Lab 9: Over-the-Counter Drugs

Report:
You work in a clinical lab for a hospital. A doctor has sent down an unknown sample for you to identify. A small child got into his parent’s drug cabinet and swallowed a pill from a bottle. The child took the label off of the bottle and flushed it down the toilet. To make matters worse, the child had an allergic reaction to the drug. Fortunately, he is okay but the doctor wants to know what drug it was so that his parents know not to give him the drug in the future. Based on the type of bottle and place that the drug was located, we know that the pill was an over-the-counter pain reliever. In your report, make sure that you address the following points/questions:
1. Based on your data, what is the identity of the unknown pain reliever (make sure that you include the unknown #)? Analyze your data from Parts One and Two and list all evidence for choosing this pain reliever.
3. Which of the five pain relievers tested was the most acidic? Which was the least acidic? (Remember, the lower the pH, the more acidic the substance becomes.)
4. Did the pH (acidity) of any of the pain relievers change over time? Which ones? Explain.
5. When the “simulated stomach acid” (0.5 M HCl) was added to the pain relievers, what happened to the pH? Did any pain relievers resist a drastic drop in pH? Explain.
6. Compare the structures of acetylsalicylic acid, acetaminophen, and ibuprofen from the background section. What similarities do you notice in terms of structure? What differences?
7. Explain what would happen if an overdose of your unknown drug occurred.

In addition, your friend makes a bet with you that you can’t identify an unknown over-the-counter antacid. She believes they are all exactly alike. Looking to make some easy money and gloat over your friend for winning the bet (hopefully), you accept her bet. In a second and more informal report, make sure that you address the following points/questions:
1. Based on your data, what is the identity of the unknown antacid (make sure that you include the unknown #)? Analyze your data from Parts Three and Four and list all evidence for choosing this antacid.
2. Why is it important for antacids to dissolve slowly in acids? Hint: Refer to the background section.
3. Compare the pH of the three antacids tested before adding HCl. Then compare the pH of the three antacids after adding HCl, “stomach acid”. Which antacid(s) seem to be the most effective? Which antacid(s) seem to be least effective? Explain.
4. Did you win the bet? 😊
Procedure:
Part One: Known OTC Drug Testing – Pain Relievers
1. Place a 24-well reaction plate on a sheet of white paper on the lab bench. Label the sheet of paper as indicated in Data Table 1.
2. Use a mortar and pestle to grind up a single tablet of the first pain reliever, aspirin.
3. Use a spatula to add a few granules of powdered aspirin to each of the four wells of Column 1 of the well plate. Save the remaining powdered aspirin in a labeled test tube – in case a test needs to be repeated later.
4. Clean the mortar and pestle by wiping both with a dry paper towel.
5. Repeat steps 2-4 for the remaining four OTC pain reliever tablets. Place a few granules of powdered acetaminophen in each well of Column 2 of the well plate, ibuprofen in Column 3, Bufferin in Column 4, and Excedrin in Column 5. Leave Column 6 empty – this will be used for the unknown pain reliever sample.

Row A – Appearance/Solubility
6. Make detailed observations about the appearance of each powder, noting the color and consistency of each. Record observations of appearance in Row A of Data Table 1.
7. Using a dropper pipet, add 10-15 drops of deionized water to each of the five powders across Row A.
8. Observe any physical or chemical changes that occur (e.g. fizzing or dissolving).
9. Stir each well of Row A with a toothpick. Observe and record the solubility of each powdered OTC pain reliever in Data Table 1. Use the following guidelines to determine the solubility of each:
   • If the resulting solution is clear, then the drug is soluble.
   • If the resulting solution is cloudy, then the drug is slightly soluble.
   • If the powder remains unchanged and there is a thick white precipitate, then the drug is insoluble.
   Note: To avoid contamination while stirring, use five toothpicks – one toothpick for aspirin, one for acetaminophen, etc.

