

It's in the Blood

Understanding Complete Blood Counts (CBC)

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Grade Level	9th – 12th Grade	**Time Frame**	90-120 minutes
Subject	Nursing, Science	**Duration**	1-2 periods
Course	Biology		

Essential Question

How is complete blood count (CBC) used in patient diagnosis?

Summary

In this lesson, students learn about Complete Blood Count (CBC), blood-specific vocabulary, common disorders which may be detected with a CBC and the role of CBC in patient diagnosis. They will conduct an investigation where they analyze the characteristics of simulated blood samples and diagnose patients based on their findings. Additionally, they will watch an interview with a Biomedical Educator to learn about her career and becoming a certified phlebotomist.

Snapshot

Engage

Students watch a video introducing the concept of a complete blood count (CBC).

Explore

Students complete a lab activity identifying the characteristics of artificial blood samples.

Explain

Students complete scavenger hunt notes to learn about conditions that can be indicated by a CBC and cover relevant vocabulary.

Extend

Students revisit the lab activity to determine possible diagnoses for each sample and watch a video about a career in biomedical education.

Evaluate

Students will complete an exit ticket assessing a hypothetical patient CBC.

Standards

ACT College and Career Readiness Standards - Science (6-12)

IOD505: Analyze presented information when given new, simple information
SIN401: Understand a simple experimental design
EMI401: Determine which simple hypothesis, prediction, or conclusion is, or is not, consistent with a data presentation, model, or piece of information in text

Next Generation Science Standards (Grades 9, 10, 11, 12)

HS-LS1-2: Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

Oklahoma Academic Standards (Biology)

B.LS1.2: Develop and use a model to illustrate the hierarchical organization of interacting systems that provide specific functions within multicellular organisms.

Attachments

- Falcon Tube Examples - It's in the Blood.pdf
- ICAP Reflection - It's in the Blood - Spanish.docx
- ICAP Reflection - It's in the Blood - Spanish.pdf
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- ICAP Reflection - It's in the Blood.pdf
- Investigation Handout - It's in the Blood - Spanish.docx
- Investigation Handout - It's in the Blood - Spanish.pdf
- Investigation Handout - It's in the Blood.docx
- Investigation Handout - It's in the Blood.pdf
- Investigation Set Up - It's in the Blood.docx
- Investigation Set Up - It's in the Blood.pdf
- Lesson Slides - It's in the Blood.pptx
- Scavenger Hunt Answers - It's in the Blood.docx
- Scavenger Hunt Answers - It's in the Blood.pdf
- Scavenger Hunt Notes - It's in the Blood - Spanish.docx
- Scavenger Hunt Notes - It's in the Blood - Spanish.pdf
- Scavenger Hunt Notes - It's in the Blood.docx
- Scavenger Hunt Notes - It's in the Blood.pdf
- Scavenger Hunt Stations - It's in the Blood.docx
- Scavenger Hunt Stations - It's in the Blood.pdf

Materials

- Falcon tubes (8, plus 1 for each student lab group)
- Cinnamon imperials/Red Hots candy (heart shaped if available, not gummies)
- Dried lima beans (small)
- Lentils (dark)
- Investigation Handout (one per student)
- Scavenger Hunt Notes (one per student)
- Scavenger Hunt Stations (one printed set)
- ICAP Reflection (cut in half sheets, one per student)

15 minutes

Engage

Go to **slides 2-3** to share the essential question and lesson objectives with students.

Go to **slide 4**. Next, play the In the Lab - Complete Blood Count (CBC) video, which goes behind the scenes of a medical testing lab and introduces the concept of a complete blood count (CBC). Explain to students that they will analyze samples like a lab technician during the rest of the lesson.

Embedded video

https://youtube.com/watch?v=7kqpOz5VfU0

Teacher's Note: Medical Technology Video (optional)

What Happens to Your Blood Test (4:47) discusses the cutting-edge technologies and ways in which samples are processed in a high-output laboratory. It was published in 2023 and provides a more modern image of how scientists analyze blood samples, but it does not discuss CBCs. (*Content warning*: Blood collection, including the insertion of a needle and filling sample vials, is shown from 0:14-0:38.)

Conduct a short class discussion focused on the key points in the video.

45 minutes

Explore

Teacher's Note: Investigation Set Up

There are eight diagnosable samples and one control/normal sample. Make enough controls for each lab group so that they can bring it with them to each sample station. See the **Investigation Set Up attachment** for detailed numbers of "blood cells" used to create each one. Specific varieties of Cinnamon Imperials candy, lima beans, and lentils are also recommended for best results.

