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LearnSmart Labs: Blood

General Lab Outline

Total Time: 2 hr, 15 min

I. Core Concepts: Blood (15 min)
II. Blood Smear and Differential White Cell Count (40 min)
III. Hematocrit (20 min)
IV. Hemoglobin Content (20 min)
V. Blood Typing Test (20 min)
VI. Final Summary Questions (10 min)
VII. Reports

Assessed Learning Outcomes

1. Core Concepts: Blood
    a. Recall that blood is composed of plasma and the formed elements
    b. Structure and function of the formed elements
        i. Recall the structure and function of red blood cells
        ii. Recall the structure and function of white blood cells
        iii. Recall the structure and function of platelets
        iv. Compare the structure and function of the formed elements
    c. Understand the basis of blood typing
        i. Recall the red blood cells are covered in antigens, and plasma contain antibodies for foreign antigens
        ii. Match blood types and antibodies
        iii. Explain when transfusion reactions occur
    d. Recall how to safely handle human blood
2. **Blood Smear and Differential White Cell Count**
    a. Pre-lab Briefing
        i. Recall the steps to perform a blood smear
        ii. Recall how to perform a differential white blood cell count
    b. Identify different white blood cells
        i. Identify platelets in a blood smear slide
        ii. Identify erythrocytes in a blood smear slide
        iii. Identify neutrophils in a blood smear slide
        iv. Identify lymphocytes in a blood smear slide
        v. Identify monocytes in a blood smear slide
        vi. Identify eosinophils in a blood smear slide
        vii. Identify basophils in a blood smear slide

c. Stimulation of Blood Smear and Differential White Cell Count
    i. Prepare a blood smear
        1. Add a drop of blood
        2. Smear the blood drop
        3. Let blood smear dry in the air
    ii. Stain the blood smear
        1. Add Wright's stain to blood smear
        2. Let Wright's stain react for a suitable time
        3. Add distilled water to the slide with stain
        4. Let the stain and water mixture react for a suitable time
        5. Rinse the stained blood smear
        6. Let the slide air dry
    iii. Perform the correct procedure without guidance
    iv. Dispose of materials contaminated with blood in biohazard container
    v. Perform a different count on prepared microscope slide
    vi. Differential cell count
        1. Count the correct number of neutrophils
        2. Count the correct number of lymphocytes
        3. Count the correct number of monocytes
        4. Count the correct number of eosinophils
        5. Count the correct number of basophils
    vii. Infer the patient's health problem from the results of the differential white cell count
d. Post-lab probing
    i. Explain the outcome if the stain acts for the wrong time
    ii. Identify the normal values of a differential's white blood cell count
    iii. Know the relationship between an abnormal differential white cell count and likely diseases

3. Hematocrit
    a. Pre-lab Briefing
        i. Recall how to prepare a blood sample for a hematocrit test
    b. Stimulation of Hematocrit Test
        i. Fill a capillary tube with blood
        ii. Seal capillary tubes
        iii. Separate blood and plasma in the centrifuge
        iv. Measure the hematocrit for one blood sample
        v. Test all 5 blood samples
        vi. Balance centrifuge
        vii. Recall how to place the capillary tubes in centrifuge
        viii. Infer whether test results indicate doping
        ix. Use safe blood handling practices
        x. Avoid cross-contamination samples

    c. Post-lab Probing
        i. Explain the purpose of a hematocrit test
        ii. Recall the normal hematocrit levels
4. Hemoglobin Content
    a. Pre-lab Briefing
        i. Recall how to prepare a blood sample for a hemoglobin test
    b. Simulation of Hemoglobin Test
        i. Test the three blood samples and positive and negative controls
        ii. Stir until all hemoglobin is out of the red blood cells
        iii. Measure the hemoglobin content
        iv. Use safe blood handling practices
        v. Avoid cross-contaminating samples
        vi. Recall why hemolysis applicators are used
        vii. Infer whether test results indicate doping
    c. Post-lab Probing
        i. Explain the purpose of hemoglobin test
        ii. Recall the normal hemoglobin content
5. Blood Typing Test
    a. Pre-lab Briefing
        i. Recall how to determine the blood type
        ii. Recall which transfusions lead to transfusion reactions
    b. Simulation of Blood Typing Test
        i. Test all blood samples
        ii. Label the test slides
        iii. Recall how the slides should be labeled
        iv. Add blood from only one patient to each slide
        v. Add the test serum to the labeled spot on the slide
        vi. Determine the blood type
        vii. Use safe blood handling practices
        viii. Avoid cross-contaminating blood samples
        ix. Recall why toothpicks are used in this experiment
        x. Use your results to determine who can donate blood to whom
    c. Post-lab Probing
        i. Realize the need for type O packed cell transfusion when donor and recipient do not exactly match
6. Final Summary Questions
    a. Differentiate between the purpose of the various blood tests