Row B – Acidity/pH
10. Using a dropper pipet, add 10 drops of deionized water to each of the five powders across Row B. Stir.
11. Using a different dropper pipet, add 3-4 drops of universal indicator to each well of Row B. Record the color of each solution in Row B of Data Table 1. Be very specific when describing the color so as to distinguish between the wells. Note the approximate pH of each solution by comparing the color to the universal indicator color chart.
12. Determine an accurate pH of each OTC drug by dipping one end of a strip of 1-12 pH paper into each of the corresponding wells of Row B. Save resources by using each end of the pH paper for a different well (but don’t get the solution on your hands). Use the color chart on the pH paper tube to determine the pH. Record the pH of each in Row B of Data Table 1. Note: Monitor the color in the wells of Row B as the lab progresses. Watch for any changes in color over time. For any wells that do change color, be sure to retest the pH using a fresh pH strip and record data in Data Table 1.
**Row C – Reaction with HCl, “Simulated Stomach Acid”**

13. Using a dropper pipet, add 10 drops of 0.5 \( M \) HCl “simulated stomach acid” solution to each well of Row C.
14. Stir each well of Row C with a toothpick. Observe any reactions that occur as noted by fizzing (slight or rigorous) or dissolving (insoluble, slightly soluble, or fully soluble). Record detailed observations in Row C of Data Table 1.
15. Determine the pH of each OTC pain reliever in the “stomach” by dipping one end of a strip of 1-12 pH paper into each of the corresponding wells of Row C. Save resources by using each end of the pH paper for a different well. Use the color chart on the pH paper tube to determine the pH. Record the “stomach” pH of each in Row C of Data Table 1.

**Row D – Reaction with Ferric Nitrate**

16. Using a dropper pipet, add 10 drops of 0.2 \( M \) Fe(NO\(_3\))\(_3\) solution to each well of Row D.
17. Stir each well of Row D with a toothpick. Observe any reactions that occur as noted by fizzing or color changes. Record detailed observations of each solution in Row D of Data Table 1. Be very specific when describing the color so as to distinguish between the wells.
18. Repeat any tests that gave unclear results using the remaining pain relievers that were saved earlier. Go on to Part Two – testing an unknown OTC pain reliever. Do not rinse out the well plate until Part Two is completed.

**Part Two: Unknown OTC Drug Testing – Pain Relievers**

1. Obtain an unknown powdered sample of an OTC pain reliever from your instructor. Record the unknown letter in Data Table 1.
2. Use a spatula to add a few granules of the powdered unknown OTC drug sample to each of the four wells of Column 6 of the well plate. Save the remaining amount of sample for later use – in case a test needs to be repeated.
3. Repeat steps 6-9 from Part One for Row A of the reaction plate. Record observations in Data Table 1.
4. Repeat steps 10-12 from Part One for Row B of the reaction plate. Record observations in Data Table 1.
5. Repeat steps 13-15 from Part One for Row C of the reaction plate. Record observations in Data Table 1.
6. Repeat steps 16-17 from Part One for Row D of the reaction plate. Record observations in Data Table 1.
7. Compare your results from the unknown to each of the five known pain reliever samples in Columns 1-5. Record observations.
8. Rinse out the reaction plate in the sink, using plenty of tap water. Use a cotton swab to clean the individual wells. Tap the plate dry for use in Part Three. Empty the test tubes containing the excess powdered pain relievers into the sink and clean them.

**Part Three: Known OTC Drug Testing – Antacids**

1. Place a 24-well reaction plate on a sheet of white paper on the lab bench. Label the sheet of paper as indicated in Data Table 2.
2. Use a mortar and pestle to grind up a single tablet of the first antacid, Alka-Seltzer.
3. Use a spatula to add a few granules of powdered Alka-Seltzer to each of the four wells of Column 1 of the well plate. Share the powdered Alka-Seltzer with another lab group as
these tablets are large in size. Save the remaining powder in a labeled test tube – in case a test needs to be repeated later.

4. Clean the mortar and pestle by wiping both with a dry paper towel.

5. Repeat steps 2-4 for the remaining two OTC antacid tablets. Place a few granules of powdered Rolaids in each well of Column 2 of the well plate and the powdered generic antacid in Column 3. Column 4 will be used for your unknown antacid sample.

**Row A – Appearance/Solubility**

6. Make detailed observations about the appearance of each powder, noting the color and consistency of each. Record observations of appearance in Row A of Data Table 2.

