Chapter 02: Immunology: Basic Principles and Applications in the Blood Bank
Howard: Basic & Applied Concepts of Blood Banking and Transfusion Practices, 4th Edition

MULTIPLE CHOICE

1. Select the cell involved in humoral immunity.
   a. Neutrophils
   b. T lymphocytes
   c. B lymphocytes
   d. Monocytes

   ANS: C
   B lymphocytes have the ability to transform into plasma cells to produce antibodies, which is considered a humoral response.

   DIF: Level 2 REF: p. 23

2. What process is described by opsonization?
   a. Lysis of cells
   b. Binding to cells or antigens
   c. Ingestion of cells
   d. Phagocytosis

   ANS: B
   Opsonization promotes phagocytosis by binding to cells or antigens.

   DIF: Level 1 REF: p. 35

3. Select the term that describes cells or tissue from a genetically different individual within the same species.
   a. Allogeneic
   b. Autologous
   c. Xenogeneic
   d. Autograft

   ANS: A
   Allogeneic cells or tissue come from a genetically different individual within the same species.

   DIF: Level 1 REF: p. 33

4. Select the substance that regulates the activity of other cells by binding to specific receptors.
   a. Cytokines
   b. Complement
   c. Immunoglobulins
   d. Anaphylatoxin

   ANS: A
   Cytokines are proteins secreted by cells that regulate the activity of other cells by binding to specific receptors.

DIF: Level 1 REF: p. 23

5. Which of the following is responsible for the activation of the classic pathway of complement?
   a. Bacteria
   b. Foreign proteins
   c. Virus
   d. Antibody bound to antigen

   ANS: D
   An antigen-antibody complex activates the classical complement cascade, whereas bacterial membranes activate the alternative pathway.

   DIF: Level 1 REF: p. 33

6. What biological molecules are considered the most immunogenic?
   a. Carbohydrates
   b. Lipids
   c. Proteins
   d. Enzymes

   ANS: C
   Protein molecules are the most immunogenic, followed by carbohydrates and lipids, which tend to be immunologically inert.

   DIF: Level 2 REF: p. 24

7. What part of the immunoglobulin molecule distinguishes the isotype?
   a. Light chain
   b. Heavy chain
   c. Kappa chain
   d. Lambda chain

   ANS: B
   The five distinctive heavy-chain molecules distinguish the class or isotype**.** Each heavy chain imparts characteristic features, which permit them to have unique biological functions.

   DIF: Level 2 REF: p. 24

8. Select the immunoglobulin class produced first in the primary immune response.
   a. IgG
   b. IgE
   c. IgA
   d. IgM

   ANS: D
   IgM antibodies are produced first, followed by the production of IgG antibodies.

   DIF: Level 1 REF: p. 28

9. In a serologic test, the term *prozone* is also known as:

a. equivalence.
b. antigen excess.
c. antibody excess.
d. serum-to-cell ratio.

ANS: C
Antibody excess is termed *prozone*, often leading to a false-negative reaction.

DIF: Level 1 REF: p. 38

10. What is the potential effect in a tube agglutination test if a red cell suspension with a concentration greater than 5% is used?
a. False negatives
b. False positives
c. Hemolysis
d. No effect

ANS: A
Antigen excess is termed *postzone* and will lessen the reaction, causing a false-negative.

DIF: Level 3 REF: p. 38

11. After adding antigen and antibody to a test tube, one large agglutinate was observed. How should this reaction be graded?
a. 2+
b. 3+
c. 4+
d. 0

ANS: C
One large agglutinate is graded a 4+ reaction.

DIF: Level 2 REF: p. 39

12. Select the portion of the antibody molecule that imparts the antibody's unique class function.
a. Constant region of the heavy chain
b. Constant region of the light chain
c. Variable region of the heavy chain
d. Variable region of the light chain

ANS: A
The heavy-chain constant region has the function of the class.

DIF: Level 1 REF: p. 26

13. What portion of the antibody molecule binds to receptors on macrophages and assists in the removal of antibody bound to red cells?
a. Fab fragment
b. Hinge region
c. Fc fragment
d. J chain

ANS: C

The Fc portion of the antibody binds to the macrophage, which then carries the antigen-antibody complex to the spleen for removal.

DIF: Level 1 REF: p. 26

14. Select the region of the antibody molecule responsible for imparting unique antibody specificity.
    a. Variable region
    b. Constant region
    c. Hinge region
    d. Fc fragment

    ANS: A
    The variable region is the unique antigen-binding site that gives each antibody its specificity.

    DIF: Level 1 REF: p. 26

15. What immunoglobulin class is capable of crossing the placenta?
    a. IgM
    b. IgA
    c. IgE
    d. IgG

    ANS: D
    Only IgG can cross the placenta as a result of IgG receptor binding sites on placental cells.

    DIF: Level 1 REF: p. 26

16. What immunoglobulin class reacts best at room temperature at immediate-spin?
    a. IgM
    b. IgA
    c. IgE
    d. IgG

    ANS: A
    IgM is a large immunoglobulin with multiple binding sites that is detectable at room temperature and the immediate-spin phase.

    DIF: Level 2 REF: p. 27

17. An antigen that originates from the individual is termed:
    a. autologous.
    b. allogeneic.
    c. hapten.
    d. immunogen.