INSTRUCTOR NOTE: Safety requirements for blood handling may vary slightly from those used in this lab. Students may become frustrated if they begin to miss questions. Remind them that when missing a question they should remediate using the provided learning resource, most often a Slide, or the Library for that topic.

Student Instructions for Lab Experiments

Overview for All Experiments:

In the following exercises you will perform tests that allow you to examine the nature of blood and also let you evaluate different samples of blood.

These tests are useful diagnostic tools for physicians because blood composition reflects the status of many body functions and malfunctions.

Before getting started on the actual lab, I would like to go over some core concepts related to blood testing. Then you will proceed with the experiments.

Differential WBC Count:

In this experiment, you will prepare a microscope slide with a blood smear and perform a differential white blood cell count.

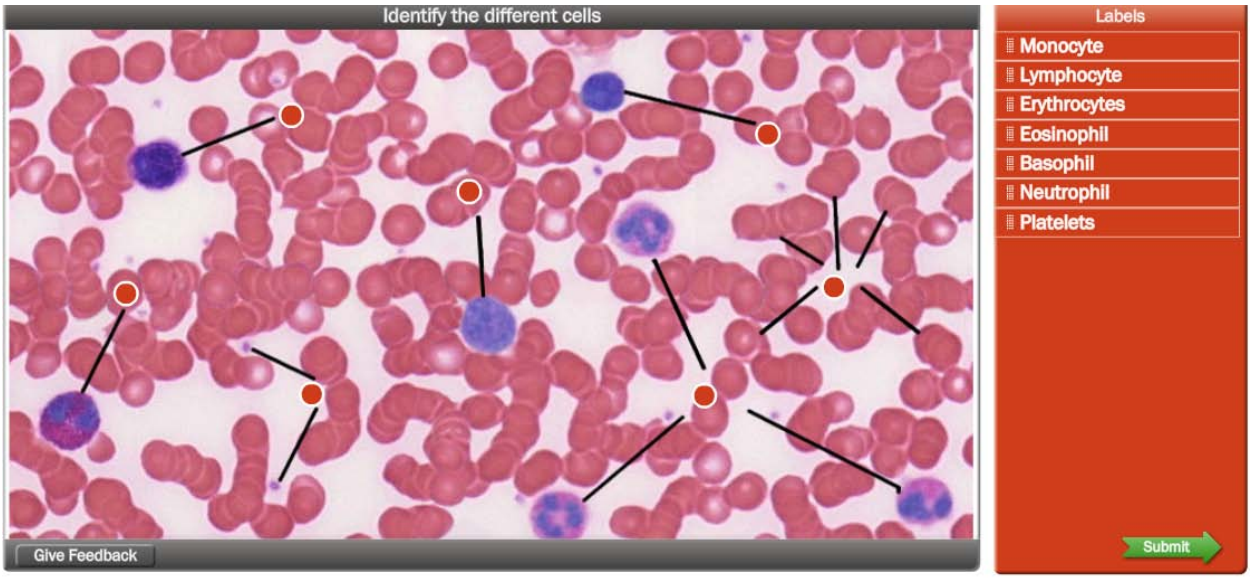
Before you start, I want to make sure that you have the necessary knowledge to execute the experiments.

Let's make sure you know how to prepare a blood smear microscope slide and how to perform a differential white blood cell count.

