1. Urinary System, General

a. Label the figure by placing the numbers of the structures in the spaces by the correct labels.

- 7 Aorta
- 2 Inferior vena cava
- 5 Hilum
- 6 Kidney
- 4 Renal artery
- 1 Renal vein
- 8 Ureter
- 9 Urethra
- 3 Urinary bladder

b. Write the names of the organs that match the functions in the spaces at the right.

1) Stores urine temporarily.  
   - Urinary bladder

2) Produces urine.  
   - Kidneys

3) Carries urine from the body.  
   - Urethra

4) Carries urine from the kidneys.  
   - Ureters

5) Maintains composition and volume of body fluids.  
   - Kidneys
2. Kidneys

a. Write the names of the structures that match the statements in the spaces at the right.

1) Outer layer containing renal corpuscles.
2) Region containing renal pyramids.
3) Flattened cavity continuous with ureter.
4) Receptacles surrounding renal papillae.
5) Thin layer of connective tissue enveloping kidney.
6) Arterial capillaries in renal corpuscle.
7) Functional units of the kidneys.
8) U-shaped portion of renal tubule.
9) Part of renal tubule joined to glomerular capsule.
10) Part of renal tubule joined to a collecting duct.
11) Formed of modified cells at point of contact of distal tubule and afferent arteriole.

b. Label the figure by placing the numbers of the structures in the spaces by the correct labels.

1 2 3 4 5 6 7 8 9

Cortex
Medulla
Pelvis
Calyces

Renal capsule
Glomerulus
Nephrons
Loop of Henle
Proximal convoluted tubule
Distal convoluted tubule

Juxtaglomerular apparatus

4 2 6 1 3 7 5 8 9

Calyx
Renal capsule
Renal column
Renal cortex
Renal medulla
Renal papilla
Renal pelvis
Renal pyramid
Ureter
3. Urine Formation

a. Write the words that complete the sentences in the spaces at the right.

A decrease in the glomerular filtration rate causes the ____1____ apparatus to secrete __2__, which triggers the ____3____-____4____ mechanism. The end product of these reactions is ____5____, which increases systemic blood pressure by ____6____ arterioles, stimulating ____7____ secretion by the posterior pituitary, and stimulating ____8____ secretion by the adrenal cortex.

b. Write the terms that match the statements in the spaces at the right.

1) Passage of water and solutes from glomerulus into glomerular capsule.
2) Plasma component that cannot pass through glomerular pores.
3) Force producing filtration.
4) Fluid in glomerular capsule.
5) Recovery of needed materials from filtrate into the blood.
6) Volume of filtrate formed per day.

**Filtration**

**Proteins**

**Glomerular blood pressure**

**Filtrate**

**Tubular reabsorption**

180 liters
7) Method of transport of sodium ions.  

| Mostly active transport |
| Osmosis |
| Active transport |
| Mostly passive electro-chemical attraction |

8) Method of transport of water.  

| Water |

9) Method of transport of glucose.  

10) Method of transport of chloride ions.  

11) Substance reabsorbed that concentrates the urine.  

12) Passage of substances from blood into the filtrate.  

13) Actively secreted ion.  

14) Passively secreted ion.  

c. Indicate whether each statement is true (T) or false (F).

- T Urine contains waste and excessive materials removed from the blood.
- T Urine formation depends upon maintenance of the blood pressure within the glomeruli.
- T Most of the filtrate volume is reabsorbed.
- T Negatively charged ions and positively charged ions are electrochemically attracted to each other.
- T The active reabsorption of sodium ions increases the rate of water reabsorption by osmosis.

4. Maintenance of Blood Plasma Composition  

a. Write the terms that match the statements in the spaces at the right.

1) Hormone promoting water reabsorption.  

| Antidiuretic hormone |
| Aldosterone |

2) Hormone promoting reabsorption of Na⁺.  

| Aldosterone |
| Calcitonin |
| Parathyroid hormone |

3) Hormone promoting secretion of K⁺.  

4) Hormone decreasing blood level of Ca²⁺.  

5) Hormone increasing blood level of Ca²⁺.  

6) Three nitrogenous wastes in urine.  

b. Indicate whether each statement is true (T) or false (F).

