ADH increases the permeability of the distal

tubule and collecting duct, allowing more water to be reabsorbed into the blood.

5. Aldosterone has the net effect of retaining both salt and water. Aldosterone also stimulates the secretion of K^+ ions into the distal tubule and collecting duct if the K^+ ion concentration in the blood is too high. Without aldosterone, the body would not be able to maintain Na^+ and K^+ ion balances.
6. Creatine is excreted because the concentration is higher in the urine than it is in the plasma.
Uric acid is excreted because the concentration is higher in the urine than it is in the plasma.
Bicarbonate ion is absorbed because the concentration is higher in the blood plasma than it is in the urine.
7. The kidneys regulate the acid-base balance of the blood (pH of blood around 7.4). The kidneys monitor and control blood pH levels, mainly by excreting hydrogen ions (H^+) and reabsorbing bicarbonate ions (HCO_3^-).
8. Low blood pressure can result in acute kidney failure. The cause of acute kidney failure is often a drastic drop in blood pressure that prevents an adequate amount of blood from reaching your kidneys. The kidneys would not be able to remove waste products from the blood.
9. Humans can't drink salt water because the kidneys can only make urine that is less salty than salt water. Therefore, to get rid of all the excess salt taken in by drinking salt water, you have to urinate more water than you drank, so you would die of dehydration.
10. (a) Protein in the urine—one symptom of increased permeability of the glomerulus and Bowman's capsule caused by infection or injury; sometimes occurs with no known cause in adolescents—usually disappears in adulthood.
(b) Blood in the urine—one symptom of serious damage to the glomeruli and Bowman's capsules by infection (such as *Streptococcus* bacteria) or physical trauma that has created large pores that allow red blood cells into the filtrate.
(c) Glucose in urine—one sign of diabetes mellitus; frequently occurs naturally after a meal rich in sugary foods. (If diabetes mellitus is suspected, patients must fast several hours before giving a urine sample for a glucose test.)
(d) White blood cells in urine—a sign of a kidney or bladder infection.

11.

Disorder	Causes	Symptoms	Treatment
kidney stones	development of crystalline formations due to excess calcium in urine	abdominal and/or back pain	many stones pass through the urinary tract on their own; medications may break down the crystalline formations; ultrasound shock waves can be used to disintegrate the crystalline structures; surgery to remove larger stones
renal insufficiency	kidney infection, high blood pressure, diabetes mellitus, trauma, poisoning, atherosclerosis, blockage of tubules	kidneys cannot maintain homeostasis due to damage to their nephrons	kidney transplant; dialysis
urinary tract infections	bacteria or virus	painful burning sensation during urination, a need to urinate more frequently, bloody or brown urine	antibiotics, surgery in severe cases