Chapter 03: The Cellular Environment: Fluids and Electrolytes, Acids and Bases
McCance/Huether: Pathophysiology: The Biologic Basis of Disease in Adults and Children, 8th Edition

MULTIPLE CHOICE

1. Why are infants most susceptible to significant losses in total body water?
   a. High body surface-to-body size ratio
   b. Slow metabolic rate
   c. Kidneys are not mature enough to counter fluid losses
   d. Inability to communicate adequately when he or she is thirsty

   ANS: C
   Renal mechanisms that regulate fluid and electrolyte conservation are often not mature enough to counter the losses; consequently, dehydration may rapidly develop. Infants can be susceptible to changes in total body water because of their high metabolic rate and the turnover of body fluids caused by their greater body surface area in proportion to their total body size. An infant's ability to communicate is limited and caregivers must become adept at reading their signals.

   PTS: 1 DIF: Cognitive Level: Remembering

2. Why does obesity create a greater risk for dehydration in people?
   a. Adipose cells contain little water because fat is water repelling.
   b. The metabolic rate of obese adults is slower than the rate of lean adults.
   c. The rate of urine output of obese adults is higher than in lean adults.
   d. The thirst receptors of the hypothalamus do not function effectively.

   ANS: A
   The percentage of total body water (TBW) varies with the amount of body fat and age. Because fat is water repelling (hydrophobic), very little water is contained in adipose cells. Individuals with more body fat have proportionately less TBW and tend to be more susceptible to fluid imbalances that cause dehydration.

   PTS: 1 DIF: Cognitive Level: Remembering

3. A patient's blood gases reveal the following findings: pH 7.3; bicarbonate (HCO_3) 27 mEq/L; carbon dioxide (CO_2) 58 mm Hg. What is the interpretation of these gases?
   a. Respiratory alkalosis
   b. Metabolic acidosis
   c. Respiratory acidosis
   d. Metabolic alkalosis

   ANS: C
   The values provided in this question characterize only acute uncompensated respiratory acidosis. Respiratory acidosis is characterized by a low pH and high CO_2. Alkalosis is characterized by higher than normal pH. A metabolic acidosis would have a lower than normal pH with a bicarbonate concentration of <22 mEq/L.

   PTS: 1 DIF: Cognitive Level: Remembering

4. Water movement between the intracellular fluid (ICF) compartment and the extracellular fluid (ECF) compartment is primarily a function of what?
   a. Osmotic forces
   b. Plasma oncotic pressure
   c. Antidiuretic hormone
   d. Hydrostatic forces

   ANS: A
   The movement of water between the ICF and ECF compartments is primarily a function of osmotic forces.

   PTS: 1 DIF: Cognitive Level: Remembering

5. In addition to osmosis, what force is involved in the movement of water between the plasma and interstitial fluid spaces?
   a. Oncotic pressure
   b. Buffering
   c. Net filtration
   d. Hydrostatic pressure

   ANS: D
   Water moves between the plasma and interstitial fluid through the forces of only osmosis and hydrostatic pressure, which occur across the capillary membrane. Buffers are substances that can absorb excessive acid or base to minimize pH fluctuations. Net filtration is a term used to identify fluid movement in relationship to the Starling hypothesis. Oncotic pressure encourages water to cross the barrier of capillaries to enter the circulatory system.

   PTS: 1 DIF: Cognitive Level: Remembering

6. Venous obstruction is a cause of edema because of an increase in which pressure?
   a. Capillary hydrostatic
   b. Interstitial hydrostatic
   c. Capillary oncotic
   d. Interstitial oncotic

   ANS: A
   Venous obstruction can increase the hydrostatic pressure of fluid in the capillaries enough to cause fluid to escape into the interstitial spaces. The remaining options are not causes of edema resulting from venous obstruction.

   PTS: 1 DIF: Cognitive Level: Remembering

7. At the arterial end of capillaries, why does fluid move from the intravascular space into the interstitial space?
   a. Interstitial hydrostatic pressure is higher than the capillary hydrostatic pressure.
   b. Capillary hydrostatic pressure is higher than the capillary oncotic pressure.
   c. Interstitial oncotic pressure is higher than the interstitial hydrostatic pressure.
   d. Capillary oncotic pressure is lower than the interstitial hydrostatic pressure.

   ANS: B

At the arterial end of capillaries, fluid moves from the intravascular space into the interstitial because capillary hydrostatic pressure is higher than the capillary oncotic pressure.

