



# What's Your Type?

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Visitors perform a simulated blood test procedure. They perform control reactions and test reactions, then use their observations to determine the blood type of different suspects.

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**OBJECTIVES:** Visitors learn how blood type can be determined.  
Visitors learn to make inferences from observations.

## SCIENCE TOPICS

## PROCESS SKILLS

## VOCABULARY

Biochemistry

Comparing/Contrasting

antibody

Chemical Reactions

Controlling Variables

solution

Laboratory Techniques

Inferring

blood type

Solutions

Interpreting Data

red blood cell

Observing

protein



# What's Your Type?

## Procedure

1. Always wear safety goggles.
2. Rinse the well plate in the sink.
3. Add 8 drops of water to each well in the water row.
4. Add 8 drops of Antibody Type A solution to each well in the antibody row.
5. You will now perform the control reactions
  - \*Add 8 drops of Type O blood to each well in column O
  - \*Add 8 drops of Type A blood to each well in column A

What happens when Type O blood mixes with A antibodies?

What happens when Type A blood mixes with A antibodies?
6. You will now perform the test reactions
  - \*Add 8 drops of Suspect X blood to each well in column X
  - \*Add 8 drops of Suspect Y blood to each well in column Y
  - \*Add 8 drops of Suspect Z blood to each well in column Z
7. Closely observe the reactions in all the wells.

Which suspect(s) have type A blood? How do you know?
8. Rinse the well plate in the sink.

## How is blood type determined?



### A Closer Look:

In this experiment, you mixed chemical solutions to simulate a blood typing reaction. In blood typing, scientists use antibodies that bind to the proteins on the surface of red blood cells. Blood cells of different blood types have different proteins on their surfaces.

When Type A antibodies mix with Type A blood, the antibodies bind to the Type A proteins and cause the blood cells to clot. Since Type O blood does not have Type A proteins, there is no clotting reaction.

People can have Type O, Type A, Type B, or Type AB blood. By using blood type tests, forensic scientists and police officers can identify people who may have left blood at a crime scene.

For our simulation, the “Type A blood” solution contains red food coloring and iron. When the “Type A blood” reacts with the “Antibody Type A” solution, a new solid compound forms. This solid mimics the blood clot formed in forensic blood tests.

## MATERIALS

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- (with amounts to have on hand)
- KOH (potassium hydroxide) (keep 20g on hand)
- $\text{FeCl}_3 \cdot 5\text{H}_2\text{O}$  (ferric chloride hexahydrate) (keep 30g on hand)
- water
- red food color
- yellow food color
- well plate
- two 75mL squeeze bottles
- five 125mL squeeze bottles
- two one-liter bottles
- one 500 mL bottle

## Setup/Takedown Procedures

### ORIGINAL SETUP

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- Label the wellplate with white label "wellplate." Attach labels to indicate the water row (blue), antibody row (yellow), Type A column (white), Type O column (white), Suspect X column (green), Suspect Y column (green), Suspect Z column (green).
- Label one 75mL squeeze bottle "water" in blue.
- Label one 125mL squeeze bottle "antibody Type A" in yellow.
- Label two large squeeze bottles in white "Type A blood" and "Type O blood."
- Label three large squeeze bottles in green "Suspect X blood," "Suspect Y blood," and "Suspect Z blood."

### WEEKLY SETUP

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- Test reactions since stored solutions may degrade. Remake solutions as necessary (see Materials Prep).
- Check that colors of blood solutions are approximately the same tint. Adjust color by addition of red and/or yellow food coloring
- Prepare  $\text{FeCl}_3$  (ferric chloride) solution, water solution, and KOH (potassium hydroxide) solution if needed (see Materials Prep).

## DAILY SETUP

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- Set out the visitor instructions in a Plexiglas holder.
- Refill all squeeze bottles with appropriate solutions.
- On a tray lined with a white mat, set out the following:
  - Labeled squeeze bottles of Type A blood, Type O blood, Suspect X blood, Suspect Y blood, and Suspect Z blood.
  - Labeled squeeze bottles of water and Antibody Type A
  - wellplate
- Group the color-coded supplies together on the tray.