Important to Know About Blood Samples:

- What is a blood smear and how to make one
- How to stain a blood sample
- How to identify the different white blood cells
- What is a differential white blood cell count

Drag the labels from the right hand side to the correct locations on the slide. Select "Submit" when you are done.



INSTRUCTOR NOTE: Often the Coach will appear at the top right. Sometimes students think she is in the way of completing the exercise. However, if they are patient, she will disappear when she completes talking. Students can reactivate her and make her repeat instructions by clicking on her refresh icon.

Drag the labels from the right hand side to the correct locations on the slide. Select "Submit" when you are done.

Simulator:

Click the Instructions button and follow the steps to make a blood smear.

Move the slide to the microscope to view it.

First, correctly focus the microscope slide. Move to the x40 objective to complete the count.

Hematocrit:

In this experiment, you will measure the hematocrit of blood samples.

Before we begin, I want to make sure you have the knowledge you need to execute the experiment and interpret your results.

Let's learn more about the hematocrit of a blood sample

Important to Know About Hematocrit Testing:

- What is the hematocrit value
- How is a hematocrit test performed

Drag the labels from the right hand side to the correct locations on the slide. Select "Submit" when you are done.

Simulator:

Click the Instructions button and follow the steps to determine the hematocrit.

Compare the hematocrit to blood doping samples.

INSTRUCTOR NOTE: Students will see a number of possible combinations of doping results and hematocrit levels. If they repeat the experiment, they should expect different results. Each student should have different results.

Hemoglobin Content:

In this experiment, you will measure the hemoglobin content of blood samples.

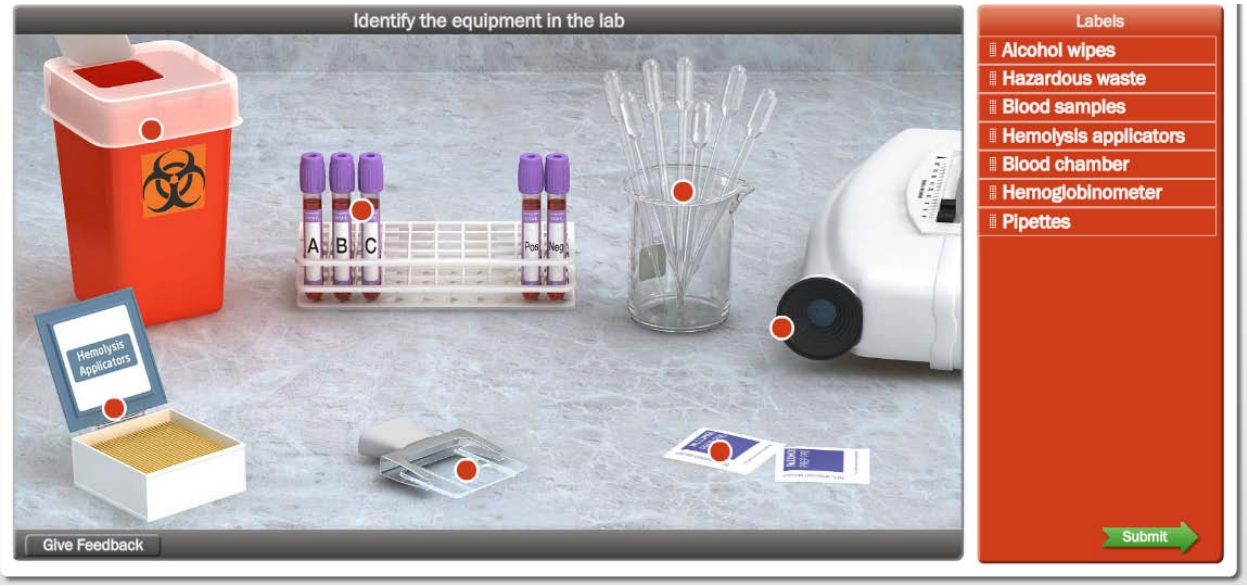
Before we begin, I want to make sure you have the knowledge you need to execute the experiment and interpret your results.

Let's learn more about the hemoglobin content of blood and how to determine it.

