PHLEBOTOMY

Essential Question: *What Is Blood Type?*

**Learning Targets:**

Students will:

- Explain blood typing and its importance.
- Use trial and error to determine if a patient can accept a transfusion based on their simplified blood type.
- Deal with frustration as they learn complex new content.

**Lesson Overview**

In this lesson, the YPs are introduced to the composition of human blood types (A, B, AB, and O) and the antibody factor. They will conduct a simplified lab simulation to determine matches of blood type before a blood transfusion. Identifying the correct blood type is very important in the health sciences, particularly in treating trauma and when conducting surgery.
Lesson Agenda

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Materials

- Young Allied Health Professional student packet
- Videos (to project)
  - 100 Greatest Discoveries: Blood Transfusions
  - What Are Blood Types
- Trials Before Transfusion lab materials (one per group)
  - 4 cups filled halfway with water
  - 4 empty cups
  - Red and blue food coloring
  - Sharpie pen
- Computer stations for the Blood Typing Game

FACILITATION NOTES

Videos. The videos in this lesson will help students build background knowledge about blood types and how blood type knowledge is used during blood transfusion. These videos are packed with vocabulary, and the information can seem complicated. Be sure you understand the content, which you can learn by reviewing the resources and materials in this lesson.

Lab Experience. The lab experience is designed to build understanding of human blood types—a complicated concept. Be prepared to go slowly and to perhaps think of multiple ways to explain the concepts, if students exhibit confusion.

Blood Typing Game. Play the Blood Typing Game yourself in advance and bookmark it on computers. It is a fun way to practice what was learned in the lab simulation. Can you keep the patient alive? You can find the Blood Typing Game here: http://www.nobelprize.org/educational/medicine/bloodtypinggame/. Students can work in pairs or alone.
  - A simplified game exists on the Red Cross site: http://www.redcrossblood.org/donating-blood/donor-zone/games/blood-type. If you
choose to use this version, be aware that the game requires flash, so test your system to ensure it is supported. This version can be supplemented with the following instructions (p. 1):
http://www.cbsd.org/cms/lib010/PA01916442/Centricity/Domain/1844/AP%20Biology%20Supporting%20Materials/Donor%20Match%20Blood%20Type%20Game.pdf. If you do not have computer stations to play the Blood Typing Game, you can have students complete the second page at this link as an alternative activity.

IN ADVANCE

☐ This lesson uses videos and online simulations. In advance, prep or reserve the necessary technology. Test video playback and web availability.
☐ Preview and load: <100 Greatest Discoveries: Blood Transfusions>
☐ Preview <What Are Blood Types>: https://www.youtube.com/watch?v=ttjn1jVACk8. The video introduces the 8 human blood types, what blood type means, and how this information influences blood transfusions. The video is 3:04 minutes in length.
☐ Preview the Lab Protocol: Blood Typing video. It shows a phlebotomist in action testing blood for blood type. This video can be found at https://www.youtube.com/watch?v=z1rRTnaWrMw. Show all 2:00 minutes of the video, as it will be needed for the game.
☐ Preview the career video: https://www.youtube.com/watch?v=ISpKAn1-6-g (1:04).

Vocabulary

<table>
<thead>
<tr>
<th>Content</th>
<th>Tier II</th>
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</thead>
<tbody>
<tr>
<td>agglutination, universal receiver, universal donor, Rh antigen</td>
<td>trials</td>
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Opening (5 min)

Feel the Blood Flow

*We’ve been learning a lot about our blood and its irreplaceable nature. We’ve learned that it is alive and is flowing through our veins. Can you feel it right now?*
1. **Invite** the YPs to stand up from their desks. Ensure each student is an arm’s length apart.
2. **Invite** them to feel their pulse.
3. **Tell** them to do jumping jacks. Time them for 45 seconds.
4. After returning to their seats, **have** the YPs feel their pulse.
5. **Ask:** Where do you feel the blood flow most? Your wrist? Your neck? Can you feel the heart pumping blood to your muscles? How did the bloody flow change before and after the jumping jacks?

