

Titration



Titration

**Do you need an idea for a scientific study?
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Titration involves controlled reactions between two substances to find the concentration of one of the participating species. Take the following brief quiz to see how much you already know about titrations. See the bottom of page 4 to check your answers.

1. Titration is used in the wine-making industry to make wines taste better.
 - a. true
 - b. false
2. Who invented the first burette that was later used in titration experiments?
 - a. Pascal
 - b. Lenz
 - c. Henri
 - d. Descroizilles
3. In what year was the first book on instructional techniques of titration written?
 - a. 1782
 - b. 1802
 - c. 1855
 - d. 1903
4. Prior to the year 2,000, the indicator used in acid-base titrations called phenolphthalein was commonly used as:
 - a. a laxative.
 - b. a headache remedy.
 - c. an oil for motors.
 - d. a dandruff remedy.
5. What is another name for the analyte used in a titration?
 - a. titrant
 - b. titrand
 - c. titler
 - d. tibbler



How Acidic?

While conducting a quantitative titration of an acid and base requires some expensive equipment, you can use some common kitchen materials to measure the relative concentrations of various acidic substances found in most homes. Milk of magnesia is an antacid for calming an upset stomach and is used as a laxative for occasional constipation. Milk of magnesia is a milky, white, opaque suspension of magnesium hydroxide in water. The hydroxide part of the substance makes the suspension a base. Milk of magnesia is also an indicator since the suspension becomes clear when enough acid is added to neutralize the base.

Materials

vinegar
small clear glass or cup

various juices (orange, apple, etc.)
Milk of Magnesia
safety glasses

various sodas
eyedropper

Procedure

1. Make sure you have parental permission to conduct this investigation.
2. Put on your safety glasses.
3. Using an eyedropper, place 30 drops of milk of magnesia in the small clear glass.
4. Rinse the eyedropper with water.
5. Select one of the test substances. Write the name of the substance selected in Table 1.
6. Using the eyedropper, draw up a dropper full of the test substance.
7. Dispense the substance into the clear glass with the milk of magnesia one drop at a time.
8. Make sure to count the number of drops.
9. When the milk of magnesia goes from being milky to clear, stop adding drops of the substance.
10. Enter the number of drops used in Table 1.
11. Clean the clear glass and dropper with water.
12. Repeat the experiment with a different substance (steps 3 – 10).
13. Rank the substances from most acidic (“1”) to the least acidic.

Substance	Number of Drops to Neutralize	Acidity Rank

Questions

1. What does it mean to say that an acid neutralized a base?

2. How does milk of magnesia help a person’s upset stomach feel better?

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Titration Requirements

While acid-base titrations are most common, other substances' concentrations can be determined by reacting a known concentration of the titrant with the analyte. These include the concentration of lead in water, the amount of salt in foodstuff, the concentration of acid rain in a pond, and the amount of fatty acid in various foods. Conducting a relative acidity titration does *not* involve fancy equipment or calculations; however, true analytical titrations have four requirements that must be met to find the exact concentration of the analyte. The four requirements of any titration include:

1. The chemical reaction between the titrant and analyte must be rapid and complete.
2. The chemical equation for the chemical reaction must be known in order to determine the stoichiometric ratio of reactants and products.
3. There must be a point in the chemical reaction when the reactants combine exactly. This combination must produce a clear change in the measurable properties of the reaction mixture. This complete reaction point is called the equivalence point. Two of the most common property measurements used to indicate the equivalence point are solution color changes and pH values changes.
4. Extremely accurate measurements of the amount of each reactant must be made. This is a case where accuracy in volumetric readings and the use of significant figures are of paramount importance.



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Answers: Page 2 Answers: (1) a, (2) d, (3) c, (4) a, (5) b. **Page 3 Answers:** (1) An acid reacts with a base to form water and a salt. (2) An upset stomach is sometimes caused by excess stomach acid. Milk of magnesia neutralizes this acid and turns it into water and a salt.

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