## DAILY TAKEDOWN

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- Rinse the wellplate. Use a paper towel to wipe out any rust in all wells.
- Rinse and wipe the tray, clean off all rust spots. Stubborn rust spots may be removed with vinegar.
- Cap all bottles and store upright in tub under counter.

## WEEKLY TAKEDOWN

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- Sponge out the tub.
- Rinse the wellplate. Use a paper towel to wipe out any rust in all wells. Stubborn rust spots may be removed with vinegar.
- Cap all bottles and store upright in tub.
- Rinse and wipe the tray, clean off all rust spots. Clean the tray and leave it at the station.

## RUNNING SUGGESTIONS

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- Wipe up any rust stains as they appear. Wipe out well plate as needed. Simple friction should be enough to remove rust.
- Suggest to visitors to hold the well plate up to the light to better detect reaction of Type A blood and antibody Type A solution.

## EXTENSIONS

- Discuss the importance of blood typing in medical practice. Using an inappropriate blood type in transfusions leads to complications since a patient's body will reject an incorrect blood type.
- Blood type is hereditary and distribution varies in different populations. For instance, among Americans Type O blood is most common, and Type AB blood is very rare. Among Japanese the four types Type O, Type A, Type B, and Type AB are almost evenly distributed.
- This simulation uses a replacement reaction to create a precipitate. The actual reaction is:



$\text{FeCl}_3$  and  $\text{KOH}$  are both soluble in water. But when iron replaces potassium, an insoluble compound is formed.

## Safety & Disposal

**Health: 3**  
**Flammability: 0**  
**Reactivity: 2**  
**Contact: 4**

Caution: Solid potassium hydroxide causes severe burns and may be fatal if swallowed. Wear goggles and gloves while using, and wash hands after use. See MSDS for further information.

**Health: 3**  
**Flammability: 0**  
**Reactivity: 2**  
**Contact: 4**

Caution: Solid ferric chloride hexahydrate is a skin irritant. Wear goggles and gloves while using, and wash hands after use. See MSDS for further information.

Unused solutions may be poured down sink drain. Follow standard lab procedures.

**MATERIALS PREP**

To prepare 0.6 M KOH (potassium hydroxide) solution:

**\*\*This solution is used for antibody Type A solution\*\***

**Caution: Solid potassium hydroxide causes severe burns and may be fatal if swallowed. Wear goggles and gloves while using, and wash hands after use. See MSDS for further information.**

1. Measure 300 mL water in a 1-liter beaker.
2. Weigh 16.83g KOH. Add it to the beaker. Stir to dissolve.
3. Add water to final volume of 500 mL.
4. Store in 500 mL bottle. Label should read "Antibody Type A, 0.6 M KOH."

To prepare 0.1 M FeCl<sub>3</sub> (ferric chloride) solution:

**\*\*This solution is used for Type A blood, Suspect Y blood, and Suspect Z blood\*\***

**Caution: Solid ferric chloride hexahydrate is a skin irritant. Wear goggles and gloves while using, and wash hands after use. See MSDS for further information.**

1. Measure 800 mL water in a 1-liter beaker.
2. Weigh 27.03g FeCl<sub>3</sub>•5H<sub>2</sub>O. Add it to the beaker. Stir to dissolve. This will make a bright yellow solution.
3. Add water to final volume of 1 liter.
4. Add red food color until solution appears "bloody."
5. Store in 1 liter bottle. Label should read "Type A blood, Suspect Y blood, Suspect Z blood, 0.1 M FeCl<sub>3</sub>."

To prepare water solution:

**\*\*This solution is used for Type O blood, Suspect X blood\*\***

1. Measure 1 liter of water in a 1-liter beaker.
2. Add yellow and red food coloring to match the color of the Type A blood solution prepared above. Use yellow generously and red sparingly.
3. Store in 1 liter bottle. Label should read "Type O blood, Suspect X blood."