Invisible Ink

Materials:

Paper
Q-tip
NaOH solution
Phenolphthalein solution

Procedure:

1. Dip a Q-tip in the phenolphthalein solution. (Do not touch either solution.)
2. Write a message or draw a picture of your choice with the Q-tip on the paper.
3. Set your paper aside and allow it to dry.
4. After the paper is dry, dip the other end of the Q-tip in the NaOH solution.
5. Rub the Q-tip over the paper.

Questions:

1. Why did the phenolphthalein act the way that it did?
2. What is a common use of phenolphthalein in the chemistry lab?
3. List five other acid-base indicators and what pH range do they change colors.

Lab 1: Invisible Ink

Introduction:

Invisible ink has been used for many applications such as use in espionage, counterfeiting, and even in certain coloring books for kids. The ink is applied to paper and upon drying becomes invisible. The ink becomes visible by many different methods such as addition of heat, ultraviolet light, or chemicals. Lemon juice, milk, or vinegar will appear once heat has been applied. Laundry detergent or body fluids can be revealed using ultraviolet light. Some chemicals that are used for invisible ink involve acids and bases. Acids produce an H^+ ion in solution, and bases produce an OH^- ion in solution. Acids and bases have different effects on a unique group of chemicals called acid-base indicators. Indicators change color as the pH of the solution changes. There are many known indicators that change color at different pH ranges.

Materials:

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Procedure:

1. Dip a Q-tip in the phenolphthalein solution. (Do not touch either solution)
2. Write a message or draw a picture of your choice with the Q-tip on the paper.
3. Set your paper aside and allow it to dry.
4. After the paper is dry, dip the other end of the Q-tip in the NaOH solution.
5. Rub the Q-tip over the paper.

Data:

When the phenolphthalein solution dried, the message was invisible. When the NaOH solution was added, the message turned pink.

Questions and Answers:

1. Why did the phenolphthalein produce the result that it did?
   Phenolphthalein is an acid-base indicator that is colorless in a pH of less than 8 and is pink in a pH of more than 8. NaOH is a strong base that in large concentrations has a high pH above 8, so when the phenolphthalein was added, it changed to pink.
2. What is a common use of phenolphthalein in the chemistry lab?
   Phenolphthalein is commonly used in acid-base titrations. An acid-base titration involves a change in pH that is shown by an indicator. Most acid-base titrations involve a neutralization (pH = 7) so phenolphthalein is used to show a change from acidic to basic. Phenolphthalein was also used as a laxative.
3. List five other acid-base indicators and at what pH range do they change color.
   Five other examples of acid-base indicators are thymol blue (pH = 1.2 – 2.8), alizarin yellow (pH = 10 – 12), bromcresol green (pH = 4 – 5.6), phenol red (pH = 6.4 – 8), and methyl orange (pH = 3.1 – 4.4).

Conclusion:

Acid-base indicators have many uses for titrations and in invisible ink. Further experimentation could include using a wide range of indicators to create different colors. A similar chemical reaction was used to create Crayola Color Wonder paper.