

Advance Preparation

Use a mortar and pestle to grind the pills into powder, or have the students do it, but this will increase the risk of contamination.

Twelve-well white ceramic spot plates are best for this activity because they don't stain or dissolve by inadvertent contact with solvents such as acetone; however, they are more expensive than the white plastic type. Check with your Kendall/Hunt representative or your preferred science supplier. You will need two per group.

For 0.6 M HCl, dilute the 6 M HCl used in Chapter 6 ("Fibers") 1:10; that is, 1 ml 6 M HCl to 9 ml water. Add 3 g of $\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$ to 100 ml water (3 g of the hydrated iron chloride gives about 2 g of the iron chloride itself). You will also use this reagent later in the chapter.

For each group, you will need a spatula, four labeled dropping bottles or reagent bottles with Beral pipettes for the reagents (include the water), seven labeled containers for the drugs and unknowns, toothpicks for mixing, and a grain of rice.

LABORATORY ACTIVITY 7.1: Spot Test Lab

This activity will give you practice in identifying some over-the-counter drugs with spot tests.



Color spot tests

Materials

For each lab group:

- aspirin
- Alka-Seltzer
- sodium bicarbonate
- acetaminophen
- Excedrin
- stereomicroscope
- distilled water
- Beral pipette
- universal indicator
- 0.6 M HCl
- 2 percent ferric chloride solution
- spot plates
- spatula
- toothpicks
- unknown powders #1 and #2
- mortar and pestle

If you do not use distilled water, test your water with the universal indicator.



SAFETY ALERT! CHEMICALS USED

Always wear goggles and an apron when working in the laboratory

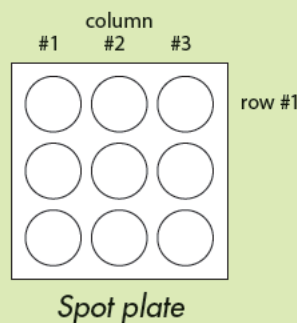


SAFETY NOTE Also wear disposable lab gloves. Avoid inhalation, ingestion, and skin contact with chemicals.

Procedure

Do not write in your textbook. Take notes in your science notebook.

1. In the first horizontal row of the spot plate, place a small amount of aspirin (no bigger than a grain of rice) into each of the three depressions. Label the row.
2. Repeat step 1 for each of the other five powders. Label each row.
3. Examine each of the powders, noting color and texture. Make a data table and record your observations on it.
4. Examine each of the powders under the microscope. Record your observations.
5. Add five drops of distilled water to each powder in column #1 of the spot plate. Record your observations.
6. Add one drop of universal indicator to each of the depressions in column #1. Use a different toothpick to stir each one. Record the color and pH of each powder. Note whether the substances are acidic or basic.
7. Add two drops of HCl to each of the powders in column #2. Record your observations.
8. Add two drops of the ferric chloride solution to each of the powders in column #3. Use a different toothpick to stir each one. Record your observations.
9. Carefully discard all solutions into the sink and rinse the plate with water.



Analysis

1. Aspirin (acetylsalicylic acid), the most widely used drug in the world, is usually taken as a pain reliever. An acidified solution of ferric chloride can be used to detect the presence of aspirin in an unknown powder. The aspirin hydrolyzes to form acetic acid, and the ferric ion reacts with the salicylic acid to form a compound of what color?
2. Acetaminophen, a widely used pain reliever, is not acidic; therefore, it is often taken by people who cannot tolerate aspirin. How can you tell that a sample contains acetaminophen?
3. Antacids are slightly basic compounds used to treat hyperacidity, too much hydrochloric acid in the stomach. Many of these products contain carbonates that react with or neutralize the acid in the stomach to produce a salt, water, and carbon dioxide gas. How can you tell that a sample contains an antacid (sodium bicarbonate)?
4. Alka-Seltzer contains sodium bicarbonate, citric acid, and aspirin; it reacts with water to produce carbon dioxide gas. How can you tell that Alka-Seltzer is present in a sample?

Drug possession defendant Christopher Jansen, on trial in Pontiac, Michigan, said he had been searched without a warrant. The prosecutor responded that the officer didn't need a warrant because a bulge in Jansen's jacket could have been a gun. Nonsense, said Jansen, who happened to be wearing the same jacket that day in court. He handed it over so the judge could see it. The judge discovered a packet of cocaine in the pocket and laughed so hard he required a five-minute recess to compose himself.

Answers to Analysis Questions

1. The universal indicator turns purple; ferric chloride turns violet.
2. The universal indicator turns green; ferric chloride turns violet.
3. There will be no reaction with ferric chloride, the universal indicator turns greenish blue, and an addition of HCl fizzes.
4. The addition of water causes fizzing.
5. Excedrin reacts the same as aspirin and acetaminophen.
6. You can use any of the powders to make unknowns for student analysis.

LAB ACTIVITY 7.1: Spot Test Lab continued

5. Excedrin is a mixture of aspirin, acetaminophen, and caffeine. What would be a good test for Excedrin? Would you need more than one test?
6. Use what you know about color spot tests to identify unknown powders #1 and #2.

Procedure Note:

Have students set up a test protocol. They don't know if the sample is one of the drugs they have tested or if it is ibuprofen. They haven't tested a known ibuprofen yet, so that must be done first. Then their results can be compared to those from the previous color tests.

It turns out that ibuprofen shows no reaction with any of the three reagents. Here is a case in which no result (that is, no reaction) is a result; it defines ibuprofen in this particular field of tests.

Different investigative groups of students can be assigned different unknowns; just add more canisters to the passenger's suitcase.

You may want the students to weigh the sample and determine the penalty for possession. The students should realize that a confirmatory test must be performed subsequently.

LABORATORY ACTIVITY 7.2: Is It Ibuprofen?

At the international arrivals area of the Detroit airport, a random inspection of a passenger's suitcase reveals an unmarked prescription bottle containing a white powder. The passenger indignantly says it is ibuprofen, powdered for quick dissolving as a headache remedy, and that he never travels without it. Customs agents need to have a quick spot test done because they don't know whether to call the DEA or let the man go. You run a quick test. What do you advise them to do?



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