

## Chapter 1: Immunology: Basic Principles and Applications in the Blood Bank

### Test Bank

---

#### 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. 2

2. Opsonization is a term to describe what process?
  - 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. 14

3. Select the term that is associated with the B-cell response to antigens.
  - a. Humoral immunity
  - b. Cellular immunity
  - c. Innate immunity
  - d. Nonspecific immunity

ANS: A

B cells produce antibody, a humoral response.

DIF: Level 2      REF: p. 2

4. Select the substance that regulates the activity of other cells by binding to specific receptors.
- Cytokines
  - Complement
  - Immunoglobulins
  - 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. 2

5. Which of the following is responsible for the activation of the classic pathway of complement?
- Bacteria
  - Foreign proteins
  - Virus
  - 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. 13

6. The major histocompatibility complex is located on chromosome 6 and is important in all the following immune functions *except*:
- recognition of nonself.
  - graft rejection.
  - hemolysis.
  - coordination of cellular and humoral immunity.

ANS: C

The major histocompatibility complex codes for molecules on all nucleated tissues and cells to allow for immune recognition and response to foreign antigens.

DIF: Level 2      REF: p. 19

7. A poor response to platelet transfusion that can be caused by antibodies to human leukocyte antigens is known as:
- nonresponders.
  - refractoriness.
  - immune activation.
  - responders.

ANS: B

Blood components that contain leukocytes can increase the immune response to human leukocyte antigens, which may decrease the effectiveness of platelet transfusion, known as refractoriness.

DIF: Level 2      REF: p. 19

8. In a lymphocytotoxicity test, cells that take on the dye:
- do not recognize a human leukocyte antigen.
  - recognize a red cell antibody.
  - are not affected by complement.
  - are recognized by a specific antibody.

ANS: D

A specific antigen-antibody complex in the lymphocytotoxicity test is detected by membrane damage, which allows the cells to become permeable to dye.

DIF: Level 2      REF: p. 21

9. In a serologic test, the term *prozone* is also known as:
- equivalence.
  - antigen excess.
  - antibody excess.
  - serum-to-cell ratio.

ANS: C

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

DIF: Level 1      REF: p. 17

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

ANS: A

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

DIF: Level 3      REF: p. 17

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

ANS: C

One large agglutinate is graded a 4+ reaction.

DIF: Level 2      REF: p. 18

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

ANS: A

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

DIF: Level 1      REF: p. 4

13. What portion of the antibody molecule binds to receptors on macrophages and assists in the removal of antibody bound to red cells?
- Fab fragment
  - Hinge region
  - Fc fragment
  - 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. 5

14. Select the region of the antibody molecule responsible for imparting unique antibody specificity.
- Variable region
  - Constant region
  - Hinge region
  - Fc fragment

ANS: A

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

DIF: Level 1      REF: p. 5

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. 6

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. 6

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. 2

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. 3

19. Extravascular destruction of blood cells occurs in the:
- blood vessels.
  - lymph nodes.
  - spleen.
  - 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. 5

20. It was observed that 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 is:
- affinity maturation of the immunoglobulin molecule.
  - anamnestic response.
  - isotype switching.
  - 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 2      REF: p. 8

21. In the complement cascade, lysis of the target cell is mediated by which of the following components?
- C1qrs
  - C4a, C3a, and C5a
  - C5 to C9
  - 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. 12

22. In order to enhance the reaction of an antibody *in vitro*, it may be necessary to adjust which of the following?
- Temperature above 37° C
  - Speed of the centrifuge above the calibrated settings
  - Increase the concentration of red cells in the test system
  - 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. 15

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?
- The plasma sample was collected incorrectly.
  - The serum sample was contaminated.
  - Complement activation was inhibited by calcium in the plasma sample.
  - 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. 18

24. Which class of HLA antigens would be typed when matching patient and donors for platelet transfusion?
- Class I only
  - Class II only
  - Class I and II
  - Classes I, II, and III

ANS: A

Class I antigens are found on the surface of platelets; however, class II are not.

DIF: Level 2      REF: p. 21

25. The mixed lymphocyte culture (MLC) is a procedure that has been used in HLA testing to determine:
- Class I HLA antigen determination.
  - Class II HLA antigen determination.
  - HLA antibody identification.
  - compatibility testing for tissue typing.
  - B and D.

ANS: E

The mixed lymphocyte culture (MLC) was an *in vitro* procedure used to determine tissue compatibility and D (class II) typing that has been largely replaced by molecular typing and flow cytometer techniques.

DIF: Level 2      REF: p. 22

26. A patient's record indicated that he had a history of an antibody to HPA-1a. What is the significance of this antibody if this patient requires a platelet transfusion?
- The patient would require HPA-1a negative platelets, which are relatively rare.
  - Transfusion of HLA-matched platelet donors would yield a better response.
  - Washed platelets are necessary to avoid antibody interference.
  - No testing is necessary because the frequency of HPA-1a positive donors is very rare.

ANS: A

Anti-HPA-1a is a platelet antibody that would react with about 98% of the population, requiring the search for a relatively rare negative donor. In order for platelets to be successfully transfused, HPA-1a negative platelets should be transfused.

DIF: Level 3      REF: p. 23

27. HLA matching between the donor and recipient is important for progenitor cell transplantation to avoid:
- graft versus host disease (GVHD).
  - graft rejection.
  - transfusion reactions.
  - A and B.

ANS: D

HLA typing is essential to avoid GVHD and rejection in HPC transplants.

DIF: Level 2      REF: p. 23



## 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 |