

RAFT IDEAS

Topics: Scientific Investigation, Circulation, Blood Composition

Materials List

- ✓ Graduated sample tubes (35 mL) or graduated preforms (2-liter) with caps (See RAFT Idea Sheet *Graduated Preforms*)
- ✓ String
- ✓ Tape
- ✓ Vegetable oil
- ✓ Granulated sugar
- ✓ Food coloring, red

This activity can be used to teach:

- Circulatory System (CA Science Standards: Grade 5, 2.b)
- Investigation & Experimentation (CA Science Standards: Grade 7, 7.c; Grade 8, 9.f; HS, 1.g)
- Body Systems (CA Science Standards: HS Physiology, 9.a)

Bloodless Hematocrit

Investigating an important medical parameter



Use “blood” samples of red sugar in a vegetable oil suspension to investigate hematocrit measurement and its significance.

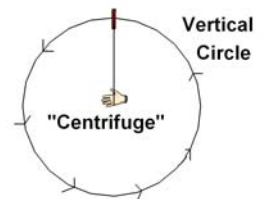
Assembly (Once created, “blood” samples can be stored and re-used indefinitely)

1. Label the caps of 4 tubes or preforms with unique identifiers (e.g., A10, S24).
2. Fill each tube/preform with 35 mL (~1.2 oz.) vegetable oil and set aside.
3. Add 20 drops red food coloring to 70 grams (~5 tbsp) sugar, mix, then let dry.
4. Fill the 4 tubes with dry, non-clumped, sugar “blood” samples in amounts as specified in the table below, apply caps, and mix well (see illustration).
5. Tie 60 cm (~2 ft) string tightly around neck of each tube and secure with tape.

Amount	7g (1/2 tbsp)	14g (1 tbsp)	21g (1 ½ tbsp)	28g (2 tbsp)
Condition	Anemic	Normal	Dehydrated	Polycythemic
Hematocrit	0.21 (21%)	0.43 (43%)	0.64 (64%)	0.85 (85%)

To Do and Notice (CAUTION: String could break leading to breakage, injury, and mess. Swing away from others.)

1. Swing each sample vertically, as shown, 10-15 revolutions.
2. Measure, record, and tabulate the volume of sugar “blood cells” for each sample after spinning (“centrifuging”).
3. Calculate the hematocrit and compare with normal range to determine condition (see equation below).



$$\text{Hematocrit (\%)} = \frac{\text{Volume (red "blood" cells)}}{\text{Volume (total)}} \times 100$$

Volume (total) = 35 mL

The Science Behind the Activity

When the tube containing the sample is spun in a circle the sugar packs onto the bottom of the tube due to centrifugal force, simulating the behavior of red blood cells spun in a centrifuge machine at high speeds.

Hematocrit (from Greek “haima” meaning “blood” and “krinein” meaning “to separate”) is a tool to examine patient blood samples. Human blood is a mixture of white and red cells suspended in a liquid called plasma. Red blood cells (RBC) carry oxygen and nutrients to, and remove waste from all parts of the body. The hematocrit is the ratio of red blood cell volume per *total* volume of the sample, expressed as a percent. Hematocrit measurements are important in helping to diagnose conditions such as anemia and polycythemia. Anemia is a common condition that occurs when a red blood cell count is low (low hematocrit reading). It can be chronic or acute, with symptoms including decreased energy and tiredness. High hematocrits are common in people who live at high altitudes, in chronic smokers, and during dehydration. It could indicate a bone marrow disorder called polycythemia. The normal hematocrit ranges for adults are: males (42-54%), females (38-46%).

Web Resources (Visit www.raft.net/more for how-to videos and more ideas!)

- Hematocrit analysis techniques - <http://www.heartpumper.com/hematocrit.htm>
- Blood composition - http://anthro.palomar.edu/blood/blood_components.htm