BLOOD TYPE

Introduction

All human blood has four major components and each serves a different purpose. **Red blood cells** carry oxygen from the lungs to cells and produce carbon dioxide as a waste product. **White blood cells** are important for the immune system as they circulate the body and destroy invading particles like viruses and bacteria. **Plasma** is the fluid part of blood that controls the amount of water in the blood as well as transporting waste. The **platelets** are what allows blood to clot when there is an injury.

While all blood has the same components, the blood type of each individual is dependent on genetics. The type depends on what **antigen** (a protein found on the surface of the red blood cell) and **antibody** (protein molecules found in the plasma) is found in the blood. The four types defined by the **ABO system** are A, B, AB and O:

Type	What is present
A	A antigens with B antibodies
B	B antigens with anti-A antibodies
AB	A and B antigens with no antibodies
O	No antigens with A and B antibodies

The other antigen that is found on the red blood cell is the **Rh factor**. When this antigen is present, it is known as being **Rh positive** and when it is missing, it is known as being **Rh negative**. This means that all humans fall under one of eight blood types:

ABO system	Blood type
A	A+ or A-
B	B+ or B-
AB	AB+ or AB-
O	O+ or O-

There is a test that can determine what someone's blood type is. The blood to be tested is mixed with different antibody solutions. **Agglutination** (clumping of the cells) will occur when antibodies react with

antigens. This testing is useful in the medical field when it comes to determining suitable transfusions as well as in law enforcement when it comes to analysing blood evidence at a crime scene.

Purpose

The purpose of this experiment is for students to use forensic analysis (blood typing) to determine which suspect attacked the victim.

Materials

- 3 cups *per group* at each station
- 3 toothpicks *per group* at each station
- 1 sample of blood at each station
- 4 pipettes per station
- 1 waste beaker per station
- A-antibodies serum per station
- B-antibodies serum per station
- Rh-antibodies serum per station
- 1 Marker per station

Notes:
There is a teacher document attached concerning how to set-up the samples.

Background information

Police have been called to the scene of a crime. Once arrived at the scene, they have found someone unconscious with a head wound being treated by paramedics. While going over the home looking for clues, police found blood on the front door. Several hours later, police found a weapon in an alley not far from the home with blood on it.

The forensic scientists took samples of blood from the weapon and front door. Both samples are human, but are still waiting on blood type. It's necessary to know the type in order to figure out if the blood on the door and weapon belong to the victim or the attacker.

After an investigation, the police have come up with two possible suspects. The investigators will have to determine the blood type of each suspect to either eliminate or condemn them.

Procedure

At each station, there is a cup of blood that corresponds to either the suspects, the victim, the door or the weapon.

1. Label three cups with: A, B and Rh.

2. Place 10 drops of blood in each cup.

3. Add 5 drops of A-antibodies into the A cup and stir for 10 seconds using a clean toothpick.

4. Add 5 drops of B-antibodies into the B cup and stir for 10 seconds using a clean toothpick.

5. Add 5 drops of Rh-antibodies into the Rh cup and stir for 10 seconds using a clean toothpick.

6. Record observations using a table.

7. Dispose of liquid from three cups into WASTE beaker.

8. Dispose of the three empty cups and toothpicks into appropriate trash/recycling bin.

9. Rotate to next station.

10. Repeat steps 1-9 until all stations are complete.

Caution: other groups will be using the same samples, so do not cross-contaminate the serums.

Data

Station Name	Reaction Anti-A	Reaction Anti-B	Reaction Anti-Rh	Blood Type

Results

1. According to the data, which suspect is guilty: _____

2. Justify your reasoning:

_____

_____

_____

3. Did the blood on the weapon match anyone? If so, who: _____

Notes for set-up

1. Label 5 cups as follows (they are the main "blood" that will be found at each station): suspect 1, suspect 2, victim, weapon, front door

2. Mix equal amounts of milk and water adding red and green food colouring until the mixture reaches a blood colour. Split this mixture into the five cups from step 1. The amount you create depends on how many groups will be going through each station. Have extra in case students spill.

3. For the blood types, depending on what you choose for stations, use this breakdown:

AB+ blood - Anti-A serum cup is vinegar - Anti-B serum cup is water - Anti-Rh serum cup is vinegar	**AB- blood** - Anti-A serum cup is vinegar - Anti-B serum cup is water - Anti-Rh serum cup is water
B+ blood - Anti-A serum cup is water - Anti-B serum cup is vinegar - Anti-Rh serum cup is vinegar	**B- blood** - Anti-A serum cup is water - Anti-B serum cup is vinegar - Anti-Rh serum cup is water
A+ blood - Anti-A serum cup is vinegar - Anti-B serum cup is water - Anti-Rh serum cup is vinegar	**A- blood** - Anti-A serum cup is vinegar - Anti-B serum cup is water - Anti-Rh serum cup is water
O+ blood - Anti-A serum cup is water - Anti-B serum cup is water - Anti-Rh serum cup is vinegar	**O- blood** - Anti-A serum cup is water - Anti-B serum cup is water - Anti-Rh serum cup is water

This way, the lab can be changed as often as necessary. It also allows for adding more suspects if you believe that 5 stations will be too short in terms of lab period.

All that is necessary is:
- the blood type of one suspect matches the blood type of the front door
- the blood type of the victim matches the blood type of found on the weapon

For example: weapon is A+, victim is A+, suspect 1 is O-, front door is O-, suspect 2 is B+

In terms of the cups students will use with the serum, something small is best, like a Dixie cup or a small plastic shot glass.