7. Using a dropper pipet, add 10-15 drops of deionized water to each of the three powders across Row A.

8. Observe any physical or chemical changes that occur (e.g. fizzing or dissolving).

9. Stir each well of Row A with a toothpick. Observe and record the solubility of each powdered OTC antacid in Data Table 2. Use the following guidelines to determine the solubility of each:

- If the resulting solution is clear, then the drug is *soluble*.
- If the resulting solution is cloudy, then the drug is *slightly soluble*.
- If the powder remains unchanged and there is a thick white precipitate, then the drug is *insoluble*.

Note: To avoid contamination while stirring, use three toothpicks – one toothpick for Alka-Seltzer, one for Rolaids, etc…

**Row B – Acidity/pH**

10. Using a dropper pipet, add 10 drops of deionized water to each of the three powders across Row B. Stir.

11. Using a different dropper pipet, add 3-4 drops of universal indicator to each well of Row B. Record the color of each solution in Row B of Data Table 2. Be very specific when describing the color so as to distinguish between the wells. Note the approximate pH of each solution by comparing the color to the universal indicator color chart.

12. Determine an accurate pH of each OTC drug by dipping one end of a strip of 1-12 pH paper into each of the corresponding wells of Row B. Save resources by using each end of the pH paper for a different well (but don’t get the solution on your hands). Use the color chart on the pH paper tube to determine the pH. Record the pH of each in Row B of Data Table 2.

**Row C – Reaction with HCl, “Simulated Stomach Acid”**

13. Using a dropper pipet, add 10 drops of 0.5 M HCl “simulated stomach acid” solution to each well of Row C.

14. Stir each well of Row C with a toothpick. Observe any reactions that occur as noted by fizzing (slight or rigorous) or dissolving (insoluble, slightly soluble, or fully soluble). Record detailed observations in Row C of Data Table 2.

15. Determine the pH of each OTC antacid in the “stomach” by dipping one end of a strip of 1-12 pH paper into each of the corresponding wells of Row C. Save resources by using
each end of the pH paper for a different well. Use the color chart on the pH paper tube to determine the pH. Record the “stomach” pH of each in Row C of Data Table 2.

**Row D – Reaction with Ferric Nitrate**

16. Using a dropper pipet, add 10 drops of 0.2 M Fe(NO₃)₃ solution to each well of Row D.
17. Stir each well of Row D with a toothpick. Observe any reactions that occur as noted by fizzing or color changes. Record detailed observations of each solution in Row D of Data Table 2. Be very specific when describing the color so as to distinguish between the wells.
18. Repeat any tests that gave unclear results using the remaining antacids that were saved earlier. Go on to Part Four – testing an unknown OTC antacid. Do not rinse out the well plate until Part Four is completed.

**Part Four: Unknown OTC Drug Testing – Antacids**

1. Obtain an unknown sample of an OTC antacid from your instructor. Record the unknown letter in Data Table 2.
2. Use a spatula to add a few granules of the powdered unknown OTC drug sample to each of the four wells of Column 4 of the well plate. Save the remaining amount of sample for later use – in case a test needs to be repeated.
3. Repeat steps 6-9 from Part One for Row A of the reaction plate. Record observations in Data Table 2.
4. Repeat steps 10-12 from Part One for Row B of the reaction plate. Record observations in Data Table 2.
5. Repeat steps 13-15 from Part One for Row C of the reaction plate. Record observations in Data Table 2.
6. Repeat steps 16-17 from Part One for Row D of the reaction plate. Record observations in Data Table 2.
7. Compare your results from the unknown to each of the three known antacid samples in Columns 1-3. Record observations.
8. Clean out the reaction plate in the sink, using plenty of tap water and soap. Use a cotton swab to clean the individual wells. Tap the plate dry and return to the center of the room. Empty the test tubes containing the excess powdered pain relievers into the sink and clean them.

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**Paper Idea III:**

Write a paper about the drug methamphetamine. When was this drug first synthesized? During what decade was there a rise in recreational use of the drug? Why do some people believe that this drug is an epidemic problem in the United States? Besides the effects of the drug on your body and the fact that it is illegal, what are some dangers of making the drug? Why can we no longer buy over-the-counter drugs in Illinois that contain pseudoephedrine unless we obtain it from a pharmacist? Do you agree with this law? Why or why not?

Note: Do not merely answer these questions given in the description in the given order, but write a coherent paper that addresses these issues. The paper must be typed, should not be longer than 5 pages (double spaced, reasonable margins), and must include at least 2 references (web references are fine). The work must be your own.