**Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Identifying Unknown Substances using Physical and Chemical Properties**

You have been called in by the VSS crime lab to solve the mystery of the white powder. Over the last few weeks, small packages of white powder have been found around the school. The packages have been screened for illegal substances, and fortunately it has been found that they contain common household substances.

They have come to you to determine the identity the different substances.

**Part 1: Determining Chemical and Physical Properties of the Known Substances**

First you will need to determine the physical and chemical properties of the different possible chemicals that are being used. To do this, you will use the procedure below.

**To determine physical properties:**

1. Obtain a small amount of a known substance. Record its name in the data chart provided.
2. Observe the following physical properties of the substance: colour, lustre, clarity, odour, solubility in water, crystal/ particle size.
3. Repeat for all known substances.

**To determine chemical properties:**

1. Obtain a small amount of a known substance. Place the small amount in a well on the spot plate.
2. Perform the following chemical tests:
* **Reaction with water:** Add 3 drops of water to the sample. Record your observations.
* **Reaction with vinegar:** Add 3 drops of vinegar to the sample. Record your observations.
* **Reaction with iodine:** Add 3 drops of iodine to the sample. Stir. Record your observations.
* **Reaction with phenolphthalein:** Add 1 drop of water to the sample. Stir. Add 2 drops of phenolphthalein. Record your observations.

**Part 2: Determining the identity of the unknown substance:**

Once you have completed the tests for the known samples, obtain one of the crime samples from the front lab bench.

1. Determine the physical and chemical properties of the unknown substance using the methods above. Record your observations in the chart.

**Table 1: Physical and Chemical Properties of Known Substances**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Known Substance** | **Physical Properties** | **Reaction with water** | **Reaction with Vinegar** | **Reaction Iodine** | **Reaction with Phenolphthalein** |
| **sodium bicarbonate** |  |  |  |  |  |
|  |
|  |
|  |
|  |
| **baking powder** |  |  |  |  |  |
|  |
|  |
|  |
|  |
| **Icing sugar** |  |  |  |  |  |
|  |
|  |
|  |
|  |
| **cornstarch** |  |  |  |  |  |
|  |
|  |
|  |
|  |
| **sodium chloride** |  |  |  |  |  |
|  |
|  |
|  |
|  |
| **baby powder** |  |  |  |  |  |
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|  |

**Table 2: Physical and Chemical Properties of the Unknown Substance**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Unknown Substance** | **Physical Properties** | **Reaction with water** | **Reaction with Vinegar** | **Reaction Iodine** | **Reaction with Phenolphthalein** |
| **Sample # \_\_\_\_\_\_** |  |  |  |  |  |
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**Analysis and Conclusions:**

1. Based on your observations, what is the identity of the unknown substance? Justify your answer using evidence from the lab.
2. Which properties, physical or chemical, did you find most helpful in identifying the unknown powder? Why? Justify using examples from the lab.
3. What other properties might have been useful in helping you identify the unknown sample. Choose 2 properties and explain how you would go about obtaining information on these properties using the samples provided (you may bring in any type of lab equipment you wish) (i.e. what procedure might you use).
4. Present me with a real-life situation where you might need to identify an unknown substance. Given the situation, what methods might you use to identify it.