Part I. Clinical Applications

1. Mrs. Carlyle is pregnant for the first time. Her blood type is Rh negative, her husband is Rh positive, and their first child has been determined to be Rh positive. Ordinarily, the first such pregnancy causes no major problems, but the baby is born blue and cyanotic.

   A. What is this condition, a result of Rh incompatibility, called?

   B. Why is the baby cyanotic?

   C. Because this is Mrs. Carlyle’s first pregnancy, how can you account of the baby’s problems. Assume that there has been no fetal blood leakage to the mother.

   D. Assume that the baby was born pink and healthy. What measures should be taken to prevent the previously described situation from happening in a second pregnancy and an Rh-positive baby?

2. Cancer patients being treated with chemotherapy drugs designed to destroy rapidly dividing cells are monitored closely for changes in their RBC and WBC counts. Why?

3. A person with type B blood has been involved in an accident and excessive bleeding necessitates a blood transfusion. Due to an error by a careless laboratory technician, the person is given type A blood. Explain what will happen.
Part II

Complete the following description of the components of blood by writing
the missing words in the answer blanks.

1. In terms of its tissue classification, blood is classified as a
   because it has living blood cells, called , sus-

2. 2. in a nonliving fluid matrix called . The “fibers”
    of blood only become visible during .

3. 3.

4. If a blood sample is centrifuged, the heavier blood cells
   become packed at the bottom of the tube. Most of this com-
   pacted cell mass is composed of , and the volume of
   blood accounted for by these cells is referred to as the .
   The less dense rises to the top and constitutes about
   45% of the blood volume. The so-called “buffy coat,” com-
   posed of and , is found at the junction between
   the other two blood elements. The buffy coat accounts for
   less than % of blood volume.

5. 5.

6. 6.

7. Blood is scarlet red in color when it is loaded with ;
   otherwise, it tends to be dark red.

8. 8.

9. 10.

For each true statement, insert . If any of the statements are false, correct
the underlined term by inserting the correction in the answer blank.

12. White blood cells (WBCs) move into and out of blood vessels
    by the process of .

13. An abnormal decrease in the number of WBCs is .

14. When blood becomes too acidic or too basic, both the respiratory
    system and the may be called into action to restore it to its
    normal pH range.

15. The normal pH range of blood is .

16. The cardiovascular system of an average adult contains
    approximately liters of blood.

17. The only WBC type to arise from lymphoid stem cells is the .

18. An abnormal increase in the number of white blood cells is .

19. The normal RBC count is .

20. Normal hemoglobin values are in the area of % of the
    volume of whole blood.

21. An anemia resulting from a decreased RBC number causes the
    blood to become more viscous.

22. Phagocytic agranular WBCs are .
Using the key choices, identify the cell type(s) or blood elements that fit the following descriptions. Insert the correct term or letter response in the spaces provided.

**Key Choices**

A. Red blood cell  
B. Megakaryocyte  
C. Eosinophil  
D. Basophil  
E. Monocyte  
F. Neutrophil  
G. Lymphocyte  
H. Formed elements  
I. Plasma

1. Most numerous leukocyte
2. ____________________ 3. ____________________ 4. Granular leukocytes
5. Also called an erythrocyte; anucleate
6. ____________________ 7. Actively phagocytic leukocytes
8. ____________________ 9. Agranular leukocytes
10. Fragments to form platelets
11. (A) through (G) are examples of these
12. Increases during allergy attacks
13. Releases histamine during inflammatory reactions
14. After originating in bone marrow, may be formed in lymphoid tissue
15. Contains hemoglobin
16. Primarily water, noncellular; the fluid matrix of blood

**Monocyte**

17. Increases in number during prolonged infections
18. Least numerous leukocyte
19. ____________________ 20. Also called white blood cells (#19–23)
21. ____________________ 22. ____________________

Rank the following lymphocytes from 1 (most abundant) to 5 (least abundant) relative to their abundance in the blood of a healthy person.

24 Lymphocyte  
25 Basophil  
26 Neutrophil  
27 Eosinophil  
28 Monocyte

29 Check (✓) all the factors that would serve as stimuli for erythropoiesis.

Hemorrhage  
Living at a high altitude  
Aerobic exercise  
Breathing pure oxygen
Correctly complete the following table concerning ABO blood groups.

<table>
<thead>
<tr>
<th>Blood Type</th>
<th>Agglutinogens or antigens</th>
<th>Agglutinins or antibodies in plasma</th>
<th>Can donate blood to type</th>
<th>Can receive blood from type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Type A</td>
<td>A</td>
<td>anti-A</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Type B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Type AB</td>
<td></td>
<td></td>
<td>AB</td>
<td></td>
</tr>
<tr>
<td>4. Type O</td>
<td>none</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

13. What blood type is the *universal donor*? __________________________

14. The *universal recipient*? __________________________

**Physical Characteristics of Blood**

15. Blood is *(thinner? thicker?) than water and is therefore *(more? less?) viscous.*

Complete the statements below that describe the physical characteristics of blood.

