



Exercise 1: Starch and Sugar

Data Table 1: Benedict's Reagent Data

Sample	Initial Color	Final Color	Reducing Sugar Present in Sample (Y/N)
dH ₂ O	Light Blue	Light Blue	N
Albumin	Light Blue	Light Blue	N
Unknown	Light Blue	Blue	N
Milk	Light Blue	Green	Y
Glucose	Light Blue	Orange	Y

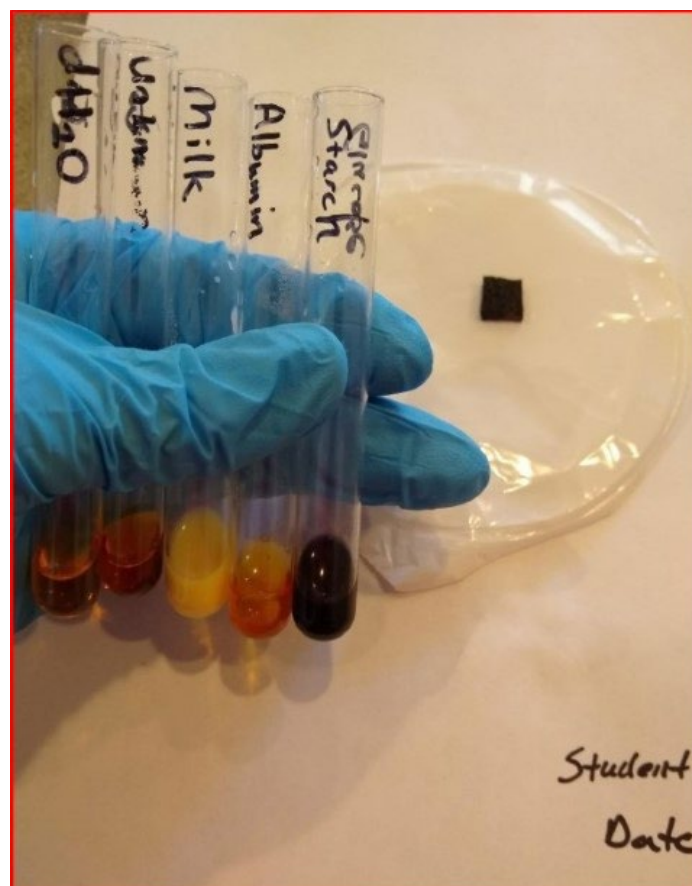
Photo 1: Benedict's Test Results



Data Table 2: IKI Test

Sample	Initial Color	Final Color	Starch Present in Sample (Y/N)
dH ₂ O	Clear	Amber	N
Albumin	Clear with cloudy bits	Amber	N
Unknown	Clear	Amber	N
Milk	White	Amber	N
Starch	Clear	Black	Y
Raw Potato	Yellow	Black	Y

Photo 2: IKI Test Results



Question 1

What are the structural and functional differences between simple and complex carbohydrates?

Simple carbohydrates contain only one or two sugar monomers and function as energy for cellular processes. Complex carbohydrates are composed of at least three sugar monomers and may

consist of hundreds of these units as with starch. Complex carbohydrates function as storehouses for energy, but these molecules must be broken down into simple carbohydrates before they can fuel cellular processes.

Question 2

Did the Benedict's test of reducing sugars for the glucose and milk samples indicate similar sugar content? Reference Data Table 1 and Photo 1 in your explanation.

While both milk and glucose tested positive for reducing sugars as recorded in Data Table 1, the milk sample turned green indicating it had lower levels of reducing sugars than the 20% glucose sample which turned orange as shown in Photo 1.

Question 3

Were reducing sugars or starch present in the unknown sample? Use your results in the data tables and photos to explain your answer.

