

A Check on the Density of Maple Syrup Level 1, Sample 1

A



Confederation Maple Syrup Company Quality Control Report

A. Hourly Qualitative Check of Samples

1. What are the technicians trying to find out with their test?

They are trying to find out if it is true maple syrup or not.

2. (a) What observation, from the layered solutions, would indicate that one of the solutions is denser than the other?

The one closer to the bottom is more dense

(b) Explain

The more dense it is the further to the bottom it will go. The lighter it is the higher it will go.

5

B

3. (a) Prepare a data table in which you can record your qualitative data for each test that you do. Include a column in which you indicate your conclusion on the test (e.g. "Therefore, Red is more dense than Green, R>G). Enter all of your data in your table.

Substance	mixed with			most dense		
blue	red	Green	Yell	Blue	Blue	=
Green	blue	red	Yell	Blue	=	Yell
red	Green	blue	Yell	=	blue	Yell
Yellow	blue	Green	red	=	yellow	yellow

3. (b) State what you found out.

I found out that blue and yellow have the same density and red and green also have the same. Yellow and blue are more dense than red and green.

4. (a) Rank the densities of the three "unknown" sample solutions

Blue is most dense
= { red is next
then green.

(b) Which "unknown" solution has the same density as the yellow "standard" solution?

The blue unknown substance has the same a yellow.

6

C

5. Why would "Confederation" want their product to have a minimum density of 1.1 g/mL, BUT no higher or lower than this value?

Because if it was denser or more dense than 1.1 it would not be real maple syrup. So for companies might not act anyone to buy it or it will not be good quality.

B. Daily Quantitative Tests

$$\text{Density} = \text{mass} \div \text{Volume}$$

6. (a) Use the equipment necessary to find the density of the "unknown" solution that has the same density as the yellow "standard" solution. Prepare a chart in the space below and enter your quantitative measurements in it.

Solution	Mass	Volume Density	Density
Blue	$9.20 - 6.72 = 2.48\text{g}$	2.5ml	.01
Yellow	$9.20 - 6.72 = 2.48\text{g}$	2.5ml	.01
Red	$8.63 - 6.72 = 1.91$	2.5	.08
Green	$8.68 - 6.72 = 1.96$	2.5	.08

Cylinders mass = 6.72

6. (b) Use the data from 6(a) to calculate the density of the solution, showing all work.

$$\text{Density} = \text{mass} \div \text{Volume}$$

$$\text{Blue} = 2.48\text{g} \div 2.5\text{ml} = .00992 \text{ or } .01$$

$$\text{Yellow} = 2.48\text{g} \div 2.5\text{ml} = .00992 \text{ or } .01$$

$$\text{Red} = 1.91\text{g} \div 2.5\text{ml} = .076 \text{ or } .08$$

$$\text{Green} = 1.96\text{g} \div 2.5\text{ml} = .0784 \text{ or } .08$$

D

7. (a) Did the results from the layering activity in 4 (a) and 4(b) match your calculated results?

Yes because when I said Blue and yellow and then red and green had same densities I was right

7. (b) Account for any errors that could have occurred.

I could have put too much or a little solution in at one time so my density's could be different. also the scale could have been off.

Daily Tours

8. (a) A tour of Grade 5 students from an elementary school has just arrived at your laboratory. Explain, in language they can understand, how you used the equipment in 6(a) to determine the actual density of one of the unknown sample solutions.

When I did this experiment to measure the density I found out the mass and then I found out the volume. To get density you take the mass and subtract the volume.

8. (b) Explain to the students what skills are necessary for a quality control technician AND why your job is important to the company.

A quality control person needs good science skills and is important because we make sure the syrup is the right density.

Teacher's Notes

Knowledge/Understanding

- The student demonstrates a somewhat limited understanding of the concept of density (e.g., in question 2a, states "The one closer to the bottom is more dense", but in question 2b, fails to explain the concept).
- The student applies the density formula with some competence (e.g., includes the formula and substitutes correctly, but omits density units).

