

**Introduction:**

Most of us have had a urine test (urinalysis) as part of a routine check-up or an exam at the doctor’s office. This test is ordered frequently by doctors because it can alert them of health problems even before the patients have symptoms. Usually, urine should contain almost no glucose (sugar) or protein because they are reabsorbed in the kidneys when they are present at normal levels. Protein in the urine (called proteinuria) most often occurs when there is a problem in the patient’s kidneys, but is also associated with other conditions (that would require further testing to identify). If glucose is found in the urine (called glucosuria), it may indicate that the patient has diabetes. Diabetics do not produce enough of the hormone insulin which helps their cells absorb glucose from the blood that carries it to all of the body parts. As a result, the excess sugar is excreted in the urine. So, how do doctors detect protein or glucose in urine? Today you will find out. In this activity you will act as medical investigators and test the urine samples of 3 patients for protein and glucose to detect disease.

**Materials:**

6 test tubes

6 plastic droppers

Glucose solution

Marking pencil

Glucose test strips

3 Urine samples

Test tube rack

Water

Protein solution

Paper towels

Biuret solution

**SAFETY: Wear safety goggles and handle the glassware carefully. Biuret solution can harm skin and damage clothing.**

**Procedure:**

1. Label 3 test tubes with the following: 1 tube **“W”** for water, 1 tube **“G”** for glucose, 1 tube **“P”** for protein. Place them in the test tube rack.
2. Label the 3 remaining test tubes as follows: 1 tube **“A”** for Patient A, 1 tube **“B”** for Patient B, 1 tube “**C**” for Patient C. Place them in the test tube rack.
3. Label six glucose test strips with the same letters as the test tubes.
4. Fill each tube about ½ full with the solution that corresponds to its label. Be careful not to get any of the solutions mixed up! If you were a doctor, you would not want to mix up your patients’ test results!!
5. Place the “W” glucose test strip on a clean, dry paper towel. Use a clean dropper to place 2 drops of the water (from the “W” test tube) on the test strip. In the data table on the next page, record if the test strip changes color or if there was “No Change” in the test strip.
6. Repeat the procedure to test the other 5 solutions for glucose. Record your results.
7. Obtain a bottle of Biuret solution. **Note the color of the Biuret Solution**.

**\*CAUTION: Handle the Biuret solution with care. Biuret solution can harm skin and clothing.\***

1. Add 20 drops of Biuret solution to the “W” (water) test tube. Gently swirl the test tube to mix the solutions together. Observe and record if there were any color changes. You may hold the test tube up against a white paper towel if it is difficult to tell if there was a color change or not.
2. Repeat step 8 for the other 5 solutions.
3. WAIT to dispose of your solutions until your teacher gives you further instructions.

Urinalysis Results:

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Test For: | W  (water) | G  (glucose) | P  (protein) | A  (Patient A) | B  (Patient B) | C  (Patient C) |
| Glucose Test Strips |  |  |  |  |  |  |
| Biuret Solution (Protein) |  |  |  |  |  |  |

**Critical Thinking:**

1. Why was it important to test the known solutions (the water, glucose, and protein) with the glucose test strip and Biuret solution before we tested the patients’ urine samples?
2. Which of the three patients’ appear to be healthy based on the test results of their urine samples? How do you know?
3. Which urine sample(s) indicated that the patient may have diabetes? Explain.
4. Which urine sample(s) indicated that the patient may have kidney problems? Explain.
5. If you were a doctor, how could you determine if diet changes would be effective at reducing the amount of glucose in patient’s urine, thus preventing them from having to start taking medications for their illness?