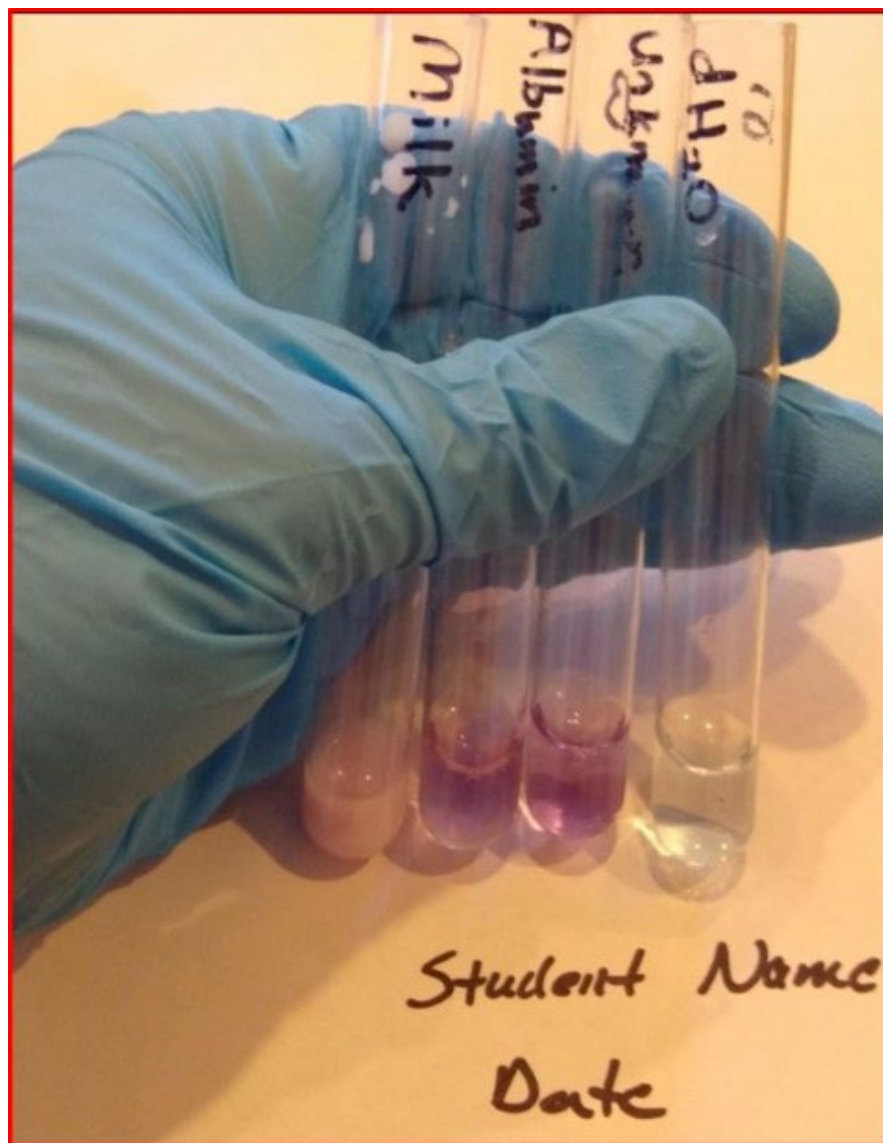
Reducing sugars were not present in the unknown, as indicated by the blue color when testing with Benedict's reagent as recorded in Data Table 1 and Photo 1. Starch was also not present, as indicated by the lack of an inky black color during the IKI test and as reported in Data Table 2 and Photo 2.

Exercise 2: Protein, Lipids, Nucleic Acids, and Unknown Determination

Data Table 3: Biuret Reagent Data

Sample	Initial Color	Final Color	Protein Present in Sample (Y/N)
dH ₂ O	Clear	Clear Blue	N
Albumin	Clear with Cloudy Bits	Purple with White Bits	Y
Unknown	Clear	Purple	Y
Milk	White	Purple/Cloudy	Y