1) F Cellular activity does not affect plasma composition.
2) T Plasma composition is changed by the work of kidneys.
3) F Electrolytes are totally reabsorbed into the blood.
4) T About 99% of water in the filtrate is reabsorbed.
5) F Water is lost from the body only in urine.
6) T Urine volume is reduced when water intake is curtailed.
7) T Perspiring heavily may reduce the volume of urine.
8) T Electrolyte balance is largely maintained by the active reabsorption of positively charged ions.
9) F Nephrons remove all nitrogenous wastes from the blood.
10) T Urea is the most abundant nitrogenous waste in urine.
11) F Urea is formed by the kidneys from amine groups.
12) T Buffers are chemicals in body fluids that either combine with or release hydrogen ions.
13) F The production of carbon dioxide by metabolizing cells tends to make the blood more alkaline.
14) **T** Kidneys help to regulate the pH of body fluids by secreting excess hydrogen ions into the filtrate.

15) **T** Water and electrolyte balance in body fluids is essential for normal cell functioning.

16) **T** ADH is released by the posterior pituitary gland when the water concentration of the blood is reduced.

17) **F** Aldosterone is secreted by the adrenal cortex when the concentration of $K^+$ in the blood is reduced.

18) **T** ADH increases the permeability of the distal tubules and collecting ducts to water.

19) **T** Electrolyte concentrations in the blood affect the movement of water into cells by osmosis.

5. **Excretion of Urine**

a. Write the terms that match the statements in the spaces at the right.

1) Carry urine to urinary bladder. ____________________________

2) Provides temporary storage of urine. ____________________________

3) Muscle in wall of urinary bladder. ____________________________

4) Carries urine from urinary bladder. ____________________________

5) Method of urine transport by ureters. ____________________________

6) Type of muscle composing the internal urethral sphincter. ____________________________

7) Type of muscle composing the external urethral sphincter. ____________________________

8) Type of muscle in walls of ureters. ____________________________

b. Write the words that complete the sentences in the spaces at the right.

The accumulation of ___1___ stretches the urinary bladder wall, which triggers the ___2___ reflex. This reflex causes rhythmic involuntary contractions of the ___3___ muscle and opens the involuntarily controlled ___4___ urethral sphincter. If the voluntarily controlled ___5___ urethral sphincter is relaxed, ___6___ occurs.

6. **Characteristics of Urine**

Indicate whether each statement is true (T) or false (F).

1) **T** The color of urine is due to the presence of urochrome.

2) **T** The pH of urine is usually slightly acidic.

3) **F** Normal urine is never alkaline.

4) **T** Urine has a specific gravity greater than 1.000.

5) **T** Normal urine does not contain proteins or hemoglobin.
## 7. Disorders of the Urinary System

Write the names of the disorders matching the statements in the spaces at the right.

1) Inflammation of the glomeruli. ________________
2) Inflammation of the urinary bladder. ________________
3) Inflammation of nephrons and renal pelvis. ________________
4) Excessive urine production. ________________
5) Kidney stones. ________________
6) Inflammation of the urethra. ________________
7) Deposits of uric acid in the renal pelvis. ________________
8) Characterized by uremia. ________________
9) Characterized by protein in the urine. ________________

### 8. Clinical Applications

**a.** A 60-year-old woman comes to the clinic with severe edema of her lower legs and feet. A diuretic is prescribed, and she is placed on a salt-free diet. She is also advised to take a 30-minute walk each morning and afternoon and to elevate her feet higher than her head for 20-minute periods morning and afternoon. Explain how the diuretic will reduce her edema. **The diuretic counters the action of ADH to increase the excretion of water. As the concentration of water in blood decreases, more interstitial fluid is reabsorbed into the blood and then excreted by the kidneys.**

Explain how the salt-free diet will help reduce her edema. **Decreasing salt intake decreases the osmotic pressure of body fluids and reduces blood volume which helps the removal of excessive interstitial fluid.**

Explain how elevating her feet and walking will help reduce her edema. **Elevating the feet uses gravity to aid the return of venous blood and lymph, and contractions of leg muscles propels venous blood and lymph upward. The improved circulation of blood and movement of lymph aids removal of excess interstitial fluid.**

**b.** Explain why women develop cystitis more frequently than men. **The shorter female urethra makes it easier for bacteria to enter the urinary bladder.**