    ANS: A
    Autologous is a term that refers to cells or tissue from self.

    DIF: Level 1 REF: p. 33

18. Which of the following will cause an antigen to elicit a greater immune response?

a. Small antigen size
b. Composed largely of carbohydrates
c. Size greater than 10,000 daltons
d. Similarity to the host

ANS: C
Antigens will elicit a better immune response if they are larger than 10,000 daltons, are foreign to the host, and are made of proteins.

DIF: Level 1 REF: p. 25

19. Extravascular destruction of blood cells occurs in the:
a. blood vessels.
b. lymph nodes.
c. spleen.
d. thymus.

ANS: C
Extravascular destruction of blood cells is initiated by macrophage interaction with IgG molecules attached to red cells that transport the red cells to the spleen for clearance.

DIF: Level 2 REF: p. 35

20. An antibody identified in the transfusion service appeared to be reacting stronger following the second exposure to an antigen from a transfusion. The most likely explanation of this observation is:
a. affinity maturation of the immunoglobulin molecule.
b. anamnestic response.
c. isotype switching.
d. All of the above

ANS: D
Genetic changes in the variable region, stimulation of memory B cells, and class switching contribute to the increased strength and specificity of an antibody following the second exposure to an antigen.

DIF: Level 3 REF: p. 29

21. Which of the following components in the complement cascade mediates the lysis of the target cells?
a. C1qrs
b. C4a, C3a, and C5a
c. C5 to C9
d. C3a and C3b

ANS: C
The membrane attack complex includes the C5 to C9 proteins that mediate lysis of the target cell.

DIF: Level 2 REF: p. 34

22. Which of the following requires adjustment in order to enhance the reaction of an antibody *in vitro*?
    a. Temperature above 37° C
    b. Speed of the centrifuge above the calibrated settings
    c. Increase the concentration of red cells in the test system
    d. Increase the incubation time in the incubator

    ANS: D
    Increasing incubation time is effective in increasing antibody reactions; however, optimal temperatures, centrifugation, and antigen concentrations are normally not altered when performing routine transfusion service testing.

    DIF: Level 3 REF: p. 37

23. Hemolysis was observed at room temperature when testing a patient's serum with reagent red cells used for screening. When this test was repeated using the patient's plasma, no hemolysis was observed. What was the most likely explanation for the different reactions?
    a. The plasma sample was collected incorrectly.
    b. The serum sample was contaminated.
    c. Complement activation was inhibited by calcium in the plasma sample.
    d. The serum sample was fresher.

    ANS: C
    Complement can be activated by some red cell antibodies; however, fresh serum samples are necessary to observe this reaction. Plasma samples contain calcium to inhibit the coagulation cascade, which also will inhibit complement activation.

    DIF: Level 3 REF: p. 33

24. Which immunoglobulin class is impacted by the zeta potential in a hemagglutination test?
    a. IgM
    b. IgG
    c. IgA
    d. IgE

    ANS: B
    IgG is a small molecule that cannot span the distance between red cells suspended in saline. The zeta potential prevents direct agglutination with IgG molecules.

    DIF: Level 2 REF: p. 37

25. When testing for the A antigen in a patient, what would you use to perform the test?
    a. Patient's plasma and commercial A red cells
    b. Commercial A cells and anti-A
    c. Patient's red cells and anti-A
    d. None of the above

    ANS: C
    For antigen testing, antigens are on the red cell; antibodies are in the antisera (commercial antibodies).

    DIF: Level 2 REF: p. 40

26. A technologist added 4 drops of a 5% red cell suspension instead of the required 1 drop to a hemagglutination test. What is the potential consequence to the test results?
    a. False-positive
    b. False-negative
    c. Hemolysis due to complement activation
    d. Test results are not affected

    ANS: B
    Postzone occurs when the concentration of antigen exceeds the number of antibodies present. The amount of agglutinates formed under these circumstances is also suboptimal and diminished.

    DIF: Level 3 REF: p. 38

MATCHING

Select the immunoglobulin class from the list below that best fits the characteristic described. Each class can be used more than once.

a. IgA
b. IgM
c. IgG
d. IgE

1. Found in secretions, such as breast milk
2. Able to cross the placenta
3. Associated with intravascular cell destruction
4. Associated with allergic reactions and mast cell activation
5. Efficient in activation of the complement cascade
6. Has the highest serum concentration
7. Associated with immediate-spin *in vitro* reactions
8. Has the highest number of antigen binding sites

1. ANS: A DIF: Level 2
2. ANS: C DIF: Level 2
3. ANS: B DIF: Level 2
4. ANS: D DIF: Level 2
5. ANS: B DIF: Level 2
6. ANS: C DIF: Level 2
7. ANS: B DIF: Level 2
8. ANS: B DIF: Level 2

Select the term from the list below that best fits the definitions.

a. Kappa
b. Epitope
c. Hinge region
d. Isotype
e. Idiotype

9. Variable region of an immunoglobulin

10. Imparts flexibility to the immunoglobulin molecule
11. Part of the antigen that the immunoglobulin binds to
12. The type of immunoglobulins determined by the heavy chain
13. One of the two types of light chains

9. ANS: E DIF: Level 1
10. ANS: C DIF: Level 1
11. ANS: B DIF: Level 1
12. ANS: D DIF: Level 1
13. ANS: A DIF: Level 1