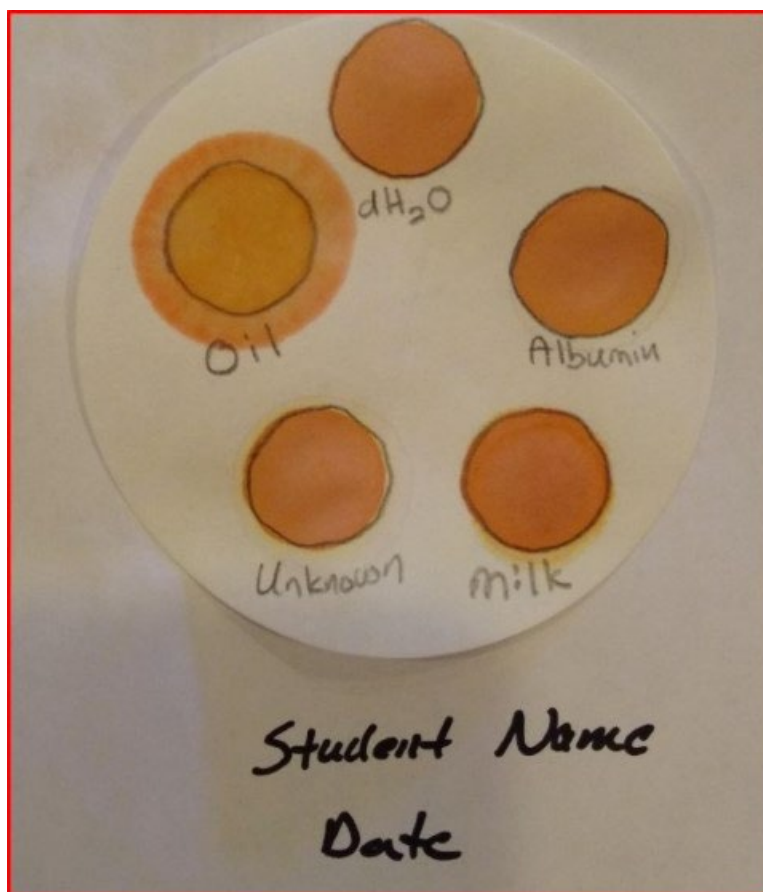
Photo 3: Biuret Reagent Results



Data Table 4: Sudan III Data

Sample	Sample Observations	Lipid Present in Sample (Y/N)
dH ₂ O	The Sudan III did not extend over the pencil line.	N
Albumin	The Sudan III did not extend over the pencil line, yet there was a small gray colored ring that formed just outside of the pencil line.	N
Unknown	The Sudan III did not extend over the pencil line, yet there was a small gray colored ring that formed just outside of the pencil line.	N
Milk	The Sudan III slightly migrated outside the pencil line as a pale orange color.	Y
Vegetable Oil	The Sudan III extended over the pencil line, approximately 0.5 inches around the line.	Y

