1. Lymph and Lymphatic Vessels
   a. Write the answers that match the statements in the spaces at the right.
      1) Fluid within tissue spaces. Interstitial fluid
         2) Fluid within lymphatic vessels. Lymph
         3) Smallest lymphatic vessels. Lymphatic capillaries
         4) Lymphatic vessels draining large body regions. Lymphatic trunks
         5) Forms wall of lymphatic capillaries. Endothelium
         6) Lymphatic duct draining upper right portion of the body. Right lymphatic duct
         7) Lymphatic duct draining rest of the body. Thoracic duct
         8) Prevent backflow of lymph. Valves in vessels
         9) Provide forces that move lymph. Skeletal muscle contractions
         10) Receives lymph from thoracic duct. Respiratory movements
         11) Empties into right subclavian vein. Left subclavian vein
         12) Vessels collecting interstitial fluid. Right lymphatic duct
         13) Source of interstitial fluid. Lymphatic capillaries
   b. Explain the value of the lymphatic system collecting interstitial fluid and returning it to the blood.
      Removal of interstitial fluid prevents edema and maintains the normal blood volume. Also, lymph nodes remove pathogens and cellular debris from lymph as it is carried back to the blood.

2. Lymphatic Organs
   Write the answers that match the statements in the spaces at the right.
   1) Grouped along larger lymphatic vessels. Lymph nodes
      2) Bilobed gland located above the heart. Thymus
      3) Large lymphatic organ located near stomach. Spleen
      4) Clustered at entrance to pharynx. Tonsils
      5) Organs that filter lymph. Lymph nodes
      6) Lymphatic organ that filters blood. Spleen
      7) Site of T cell differentiation. Thymus
      8) Vessels carrying lymph to lymph node. Afferent vessels
      9) Vessels carrying lymph from lymph node. Efferent vessels
      10) Intercept pathogens entering pharynx. Tonsils
      11) Contains a reserve supply of blood. Spleen
      12) Hormone that promotes T cell maturation. Thymosin
### 3. Nonspecific Resistance Against Disease

Match the type of nonspecific resistance with the statements.

<table>
<thead>
<tr>
<th>1) Mechanical barriers</th>
<th>3) Phagocytosis</th>
<th>5) Fever</th>
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<tbody>
<tr>
<td>2) Chemicals</td>
<td>4) Inflammation</td>
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</table>

1. Skin
2. Mucus
2. Lysozyme
1. Mucous membranes
2. Low pH
2. Gastric juice
2. Interferon
4. Produces edema
4. Pus formation
1. Flow of tears

- 1) Release of histamine
- 2) Attracts neutrophils and monocytes
- 3) Tissue macrophage system
- 4) Abnormally high body temperature
- 5) Increases local blood supply
- 1) Flow of saliva
- 3) Granulocytes and macrophages
- 1) Clot seals off pathogens
- 5) Speeds up body processes
- 3) Pathogens are engulfed and digested

### 4. Immunity

#### a. Indicate whether the following statements are true (T) or false (F).

1. Immunity is resistance against specific pathogens.  
2. Nonspecific resistance is directed against all pathogens.  
3. Immunity involves granulocytes and macrophages.  
4. Immunity requires lymphocytes to distinguish between self and nonself molecules.  
5. Antigens are foreign molecules that cause an immune response.  
6. Undifferentiated lymphocytes are produced in the spleen.  
7. All lymphocytes differentiate in the thymus gland.  
8. The majority of lymphocytes in the blood are T cells.  
9. Differentiation of lymphocytes occurs throughout life.  
10. T cells provide cell-mediated immunity.  
11. B cells provide antibody-mediated immunity.  
12. Lymphocyte receptors for specific antigens are inherited.  
13. Lymphocyte receptors are formed by contact with specific antigens.  
14. There are thousands of different types of B and T cells, and each type responds to a different specific antigen.  
15. Immunity depends upon lymphocytes whose receptors fit with a specific antigen.  
16. Immunity involves the interaction of lymphocytes, antigens, and macrophages.  
17. At any one time, either cell-mediated immunity or antibody-mediated immunity is at work; never both at the same time.  
18. Reproduction of differentiated lymphocytes occurs in lymphatic organs.
b. Write the words that complete the sentences describing cell-mediated immunity in the spaces at the right.