PTS: 1 DIF: Cognitive Level: Remembering

8. Low plasma albumin causes edema as a result of a reduction in which pressure?
   a. Capillary hydrostatic
   b. Interstitial hydrostatic
   c. Plasma oncotic
   d. Interstitial oncotic

   ANS: C
   Albumin is the plasma protein that is primarily responsible for the plasma oncotic pressure because it has the highest concentration. Therefore a low concentration of albumin would lower the plasma oncotic pressure, leading to edema.

   PTS: 1 DIF: Cognitive Level: Remembering

9. How are secretion of antidiuretic hormone (ADH) and the perception of thirst stimulated?
   a. Decrease in serum sodium
   b. Increase in plasma osmolality
   c. Increase in glomerular filtration rate
   d. Decrease in osmoreceptor stimulation

   ANS: B
   Secretion of ADH and the perception of thirst are primary factors in the regulation of water balance. Thirst is a sensation that stimulates water-drinking behavior. Thirst is experienced when water loss equals 2% of an individual's body weight or when osmotic pressure increases. A decrease in serum sodium would have the opposite effect. Increased glomerular filtration and decreased osmoreceptor stimulation would not lead to secretion of ADH and the feeling of thirst.

   PTS: 1 DIF: Cognitive Level: Remembering

10. Thirst activates osmoreceptors following an increase in which blood plasma component?
    a. Antidiuretic hormone
    b. Aldosterone
    c. Hydrostatic pressure
    d. Osmotic pressure

    ANS: D
    Thirst is experienced when water loss equals 2% of an individual's body weight or when osmotic pressure increases. Dry mouth, hyperosmolality, and plasma volume depletion activate *osmoreceptors* (neurons located in the hypothalamus that are stimulated by increased osmotic pressure). Increased antidiuretic hormone, aldosterone, and hydrostatic pressure do not activate osmoreceptors.

    PTS: 1 DIF: Cognitive Level: Remembering

11. A student asks about natriuretic peptides. Which statement by the professor is most accurate?
    a. Decrease blood pressure and increase sodium and water excretion.
    b. Increase blood pressure and decrease sodium and water excretion.

c. Increase heart rate and decrease potassium excretion.
d. Decrease heart rate and increase potassium excretion.

ANS: A
Natriuretic peptides are hormones that include atrial natriuretic peptide (ANP) produced by the myocardial atria, brain natriuretic peptide (BNP) produced by the myocardial ventricles, and urodilatin within the kidney. Natriuretic peptides decrease blood pressure and increase sodium and water excretion. They do not increase blood pressure, decrease sodium and water excretion, directly affect heart rate, or change potassium excretion.

PTS: 1 DIF: Cognitive Level: Remembering

12. When changes in total body water are accompanied by proportional changes in electrolytes, what type of alteration occurs?
a. Isotonic
b. Hypertonic
c. Hypotonic
d. Normotonic

ANS: A
Isotonic alterations occur when proportional changes in electrolytes and water accompany changes in total body water leaving osmolality unchanged. Hypertonic changes develop when the osmolality of the ECF is elevated higher than normal. Hypotonic changes occur when the osmolality of the ECF is lower than normal. Normotonic is not a description of changes in body water.

PTS: 1 DIF: Cognitive Level: Remembering

13. Which enzyme is secreted by the juxtaglomerular cells of the kidney when circulating blood volume is reduced?
a. Angiotensin I
b. Angiotensin II
c. Aldosterone
d. Renin

ANS: D
When circulating blood volume or blood pressure is reduced, *renin*, an enzyme secreted by the juxtaglomerular cells of the kidney, is released in response to sympathetic nerve stimulation and decreased perfusion of the renal vasculature. Renin stimulates the formation of angiotensin I, which is an inactive polypeptide, In the presence of angiotensin-converting enzyme, angiotensin I is transformed into angiotensin II, which is a potent vasoconstrictor. Aldosterone promotes sodium and water reabsorption by the kidneys.

PTS: 1 DIF: Cognitive Level: Remembering

14. A patient in the hospital has hypernatremia. What condition should the healthcare professional assess for?
a. Syndrome of inappropriate antidiuretic hormone
b. Hypersecretion of aldosterone
c. Brief bouts of vomiting or diarrhea
d. Excessive diuretic therapy

ANS: B
Hypernatremia occurs because of (1) inadequate free water intake, (2) inappropriate administration of hypertonic saline solution (e.g., sodium bicarbonate for treatment of acidosis during cardiac arrest), (3) high sodium levels as a result of oversecretion of aldosterone (as in primary hyperaldosteronism), or (4) Cushing syndrome (caused by the excess secretion of adrenocorticotropic hormone [ACTH], which also causes increased secretion of aldosterone). The other options do not result in hypernatremia. The healthcare professional should assess the patient for hypersecretion of aldosterone.

