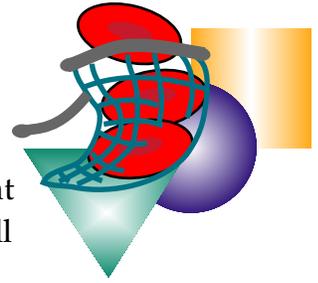


“P.L.E.P.: Parts of Blood”

Student Information Page 1A



Activity Introduction:

We’ve all seen blood when we get a cut or scrape; did you ever wonder what it’s made of? What does P.L.E.P. have to do with blood? In this activity, you’ll find out!

Activity Background:

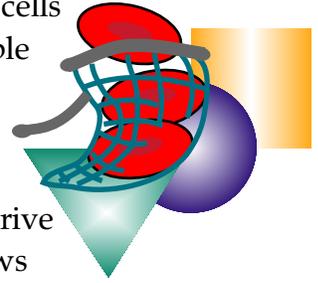
Blood has been called our most precious commodity. Without this life sustaining substance, oxygen would not be circulated throughout the body, waste products could not be removed, and our infection fighting abilities would be lost. While the importance of blood has been known for centuries, it was not until 1658, when Jan Swammerdam first discovered red blood cells, that its composition was finally revealed.

Blood is comprised of four main parts which include *Plasma*, *Leukocytes* (white blood cells), *Erythrocytes* (red blood cells), and *Platelets* (thrombocytes).

- **Plasma** is a pale yellowish colored liquid that carries blood cells, glucose, hormones, nutrients, enzymes, and waste products. Plasma is comprised of approximately 90% water. It accounts for a total of 55% of blood’s total composition.
- **Leukocytes** are also known as white blood cells, and they make up 1% of blood’s composition. These cells are responsible for fighting infection in the body. There are three types of leukocytes and each have a distinct function. These types are lymphocytes, granulocytes, and monocytes.
 - **Lymphocytes** primarily aid the immune system. There are two different kinds of lymphocytes which are T cells and B lymphocytes.
 - **T cells** direct the immune system to fend off infection.
 - **B lymphocytes** produce antibodies.
 - **Granulocytes** carry digestive enzymes. The three types are neutrophils, eosinophils, and basophils.
 - **Neutrophils** are responsible for killing bacteria.
 - **Eosinophils** destroy various parasites and are involved in allergic responses.
 - **Basophils** are capable of digesting micro organisms. These cells are responsible for allergy symptoms.



- **Monocytes** are the largest of the various white blood cells. These cells can transform into macrophages, which kill bacteria and are capable of digesting damaged cells.



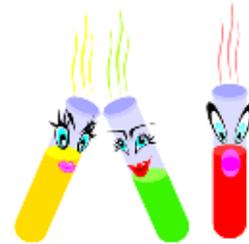
- **Erythrocytes** are also known as red blood cells; they are flat, disc-shaped cells that comprise 45% of blood's composition. These cells derive their red color from hemoglobin, an iron-containing protein that allows the cells to transport oxygen from the lungs to all parts of the body. The proportion of blood consisting of packed red blood cells is called *hematocrit*, which is written as a percentage by volume. For example, a hematocrit of 50 % means that there are 50 mL of red blood cells in 100 mL of blood.

- **Platelets (thrombocytes)**, play a significant role in blood clotting. These cell fragments have a sticky surface which allows them to bind together with fibrin molecules to form a clot.



Activity Materials: (per group)

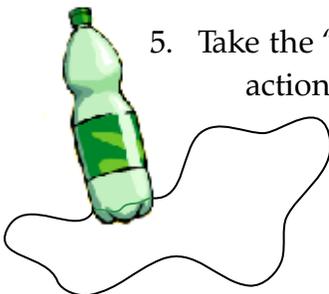
- 20 mL of simulated "blood" from sample A, B, and C
- 3 test tubes with stoppers
- 1 student "centrifuge"
- 1 Test tube rack
- 1 Copy *Student Information Page*
- 1 Copy *Student Data Page* (per student).



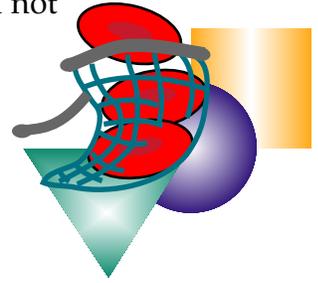
Activity Instructions:

Day 1

1. Gather your materials. Label the 3 test tubes Patient A, Patient B, and Patient C.
2. Put 20 mL of simulated blood from the Patient A container into the test tube labeled Patient A and place a stopper in the test tube.
3. Record your observations for Day 1 on your *Student Data Page* in Table 1. Use a ruler to measure the height of the "blood" in the test tube 9n millimeters. Record your data in Table 1.
4. Place the test tube in the "centrifuge" so that the stopper goes in first and close the lid.
5. Take the "centrifuge" outside and swing it around your head for 1 minute. This action is similar to what happens in a laboratory centrifuge. This action causes the "blood" to separate into layers. The heaviest layer containing erythrocytes will be at the bottom of the test tube. The middle layer will be made up of leucocytes and platelets and the top layer will contain the plasma.



- Bring the “centrifuge” back inside and remove the test tube being careful not to disturb the “blood”.
- Place the test tube into the test tube rack and let sit overnight. This will allow the “blood” to finish settling into layers.
- Repeat steps 2-7 for the blood from Patients B and C.



Day 2

- Record your observations for Day 2 for each test tube in Table 1 on your *Student Data Page*.
- Use a ruler to measure (in millimeters) the layers in each tube. Record these measurements in Table 1 on your *Student Data Page*.
- Calculate the *percentage of Red Blood Cells (erythrocytes)* in each test tube; divide the measurement for the bottom layer of “blood” by the total height of the “blood” in the tube and multiply by 100. Record your answer.
- Calculate the *percentage of plasma* in each test tube by dividing the measurement for the top layer of “blood” by the total height of the “blood” in the tube and multiply by 100.
- Determine the blood health of the patients using the Hematocrit Values table below..

HEMATOCRIT VALUES

<i>Normal Hematocrit (%)</i>		<i>Low Hematocrit (%)</i>		<i>High Hematocrit (%)</i>	
<i>Male</i>	<i>Female</i>	<i>Male</i>	<i>Female</i>	<i>Male</i>	<i>Female</i>
<i>42–54</i>	<i>35–46</i>	<i><42</i>	<i><35</i>	<i>>54</i>	<i>>46</i>

- Research the types of conditions associated with high and low percentages of erythrocytes.