When a macrophage engulfs an antigen, part of it is carried to the cell surface and displayed. If a ____1____ cell's ____2____ can bind with the presented antigen, it does so and becomes activated. Activated ____3____ cells divide, rapidly forming a ____4____ of T cell subtypes that have the same antigen receptor. ____5____ secrete cytotoxins that rupture antigen-bearing plasma membranes and substances that recruit additional lymphocytes and ____6____. ____7____ secrete chemicals that help activate B cells and stimulate ____8____ by macrophages. When the pathogens have been destroyed, ____9____ secrete chemicals to slow and stop the immune response. The dormant ____10____ remain to recognize and start an immune response if the same ____11____ should ever reenter the body.

c. Write the words that complete the sentences describing antibody-related immunity in the spaces at the right.

B cells are activated when their antigen receptors bind to an ____1____. Activated B cells are stimulated to divide rapidly by ____2____, chemicals released from activated ____3____ cells that have receptors that can bind to the same antigen. The expanding B cell population is called a ____4____, which consists of ____5____ cells that produce antibodies and ____6____ cells that remain dormant. Once the pathogen has been eliminated, ____7____ slow and stop the immune response. If the same antigen later reenters the body, ____8____ start a rapid and intense ____9____ response.

d. Match the antibodies with the statements. More than one answer may apply.

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<tr>
<th>IgA</th>
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<th>IgE</th>
<th>IgG</th>
<th>IgM</th>
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5. Immune Responses

a. Match the immune responses with the statements.

1) Primary immune response 2) Secondary immune response

1__ Occurs when an antigen is encountered for the first time.
2__ Occurs in subsequent encounters with same antigen.
2__ Results from activation of memory cells.
2__ The more rapid and intense response.

b. Match the types of immunity with the statements.

1) Naturally acquired active 3) Naturally acquired passive
2) Artificially acquired active 4) Artificially acquired passive

3__ Immunity from antibodies received in mother’s milk.
2__ Immunity from a vaccine of dead pathogens.
1__ Immunity after having the disease and recovering.
4__ Immunity from injected antibodies.
2__ Immunity from DPT injections.
4__ Immunity from monoclonal antibodies.

6. Disorders of the Lymphatic and Immune Systems

Write the answers that match the statements in the spaces at the right.

1) Microscopic worms plug lymphatic vessels. Elephantiasis
2) An abnormally intense immune reaction. Allergy
3) HIV destroys helper T cells. AIDS
4) A tumor of lymphatic tissue. Lymphoma
5) Inflammation of the tonsils. Tonsillitis
6) Lymphocytes attack own body tissues. Autoimmune disease
7) Allergy attack that involves entire body. Anaphylaxis
8) Transmitted via blood exchanges and sexual intercourse. AIDS

7. Clinical Applications

a. Mary is a grocery checker with no evidence of heart disease. She complains that when she comes home from work, her feet and legs are swollen and sometimes painful. In the morning, the swelling is gone. How do you explain this? Standing for long hours causes interstitial fluid to pool in the legs and feet because, without muscle contractions, the lymphatic system cannot remove the excess fluid against the force of gravity. When lying down at night, the force of gravity is minimized enabling the removal of excess fluid.

b. The AIDS virus attacks helper T cells. Explain how this, in time, causes immunodeficiency. Immunity is gradually diminished as more and more helper T cells are destroyed since helper T cells are the only cells that can start an immune response.

c. Infants typically receive a series of three DPT injections (vaccinations) followed by a booster shot at four to six years of age. Explain the value of the booster shot. A booster shot tricks the immune system into “thinking” that an invasion of the pathogen has begun. Therefore, it triggers a powerful secondary immune response raising to new heights the level of protective antibodies in the blood.