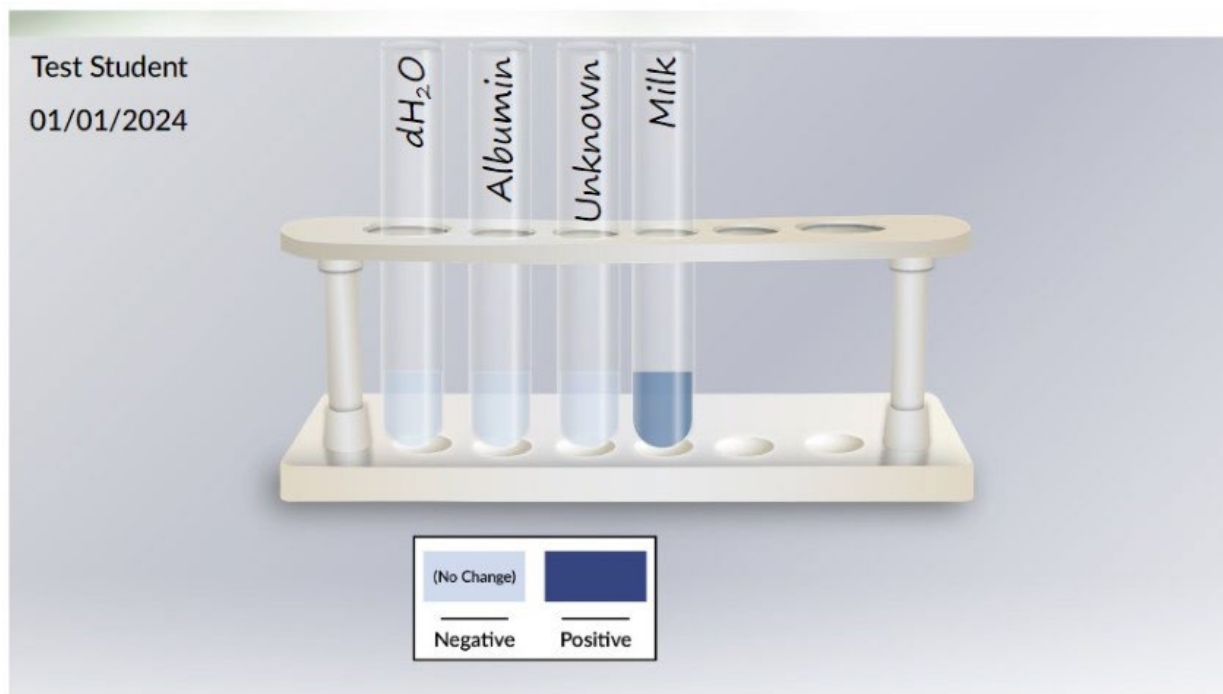
Photo 4: Sudan III Results



Data Table 5: Dische Diphenylamine Data

Sample	Sample Observations	DNA Present in Sample (Y/N)
dH ₂ O	No color change	N
Albumin	No color change	N
Unknown	No color change	N
Milk	The solution turned dark blue	Y

Photo 5: Dische Diphenylamine Reagent Results



Data Table 6: Results Summary

Sample	Reducing Sugars (Y/N)	Starch (Y/N)	Protein (Y/N)	Lipids (Y/N)	DNA (Y/N)
dH ₂ O	N	N	N	N	N
Albumin	N	N	Y	N	N
Unknown	N	N	Y	N	N
Milk	Y	N	Y	Y	Y

Panel 1: Unknown Identity

The unknown is albumin. Albumin was determined as the results for unknown testing matched only albumin: positive for protein and negative for reducing sugars, starches, lipids, and nucleic acids.

Question 1

Which of the macromolecules tested in this exercise (proteins, lipids, nucleic acids) were formed by dehydration reactions? Explain your answer by describing the structure of each macromolecule.

Proteins, lipids, and nucleic acids are all formed by dehydration reactions. Each of these macromolecules consists of small, repeated units, called monomers, bound together to form a chain. As each bond is formed in the chain, a molecule of water is produced.

Question 2

Would it have been possible to determine the identity of the unknown if a whole egg was used instead of only the albumin? Explain your answer noting that egg yolks contain lipids and proteins.

No. If the yolk of the egg were used in addition to the albumin, the sample would have generated positive results in the protein test and in the lipid test. The unknown sample results would not have been consistent with any of the other samples and its identity would not have been determined.

Extension Question

Sam is a biology lab instructor at a local college. One of his online students asks if they can replace the 2% fresh milk required for their macromolecule testing experiment with unsweetened almond milk, a plant-derived product. The nutrition label is pictured below.

Nutrition Facts	
Serving Size 8 fl oz (237ml)	
Servings Per Container 6	
Amount Per Serving	
Calories 35	Calories from Fat 30
% Daily Value*	
Total Fat 3g	5%
Saturated Fat 0g	0%
Trans Fat 0g	
Cholesterol 0mg	0%
Sodium 160mg	7%
Total Carbohydrate 1g	0%
Dietary Fiber 1g	4%
Sugars 0g	
Protein 1g	
Vitamin A 0%	Vitamin C 0%
Calcium 45%	Iron 2%
*Percent Daily Values are based on a 2,000 calorie diet.	

What should Sam recommend to the student regarding the substitution for procedures that mirror the ones used in the lab you just completed? Explain your answer by including the testing results that the almond milk will generate for proteins, lipids, reducing sugars, starch, and DNA based on your experience when completing the exercises for this laboratory.

Sam should not recommend the student use almond milk as the macromolecules differ from those in 2% milk. Unsweetened almond milk lacks reducing sugars and would produce negative results when performing Benedict's test. Conversely, almonds contain starch (dietary fiber) and would produce positive results when using IKI indicator, unlike 2% milk. Lastly, almond milk contains very little protein and might not produce positive results for the Biuret test.