At all times, your blood is flowing through your veins. During physical activity, your heart works harder to pump blood to the muscles being used. By checking your pulse after exercise, you can actually feel your blood flow!

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**Work Time**

**What’s a Blood Type? (15 min)**

*The staff in the emergency room stabilized our patient skateboarder and determined that surgery was needed to fix his leg. There is a lot that goes into preparing for surgery. The patient and his family have to go to a pre-admission testing appointment where they meet with the anesthesiologist (what do you think they do?), the nurse, and often a phlebotomist, who has a very important job. The phlebotomist is responsible for drawing our patient’s blood. That blood will be analyzed and typed to ensure that if something goes wrong during surgery, we have blood available in case we need to transfuse our patient.*

1. **Project** the video, *<100 Greatest Discoveries: Blood Transfusions>.*
   
   - This video offers background information on the life-saving breakthrough of blood typing and transfusions. If students have a hard time understanding the dangers of mismatching blood types during transfusion, here is a great visual aid (mute the background music): [https://www.youtube.com/watch?v=VgPdjIlb1tE](https://www.youtube.com/watch?v=VgPdjIlb1tE).
   - **Ask:** What happens when a transfusion fails? Based on what you saw, how would you describe agglutination? Why do we test a person’s blood type before a surgery?

**Trials Before Transfusion (30 min)**

**Modeling the Lab**

This lab is complicated, so take the time to model the process of mixing and recording results.
1. **Set out** four clear plastic cups labeled: O, A, B, and AB. Ensure the labels are high on the cups so they can be seen through the liquid. Mix the blood type cups in advance:

- Fill each cup about halfway with water.
- Leave one cup filled with clear water - this will be the ‘O’ cup.
- Put several drops of red food coloring in the ‘A’ cup and stir.
- Put several drops of blue food coloring in the ‘B’ cup and stir.
- Put equal amounts of red and blue in the ‘AB’ cup and stir (purple).
- There will now be a cup of clear water (Type O), a red water (Type A), a blue water (Type B), and a purple water (Type AB).

2. **Share:** *We just watched a video on blood types. In a moment, you will take on the role of a phlebotomist preparing a trauma patient for a blood transfusion. We do not want you to harm your patient! This demonstration should help clarify the complex topic of blood type compatibility (making sure blood types are the same) and prepare you for the lab.*

3. **Explain:** If I can pour one type into another and not change the color of the receiver, then the receiver can accept the donation—the transfusion will be successful!

   - **Hold up** type O and act as if you are about to pour type A into it. Pause.
   - **Ask:** What would happen if I poured A into O?
   - **Invite** a student to share.
   - **Listen for:** The clear water would change color, so type O cannot receive type A—*the transfusion would fail.*
   - **Model** combining a few of the samples and recording the information in the chart (see student packet).

*Now you will take on the role of a phlebotomist.*

Who can recap the procedure you will use as you test “blood types”? Who would like to share their first question about the procedure?

You are going to work with a colleague to decode the mystery of blood types using your critical thinking and problem solving skills. It is important to learn a person’s blood type before any surgery or transfusion.

**Ask:** Why is this important?

You are going to test various patients’ blood types to learn what kind of blood they can receive in an upcoming surgery. Remember, this is life or death, so stay focused as you collaborate with your partner.
1. **Distribute** the materials for the *Phlebotomist: Trials Before Transfusion Lab*.
   - Students will repeat an activity similar to what was modeled, recording their data.

