In the last packet, we discussed antigens on the surface of red blood cells. Remember, antigens are found on the surface of every red blood cell. They determine the blood type. Also in the blood are antibodies. Antibodies are found in the blood plasma. Antibodies react to a specific antigen to create agglutination. Agglutination is the clumping of blood. See the picture to the right. That shows agglutination when an antibody in the blood comes in contact with a specific antigen.

Each blood type produces specific antibodies in the blood plasma. The antibodies are whatever antigens are NOT on the surface of blood cells. A positive blood has A and D antigen; therefore it has B antibody. A negative blood has A antigen; therefore it has B and D antibodies. B positive blood has B and D antigen; therefore it has A antibody. B negative blood has B antigen; therefore it has A and D antibody. O negative blood has no antigens; therefore, it has A, B, and D antibodies. O positive blood only has D antigen; therefore it has A and B antibodies. AB negative blood has A and B antigen; therefore it has D antibodies. AB positive blood has A, B, and D antigens (all of them); therefore it has no antibodies. The chart below describes this.

<table>
<thead>
<tr>
<th>Blood Type</th>
<th>Antigens</th>
<th>Antibodies</th>
</tr>
</thead>
<tbody>
<tr>
<td>A positive</td>
<td>A, D</td>
<td>B</td>
</tr>
<tr>
<td>A negative</td>
<td>A</td>
<td>B, D</td>
</tr>
<tr>
<td>B positive</td>
<td>B, D</td>
<td>A</td>
</tr>
<tr>
<td>B negative</td>
<td>B</td>
<td>A, D</td>
</tr>
<tr>
<td>O positive</td>
<td>D</td>
<td>A, B</td>
</tr>
<tr>
<td>O negative</td>
<td>none</td>
<td>A, B, D</td>
</tr>
</tbody>
</table>
Agglutination is the reason that certain blood types can only receive from some blood types and only give to some blood types. The antibodies in the blood plasma of that blood type determine what type of blood that person can receive. Whatever the antibodies in the blood plasma are, the person cannot get blood from anyone with those antigens. For instance, an A positive person has antibody B. Therefore, they cannot get blood from anyone with antigen B on the surface of their blood cells. This means if a person’s blood is A positive they cannot get blood from B positive, B negative, AB positive, and AB negative. Another instance, a B negative person has antibodies A and D. Therefore, they cannot get blood from anyone with antigen A and D on the surface of their blood cells. This means if a person’s blood is B negative they cannot get blood from A positive, A negative, AB positive, and AB negative. Because of this reason O negative is a universal donor because there are no antigens on the surface of the blood while AB positive is the universal receiver because there are no antibodies in their blood plasma. If a person is giving the wrong blood type, agglutination will occur which causes clumping of the blood and can lead to death.

Agglutination is what is used to determine blood types of people. Blood type testing uses three different types of antibody serums. They are called anti-A, anti-B, and anti-D. When these antibodies come into contact with antigens, it will clump or agglutinate. If that antibody serum causes the blood to clump then that blood has that antigen. From knowing what antigens are on the surface of the blood, you can determine the blood type. (See the chart above.) See below for examples of blood typing.

<table>
<thead>
<tr>
<th>AB positive</th>
<th>A, B, D</th>
<th>none</th>
</tr>
</thead>
<tbody>
<tr>
<td>AB negative</td>
<td>A, B</td>
<td>D</td>
</tr>
</tbody>
</table>

In this picture on anti-A has clumped. This means it only has antigen A. Therefore this blood is A negative.
In this picture, anti-B and anti-D shows clumping. Therefore, it has B and D antigen. This blood type is B positive.
Task #1

1. What is an antibody?

2. What is an antigen?

3. What type of antibodies does type A positive blood have?

4. What type of antibodies does type A negative blood have?

5. What type of antibodies does type B positive blood have?

6. What type of antibodies does type B negative blood have?

7. What type of antibodies does type AB positive blood have?

8. What type of antibodies does type AB negative blood have?

9. What type of antibodies does type O positive blood have?

10. What type of antibodies does type O negative blood have?

11. What is agglutination?

12. Why are blood antibodies and antigens essential to understand in terms of blood transfusions and receiving blood?

Task #2
1. What is the clotting of blood called?
   a. Agglutination
   b. Antigen
   c. Antibody
   d. Platelets

2. What antibodies are found in O negative blood?
   a. None
   b. All
   c. B
   d. B and D

3. What antibodies are found in A negative blood?
   a. All
   b. B and D
   c. A and D
   d. B

4. What antibodies are found in B negative blood?
   a. B
   b. A and B
   c. None
   d. A and D

5. What antibodies are found in AB negative blood?
   a. A
   b. D
   c. A and D
   d. B and A

6. What antibodies are found in B positive blood?
   a. B and D
   b. A and D
   c. A
   d. B and A

7. What antibodies are found in A positive blood?
   a. A
   b. A and D
   c. B and A
   d. B

8. What antibodies are found in O positive blood?
   a. A
   b. B and A
   c. None
   d. A and D

9. What antibodies are found in AB positive blood?
   a. All
   b. None
   c. D
   d. B and D

Task #3

Part 1: Look at the pictures below. Tell me what blood type that individual has.
Part 2: In a paragraph, explain what blood types B positive, O positive, and AB negative are able to receive. Once you have done this explain why it can only receive these blood types.