PTS: 1 DIF: Cognitive Level: Applying

15. A patient has a serum sodium level of 165 mEq/L. The healthcare professional explains that the clinical manifestations of confusion, convulsions, cerebral hemorrhage, and coma are caused by what mechanism?
    a. High sodium in the blood vessels pulls water out of the brain cells into the blood vessels, causing brain cells to shrink.
    b. High sodium in the brain cells pulls water out of the blood vessels into the brain cells, causing them to swell.
    c. Low sodium in the blood vessels pulls potassium out of the brain cells, which slows the synapses in the brain.
    d. Low sodium in the blood vessels draws chloride into the brain cells followed by water, causing the brain cells to swell.

    ANS: A
    A normal serum sodium level is 135 to 145 mEq/L so this patient's level is high. Hypernatremia causes manifestations by pulling water out of the brain cells into the blood vessels.

    PTS: 1 DIF: Cognitive Level: Applying

16. What does vomiting-induced metabolic alkalosis cause?
    a. Retained sodium to bind with the chloride
    b. Hydrogen to move into the cell and exchange with potassium
    c. Retention of bicarbonate to maintain the anion balance
    d. Hypoventilation to compensate for the metabolic alkalosis

    ANS: C
    When vomiting with the depletion of ECF and chloride (hypochloremic metabolic alkalosis) causes acid loss, renal compensation is not effective; the volume depletion and loss of electrolytes (sodium [Na^+], potassium [K^+], hydrogen [H^+], chlorine [Cl^-]) stimulate a paradoxic response by the kidneys. The kidneys increase sodium and bicarbonate reabsorption with the excretion of hydrogen. Bicarbonate is reabsorbed to maintain an anionic balance because the ECF chloride concentration is decreased. Metabolic alkalosis will not lead to retained sodium, hydrogen movement into the cell, or hypoventilation.

    PTS: 1 DIF: Cognitive Level: Remembering

17. The pathophysiologic process of edema is related to which mechanism?
    a. Sodium depletion
    b. Decreased capillary hydrostatic pressure
    c. Increased plasma oncotic pressure

d. Lymphatic obstruction

ANS: D
The pathophysiologic process of edema is related to an increase in the forces favoring fluid filtration from the capillaries or lymphatic channels into the tissues. The most common mechanisms are increased capillary hydrostatic pressure, decreased plasma oncotic pressure, increased capillary membrane permeability and lymphatic obstruction, and sodium retention.

PTS: 1 DIF: Cognitive Level: Remembering

18. Why is insulin used to treat hyperkalemia?
a. Stimulates sodium to be removed from the cell in exchange for potassium
b. Binds to potassium to remove it through the kidneys
c. Transports potassium from the blood into the cell along with glucose
d. Breaks down the chemical components of potassium, inactivating it

ANS: C
Insulin promotes the uptake of K^+ by stimulating the Na^+-K^+-ATPase pump. It does not stimulate the removal of sodium from the cell nor does it bind to K^+ to excrete it. The Na^+-K^+-ATPase pump does facilitate movement of K^+ into liver and muscle cells along with glucose to regulate blood glucose after eating.

PTS: 1 DIF: Cognitive Level: Remembering

19. A major determinant of the resting membrane potential necessary for the transmission of nerve impulses is the ratio between what?
a. Intracellular and extracellular Na^+
b. Intracellular and extracellular K^+
c. Intracellular Na^+ and extracellular K^+
d. Intracellular K^+ and extracellular Na^+

ANS: B
The ratio of K^+ in the ICF to K^+ in the ECF is the major determinant of the resting membrane potential, which is necessary for the transmission and conduction of nerve impulses, for the maintenance of normal cardiac rhythms, and for the skeletal and smooth muscle contraction. This is not true of the other options.

PTS: 1 DIF: Cognitive Level: Remembering

20. During acidosis, the body compensates for the increase in serum hydrogen ions by shifting hydrogen ions into the cell in exchange for which electrolyte?
a. Oxygen
b. Sodium
c. Potassium
d. Magnesium

ANS: C
In states of acidosis, hydrogen ions shift into the cells in exchange for intracellular fluid potassium; hyperkalemia and acidosis therefore often occur together. This is not true of the other options.