2. As groups finish, have them discuss and answer the *Lab Questions*.

3. **Debrief**.
   - **Ask**: One of these blood types is called the **universal donor**. It can be given to any other blood type. Which type is the universal donor? Can you justify your thinking using your data?
   - **Listen for**: Type O is the universal donor because it can be added to all of the cups without changing the color of the water.
   - **Ask**: One of these blood types is called the universal receiver. It can receive all blood types. Which type is the universal receiver? Can you justify your thinking using your data?
   - **Listen for**: Type AB is the universal receiver because all types can be added to it without changing the color of the water.

4. **Watch** the video *What Are Blood Types?* ([https://www.youtube.com/watch?v=ttjn1jVAck8](https://www.youtube.com/watch?v=ttjn1jVAck8))

5. **Say**: Clearly, blood types are more complex than the demonstration we did in the lab. We made a simplified chart based on blood types, without thinking of the influence of the **Rh antigens**. Positive can accept positive and negative, while negative can only accept negative.

   **In summary**:
   - O can receive only O blood.
   - A can receive both A and O blood.
   - B can receive both B and O blood.
   - AB can receive all blood types and is the **universal receiver**.
   - O is the **universal donor**—it can give to any blood type.
   - **Note**: this experiment does not deal with positive and negative blood types, but is meant as an introduction to blood types.

**Blood Transfusion Game (20 min)**

*Young phlebotomist, are you ready for a life or death simulation? Use your new knowledge and your chart from the blood transfusion lab to help—and hopefully not hurt—your patient!*
1. **Project** the website:
   http://www.nobelprize.org/educational/medicine/bloodtypinggame/

2. **Hand** the YPs the prepared chart as a reference for the game.

3. **Walk** students through identifying the blood type of the patient, and then choosing what blood he/she can receive. This is a two-step process.

4. **Assign** the young professionals a colleague and a computer station.

5. **Provide** time for the young professionals to play the game.

6. **Remind** them to use their charts from the blood transfusion lab to assist them.

7. As they play the game, **challenge** them to complete the chart for matching donor and recipient blood types in their student packet so they can track their progress. If students are struggling to complete this chart, you can provide them with the answer key to assist:

   ![Blood Type Chart](chart.png)

   Note: If there are not enough computers for students to try this in pairs, consider projecting it and having the class problem solve together.

8. **Be prepared** to support struggling or frustrated pairs.

   - http://www.redcrossblood.org/donating-blood/donor-zone/games/blood-type provides an easier game (but requires flash).

9. **Circulate** and assist pairs as needed.
Closure (5 min)

Phlebotomist: Career Droplets

If the sight of blood won’t make you queasy or faint, the important work of the phlebotomist in the health care professions might be for you. You can gain certification and employment as a phlebotomist in less than a year after high school! Training programs are a mix of classwork and hands-on training—how else could you learn to draw blood and do all the lab testing? After the yearlong certification, you can work anywhere blood needs to be drawn in patient treatment. Phlebotomists can double their salary by continuing along a career ladder to become registered nurses, medical laboratory technicians, or clinical laboratory scientists.

Project: https://www.youtube.com/watch?v=ISpKAn1-6-g (1:04).

Let’s take a moment to look at this career using your three lenses. As you read through the statements, color the one’s that apply to you red. Select three elements about the career of phlebotomist that match your talents, interests or goals. As an alternative to this activity, consider having the YPs do a career line-up from 0-100 using the same statements on the student sheet.

- Remember, the idea is not to convince the YPs to become phlebotomists, but to help them think about their futures and transferable elements of careers available.
- A phlebotomist is considered an entry-level career due to its limited salary options.

  Discussion Extensions:
  - Why might people be interested in an entry-level career?
  - What is the difference between an entry-level job and an entry-level career? (Entry-level careers may allow students to gain experience in the Allied Health field as they work their way through college—or take advantage of an employer’s educational benefits to pursue further opportunities.)
Name:
Date:

PHLEBOTOMY: What Is Blood Type?

Today’s Learning Objectives:

I can:

☐ Explain blood typing and its importance.
☐ Use trial and error to determine if a patient can accept a transfusion based on their simplified blood type.
☐ Deal with frustration as I learn complex new content.

