

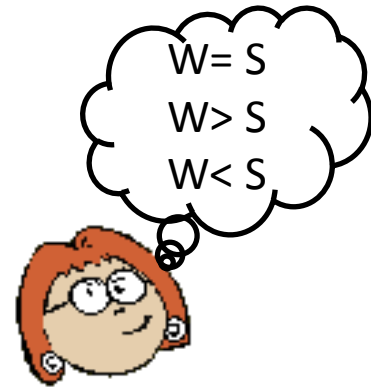
Which makes better bubbles, skim milk or whole?

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*It's good
to have an
opinion*



*But, It's better to
have a plan . . .
a plan to test
different possible
explanations.*



Before trying to answer, ask a second question:
What are some different ways of finding out which makes better bubbles?

You could . . .

- ask an adult
- take a vote
- use your memory
- look it up in a book, or . . .
- test it out.

Testing it out is an obvious choice, since the subject is science.

What makes this test a fair comparison?

It's fair because there is only one known difference between the two milks:

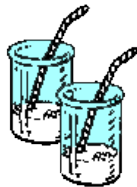


whole milk
has 3.25% fat,



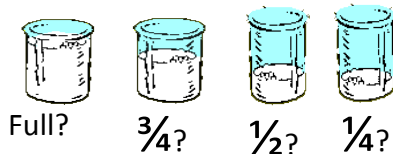
and skim has
almost no fat.

How many cups and straws do you need for the experiment?



Two cups and two straws, one for skim and the other for whole, will get you started. But will it be enough to answer all of the questions you generate?

How much milk do you need in each cup?



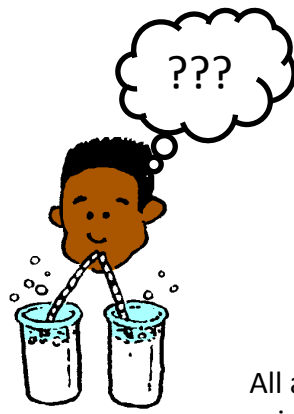
Is the actual amount important? Or is it more important that both cups have the same amount of milk?

Do you blow simultaneously or sequentially - at the same time or one after the other?



Either way-there-is no right answer. But, what are the advantages and disadvantages of each way? The materials you are using are relatively inexpensive. One advantage here is that you can try it both ways-it's not an either/or proposition. And you can try it repeatedly (the joys of practice).

How long should you blow bubbles?

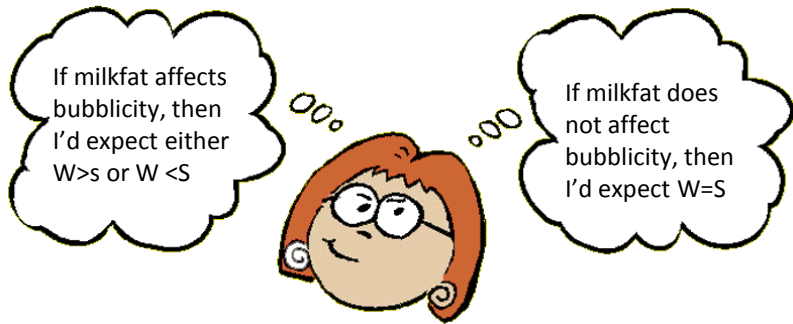


The key is that you blow the same amount of time for each cup, and that you blow just long enough to best see any differences in the amount of bubbles.

What do you mean by better bubbles? More bubbles? Bigger bubbles? Clearer bubbles?

All are fair questions that show that the original question really isn't crafted well. One solution is to restate the question and then repeat the experiment. This time you will be able to collect data with greater precision

So, does milkfat affect bubblicity?

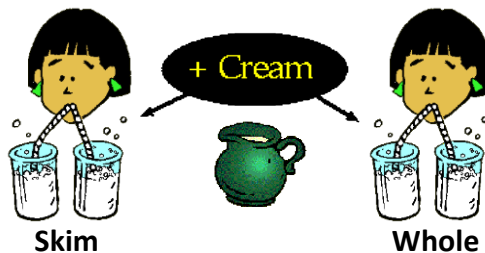


Do you have evidence that milkfat affects bubblicity?

Do the two types of milk give identical or different bubbles? If they're different, in what ways are they different?

How can you confirm that milkfat affects bubblicity?

One way is to add milkfat to skim. In this "reconstruction experiment" you add milkfat (in the form of cream) to skim milk and whole milk..



You can then compare the bubble qualities of skim, of skim plus cream, of whole, and of whole plus cream.

How do you know you are blowing the same amount of air through both straws?