PTS: 1 DIF: Cognitive Level: Remembering

21. A healthcare professional is caring for four patients. Which patient should the professional assess for hyperkalemia?
    a. Hyperparathyroidism
    b. Vomiting
    c. Renal failure
    d. Hyperaldosteronism

    ANS: C
    Hyperkalemia should be investigated when a history of renal disease, massive trauma, insulin deficiency, Addison disease, use of potassium salt substitutes, or metabolic acidosis exists. Hyperparathyroidism might lead to hyperphosphatemia. Vomiting is frequently associated with potassium depletion. Hyperaldosteronism also can lead to potassium wasting.

    PTS: 1 DIF: Cognitive Level: Applying

22. In hyperkalemia, what change occurs to the cells' resting membrane potential?
    a. Hypopolarization
    b. Hyperexcitability
    c. Depolarization
    d. Repolarization

    ANS: A
    In hyperkalemia, the cells' resting membrane potential becomes more positive (i.e., changes from –90 to –80 mV) and the cell membrane is *hypopolarized* (i.e., the inside of the cell becomes less negative or partially depolarized).

    PTS: 1 DIF: Cognitive Level: Knowledge

23. A patient's chart indicates Kussmaul respirations. The student asks the healthcare professional what this is caused by. What response by the professional is most accurate?
    a. Anxiety leads to Kussmaul respirations and is a cause of respiratory acidosis.
    b. A compensatory measure is needed to correct metabolic acidosis.
    c. Diabetic ketoacidosis is leading to metabolic acidosis.
    d. More oxygen is necessary to compensate for respiratory acidosis.

    ANS: B
    Deep, rapid respirations (Kussmaul respirations) are indicative of respiratory compensation for metabolic acidosis. Anxiety would lead to respiratory alkalosis as carbon dioxide is blown off by the lungs. Kussmaul's respirations may be seen in diabetic ketoacidosis, but they do not diagnose it. Kussmaul's respirations are not present in respiratory acidosis.

    PTS: 1 DIF: Cognitive Level: Comprehension

24. A healthcare provider notes that tapping the patient's facial nerve leads to lip twitching. What electrolyte value is correlated with this finding?
    a. K^+: 2.8 mEq/L
    b. K^+: 5.4 mEq/L
    c. Ca^{++}: 8.2 mg/dL
    d. Ca^{++}: 12.9 mg/dL

    ANS: C

This patient has a positive Chvostek sign, which is indicative of hypocalcemia. The normal range of Ca^{++} is 9 to 10.5 mg/dL. 12.9 mg/dL indicates hypercalcemia. Potassium imbalances are not related.

PTS: 1 DIF: Cognitive Level: Analyzing

25. A patient has a history of excessive use of magnesium-containing antacids and aluminum-containing antacids. What lab value does the healthcare professional correlate to this behavior?
    a. Magnesium 1.8 mg/dL
    b. Phosphate 1.9 mg/dL
    c. Sodium 149 mEq/L
    d. Potassium 2.5 mEq/L

    ANS: B
    Excessive use of magnesium-containing and aluminum-containing antacids can lead to hypophosphatemia, which is a serum level less than 2 mg/dL. The magnesium level is normal, but magnesium is not related. The sodium level is high, but that is not related. The potassium level is low, but this is also not related.

    PTS: 1 DIF: Cognitive Level: Analyzing

26. A healthcare professional is caring for four patients. Which patient should the professional assess for hypermagnesemia as a priority?
    a. Hepatitis
    b. Renal failure
    c. Trauma to the hypothalamus
    d. Pancreatitis

    ANS: B
    Renal failure usually causes hypermagnesemia, in which magnesium concentration is greater than 2.5 mEq/L. Hypermagnesemia is not a result of the other options.

    PTS: 1 DIF: Cognitive Level: Applying

27. Physiologic pH is maintained at approximately 7.4 because bicarbonate (HCO_3) and carbonic acid (H_2CO_3) exist in what ratio?
    a. 20:1
    b. 1:20
    c. 10:2
    d. 10:5

    ANS: A
    The relationship between HCO_3 and H_2CO_3 is usually expressed as a ratio. When the pH is 7.4, this ratio is 20:1 (HCO_3:H_2CO_3). The other options do not accurately identify physiologic pH by the correct ratio of HCO_3 and H_2CO_3.