Inquiry

- The student has interpreted the data based on his or her observations, although the observations contain some inaccuracies.
- The student uses technical skills and procedures with limited accuracy (e.g., in question 6a, makes a major error in measuring the cylinder's mass – the mass of 6.72 g is much too low).
- The student draws conclusions with limited support (e.g., in question 7a, does not support or justify the conclusions; does not identify or comment on the fact that the calculated densities are far below the expected value of 1.1 g/mL).

Communication

- The student communicates observations and information with limited clarity (e.g., in question 3a, the table of observations is confusing; the conclusion in question 4a that blue is most dense is contradicted by the density calculation of .01 g/mL for blue in question 6b).
- The student uses scientific terminology with limited appropriateness and accuracy, and omits the SI unit for density in question 6b.
- The student communicates with a limited sense of audience (e.g., in question 8a, the description of the process is much too vague for Grade 5 students to understand).

Making Connections

- The student shows limited understanding of the skills required for the occupation of a quality control technician (e.g., in question 8b, does not identify or explain the importance of specific skills; misses the connection between skills for this particular task and the general skills of a quality control technician – “we make sure the syrup is the right density”).

Comments/Next Steps

- The student should work on recording observations in a well-organized format.
- The student needs to practise technical skills of measuring.
- The student should work on developing scientific terminology to communicate more effectively and with more clarity.
- The student should consider that unreasonable results are a clue to major source(s) of error.

A Check on the Density of Maple Syrup Level 1, Sample 2

A

A. Hourly Qualitative Test

- One of the coloured solutions has the same density as the yellow "standard" solution.

Procedure A

- Add 25 drops of solution #1 to one of the thin test tubes. Without shaking the test tube, carefully allow one drop at a time of solution #2 to run down the inside of the test tube until it hits the surface of solution #1. Make sure that you wait ten seconds between each drop. Observe carefully as the added drops interact with solution #1. You will have to add at least five drops of solution #2 to see the result.
- Prepare a chart in the Quality Control Report (Question 3(a)) to record the results when each pair of liquids is mixed.
- Repeat the steps until you have tested and recorded all possible combinations of the four solutions. To observe all possibilities, make certain that you test each pair of solutions in two ways: put 25 drops of solution #1 in the test tube, then add five drops of solution #2; put 25 drops of solution #2 in a second test tube, then add five drops of solution #1, etc.

Solutions	
#1	Blue
#2	Red
#3	Green
Standard	Yellow

- Record your data in Question 3(a) of the Quality Control Report.

Mix #1	Mix #2	Solution/observation
Blue	red	The red settles to top of blue
Blue	yellow	The yellow settles on blue
Blue	green	The green settles on blue
Red	green	green settles on top of red
Red	yellow	The substances mix together
green	yellow	green settles on yellow.

4

B



Confederation Maple Syrup Company Quality Control Report

A. Hourly Qualitative Check of Samples

- What are the technicians trying to find out with their test?

The technicians are trying to find which syrup (colour) has the same density as the standard (yellow).

- (a) What observation, from the layered solutions, would indicate that one of the solutions is denser than the other?

The observations from the layered solutions indicated that the first substance put into the test tube was more dense, it stayed on the bottom.

(b) Explain

The mixture that showed no layering was the red and yellow, both substances were the same density.

5

C

3. (a) Prepare a data table in which you can record your qualitative data for each test that you do. Include a column in which you indicate your conclusion on the test (e.g. "Therefore, Red is more dense than Green, R>G). Enter all of your data in your table.

Mix #1	Mix #2	Observations
Blue	red	Blue > red
Blue	yellow	Blue > yellow
Blue	green	Blue > green
Red	green	Red > green
Red	yellow	Red = yellow
green	yellow	green < yellow

3. (b) State what you found out.

I found that the first mixture in each experiment seemed to be more dense, except green was less dense than yellow and the red and yellow mixed.

