

Teacher Notes & Tips

In a self-directed learning activity, expect students to be at different levels in their pursuits and thus needing instantaneous help from the teacher. Thus, a great level of preparation is required by the teacher.

For a preliminary review on homogeneous and heterogeneous mixtures, refer to the activity's PowerPoint® file: *Heterogeneous vs. Homogeneous Mixtures Presentation*.

It is essential that the teacher read and review in advance the content on the *Self-Guided Learning Module Handout* and its extensive *Answer Key*. Note that the organization of learning experiences proceeds in a gradual manner so that at no point are students provided with an overwhelming amount of information.

The teacher must be somewhat extensively versed about the erythrocyte sedimentation rate (ESR) test, which takes advantage of the sedimentation principle to identify signs of inflammation and other disease conditions in people's blood. Watch the following video to gain some familiarity with the ESR test:

MLS Erythrocyte Sedimentation Rate (4:23 minutes) <https://www.youtube.com/watch?v=h7lmji5vx6Q>

A thorough knowledge about the centrifugation process and centrifuge operation is indispensable to run this activity. Many Internet resources are available to acquire mastery of concepts related to this topic. The following are recommended resources for learning about the centrifugation process:

Chapter 3: Centrifugation (a 60-slide PDF) http://www.phys.sinica.edu.tw/TIGP-NANO/Course/2007_Spring/Class%20Notes/AC_Chapter%203%20Centrifugation%200321.pdf

Video title: *How to Use a Centrifuge* (3:16 minutes)

https://www.youtube.com/watch?v=IhJNFGfsUus&list=PLB_rLSAn1EwE5YInJwzbYCOQr20vqCy3xk

Video title: *What Does a Centrifuge Do?* (1:57 minutes) Shows blood separation after five minutes in the centrifuge https://www.youtube.com/watch?v=OvnaH_uNRbs

A few videos that show how blood is separated into blood components:

<https://www.youtube.com/watch?v=afvSUZU3fPQ> (10:08 minutes)

<https://www.youtube.com/watch?v=UWwM71SNpJ8> (4:11 minutes)

<https://www.youtube.com/watch?v=RF3hK0aK2sk> (1:33 minutes)

Troubleshooting Tips

On Day 1 during Task 3: Rejecting milk as a model of blood, if some students choose milk as a model, make sure to have one-on-one discussions with those students. Mention the factual differences between milk and blood. Highlight the density differences in the constituents of blood and milk. Show them a visual of centrifuged milk. Stress the standing behavior of milk compared blood so they realize the absence of sedimentation in milk, compared to blood (as seen in an ESR test). Then reiterate blood's feature as a dynamic fluid that is so meticulously able to flow with transport as the chief function and all other functions made possible because of the transport property.

A good visual of centrifuged milk (shows cream at the top and skim milk (the plasma phase) at the bottom) is available from the University of Illinois at Urbana-Champaign's Department of Animal Sciences at: http://ansci.illinois.edu/static/ansc438/Milkcompsynth/milkcomp_protein.html

Consider centrifuging some milk to show what happens. If you do this, use only raw milk because the milk available at most grocery stores will not separate (show layers) upon centrifugation (hence, the name "homogenized" milk!).

On Day 2, during the experimentation portion of the activity, expect students to ask you to verify whether their approach is correct. Because students are working in groups, it is easy to provide one-on-one assistance in each group. Make sure students get the idea that they are going to use the centrifuge to obtain the three-layered partition by centrifugation. Talk to them about the sedimentation protocol; ask them they look forward to seeing petroleum jelly separating out. If they say yes, continue the discussion to identify and eliminate any misconceptions. In order to cultivate their own probing and discovery process about the behavior of petroleum jelly in oil, provide tips on polarity and hence the expected

solubility of petroleum jelly in different solvents. (Petroleum jelly is a covalent compound, non-polar in nature, so it does not dissolve in water, which is a polar solvent, but it does dissolve in oil, which is a non-polar solvent.)

On Day 2, Task 10, during the theory development portion of the activity, make sure every student understands the following points in the proposed theory:

1. Blood is a heterogeneous mixture as proved by the erythrocyte sedimentation test.
2. Blood behaves like a homogeneous mixture as proved by the experimental evidence that erythrocytes sediment and thus separate out from plasma.
3. Blood behaves like a homogeneous mixture as proved by the experimental evidence that blood can be centrifuged to get three parts: plasma, buffy coat and erythrocytes.
4. Since blood behaves both as a homogeneous mixture and a heterogeneous mixture, it can be said to have a ***dual mixture*** behavior.
5. Blood is homogeneously heterogeneous (or heterogeneously homogeneous).

For the improvement of the theory, talk about the possibility of blood as a mixture system.