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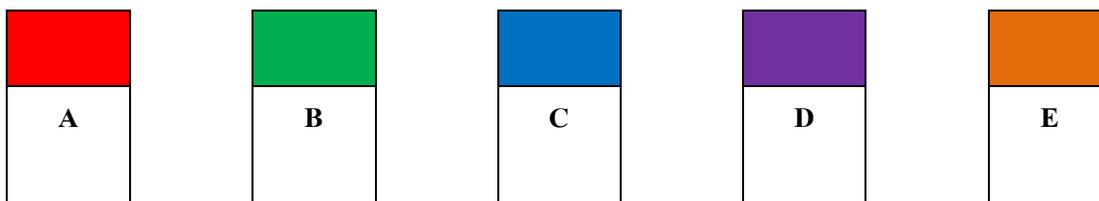
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**EXPERIMENT I : What are those white powders?**

Today is mother's birthday. You want to cook an easy meal for her. It is your first time venture into her kitchen territory. Opening the seasoning shelf, you found five unlabeled jars which have different lid color. Each jar contains white or colorless solid. You kind of have an idea that they could be **salt, sugar, baking soda, starch, and monosodium glutamate (MSG)**. Before start cooking anything, you must first figure out the identity of the solid in each jar. You do not dare to taste the unknown samples because you know that monosodium glutamate can trigger allergic symptoms. Luckily, there are some household chemicals, such as vinegar, Condy's crystals solution and Tincture of iodine, that can help you solve the puzzle. Can you correctly identify the mystery powder?



**Hints:**

1. Vinegar is a common acid in the kitchen. Its reaction with base gives some bubbles.
2. Condy's crystals solution (potassium permanganate,  $\text{KMnO}_4$ ) is used for wound cleansing. It turns from purple to brown when reacts with sugar, starch, and monosodium glutamate.
3. Tincture of iodine is an antiseptic. Iodine reacts with starch. The color changes from brown to purple color.
4. Solubility of MSG in water is better than that in vinegar.

**Materials:**

2 Measuring spoons	Vinegar
2 Plastic droppers	Iodine solution
2 Clear plastic plates	Condy's crystals solution ( $\text{KMnO}_4$ )
	Water

**Procedures**

1. Place one spoonful of each powder in each well of clear plastic plates.
2. Take the dropper and place 4 mL of water on each individual powder. Examine what happens? Do the powders dissolve? Write your observations in the result table.
3. Add 4 mL of water to another empty well as a blank for color comparison. Add 2 drops of Condy's crystals solution to each unknown solution and the blank solution. Record your observations in the "Color test with  $\text{KMnO}_4$ " column.
4. Repeat steps 1-2. Then, add 2 drops of iodine solution to each unknown solution and a blank solution. Record your observations in the "Iodine test" column.
5. Repeat steps 1-2, but change from 4 mL of water to 4 mL of vinegar. Record what happens? Do the powders dissolve? Write your observations in the result table.

**Caution:** Iodine solution and Condy's crystals solution should be handled with care.

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**EXPERIMENT I ANSWER SHEET**

**Write your observations in the result table. (15 points)**

**Indicate the solubility as the following:** /// = all dissolved, // = partly dissolved, / hardly dissolved

Unknown	Solubility in water	Solubility in vinegar	Color test with $\text{KMnO}_4$	Iodine test	Identity
A					
B					
C					
D					
E					

**Questions 1** Which powder undergoes a chemical reaction? Explain what supports your answer. (3 points)

**Answer:** .....

.....

.....

.....

**Questions 2** What kind of gas in the reaction of vinegar with base? (1 point)

**Answer:** .....

**Questions 3** If you don't have vinegar in the kitchen, what else can be used instead? Why? (1 point)

**Answer:** .....

**Answer Keys:**

<b>Unknown</b>	<b>Solubility in water (2.5)</b>	<b>Solubility in vinegar (2.5)</b>	<b>Color test with KMnO<sub>4</sub> (2.5)</b>	<b>Iodine test (2.5)</b>	<b>Identity (5)</b>
A	//	///	Purple	Brown	Baking soda
B	///	///	Brown	Brown	Sugar
C	///	///	Purple	Brown	Salt
D	///	/	Brown	Brown	MSG
E	/	/	Brown	Purple	Starch

1. Which powder undergoes a chemical reaction? Explain what supports your answer.

..... Baking soda + vinegar

(gas bubbles).....(1).....

..... Starch + Iodine

(color change).....(1).....

..... Sugar, MSG, salt +  $\text{KMnO}_4$

(color change).....(1).....

2. What kind of gas in the reaction of vinegar with base?

.....Carbon dioxide ( $\text{CO}_2$ )..... (1).....

3. If you don't have vinegar in the kitchen, what else can be used instead? Why?

.....Lime, lemon

(acid).....(1).....