4. (a) Rank the densities of the three "unknown" sample solutions

graduated cylinder = 48.46 g.
 green - $v = 1.5 = 49.27g$
 $D = .81 / 1.5 = 0.54$
~~pink - $v = 1.5 = 49.32g$ $D = .86 / 1.5 = .573$ $D = 0.66$~~
~~blue - $v = 1.5 = 49.43g$ $D = .99 / 1.5 = 0.66$~~

- (b) Which "unknown" solution has the same density as the yellow "standard" solution?

yellow - $v = 1.5 = 49.26g$
 $D =$
 yellow - $D = 1.5 = 49.42g$
 $D = 0.80 / 1.5$
 $D = 1.875$
 Red seems to be the closest to the original (yellow)

D

5. Why would "Confederation" want their product to have a minimum density of 1.1 g/mL, BUT no higher or lower than this value?

Confederation would want their syrup to have a 1.1 density, no higher or lower because they want their syrup to have the same density as the yellow, the syrup would be noticeably natural

B. Daily Quantitative Tests

6. (a) Use the equipment necessary to find the density of the "unknown" solution that has the same density as the yellow "standard" solution. Prepare a chart in the space below and enter your quantitative measurements in it.

pink - ~~water~~
 $v = 1.5 =$

Solution	Mass	Volume	Density
Green	.81	1.5	0.54
Red	.86	1.5	0.573
blue	.99	1.5	0.66
yellow	.80	1.5	1.875

6. (b) Use the data from 6(a) to calculate the density of the solution, showing all work.

Red
 0.57333
 $.81 \div 1.5 = 0.573$

E

7. (a) Did the results from the layering activity in 4 (a) and 4(b) match your calculated results?

No These experiments did not match, in the layering activity the solutions (red, yellow) mixed, when I calculated the density, they did not match.

7. (b) Account for any errors that could have occurred.

- Calculations weren't done correctly.
- more than the 2 colours were mixed
- wrong amounts of syrup were used.

8

F

Daily Tours

8. (a) A tour of Grade 5 students from an elementary school has just arrived at your laboratory. Explain, in language they can understand, how you used the equipment in 6(a) to determine the actual density of one of the unknown sample solutions.

- we found the actual density by first finding the mass, then the volume and used the formula $D = M/V$ which means density = mass divided (\div) by volume.
- This gave the density of the unknown substances.

8. (b) Explain to the students what skills are necessary for a quality control technician AND why your job is important to the company.

Skills

- math
 - language
- Your job is important because if the density is wrong you can cause failure for the business.

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Teacher's Notes**Knowledge/Understanding**

- The student demonstrates limited understanding of the concept of density (e.g., explanations are limited to simple observations that do not give evidence of conceptual understanding).
- The student applies the density formula with limited competence (e.g., performs most calculations correctly, but does not state the formula or show the major steps in the calculations).

Inquiry

- The student interprets the data with limited accuracy (e.g., does not correctly identify the relative densities of the solutions in some of the sample mixtures).
- The student uses technical skills and procedures with limited accuracy (e.g., in question 8a, does not provide details of the procedures followed in the experiment).
- The student draws conclusions that are supported by the data in a limited way (e.g., data tables are only partially complete).

Communication

- The student communicates observations and information with limited clarity (e.g., “I found that the first mixture in each experiment seemed to be more dense, except green was less dense than yellow and the red and yellow mixed”).
- The student displays some data with limited organization (e.g., in question 4a, does not display ranking clearly).
- The student uses SI units with limited appropriateness (e.g., uses correct units for observations of mass, but omits volume and density units).

Making Connections

- The student provides a limited analysis of production requirements (e.g., in question 5, suggests only that the company would want the syrup to be natural).
- The student demonstrates limited awareness of the skills required for the occupation (e.g., in question 8b, mentions only “math” and “language” as required skills).

Comments/Next Steps

- The student needs to recognize the importance of recording observations when conducting experiments.
- The student should focus on the consistent and appropriate use of units, and ensure that data charts incorporate all the information required.
- The student should concentrate on answering questions with greater clarity, and on attention to detail