


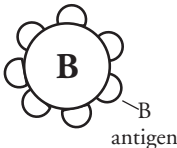
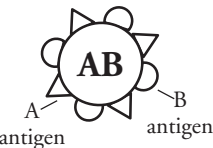



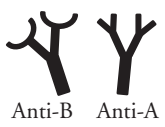

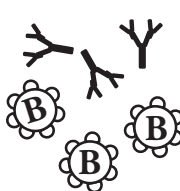


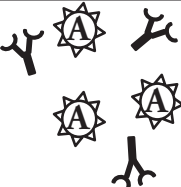



Human Blood Cell Typing

Why do blood types matter?

Why?

An organism monitors its internal environment to stay healthy and to carry out its life functions. Recognizing when foreign cells or other potentially harmful substances are in the body is one way to prevent damage and fight off infection by pathogens. Human red blood cells have a system for being recognized so that cells that belong in the body are kept safe while cells that do not belong can be destroyed.

Model 1 – Red Blood Cells and Antibodies

	Person with Blood Type A	Person with Blood Type B	Person with Blood Type AB	Person with Blood Type O
Cell with attached antigen				
Antibody produced	 Anti-B	 Anti-A	None	 Anti-B Anti-A
Cells in the presence of anti-A antibody				
Cells in the presence of anti-B antibody				

1. Blood types in the human population are characterized by the presence or absence of **antigens** on the surface of the red blood cells.
 - a. According to Model 1, how many blood types are found in the human population?
 - b. What shape is used in Model 1 to represent an A antigen?
 - c. What distinguishes a type A red blood cell from a type B red blood cell?

d. What distinguishes a type A red blood cell from a type O red blood cell?

2. Refer to the antibodies shown in Model 1.

a. How many different types of **antibodies** are shown?

b. Draw the antibody that is produced by a person with type A blood.

c. Which antigen would these antibodies fit?



3. Model 1 illustrates what happens when red blood cells are in the presence of the two antibodies. Write a description with your group that explains the **complementary** relationships between antigens and antibodies.

4. Refer to the second part of Model 1 that illustrates what happens when blood types are mixed. What happens to red blood cells when they are mixed with complementary antibodies?



5. The term **agglutination** is used to describe what happens to red blood cells when incompatible blood types are mixed.

a. Define agglutination according to Model 1.

b. What adverse effects might **agglutinated** red blood cells have on the body as they travel through veins, arteries, and capillaries?

Read This!

An **antibody** is a protein made by the immune system of an organism in response to an **antigen** (foreign substance). The ability to produce antibodies protects animals from infections due to viruses, bacteria, and other microbes. In the case of blood, the body recognizes other blood types as foreign. For example, a person with type A blood produces anti-B antibodies. This process depends upon the body's ability to recognize **self-** and **nonsself-antigens**.

6. Refer to Model 1.

- a. What antigens are self-antigens for a person with type A blood?
- b. What antigens are nonsself-antigens for a person with type A blood?
- c. What antigens are self-antigens for type AB blood?



7. A person with type A blood typically would not produce anti-A antibodies. Why is this a benefit to the person?

8. Suppose a person with type A blood needs a blood transfusion after an accident. Blood is received from a donor. Note that the antibodies in the donor blood are not significant. Only the antibodies in the recipient's blood will be considered. Use the diagrams in Model 1 to complete the following illustrations.

a. Draw the resulting mixture if the donor blood was also type A.

b. Draw the resulting mixture if the donor blood was type B.

c. Draw the resulting mixture if the donor blood was type O.

9. Why would hospitals and blood banks need to be absolutely certain that blood is typed correctly before being used for transfusions?
10. In emergency situations when the supply of blood runs short or when the need for blood is critical, type O blood can be given. Use your knowledge of blood typing from Model 1 to explain why persons with type O blood are called **universal donors**.
11. Persons with type AB blood, which is rarest, are often referred to as **universal recipients**. Use your knowledge from Model 1 to explain why people with type AB blood can receive any blood type.



12. People with type O blood are universal donors but can only receive blood from other type O donors. Use your knowledge of blood typing from Model 1 to explain why they cannot receive blood of any other types.

Extension Questions

13. People may need a replacement body part for a number of reasons. Currently, the main sources of “new” organs are other human beings. One of the first steps in determining if an available organ will be a match is to know the blood types of the donor and the recipient. Predict what would happen to the recipient and the new organ if this critical step was skipped or done incorrectly. Use the terms antigen and antibody in your explanation.

14. Another marker, **Rh factor**, is also used to type blood because it, too, is found on human red blood cells and causes antigen/antibody reactions. These reactions are separate from the so-called ABO reactions described in this activity. In the Rh-factor system, the Rh antigen is either present or absent, leading to designations of Rh-positive (Rh⁺, antigen present) or Rh-negative (Rh⁻, antigen absent). Thus, a person can be O⁺ or O⁻, A⁺ or A⁻, and so on. A person with O-negative blood can only receive O⁻ blood. Explain this limitation.