In this lesson, I will be introduced to the composition of human blood types (A, B, AB, and O) and the antibody factor. I will conduct a simplified lab simulation to determine matches of blood type before a blood transfusion. Identifying the correct blood type is very important in the health sciences, particularly in treating trauma and when conducting surgery.

Today’s Activities:

☐ What's a Blood Type?
☐ Trials Before Transfusion
☐ Blood Transfusion Game
☐ Career Droplets
New Terms

Instructions: Fill in the blanks with the correct term.

________________________________________________: a person who draws blood for diagnostic tests or to remove blood for treatment purposes.

________________________________________: a marker on a red blood cell that tells our immune system that something does not belong in our body.

Type A. This blood type has a marker known as "A."
Type B. This blood type has a marker known as "B."
Type AB. The blood cells in this type have both A and B markers.
Type O. This blood type has neither A nor B markers.

Phlebotomist: Trials Before Transfusion Lab

Adapted from NSF Focus! Lesson Are You My Type?

Materials:

☐ 4 small plastic cups of water
☐ 4 small empty plastic cups
☐ Red, blue, and purple food coloring
☐ Sharpie pen

Procedure:

1. Make a small cup of red water, label “Blood Type A”
2. Make a small cup of blue water, label “Blood Type B”
3. Make a small cup of purple water, label “Blood Type AB”
4. Pour a small amount of plain water into a cup, label “Blood Type O”
5. Pour a small amount of one of the blood types into an empty cup (recipient). Add a second blood type to it (donor), simulating a “blood transfusion.”
6. Notice the results and record on the data table.

➢ A color change indicates that the transfusion failed. (In a real blood transfusion, this failure would be evidenced by agglutination, or clumping, of the red blood cells.)
Trials Before Transfusion Lab Data Table & Lab Questions

<table>
<thead>
<tr>
<th>Blood Type</th>
<th>Receiver O</th>
<th>Receiver A</th>
<th>Receiver B</th>
<th>Receiver AB</th>
</tr>
</thead>
<tbody>
<tr>
<td>Donor O</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Donor A</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Donor B</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Donor AB</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Instructions:** Record change/no change. A color change indicates a failure. Highlight successful transfusions. Then, answer the questions below.

1. The “universal donor” is the blood type everyone can accept. Which blood type is this? Share your reasoning.

2. The “universal recipient” can accept all types of blood. Which blood type is this? Share your reasoning.

3. If a blood bank could only receive ONE type of blood, what do you think they would want? Why?

4. Why is it important to know an individual’s blood type?
**Blood Typing Game**

*Directions.* As you play the Blood Typing game, place a ✓ in the box for each matching blood type(s) for the donors and recipients in the chart below. One row, AB-, has been filled out for you. After completing the chart, answer the questions that follow.

<table>
<thead>
<tr>
<th>Blood Type of Donor</th>
<th>AB+</th>
<th>AB-</th>
<th>A+</th>
<th>A-</th>
<th>B+</th>
<th>B-</th>
<th>O+</th>
<th>O-</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood Type of Recipient</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

1. What transfusions were successful? How do you know?

2. What new challenges did you face with this game?
**Career Droplets**

**SELF**

- I am comfortable working directly with needles and blood.
- I am very detail-oriented, so I feel confident that I will make successful blood transfusions.
- I am good at calming others down, so I will be able to distract patients who might be afraid of getting their blood drawn.

**SECURITY**

- I like the idea of getting right in the laboratory after high school by completing a three weeks to six-month training program.
- I'm excited for the potential to double my salary as I gain experience as a phlebotomist. Median salary is about 30,000.
- I want to try an entry-level job to gain paid experience for future health science careers and studies.

**SOCIETY**

- I want to help people by making sure they get the transfusions they need to survive.
- I want to contribute to the growing field of research on blood and blood typing.