

2.1: MODELING HEMOPHILIA ANSWER KEY

PART 2: Testing Mixtures for Model Blood Samples

Data Table:

This is what we observed when we tried it out. Note that your results may vary based on a variety of factors, including the type of milk used (whole or low-fat), the size of the mesh in the strainer, and the amount of time between when the vinegar is added and the mixture is poured into the strainer.

Model Blood Sample	Water	Milk	Cornstarch	Observations of the model blood sample BEFORE adding vinegar	Observations of the model blood sample AFTER adding vinegar and pouring through a strainer
1	2 tbsp	x	x	Milky white Thin, watery liquid	- The mixture is very thin and quickly flows through the strainer
2	2 tbsp	x	1 tbsp	Cloudy white Thick/hard to stir at first, but the powder dissolves and the mixture becomes thinner	- Mixture is thin (slightly thicker than water without cornstarch) and quickly flows through the strainer
3	x	2 tbsp	x	Milky white Thin, watery liquid	- The mixture has lots of small clumps - Some of the liquid flows through the strainer, but then the strainer gets clogged, and it becomes a very slow drip of liquid through the strainer.

					- Lots of liquid remains in the strainer
4	x	2 tbsp	1 tbsp	Milky white Thick/hard to stir at first, but the powder dissolves and the mixture becomes thinner.	- The mixture is a little thick and has small clumps. - Some of the liquid flows through the strainer, but then the strainer gets clogged, and it becomes a very slow drip of liquid through the strainer. - The drip eventually stops, and lots of liquid remains in the strainer.
5	1 tbsp	1 tbsp	x	Cloudy white Thin, watery liquid	- The mixture is thin and quickly flows through the strainer
6	1 tbsp	1 tbsp	1 tbsp	Milky white Thick/hard to stir at first, but the powder dissolves and the mixture becomes thinner.	- The mixture is thin and quickly flows through the strainer - There are a couple of small clumps that get stuck in the strainer

PART 3: Plan Your Model Blood Samples

There is no one right answer here! There are many different ways to use the substances to model these three different types of blood. Here is one sample response. Remember: Just like in Part 2, your results may be different based on the experimental conditions.

Model Blood Sample	Water	Milk	Cornstarch	Why did you choose this combination of substances and these amounts of each substance?
A. No Hemophilia	x	2 tbsp	1 tbsp	When I tested this mixture in Part 2, there were lots of small clumps

(blood with a typical amount of clotting factor)				that clogged the strainer very quickly. This is similar to what happens in the blood of a person without hemophilia - the blood clots quickly and stops the bleeding.
B. Mild Hemophilia (blood with some clotting factor)	1/2 tbsp	2 tbsp	1 tbsp	This mixture needs to have some clumps, but not as many as Model A. Based on the results above, there are barely any clumps if the mixture has 1 tbsp of water and 1 tbsp of milk. If I use 2 tbsp of milk and a small amount of water, I think I can make a model of blood with mild hemophilia.
C. Severe Hemophilia (blood with almost no clotting factor)	1 tbsp	1 tbsp	1 tbsp	When I tested this mixture in Part 2, it was thin and quickly flowed through the strainer. This is what would happen in a person with severe hemophilia, because there is not enough clotting factor to stop the bleeding. People with severe hemophilia do have some clotting factor, so the small number of clots this mixture left in the strainer represents the tiny amount of clotted blood. I wanted all three blood models to be the same color because people with and without hemophilia both have red blood. This is another reason why I chose a mixture of water and milk instead of just water.

Investigation Reflection

1. Your challenge was to develop models of different blood samples to help people better understand hemophilia. On a scale of 1 - 5 (where a five is extremely successful), how successful do you think you were with this challenge? Explain your rating.

Answers will vary based on the model blood sample mixtures used. In general, a successful set of models would include:

- A model blood sample that clots quickly and stops the flow of liquid through the strainer (no hemophilia)
- A model blood sample that clots and slows the flow of liquid through the strainer (mild hemophilia)
- A model blood sample that does not clot stops the flow of blood through the strainer (severe hemophilia).

2. All models have limitations (things that are missing or oversimplified). What are some limitations of your model for blood samples?

There are many possible answers to this question. Here are a few limitations of our models:

- We used vinegar to represent the chemical signal that lets the body know there is a cut. The vinegar doesn't work.
- Real blood has both platelets and clotting factors that work together to stop bleeding. Our models did not differentiate between these two substances in blood. (There are also a variety of different types of clotting factors in real blood, which we did not represent in our models.)
- The mesh strainer is very different from an actual cut in a blood vessel.
- In people with mild hemophilia, their blood often clots normally unless they experience surgery or a major injury. Our model did not differentiate between minor injuries and major injuries/surgery.

3. How do you think DNA is related to blood clotting and hemophilia? Why do you think this?

Answers will vary. This is a chance to capture your current thinking about the relationship between DNA and hemophilia. You will learn more about this relationship as you complete more modules.