    PTS: 1 DIF: Cognitive Level: Knowledge

28. Where is two thirds of the body's water found?
    a. Interstitial fluid spaces
    b. Vascular system

c. Intracellular fluid compartments
d. Intraocular fluids

ANS: C
Two thirds of the body's water is in the intracellular fluid (ICF) compartment, and one third is in the extracellular fluid (ECF) compartment. The two main ECF compartments are the interstitial fluid and the intravascular fluid, which is the blood plasma. Other ECF compartments include the lymph and the transcellular fluids, such as the synovial, intestinal, biliary, hepatic, pancreatic, and cerebrospinal fluids; sweat; urine; and pleural, synovial, peritoneal, pericardial, and intraocular fluids.

PTS: 1 DIF: Cognitive Level: Knowledge

29. A healthcare professional just administered a large dose of insulin to a patient. Which electrolyte value should the professional monitor as a priority?
a. Sodium
b. Potassium
c. Calcium
d. Magnesium

ANS: B
Insulin contributes to the regulation of plasma potassium levels by stimulating the Na^+, K^+-ATPase pump, thereby promoting the movement of potassium into the cells. The professional should monitor this patient's potassium level as a priority. The other electrolytes are not directly influenced by insulin administration.

PTS: 1 DIF: Cognitive Level: Applying

30. Why does increased capillary hydrostatic pressure result in edema?
a. Losses or diminished production of plasma albumin
b. Inflammation resulting from an immune response
c. Blockage within the lymphatic channel system
d. Sodium and water retention

ANS: D
Increased capillary hydrostatic pressure can result from venous obstruction or sodium and water retention. The other options do not accurately describe the cause of edema related to increased capillary hydrostatic pressure.

PTS: 1 DIF: Cognitive Level: Knowledge

31. A patient's electrocardiogram (ECG) shows tall, peaked T waves. What lab value or assessment would the healthcare professional correlate with this finding?
a. Positive Chvostek sign
b. Serum potassium 6.7 mEq/L
c. Nausea and vomiting
d. Serum sodium 138 mEq/L

ANS: B
Tall peaked T waves on an ECG are indicative of hyperkalemia. Normal potassium is 3.5 to 5.0 mEq/L. A positive Chvostek sign is indicative of hypocalcemia. Nausea and vomiting are not related.

PTS: 1 DIF: Cognitive Level: Analyzing

MULTIPLE RESPONSE

1. Which groups are at risk for fluid imbalance? *(Select all that apply.)*
   a. Women
   b. Infants
   c. Men
   d. Obese persons
   e. Older adults

   ANS: B, D, E
   Kidney function, surface area, total body water, and the hydrophobic nature of fat cells all contribute to the increased risk for fluid imbalance among obese individuals, infants, and older adults. Gender alone is not a risk factor for fluid imbalance.

   PTS: 1 DIF: Cognitive Level: Knowledge

2. A patient is admitted to the hospital with dehydration. For which signs or symptoms would the healthcare professional assess? *(Select all that apply.)*
   a. Moist mucous membranes
   b. Weak pulses
   c. Tachycardia
   d. Polyuria
   e. Weight loss

   ANS: B, C, E
   Symptoms of dehydration include weak pulses, tachycardia, and weight loss among others. Moist mucus membranes are normal and indicate normal fluid balance. Polyuria would indicate either a disease state or fluid volume overload.

   PTS: 1 DIF: Cognitive Level: Applying

3. What are the causes of hypocalcemia? *(Select all that apply.)*
   a. Repeated blood administration
   b. Pancreatitis
   c. Decreased reabsorption of calcium
   d. Hyperparathyroidism
   e. Kidney stones

   ANS: A, B
   Blood transfusions are a common cause of hypocalcemia because the citrate solution used in storing whole blood binds with calcium. Pancreatitis causes a release of lipases into soft-tissue spaces; consequently, the free fatty acids that are formed bind calcium, causing a decrease in ionized calcium. The other options are not recognized causes of hypocalcemia.

   PTS: 1 DIF: Cognitive Level: Knowledge

4. A patient is admitted with hyponatremia. For which clinical manifestations would the healthcare professional assess? *(Select all that apply.)*

a. Headache
b. Seizures
c. Paranoia
d. Confusion
e. Lethargy

ANS: A, B, D, E
Behavioral and neurologic changes characteristic of hyponatremia include lethargy, headache, confusion, apprehension, seizures, and coma. Paranoia is not associated with hyponatremia.