16. Blood has a temperature of about ______ °C, a normal pH range of ______ to ______,

and its salt concentration is ______ percent.

17. Blood constitutes about ______ % of total body weight. Its volume in an average-sized

male is ______ to ______ liters, and ______ to ______ liters in an average-sized

female.

**Components of Blood** *(pages 378–379)*

18. Blood is composed of two portions, __________________________

(cells and cell-like structures) and __________________________ (liquid containing dissolved

substances). The former composes about ______ % of the volume of blood and the

latter about ______ %.

19. Water constitutes approximately ______ % of the plasma while other solutes, most of

which by weight are proteins, constitute about ______ % of the plasma.

20 Name two differences between leukocytes and erythrocytes.

a. __________________________

b. __________________________
Erythrocytes appear as ________________ discs averaging about ______ in diameter.

Erythrocytes (have? lack?) a nucleus and organelles.

The pigment within the cytoplasm of an RBC, which is responsible for the red color of whole blood, is called ________________. It constitutes approximately $33\%$ of the cell weight and functions to carry ________________ and ________________.

Test your knowledge of erythrocyte function by answering these questions

Hemoglobin transports about $23\%$ of the body’s total carbon dioxide, a waste product of metabolism.

A hemoglobin molecule consists of a protein called globin, which is composed of four ________________ chains plus four nonprotein pigments called ________________.

A biconcave disc has a (greater? lesser?) surface area for its volume than a cube of the same volume.

Erythrocytes (do not? do?) consume any of the oxygen that they transport.

It has been estimated that each erythrocyte contains about (200? 280?) million hemoglobin molecules.

Red blood cells live only about ______ days.

A. 110  
B. 120  
C. 130  
D. 140

Which type of anemia is associated with an inability to produce intrinsic factor?

A. iron deficiency  
B. pernicious anemia  
C. hemorrhagic anemia  
D. hemolytic anemia  
E. aplastic anemia

Which cells are responsible for the secretion of antibodies?

A. basophils  
B. eosinophils  
C. T lymphocytes  
D. B lymphocytes (plasma cells)

Which of the following statements is NOT true?

A. Blood is more viscous than water.  
B. Blood makes up approximately 10% of body weight.  
C. The pH of blood is 7.35–7.45.  
D. In an average-sized male there are about 5–6 liters of blood.

An individual whose red blood cells lack both $\text{A}$ and $\text{B}$ antigens would possess which blood type?

A. A  
B. B  
C. AB  
D. O

Which of the following cells does NOT belong with the others?

A. basophil  
B. eosinophil  
C. monocyte  
D. neutrophil
Blood temperature is roughly _______ °C, and the blood pH averages _______.

a. 0 °C; 6.8  
b. 32 °C; 7.0  
c. 38 °C; 7.4  
d. 98 °C; 7.8

Which one of the following statements is correct?

a. Plasma contributes approximately 92 percent of the volume of whole blood, and H₂O accounts for 55 percent of the plasma volume.

b. Plasma contributes approximately 55 percent of the volume of whole blood, and H₂O accounts for 92 percent of the plasma volume.

c. H₂O accounts for 99 percent of the volume of the plasma, and plasma contributes approximately 45 percent of the volume of whole blood.

d. H₂O accounts for 45 percent of the volume of the plasma, and plasma contributes approximately 99 percent of the volume of whole blood.

The three primary classes of plasma proteins are:

a. antibodies, metalloproteins, lipoproteins  
b. serum, fibrin, fibrinogen  
c. albumins, globulins, fibrinogen  
d. heme, porphyrin, globin

Erythropoietin appears in the plasma when peripheral tissues, especially the kidneys, are exposed to:

a. extremes of temperature  
b. high urine volumes  
c. excessive amounts of radiation  
d. low oxygen concentrations

Antigens are contained (on, in) the ____________, while antibodies are found (on, in) the ____________.

a. plasma; cell membrane of RBC  
b. nucleus of the RBC; mitochondria  
c. cell membrane of RBC; plasma  
d. mitochondria; nucleus of the RBC

If you have type A blood, your plasma holds circulating ____________ that will attack ____________ erythrocytes.

a. anti-B antibodies; Type B  
b. anti-A antibodies; Type A  
c. anti-A antigens; Type A  
d. anti-A antigens; Type B

A person with type O blood contains:

a. anti-A and anti-B antibodies  
b. anti-O antibodies  
c. anti-A and anti-B antigens  
d. type O blood lacks antibodies altogether