Important to Know About Hemoglobin

- Hemoglobin in red blood cells
- How to measure the hemoglobin content of blood

Student labeling activity before entering lab simulation



Simulator:

Click the Instructions button and follow the steps to determine the hemoglobin content.

Compare the hemoglobin content to blood doping samples.

INSTRUCTOR NOTE: The two halves in the hemoglobinometer will not have a line between them when the correct reading is available. Students will see a number of possible combinations of doping results and hemoglobin concentrations. If they repeat the experiment, they should expect different results. Each student should have different results.

Blood Typing:

In this experiment, you will determine the blood type of some blood samples.

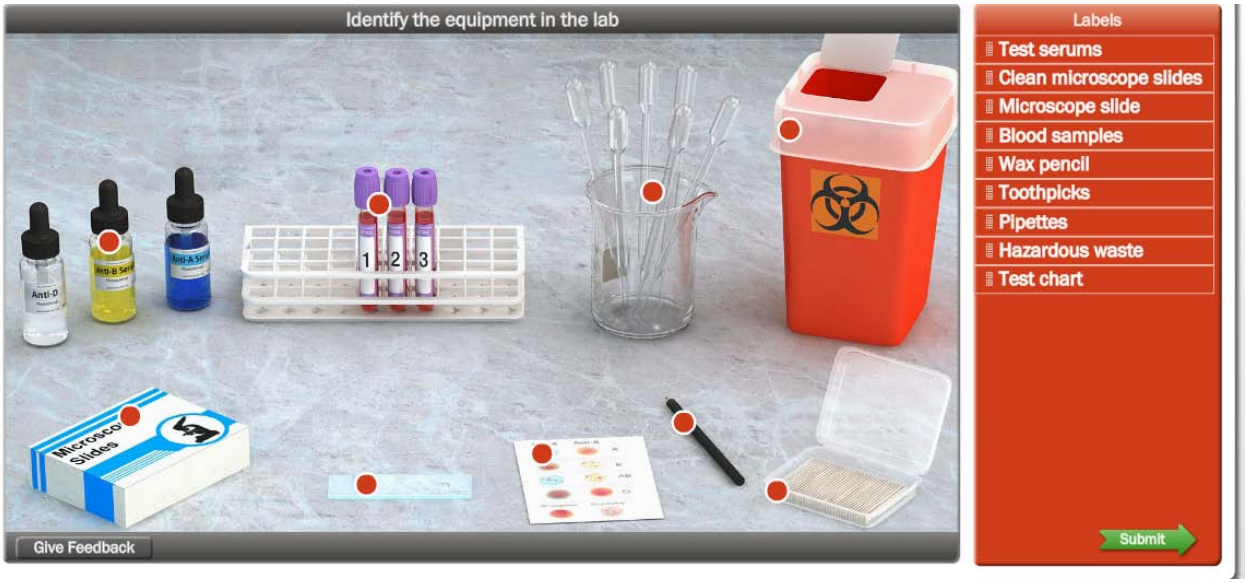
Before we begin, I want to make sure you have the knowledge you need to execute the experiment and interpret your results.

Let's learn more about the blood typing test.

Important to Know About Blood Typing

- How to determine the blood type
- Transfusion reactions

Student labeling activity before entering lab simulation



Simulator:

Click the Instructions button and follow the steps to determine the blood types.

Remember to label your slides with the sample and test types.

INSTRUCTOR NOTE: Students will see a number of possible combinations of blood types. If they repeat the experiment, they should expect different results. Each student should have different results.

Final Summary Questions

a. Differentiate between the purpose of the various blood tests

INSTRUCTOR NOTE: These final summary questions are designed to assess students that have completed all components of the lab. If you only assign some of the exercises and have not instructed students on the other techniques in class, your students may struggle with some of these questions.

Type of Student Report

Students are provided the following types of reports at the conclusion of these lab experiments.

I. Blood Smear and Differential White Cell Count – ***Debriefing***
II. Hematocrit – ***Debriefing***
III. Hemoglobin Content – ***Debriefing***
IV. Blood Typing Test – ***Debriefing***