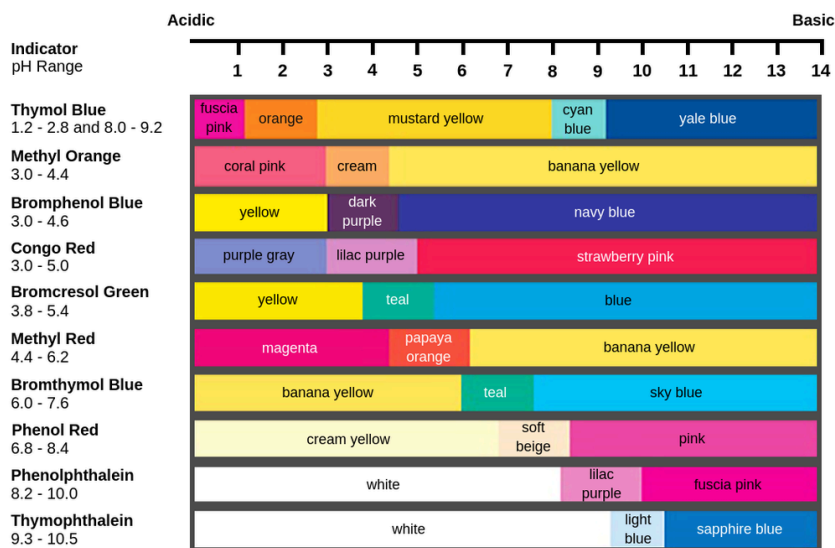


## Unit 4: Properties of Solutions

### Terminology of Titrations

This worksheet will cover the essential terminology of titrations, a critical analytical method in chemistry. It includes concepts such as the "**titrant**" (known concentration solution) slowly added to the "**analyte**" (substance of interest), leading to the pivotal "**equivalence point**" where the reaction is complete. The "**endpoint**," often signaled by an "**indicator**" like phenolphthalein in acid-base titrations, is a closely related concept. Understanding these terms is crucial for precise and controlled titrations in diverse chemical analyses.

1. What is the purpose of an indicator in a titration?
  
2. According to the chart below, which substance is known for its color change from colorless to pink as an indicator in acid-base titrations?



Cite: <https://theory.labster.com/acid-base-indicator-chart/>



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3. What is the key difference between the equivalence point and the endpoint in a titration?
4. In a titration of a strong acid (HCl) with a strong base (NaOH), which indicator would be most suitable for signaling the endpoint? (Use the chart in question 2 to assist you)
5. Define the term "equivalence point" in a titration and explain its significance.
6. Describe the role of the titrant and the analyte in a titration.
7. Explain how the choice of indicator can affect the accuracy of a titration.

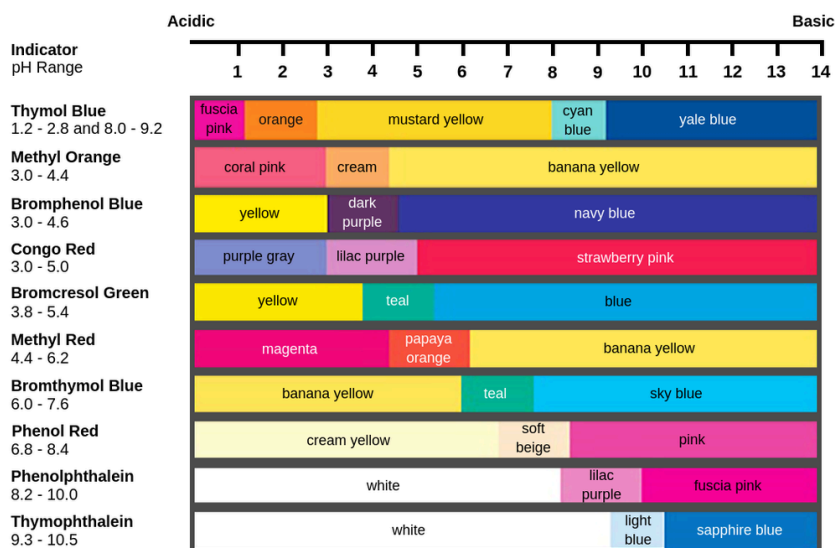
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### ANSWER KEY:

1. What is the purpose of an indicator in a titration?

The purpose of an indicator in a titration is to visually signal the endpoint of the reaction. The endpoint is the point at which the amount of titrant added is stoichiometrically equivalent to the amount of analyte present. Indicators undergo a noticeable and often abrupt color change when the pH of the solution reaches a specific value, which corresponds to the equivalence point. This color change provides a visible and easily identifiable signal to the experimenter, helping to determine when the titration is complete and allowing for precise and accurate measurements in the analysis.

2. According to the chart below, which substance is known for its color change from colorless to pink as an indicator in acid-base titrations?



Phenolphthalein turns from colorless to pink as the pH of the solution changes from acidic to slightly basic, making it a suitable indicator for acid-base titrations.

3. What is the key difference between the equivalence point and the endpoint in a titration?

The equivalence point is when the chemical reaction between the titrant and analyte is stoichiometrically complete, while the endpoint is the point at which this completion is visibly or instrumentally detected.

4. In a titration of a strong acid (HCl) with a strong base (NaOH), which indicator would be most suitable for signaling the endpoint? (Use the chart in question 2 to assist you)

Methyl orange is suitable for strong acid-strong base titrations as it changes color within the pH



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range of the equivalence point (around pH 4.0 to 6.0), making it an ideal choice to signal the endpoint of the titration. At the equivalence point, the moles of acid are equal to the moles of base added. In the case of methyl orange, the molecule undergoes a specific chemical transformation around the equivalence point, allowing it to change color.

5. Define the term "equivalence point" in a titration and explain its significance.

The equivalence point in a titration is the point at which the exact amount of titrant has been added to the analyte, resulting in complete chemical reaction or neutralization. At this stage, the moles of titrant are stoichiometrically equivalent to the moles of analyte. It is significant because it signifies the endpoint of the titration, and from the volume and concentration of the titrant used at this point, one can accurately calculate the concentration of the analyte.

6. Describe the role of the titrant and the analyte in a titration.

The titrant is a solution of known concentration that is carefully and gradually added to the analyte, which is the substance of interest with an unknown concentration. The purpose of the titrant is to react with the analyte until the equivalence point is reached. The analyte, on the other hand, is the substance being analyzed or titrated. The goal is to determine its concentration accurately by measuring the volume and concentration of the titrant required to reach the equivalence point.

7. Explain how the choice of indicator can affect the accuracy of a titration.

The choice of indicator is crucial in a titration because it must undergo a noticeable color change close to the equivalence point. If the indicator's color change occurs well before or after the equivalence point, it can lead to an inaccurate determination of the endpoint and, consequently, the analyte's concentration. Therefore, selecting an appropriate indicator that matches the pH range of the expected equivalence point is essential to achieve accurate titration results.