As Easy as Pie

Background
It’s Thanksgiving morning and you answer a frantic phone call from your grandma. She tells you she spent all day yesterday baking her famous pies for Thanksgiving dinner and left them on the counter to cool overnight. When she woke up this morning, they were gone. She doesn’t have time to make more pie, and Thanksgiving dinner won’t be the same without them. She suspects the thief is someone she knows, so she has already collected some evidence. She is depending on you and your chemistry skills to help her track down the thief and confirm her suspicions.

When you arrive at her house, you notice some white powder that has been tracked across her kitchen floor. You ask her what it is, but she used so many white powders in the creation of her masterpieces, she’s not sure which one it is. You head to her pantry and discover the following:

- Salt, NaCl, an ionic compound used for flavoring
- Baking soda, NaHCO₃, an ionic compound that is used as a leavening agent in baked goods
- Corn starch, C₆H₁₁O₅, a covalent compound used as a thickening agent
- Powdered sugar, C₁₂H₂₂O₁₁, a covalent compound used as a sweetener

You take some notes then ask her about her preliminary investigation. She hands you the following profiles:

**Suspect #1**  
**Name:** Betty Crump  
**Occupation:** Grandma’s best friend & nosy neighbor  
**Evidence:** White powdery substance collected from the stairs of the back door to her house  
**Back-story:** Betty has extended family coming to town for Thanksgiving dinner and is a terrible cook

**Suspect #2**  
**Name:** Gladys Smith  
**Occupation:** Retired teacher & vocal city councilwoman  
**Evidence:** White powdery substance collected near her kitchen sink, right next to where she keeps her dentures  
**Back-story:** Gladys is Grandma’s biggest Bingo rival, and she is jealous of Grandma’s recent winnings

**Suspect #3**  
**Name:** George Jones  
**Occupation:** Works for the city’s transportation department  
**Evidence:** White powdery substance collected from his work boot soles  
**Back-story:** George is a big fan of Grandma’s pies and has been begging her to make him one for him to take to his own family’s Thanksgiving

**Suspect #4**  
**Name:** Millie Malone  
**Occupation:** Retired lunch lady & county fair blue ribbon contender  
**Evidence:** White powdery substance collected from the door handle leading into her kitchen  
**Back-story:** Millie’s pies placed second in the last county fair behind Grandma’s, and she still hasn’t gotten over it
You collect the white powder from the kitchen floor, the white powders from the pantry, the evidence collected at the homes of the suspects, vinegar from the pantry, iodine from the medicine cabinet, a hot plate, beakers, a spot plate, a conductivity tester, and pH paper from your chemistry lab, and get to work.

**Procedure**
Design a series of tests to determine what the unknown substance on the kitchen floor is. Write out the steps you take in the space below – make sure your instructions are clear and could be easily repeated by another scientist.

**Data**
Create a data table to clearly organize the information you gather from your tests.

**Conclusion**
Who stole Grandma’s pies?! Explain how your tests led you to this conclusion.