How can you answer this question, just using the tools at hand?

- Switch and repeat: Switch the position of the two cups, so one time the skim is on the left, and the next the whole is on the left. Do you get the same amount of bubbles each time?
- Test the amount of air coming out of both straws: What are the possible outcomes when you blow through 2 straws at the same time? Straw A could get more air than straw B, straw B could get more air than straw A, or straw A and straw B could get the same amount of air. What do you have in front of you that could measure the amount of air?
- Expectations, Observations and Conclusions: What if you took 2 cups and put equal amounts of skim milk in each cup? If you blow the same amount of air through both straws, you expect to get the same amount of bubbles. If you blow different amounts of air, you expect different amounts of bubbles. Now, do the experiment and observe the bubbles. What do you conclude if you get the same amount of bubbles? What do you conclude if you get different amounts of bubbles?

You should also ask what's your "Batting Average?" If you blow 10 times into the two cups with the same type of milk, how often do you get the same amount of bubbles from both straws? Is practice important in science?

What are other factors that could affect bubblicity?

Many people find that when they first compare skim and whole milk, both bubble about the same. When they repeat the experiment with the same milk samples 20 minutes later, skim bubbles but whole milk won't! Can you list all the things the milk has been exposed to during that 20 minutes?

Time
Temperature
Light Carbon Dioxide from Breath
Plastic from Straw
Components from Cup
Air
Saliva

Can you think of any others?

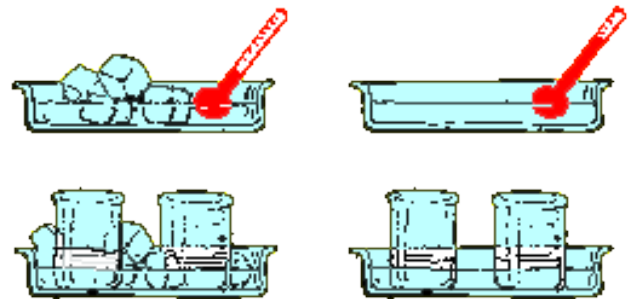


Now, how do you test these ideas?

Let's use the "if, then" tool.

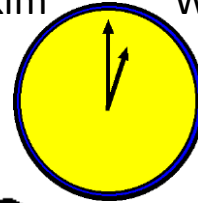
Temperature

The temperature of the milk may have been affected during the time you waited before you blew in the milk a second time when you originally did the Better Bubbles experiment. If temperature affects bubblicity, then you expect that milk at room temperature would have different bubblicity than ice-cold milk. If temperature isn't important, then ice-cold milk and room temperature milk would have about the same bubblicity.



Whole Skim

Whole Skim



5 min



How can you design an experiment to test this?

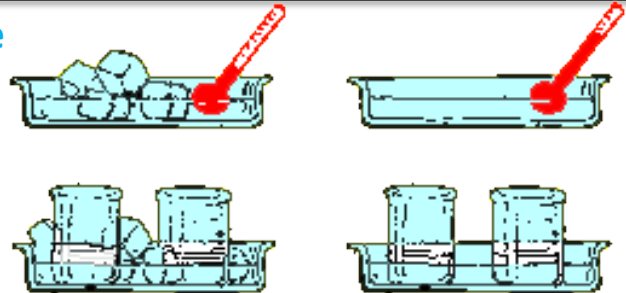
- To test the effect of temperature on bubblicity, you'll need 4 cups, 4 straws and 2 shallow pans.
- Place some ice water in one pan and some warm water in the other pan.
- Put one cup of skim and one cup of whole in each pan.
- Wait about 5 minutes and then blow.

How does the temperature of the milk affect its bubblicity?

Does the passage of time between your first blow and your second blow affect the bubblicity of the whole milk?

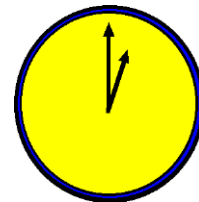
- If time is important, then you'd expect that 'older' whole milk would bubble less than 'younger' whole milk (here 20 minutes is the difference between 'older' and 'younger').
- If time is not important, then older and younger whole milk should bubble about equally, as long as all the other conditions are the same.

Time



Whole Skim

Whole Skim



20 min



How can you test this?

- To test the effect of time on bubblicity, put ice water in two shallow pans.
- Now put one cup of cold skim and one cup of cold whole in the pan.
- Blow in one cup of skim and one cup of whole simultaneously and note the results.
- Twenty minutes later, blow in the second set of cups of whole and skim milk and compare the results to the first set of cups. How does the time you wait before you blow affect bubblicity?