PTS: 1 DIF: Cognitive Level: Applying

5. A patient has been diagnosed with hypercalcemia. Which manifestations does the healthcare professional assess for? *(Select all that apply.)*
   a. Diarrhea
   b. Calcium-based kidney stones
   c. ECG showing narrow T waves
   d. Lethargy
   e. Bradycardia

   ANS: B, D, E
   Fatigue, weakness, lethargy, anorexia, nausea, and constipation are common. Behavioral changes may occur. Impaired renal function frequently develops, and kidney stones form as precipitates of calcium salts. A shortened QT segment and depressed widened T waves also may be observed on the ECG, with bradycardia and varying degrees of heart block.

   PTS: 1 DIF: Cognitive Level: Applying

6. A patient's serum potassium level is 2.7 mEq/L. Which clinical manifestations does the healthcare professional assess for? *(Select all that apply.)*
   a. Paralytic ileus
   b. Sinus bradycardia
   c. Atrioventricular block
   d. Dry mucous membranes
   e. Tetany

   ANS: A, B, C
   Normal potassium level is 3.5 to 5.0 mEq/L so this patient has hypokalemia. A variety of dysrhythmias may occur, including sinus bradycardia, atrioventricular block, paroxysmal atrial tachycardia, and paralytic ileus. The other options are not related to hypokalemia.

   PTS: 1 DIF: Cognitive Level: Analyzing

7. A third of the body's fluid is contained in the extracellular interstitial fluid spaces that include what? *(Select all that apply.)*
   a. Urine
   b. Intraocular fluids
   c. Lymph
   d. Blood plasma
   e. Sweat

   ANS: A, B, C, E

Two thirds of the body's water is in the intracellular fluid (ICF) compartment, and one third is in the extracellular fluid (ECF) compartments. The two main ECF compartments are the interstitial fluid and the intravascular fluid, such as the blood plasma. Interstitial ECF compartments include the lymph and the transcellular fluids, such as the synovial, intestinal, biliary, hepatic, pancreatic, and cerebrospinal fluids; sweat; urine; and pleural, synovial, peritoneal, pericardial, and intraocular fluids.

PTS: 1 DIF: Cognitive Level: Knowledge

8. An imbalance of potassium can produce which dysfunctions? *(Select all that apply.)*
   a. Weakness of skeletal muscles
   b. Cardiac dysrhythmias
   c. Smooth muscle atony
   d. Visual impairment
   e. Hearing loss

   ANS: A, B, C
   Symptoms of hyperkalemia vary, but common characteristics are muscle weakness or paralysis and dysrhythmias with changes in the ECG. A wide range of metabolic dysfunctions may result from hypokalemia. Neuromuscular excitability is decreased, causing skeletal muscle weakness, smooth muscle atony, and cardiac dysrhythmias. Potassium imbalances do not produce visual or hearing problems.

   PTS: 1 DIF: Cognitive Level: Knowledge

9. Which statements regarding total body water (TBW) are *true*? *(Select all that apply.)*
   a. During childhood, TBW slowly decreases in relationship to body weight.
   b. Gender has no influence on TBW until old age.
   c. Men tend to have greater TBW as a result of their muscle mass.
   d. Estrogen plays a role in female TBW.
   e. Older adults experience a decrease in TBW as a result of decreased muscle mass.

   ANS: A, C, D, E
   During childhood, TBW slowly decreases to 60% to 65% of body weight. At adolescence, the percentage of TBW approaches adult proportions, and gender differences begin to appear. Men eventually have a greater percentage of body water as a function of increasing muscle mass. Women have more body fat and less muscle as a function of estrogens and therefore have less body water. With increasing age, the percentage of TBW declines further still. The decrease is caused, in part, by an increased amount of fat and a decreased amount of muscle, as well as by a reduced ability to regulate sodium and water balance.

   PTS: 1 DIF: Cognitive Level: Knowledge

10. The calcium and phosphate balance is influenced by which three substances? *(Select all that apply.)*
    a. Parathyroid hormone
    b. Vasopressin
    c. Thyroid hormone
    d. Calcitonin
    e. Vitamin D

ANS: A, D, E
Three hormones regulate calcium and phosphate balance: parathyroid hormone (PTH), vitamin D, and calcitonin. Vasopressin and thyroid hormone do not influence calcium and phosphate balance.

PTS: 1 DIF: Cognitive Level: Knowledge