

Investigation 6.A: An Empirical Definition for Acids and Bases

Answer Key

Answers to Analysis Questions

Test	Acids	Bases
Litmus paper	Turn blue litmus red	Turn red litmus blue
pH paper	pH less than 7	pH greater than 7
Electrical conductivity of solution	Conduct electricity (electrolytes)	Conduct electricity (electrolytes)
Reaction with magnesium	React to produce H ₂ (g)	Do not react

- Acids and bases are both used as cleaners. Although you must not taste any substances in class, you may recognize that edible materials such as vinegar, apple juice, milk, and soft drinks are usually acidic or neutral, not basic, as basic substances taste unpleasant and bitter. Many pharmaceuticals, including antacids, are bases.
- As milk sours it becomes more acidic and its pH decreases.

Answer to Conclusion Question

- An empirical definition for acids might be that acids conduct electricity, have a low pH, and react with magnesium, while a definition of bases might be that bases conduct electricity, have a high pH, and do not react with magnesium.

Answers to Extension Questions

- (a) The bubbles in carbonated soda come from the decomposition of carbonic acid into carbon dioxide and water:



In flat pop, the acid has completely decomposed and the carbon dioxide gas has mostly come out of solution. The pH of flat pop should be higher than the pH of fizzy pop.

- (b) The presence of carbonic acid in carbonated water gives it a slightly sour taste, characteristic of all acids. In soda pop, as the carbonic acid is converted to carbon dioxide gas, going flat, the solution becomes less acidic and the taste becomes less sour and tangy, allowing the sweet, syrupy flavour from the sugars to dominate.
- Answers will depend on brand of product in some cases.
 - hand soap (base): amines
 - laundry detergent (base): carbonates and borates
 - glass cleaner (base): ammonia, NH₃(aq) (some brands)
 - antacid (base): magnesium hydroxide, Mg(OH)₂(s) (varies with brand and type)
 - milk (acid): lactic acid, C₃H₆O₃(aq)
 - sour milk (acid): lactic acid, C₃H₆O₃(aq)
 - soda pop (carbonated) (acid): carbonic acid, H₂CO₃(aq),
 - phosphoric acid, H₃PO₄(aq)
 - apple juice (acid): malic acid, C₄H₆O₅(aq); ascorbic acid, C₆H₈O₆(aq), (vitamin C) is sometimes added
 - vinegar (acid): ethanoic (acetic) acid, CH₃COOH
 - baking soda (base): sodium hydrogen carbonate, NaHCO₃(s)
 - water and table salt solution (neutral): sodium chloride, NaCl(s)