Note that in the investigation set up, "splash" is a relative amount. At this scale, it isn't possible to make the proportion of blood cells match reality, so it is up to your discretion approximately how many lentils make up a "splash." It should look proportionally less than the number of RBCs, with the goal of making it clear when there are significantly more or fewer platelets in a given sample compared to the control. For reference, example images of the blood samples are included in the **Falcon Tube Examples attachment**.

Be sure to edit **slide 7** to include your classroom-specific instructions for how students are expected to proceed through the stations (e.g., at their own pace, after a specific amount of time, etc.).

Students will now complete the first part of a CBC investigation. Provide each student with the **Investigation Handout**. Next, go to **slide 5** to show students which part of their handout they should fill out during this activity. Instruct students to visit each station and fill out only the "Indication" column of their handout. They will complete the "Proposed Diagnosis" section later. Divide students in groups of 2-3 and provide each group with a control/normal sample tube. Display **slide 6** and give them a moment to identify the components of their control tube as referenced in the labeled image on the slide.

Go to **slide 7** to display the specific instructions for how to conduct the investigation. At each station, students should compare their control tube to the station's sample and describe how that sample is different (e.g., fewer RBCs, less plasma, etc.).

After all groups have completed this task, continue to the next part of the lesson.

50 minutes

Explain

Teacher's Note: Set-up and Answers

Before starting the activity, print the **Scavenger Hunt Stations handout**. There are three stations on each page (a total of 12 stations), which you should cut apart and place around the classroom. The **Scavenger Hunt Answers** document is a completed notes sheet for teacher reference.

Be sure to edit **slide 8** to include your classroom-specific instructions for how students are expected to proceed through the stations (e.g., at their own pace, after a specific amount of time, etc.).

Students will now complete a Scavenger Hunt Notes activity to learn relevant vocabulary and about conditions that can be indicated by a CBC. Distribute to each student a copy of the **Scavenger Hunt Notes handout** and go to **slide 8** to provide instructions on how you would like them to visit the note-taking stations.

50 minutes

Extend

After students have completed their notes, go to **slide 9** to introduce Part Two of the investigation. Have students pair up with someone who was not in their lab group for Part One. With their new partner, students should consult their Scavenger Hunt Notes and compare them to the indicators they identified during part one to diagnose each sample. Allow them to revisit the stations/examine the sample tubes again if necessary.

Bring the class back together as a group to review the answers to the investigation. Ask for volunteers to give their diagnoses for each sample and justify their answer with the indicators they identified. If you would like to display the answers, un-hide **slide 10**.

Teacher's Note: Stations 2 & 8

Because Stations 2 and 8 have very similar indications, it is likely that across the class, some groups will have the diagnoses reversed. Use this as an opportunity for the class to discuss the difficulty of making a diagnosis based on a single test.

Following the lab discussion, go to **slide 11** and play the K20 ICAP - Biomedical Educator - It's in the Blood video.

Embedded video
https://youtube.com/watch?v=k86D4vBfo7I

After watching the video, go to **slide 12** and pass out the **ICAP Reflection handout.** Students will use this to complete the WICK strategy, reflecting on what they've learned about biomedical education and phlebotomy certification, what they found interesting and confusing, and how it connects to what they know now from the lesson. Ask for a few volunteers to share out any part of their reflection you wish to explore with the class.

20 minutes

Evaluate

To wrap up the lesson, students will complete an Exit Ticket which asks them to make a diagnosis of a patient sample and justify their answer. Go to **slide 13** and display the Exit Ticket prompt. Have students complete this in whatever format is most convenient for your class.

Teacher's Note: Exit Ticket

You conduct a complete blood count on a patient sample and determine the patient has low platelet and high white blood cell counts. What tentative diagnosis would you report to their doctor? Explain your reasoning.

Thrombocytopenia, leukemia, and infection are the correct possible options, alone or in combination. Multiple diagnoses are acceptable as long as student reasoning accurately supports their conclusions.

Resources

- In The Lab - Complete Blood Count (CBC) - https://youtu.be/7kqpOz5VfU0?si=662qRCyuU0QHqe5N
- K20 Center. (n.d.). Bell ringers and exit ticket. Strategies. https://learn.k20center.ou.edu/strategy/125
- K20 Center. (n.d.). It's in the Blood with Cassie Crowell. ICAP video. YouTube. https://www.youtube.com/watch?v=k86D4vBfo7I
- K20 Center. (n.d.). Scavenger hunt notes. Strategies. https://learn.k20center.ou.edu/strategy/3113
- K20 Center. (n.d.). WICK. Strategies. https://learn.k20cente.r.ou.edu/strategy/2513
- Sci NC. (n.d.). What Happens to Your Blood Test. YouTube video. https://www.youtube.com/watch?v=vYKzrEcVd4w