Your Breath

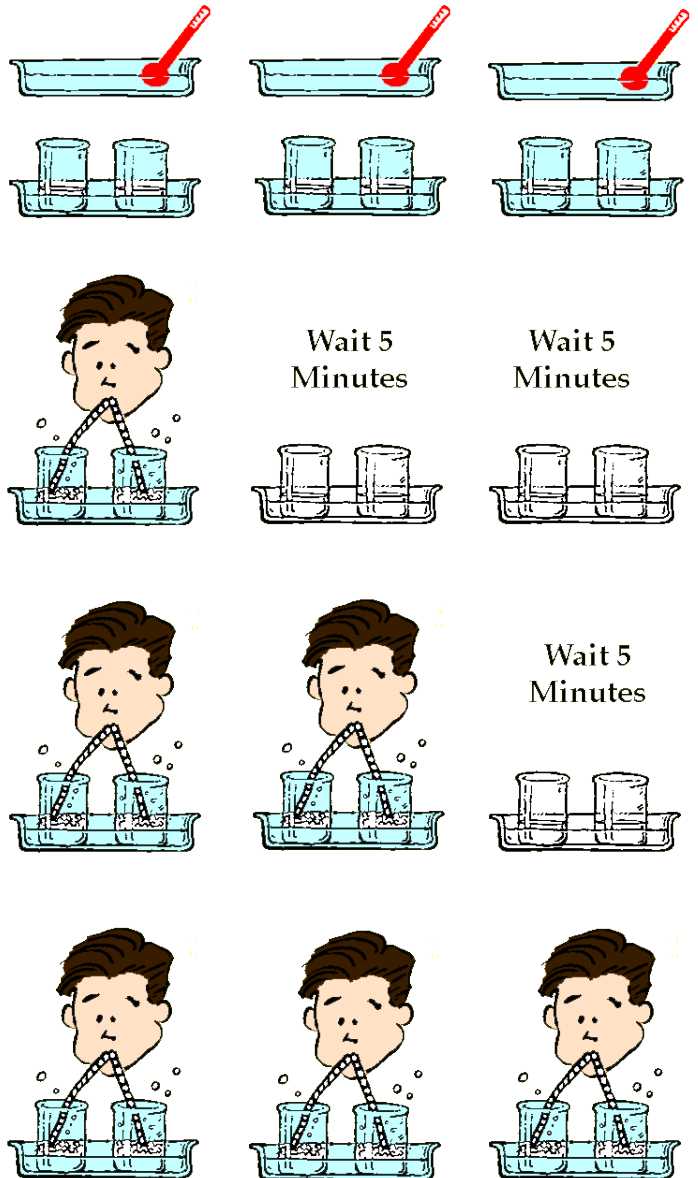
You may have blown bubbles in the same cup more than once. Could breath affect the bubblicity of whole milk?

Breath has higher concentrations of carbon dioxide than regular air, and saliva has enzymes that could affect bubblicity. If breath is important to bubblicity, then you would expect whole milk that has been breathed in would bubble differently than whole milk that has not been exposed to breath. If breath isn't important, then you would not expect to see a difference between whole milk that has or has not been breathed in, as long as everything else is the same.

How can you design an experiment to test this?

To test the effect of your breath on bubblicity of whole milk, you'll need 6 cups, 6 straws and 3 shallow pans. Pour some water in each of the pans. The water in each pan should be the same temperature. Now put one cup of skim and one cup of whole in each pan. Label the pans 1, 2, and 3.

1. Blow in the cups in pan 1 and note the bubbles.
2. Wait 5 minutes.
3. Blow in the cups in pan 1 again and note the bubbles. Now, blow in the cups in pan 2 and note the bubbles. Are there any differences between pans 1 and 2?
4. Wait 5 more minutes.
5. Blow in the cups in pan 1 and note the bubbles. Now, blow in the cups in pan 2 and note the bubbles. Finally, blow in the cups in pan 3 and note the bubbles.



How many times was each pan exposed to your breath? Does your breath affect bubblicity?

Can you think of anything else that might effect bubblicity? How would you test that?

Warning!! This is the last page of a six-page sequence. If you did not start with page one, please go back and start with page one now.



Reporting the results.

You can report your results orally or in writing. If all the students in an entire class report their results orally, how much will one student's report be affected by what other students say? As a teacher, ask yourself: How many of my students are for sure unaffected by what other students say? The for sure answer is only one person, and that's the person who reported first.

An alternative is to report in writing, without talking with other groups doing the same experiment. This improves the odds for unaffected reporting because the results aren't shared until all the written reports are read. Students can still share and discuss their written results, but the advantage of writing is to protect the student with different insights or observations.

Notes: