Artificial Blood Typing

Background:

Human blood may be classified according to the presence or absence of certain antigens or factors, that are attached to the surface of the red blood cells, or erythrocytes. Two of the antigens used in blood typing are known as A and B. A person whose red blood cells have only antigen A has type A blood, whereas a person whose red blood cells have only antigen B has type B blood. People who have both A and B antigens on their blood cells have type AB blood. Those whose blood cells have neither A nor B antigens have type O blood. The frequencies of these blood types are represented below:

Blood-Type Frequency In the United States:

Type	Percentage of Population
A	40%
B	10%
AB	4%
O	46%

Newton's Apple 3M

The plasma of each blood group contains a certain type or combination of antibodies. Antibodies are substances that attack antigens. Blood type A plasma contains anti-B antibodies, whereas blood type B plasma has anti-A antibodies. Anti-A antibodies attack red blood cells that have A antigens; anti-B antibodies attack those that have B antigens. The attacking antibodies bind to the red blood cells, causing them to agglutinate, or clump together. Type AB plasma has both A and B antigens and has neither type of antibody. Type O blood has neither A nor B antigens and contains both anti-A and anti-B antibodies. In transfusions, the blood types of the donor and recipient must be carefully matched because the transfusion of the wrong type of blood can be fatal to the recipient.

In this investigation, you will simulate human blood typing.

Research Problem:

How is a person’s blood type determined?

Materials:

Glass slide with two depressions
Simulated anti-A serum
Simulated anti-B serum
Simulated blood – types A, B, AB, O

Safety:

Use Universal Precautions when working with human fluids.
Dispose of blood and serum waste in the designated beakers.

Procedure:

1. Place two drops of the unknown blood from Bottle #1 in each of the two depressions in the glass slide. To the left depression, add 2 drops of anti-A serum; to the right depression, add 2 drops of anti-B serum.
2. Examine the substances in the two depressions for signs of clumping. Use the chart to determine blood type.

	Appearance of Clumping	
Blood Type	Anti-A Serum Left	Anti-B Serum Right
A	Yes	No
B	No	Yes
AB	Yes	Yes
O	No	No

3. Repeat the procedure for Bottles #2, #3, and #4. Record the information in an appropriate data table.

Data Table:

Discussion:

Bibliography:

Miller and Levine, Biology Laboratory Manual. Prentice-Hall, Inc. 2000

Artificial Blood Typing Teacher Instructions

Background:

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Preparation of Serum and Blood Samples:

Mix and pour into labeled dropper bottles. Red color may be added to artificial blood samples, but should not be added to serum.

Anti-A Serum

3 g sodium iodide in 100 ml distilled water

Anti-B Serum

3.4 g silver nitrate in 100 ml distilled water

Bottle #3 (type-A blood)

9.9 g lead nitrate in 150 ml distilled water

Bottle #1 (type-B blood)

6.3 g barium chloride in 150 ml distilled water

Bottle #4 (type-AB blood)

Equal parts, 50 ml each, of Bottles #1 and #3

Bottle #2 (type-O blood)

100 ml distilled water

Safety:

Use Universal Precautions when working with human fluids.

Procedure:

4. Place two drops of the unknown blood from Bottle #1 in each of the two depressions in the glass slide. To the left depression, add 2 drops of anti-A serum; to the right depression, add 2 drops of anti-B serum.
5. Examine the substances in the two depressions for signs of clumping. Use the chart to determine blood type.

	Appearance of Clumping	
Blood Type	Anti-A Serum Left	Anti-B Serum Right
A	Yes	No
B	No	Yes
AB	Yes	Yes
O	No	No

6. Repeat the procedure for Bottles #2, #3, and #4. Record the information in an appropriate data table.

Data Table:

Artificial Blood Typing Data

Bottle	Clumping on Left	Clumping on Right	Blood Type
1	No	Yes	B
2	No	No	O
3	Yes	No	A
4	Yes	Yes	AB

Discussion:

Students should discuss the clumping in relation to the serum and blood types that are mixed. Practical applications such as the type of blood for transfusion and the possibilities of clumping in the body should be considered. How is the simulation like or different from actual blood typing? Do students know their own blood type and the compatible donors for them? What blood types could they donate to without harm? Explain universal donor and universal recipient.

Extensions might include research into Rh factors of pregnant mothers and their babies, or tissue typing and transplant compatibility.

Bibliography:

Miller and Levine, Biology Laboratory Manual. Prentice-Hall, Inc. 2000